

E-X-P-A-N-D-E-D
EDITION

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H. G. CISIN'S

TUBE



REPLACEMENT
GUIDE

- ★ **RADIO** ★ **TV** ★ **HI-FI**
- ★ **TV PIX TUBES**
- ★ **FOREIGN**

H.G.CISIN'S TUBE REPLACEMENT GUIDE

This expanded edition contains over 2700 substitutes for more than 1500 tubes. Substitutes are listed for radio and television receiving tubes, television picture tubes, for tubes used in Hi-Fi and stereo equipment and also for many of the foreign tubes now being imported.

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TUBE REPLACEMENT GUIDE

By H.G.Cisin, Consulting Engineer

The first section of the TUBE REPLACEMENT GUIDE contains a list of substitute receiving tubes suitable for use where identical replacement types are unavailable. All tubes suggested for substitution have characteristics similar to the tubes they are to replace, WILL FIT INTO THE SAME SOCKET, and DO NOT REQUIRE ANY CHANCES WHATSOEVER IN WIRING. In a number of instances, where no domestic substitute exists, foreign replacements obtainable in this country have been listed.

In most cases, it is preferable to replace with the original type, if this can be obtained. In certain instances, however, due to recent improvements in tube design, a substitute type tube will actually result in better performance. Substitutes listed below capable of equal or improved results have been underscored. Substitutes not underscored will in general function satisfactorily, although it is possible in a few isolated instances, that less than desired results may be obtained due to critical or unique circuit design. Suggested substitutes which are followed by the letter "t" in parenthesis, (t), are not recommended for permanent replacement. They have been listed merely to provide temporary operation until the original type or a recommended substitute can be obtained. Substitutes followed by the letter "f" in parenthesis, (f), are foreign tubes.

Certain tubes in the following lists may be substituted only in parallel connected circuits. These are indicated by an asterisk (*) after the tube designation. If no asterisk is shown, tube may be substituted in either series or parallel connected heater systems. In cases where the asterisk appears after a suggested substitute, it is necessary to know whether the heaters or filaments are connected in series or parallel. This information may be obtained readily without consulting a diagram or tracing the circuit. If a burn-out or defective tube is to be replaced, remove it from its socket. If all other tubes remain lit when the switch is turned on, the heaters are in parallel. If, upon removal of the defective tube, any other tubes show loss of heater glow, the removed tube is part of a series system hookup.

The second section of this book contains replacement substitutes for newer model television picture tubes. The third section includes substitutes for older model television picture tubes. Over 325 picture tube substitutes are listed. In most cases, picture tube substitutes are suggested which require no changes of any kind. In other cases, changes are clearly indicated but are slight, such as change in the type of ion trap or in the anode connector.

Section four contains U. S. A. substitutes for foreign tubes. Substitutes are suggested for over 225 foreign tubes. Section five contains a list of transistor substitutes, plus a table listing transistor replacements in a number of popular transistor radio receivers.

SECTION I
REPLACEMENT SUBSTITUTES
for Radio, Television, Hi-Fi
and
Other Electronic Receiving Equipment

Tube	Substitute	Tube	Substitute
00A	- <u>01A</u> , 40	1A4	- <u>1A4</u>
01A	- <u>00A</u> , <u>00AA</u> , <u>01B</u> , 40	1A5	- DAF96(f)
0A2	- <u>0B2</u> , <u>6073</u> , <u>150C2</u> (f) STV150/30(f)	1A4	- 1AF4, DF96(f)
0A3	- <u>VR75</u> , 0B3, 5651	1A5	- 1AG5, 1AK5
0A4	- <u>1267</u> , <u>Z300T</u> (f)	1A4	- <u>1A4</u>
0B2	- <u>6074</u> , STV108/30(f)	1A5	- 1AG5, 1AJ5
0B3	- <u>VR20</u> , <u>1266</u>	1AN	- DF97(f)
0C3	- <u>VR105</u>	1AX2	- 1AX2A, 1AX2B, 1X2(t)
0D3	- <u>VR150</u> , <u>150C3</u> (f)	1B3	- <u>1G3</u> , 1J3, <u>8016</u> , 2B3(t), DY30(f)
0E3	- <u>85A1</u> (f)	1B4	- <u>1A4</u> , <u>1E5</u> , <u>32</u> , <u>34</u>
0G3	- STV85/10(f)	1B5	- <u>255</u>
0Y4	- <u>0Y4G</u> , <u>1005/CK1005</u> , 0Z4A	1B7	- <u>1A7*</u> , <u>1LC6</u>
0Z4	- <u>0Y4</u> , <u>0Z4A</u> , <u>1003</u> , <u>1005/CK1005</u> , <u>0Z4G</u>	1B8	- <u>1D8</u>
0Z4A	- <u>1003</u> , 0Y4, 0Z4, 1005/CK1005	1C5	- 1A5*, 1Q5(t), DL35(f), N14 (f)
0Z4G	- 0Z4	1C6	- 1A6
1A3	- <u>DA20</u> (f), 1D13(f)	1C7	- 1D7*, KK32(f)
1A4	- <u>1B4</u> , 1A4P, 1A4T	1C8	- 1AE5*, <u>1E8</u>
1A5	- 1C5*, 1G4(t), 1Q5*	1D5	- 1E5
1A6	- <u>1C6*</u>	1D7	- 1C7*
1A7	- <u>1B7*</u> , 1C7*, <u>DK32</u> (f), <u>X14</u> (f)	1D8	- 1B8
1AB6	- <u>1AC6*</u> , <u>DK26</u> (f)	1E3	- DC80(f)
1AC5	- <u>1V5</u>	1E4	- 1G4, 1H4(t)
1AC6	- 1AB6, <u>DK22</u> (f), <u>X18</u> (f)	1E5	- KF35(f)
1AD4	- <u>DF62</u> (f)	1E8	- 1C8
1AD5	- 1AD4*, <u>1W5</u>	1F5	- 1J5, KL35(f)
1AE4	- 1L4*(t), 1T4*(t), 1U4*(t)	1G3	- 1K3, 1B3
1AF4	- 1L4*, 1U4*, 1T4*(t), 1AJ4(t), DF96(f)	1G4	- 1E4, 1H4(t)
1AF5	- 1S5*, 1AH5	1G5	- 1J5, 1F5
1AG5	- 1AJ5, 1AK5	1G6	- 1J6*(t)
		1H4	- 1E4(t)
		1H5	- DAC32(f), HD14(f)
		1J3	- 1B3

Tube	Substitute	Tube	Substitute
1J5	- 1G5	2AF4A	- 2AF4, <u>2AF4B</u> , 2T4
1J6	- 1G6*	2AF4B	- 2AF4A, 2AF4, 2T4
1K3	- 1G3	2B3	- 1B3(t)
1L4	- 1AF4*, 1T4, 1U4, DF92(f)	2B7	- 2B7S
1L6	- 1U6*	2B7S	- <u>2B7</u>
1LA4	- 1LB4	2C51	- 5670*, 6185, 6385, 6386
1LA6	- 1LC6	2C52	- 12SL7*, 12SN7(t), 12SX7(t)
1LB4	- 1LA4	2D21	- <u>2D21W</u> , <u>5727</u>
1LC5	- 1LG5, <u>1LN5</u>	2D21W-	2D21, <u>5727</u>
1LC6	- <u>1LA6</u>	2E5	- <u>2G5</u>
1LE3	- 1293*, <u>1LF3</u>	2E30	- 5812
1LF3	- 1LE3	2E31	- <u>2E32</u>
1LG5	- 1LC5, 1LN5	2E32	- <u>2E31</u>
1LN5	- <u>1LC5</u> , 1LG5	2E35	- <u>2E36</u>
1M3	- DL70(f)	2E36	- <u>2E35</u>
1N5	- 1P5, 1D5(t), DF33(f), Z14(f)	2E41	- <u>2E42</u>
1P5	- 1N5	2E42	- <u>2E41</u>
1Q5	- 1T5*, 1A5*, 1C5(t), DL36(f)	2G5	- <u>2E5</u>
1R5	- DK91(f), X17(f)	2G21	- <u>2G22</u>
1S2	- DY86(f), 1H2	2G22	- <u>2G21</u>
1S2A	- 1H2	2T4	- 2AF4, 2AF4A, 2AF4B
1S4	- DL91(f)	3A3	- 3B2, 3C2
1S5	- <u>1AF5*</u> , DAF91(f), 1FD9(f)	3A4	- DL93(f)
1S6	- <u>1T6</u>	3A5	- DCC90(f)
1T4	- 1L4, 1AF4*, 1U4, DF91(f) 1F3(f)	3AU6	- 3BA6
1T5	- 1A5, 1C5*, 1G4(t), 1Q5	3AV6	- 3BT6
1T6	- <u>1S6</u>	3B2	- 3A3, 3C2
1U4	- <u>5910</u> , 1AF4*, 1L4, 1T4, DF904(f)	3B4	- HD30(f)
1U5	- DAF92(f)	3B5	- <u>3C5</u> , <u>3Q5</u>
1U6	- <u>1L6*</u>	3B7	- <u>1291</u>
1V	-- <u>6Z3</u>	3BA6	- 3AU6
1V5	- <u>1AC5</u>	3BE6	- 3BY6(t)
1W5	- 1V5(t)	3BT6	- 3AV6
1X2	- 1AX2(t), 1AX2A, <u>1X2A</u> , <u>1X2B</u>	3BY6	- 3CS6
1X2A	- 1AX2, DY80(f), <u>1X2B</u>	3BZ6	- 3BC5, 3CB6
1X2B	- 1AX2, 1X2A	3C2	- 3A3, 3B2
2A3	- 45, <u>5930</u>	3C4	- 3V4, DL96(f)
2A6	- <u>55*</u>	3C5	- <u>3B5</u> , <u>3Q5</u>
2A7	- <u>2A7S</u>	3CB6	- 3BC5, 3BZ6
2AF4	- 2T4, <u>2AF4A</u> , <u>2AF4B</u>	3CE5	- <u>3CB6</u> , <u>3CF6</u>
		3CF6	- 3BC5, 3BZ6, 3CB6, <u>3CE5</u>
		3CS6	- 3BY6

Tube	Substitute	Tube	Substitute
3D6	- 3LF4*, 1299	5U4G	- <u>5AS4</u> , <u>5AW4</u> , 5AX4, 5AZ4, 5T4, <u>5U4GA</u> , <u>5U4GB</u> , 5V3, 5W4, 5Y3, 5Z4, 5Y4, <u>5931</u> , 5Y3, U52(f), GZ34(f), H52(f)
3E5	- 3V4	5U4GA-	<u>5AS4</u> , <u>5AW4</u> , <u>5AU4</u> , 5AX4, 5AZ4, <u>5T4</u> , <u>5U4G</u> , <u>5U4GB</u> , 5V3, 5W4, 5Y3, 5Z4, 5Y4, <u>5931</u> , H52(f), U52(f), GZ34(f)
3LE4	- <u>3LF4</u>	5U4GB-	<u>5AS4</u> , <u>5AU4</u> , <u>5AW4</u> , 5AX4, <u>5AZ4</u> , <u>5T4</u> , <u>5U4G</u> , <u>5U4GA</u> , 5V3, 5W4, 5Y3, 5Z4, 5Y4, <u>5931</u> , U52(f)
3LF4	- <u>3LE4</u> , 3D6*, 1299*	5U8	- 5EA8
3Q4	- 3S4, DL95(f), N18(f)	5V3	- 5AS4, <u>5AU4</u> , 5AW4, 5U4GB
3Q5	- <u>3B5</u> , <u>3C5</u> , DL33(f)	5V4	- 5AX4, 5AZ4, <u>5V4GA</u> , 5T4, 5U4, 5W4, 5Y3, 5Z4, 5931, GZ32(f)
3S4	- 3Q4, DL92(f), N17(f), 1P10(f)	5W4	- 5AX4, 5AZ4, <u>5W4GT</u> , 5T4, 5U4, 5V4, 5Y3, <u>5Z4</u> , 5931
3V4	- 3C4*, 3E5*, DL94(f), N19(f)	5X3	- 5Z3, 80, 83, 83V, 1275
4BC8	- 4BK7, 4BQ7, 4BQ7A, 4BS8, 4BZ7, 4BZ8	5X4	- <u>5X4GA</u> , 5Y4G, 5Y4GA, 5Y4GT
4BK7	- 4BC8, 4BQ7, 4BS8, 4BZ8	5Y3G	- 5Y3GT, <u>5Y3GA</u> , 5AW4, 5AX4, 5AZ4, 5T4, 5V4, 5W4, 5Z4, 5931, 5U4G, 5U4GA, 5U4GB, U50(f), <u>608Z</u>
4BQ7	- 4BC8, 4BK7, 4BS8, 4BZ7, 4BZ8, <u>4BQ7A</u>	5Y4	- 5X4, 5Z4, <u>5Y4GA</u> , 5931
4BS8	- 4BC8, 4BK7, 4BQ7, 4BQ7A, 4BZ8	5Z3	- <u>5X3</u> , 80, 83, 83V, 1275
4BX8	- 4BC8, 4BK7, 4BQ7, 4BS8, 4BZ8	5Z4	- 5V4, 5V4GA, 5931, 5AX4, <u>5AZ4</u> , 5T4, 5U4, 5W4, <u>5Y3</u> , <u>GZ30</u> (f)
4BZ7	- 4BC8, 4BK7, 4BQ7, 4BQ7A, 4BS8, 4BZ8	6A4	- 52, LA
4BZ8	- 4BC8, 4BK7, 4BQ7, 4BS8	6A6	- 6E6*
4CB6	- 4BC5, 4DT6(t)	6A7	- <u>6A7E</u> (f), 6A7S
5AR4	- GZ34(f)	6A8	- <u>6D8*</u> , <u>6J8</u> , <u>6K8</u> , X63(f) <u>6A8GT</u> , <u>6A8G</u>
5AS4	- <u>5AS4A</u> , 5AW4, 5U4GA, 5U4GB, 5V3, 5931	6AB4	- <u>EC92</u> (f)
5AU4	- <u>5AW4</u> , <u>5U4GA</u> , <u>5U4GB</u> , 5V3, <u>5931</u> , 5AS4, 5R4GY, 5T4, 5U4G	6AB5	- 6E5*(t), <u>6N5</u>
5AW4	- 5U4, <u>5AU4</u> , <u>5U4GA</u> , <u>5U4GB</u> , 5V3, <u>5931</u> , 5AS4, 5R4GY, 5T4, 5U4G	6AB6	- 6AC6*
5AX4	- <u>5AS4</u> , <u>5U4GA</u> , <u>5U4GB</u> , 5X3, <u>5V4</u> , <u>5931</u> , 5T4, 5U4G, 5AZ4, 5U4, 5W4, 5Y3, 5Z4	6AB7/1853	- 6AC7/1852, 6AJ7, 6SD7*, 6SE7*, 6SJ7*, 6SK7*, 6SS7*, 5693*
5AZ4	- <u>5AX4</u> , <u>5V4</u> , 5Y3, 5U4, 5W4, <u>5Z4</u> , 5AW4, 5T4	6AB8	- <u>ECL80</u> (f), SN152(f)
5BK7	- 5BQ7, 5BZ7	6AC5G-	<u>6AC5GT</u>
5CG4	- 5V4GA	6AC5GT	- <u>6AC5G</u>
5CL8	- 5CL8A	6AC6	- 6AB6*
5R4GY	- 5AW4		
5T4	- <u>5AS4</u> , <u>5AW4</u> , 5AX4, 5AZ4, <u>5R4</u> , <u>5U4G</u> , <u>5U4GA</u> , <u>5U4GB</u> , <u>5V4</u> , 5W4, 5Y3, 5Z4, <u>5931</u>		

Tube	Substitution	Tube	Substitution
6AC7	- 6AB7, <u>6AC7W</u> , 6AJ7, 6SD7*, 6SJ7*, <u>6SK7*</u> , 6SS7*, 1852, 1853, 6006*, <u>6134</u> , 5693*	6AQ5	- <u>6BM5</u> , <u>6AQ5A</u> , <u>6AQ5W</u> , <u>6005</u> , 6669, <u>EL90(f)</u>
6AD5	- 6AE5, 6AF5, 6C5, 6J5, 6J5GT, <u>6J5WGT</u> , 6P5	6AQ6	- 6AT6*, 6AV6*, 6BF6*, 6BK6*, 6BT6*, 6BU6*, 6066*
6AD6	- 6AF6	6AQ8	- ECC85(f), B719(f)
6AE5	- 6AD5, 6AF5, 6C5, 6J5, 6J5GT, 6J5WGT, 6P5	6AR5	- 6098
6AE8	- <u>X72</u>	6AS6	- <u>6AS6W</u> , 5725
6AF4	- 6T4, 6AN4, <u>6AF4A</u>	6AS7	- <u>6080</u> , 5998*
6AF5	- 6AD5, 6AE5, 6C5, 6J5, 6P5	6AT6	- <u>6AV6</u> , 6066, <u>DH77(f)</u> , <u>EBC90(f)</u>
6AF6	- 6AD6	6AT8	- 6AT8A
6AG5	- 6AK5*, 6BC5, 6CF6, 5590*, 5591*, 9001*, 9003*, 6AJ5*(t), <u>6186</u> , 6BA6, <u>6CE5</u> , 6BD6, 6CB6, 6AH6, 6AS6(t), 6AS6W(t), 6BH6(t), 6BJ6(t), EF96(f)	6AU4	- 6AX4, 6BL4, 6W4, 6AU4GTA
6AG7	- <u>6AK7</u>	6AU5	- 6AV5*, 6BD5*
6AH6	- 6BC5*, 6AJ5*(t), 6485, 6AK5*(t), 6AU6*(t), 6BD6*(t)	6AU6	- 6BA6, 6BD6, <u>6AU6WA</u> , 6AU6A, <u>6AU6WB</u> , <u>6136</u> , 5749, 6163, 5590*, 5591*, 9001*, 9003*, 6AG5(t), 6AK5*(t), 6AK6*(t), 6AJ5*(t), EF94(f)
6AJ4	- 6AM4	6AU8	- 6AW8, 6BA8, 6BHB
6AJ5	- 6CF6*(t)	6AV4	- 6BX4, 6X4
6AJ7	- 6AC7, 6AB7, 1852, 1853 6SD7*, 6SE7*, 6SJ7*, 6SK7*, 6SS7*, 5693*	6AV5	- 6AU5, 6BD5, <u>6AV5GA</u>
6AJ8	- <u>ECH81(f)</u> , <u>DP61(f)</u>	6AV6	- 6AT6, 6AQ6*, 6066, 6BT6, EBC91(f)
6AK5	- 6AG5*, 6AJ5(t), 6CF6, 6BC5*(t), 5590*, 5591*, 9003, <u>EF95(f)</u> , <u>5654</u>	6AW8	- 6AU8, <u>6AM8A</u>
6AK7	- <u>6AG7</u>	6AX4	- 6AU4, 6BL4, <u>6U4</u> , 6W4, 6DA4
6AK8	- <u>6T8</u> , <u>6T8A</u>	6AX5	- 6W5, 6X5, 6ZY5, 1274
6AL5	- <u>6AL5W</u> , 5726, 6058, 6097, <u>6663</u> , <u>D77(f)</u> , <u>DD6(f)</u> <u>EP91(f)</u> , <u>EAA91(f)</u> , 6D2(f), DI52(f), DD7(f)	6AX8	- 6AU8, 6U8*, 6U8A*
6AM4	- <u>6AJ4</u>	6B6	- <u>6Q7</u> , <u>6Q7G</u> , <u>6Q7GT</u>
6AM5	- <u>EL91(f)</u> , <u>N7Z(f)</u> , NI44(f)	6B8	- 6B8G
6AM6	- <u>6064</u> , <u>EF91(f)</u> , <u>SP6(f)</u> , <u>SD3(f)</u> , <u>Z7Z(f)</u> , 6F12(f)	6BA6	- 6AU6, 6BD6, 6AG5, 6BC5, 6CB6, 6CG6, <u>6BA6W</u> , 5749, 6136, EF93(f), <u>EM04(f)</u> , 6660
6AM8	- <u>6AM8A</u>	6BA8	- <u>6BARA</u> , 6AU8, 6AW8, 6BHB
6AN4	- 6AF4, 6T4	6BC5	- 6CE5, 6CF6, 6AG5(t)*, 6AJ5*(t), 6AK5*(t), 9001*(t), 9003*(t), 5591*, 5654*
6AN8	- <u>6AN8A</u>	6BC8	- <u>6BQ7A</u> , 6BS8, <u>6BQ7GB</u> , 6BK7, 6BK7A, 6BK7B, <u>6BZZ</u> , XI55
6AQ4	- <u>EC91(f)</u>	6BD4	- 6BD4A, 6BK4
		6BD4A	- <u>6BK4</u>
		6BD5	- 6AU5*(t) 6AV5*(t)
		6BD6	- 6AH6*(t), 5749
		6BE6	- 5915, <u>EK20(f)</u> , 6BY6, <u>5750</u>
		6BE7	- <u>E080(f)</u>

Tube	Substitution	Tube	Substitution
6BE8	- 6BE8A	6BU6	- 6BF6
6BF5	- 6A05*(t), 6A05A*(t)	6BW4	- EZ81 *(f), ^ 6CA4
6BF6	- 6BU6	6BW7	- 6BX6
6BF7	- <u>6BG7</u>	6BX4	- 6X4, 6AV4*
6BG6G	- 6CD6*(t), 6DN6, <u>6BG6GA</u>	6BX6	- 6BN7, 6BY7, <u>EF80</u> (f), Z152(f), Z179(f)
6BG7	- <u>6BF7</u>	6BX7	- 6BL7
6BH6	- 6BJ6, 6AS6*, 6BC5*(t), 6CB6*, 6265, 6661,	6BX8	- 6BC8, 6BE6, 6BK7, 6BQ7, 6BS8, 6BZ7, 6BZ8, X155
6BH8	- 6AU8, 6AW8, 6BA8	6BY6	- 6CS6, 5915
6BJ5	- <u>N78</u> (f)	6BY7	- <u>6BX6</u> , <u>EF85</u> (f), W179(f)
6BJ6	- 6BH6, <u>6BA6*</u> , 6AS6*, 6BC5*(t), <u>6CB6*</u> , <u>6BA6W</u> , <u>5742</u> , 6136, 6662	6BZ6	- <u>6CB6</u> , <u>6DE6</u>
6BJ8	- 6BN8	6BZ7	- 6BQ7A, 6BQ7, 6BK7A, 6BK7, 6BC8, <u>6BQ8</u> , 6BS8, <u>6BZ8</u> , X155
6BK7A	- <u>6BK7B</u>	6BZ8	- 6BC8, 6BK7A, 6BK7, 6BS8, 6BZ7, 6BQ7A, 6BQ7, 6BQ8, X155
6BK4	- 6BD4A	6C4	- 5610, <u>6135</u> , 9002(t), <u>EC20</u> (f), <u>L77</u> (f), <u>6100</u>
6BK6	- 6066, 6AT6, 6AV6, 6BF6, 6BT6, 6BU6	6C5	- 6AD5, 6AE5, 6AF8, 6L5*
6BK7	- <u>6BK7B</u> , 6BQ7, 6BQ7A, 6BS8, 6BZ7, 6BZ8, X155, 6BC8	6C6	- 6D6, <u>ZZ</u> , <u>Z8</u> , <u>1221</u> , <u>1603</u> , <u>7700</u>
6BK7A	- <u>6BK7B</u> , 6BQ7, 6BQ7A, 6BS8, 6BZ7, 6BZ8, X155, 6BC8	6C8	- <u>6E8*</u>
6BL4	- 6AU4 GTA, 6AX4(t)	6CA4	- EZ81 *(f), 6BW4*
6BL7GT	- 6BX7, 6SN7*, 6SU7*(t), 5592, 5591*(t), 6SL7(t), <u>6BL7GTA</u>	6CA7	- 6L6*, EL34(f), <u>6L6GB*</u> , <u>6L6GC*</u> , KT66*, <u>5881*</u> , <u>7027*</u> , 6L6G, 6L6GA
6BM5	- <u>6A05</u>	6CB5	- <u>6CB5A</u>
6BM8	- <u>ECL82</u> (f)	6CB6	- <u>6DE6</u> , <u>6CB6A</u> , 6BZ6, 6DC6, <u>6AS6*(t)</u> , <u>6BH6*(t)</u> , 6BJ6*(t), <u>6CF6</u> , 6AG5, 6BC5, 6AJ5*, 6AK5*, 5590*, 5591*, 5654*
6BN5	- EL85(f)	6CD6G	- <u>6DN6</u> , 6BG6*, <u>6CD6-GA</u> ,
6BN8	- 6BJ8	6CD7	- <u>EM34</u> (f)
6BQ5	- <u>EL84</u> (f), N709(f)	6CF6	- <u>6CB6</u> , 6AG5, 6AK5, 6BC5, 5590, 5591, 5654, 9001(t), 9003(t), 6AJ5*(t), 6186
6BQ6G	- <u>6BQ6GT</u> , <u>6BQ6GTA</u> , <u>6BQ6GTB</u> , <u>6CU6</u> , <u>6DQ6</u> , <u>6DQ6A</u>	6CG6	- 6AG5, 6AU6, 6BA6, 6BC5, <u>6BD6</u> , 6AH6*, 6AK5*, 5591*, 5654*, 5590*(t), 9001*(t), 9003*(t), 6AJ5*(t)
6BQ7	- 6BC8, 6BK7, 6BK7A, <u>6BQ7A</u> , <u>6BZ7</u> , 6BZ8, X155	6CG8	- <u>6CG8A</u>
6BR5	- <u>EM80</u> (f)	6CH6	- <u>6132</u> , EL821(f)
6BR8	- 6CL8A, <u>6BR8A</u>	6CJ6	- <u>EL81</u> (f)
6BS8	- 6BC8, 6BK7, 6BK7A, 6BQ7, 6BQ7A, 6BZ8, X155	6CK6	- EL83(f)
6BT6	- <u>6066</u> , 6BK6, 6A06*, 6BD7*, 6AV6	6CL6	- <u>66Z7</u>

Tube	Substitute	Tube	Substitute
6CL8	- 6CL8A	6K8	- 6A8, 6J7
6CN6	- EL38(f)	6L4	- 6F4(t)
6CS6	- 6BY6, 6BE6, EH90(f)	6L5	- 6AD5*, 6AE5*, 6C5*
6CU6	- 6DQ6G, 6BQ6GT, 6DQ6A, 6BQ6GTA, 6BQ6GTB, 6DQ6, 6DQ6A	6L6	- 6F6*, 6K6*, 6U6*, 6V6*, 1614, KT66*(f), 5881, 1621*, 1622, 5932, 6550, 7027*, 6L6G, 6L6GB, 6L6GC
6D6	- 6C6, 77, 78	6L7	- 1612, 6L7G
6D7	- 6E7	6N6	- 6AB6*
6D8	- 6A8*, 6J8*, 6K8*	6N7	- 6Y7, 6Z7, 1635*, 6N7GT
6DC6	- 6BZ6, 6CB6, 6DE6	6N8	- EBF80(f)
6DE6	- 6BZ6, 6CB6, 6DC6	6P5	- 6AD5, 6AE5, 6AF5, 6C5, 6J5, 6L5*
6DG6	- 6W6, 6K6*, 6V6*	6P8G	- ECH35*
6DN6	- 6CD6, 6BG6, 6BG6GA	6Q4	- EC80
6DQ6	- 6BQ6GT, 6BQ6GTA, 6CU6, 6DQ6A	6Q5	- 884
6E5	- 6T5, 6U5, 6G5	6Q7	- 6B6, 6R7, 6T7*, 6V7, DH63(f)
6E6	- 6A6	6R4	- EC81(f)
6E7	- 6D7	6R7	- 6Q7, 6T7*, 6V7
6E8	- ECH35(f)	6R8	- 6T8, 6AK8, 6T8A
6F4	- 6L4(t)	6S4	- 6SA4
6F5	- H63(f), 6F5GT	6S7	- 5732*, 6W7, 6J7*, 6K7*, 6U7*
6F6	- 6K6*, 6L6*, 6U6*, 6V6*, 6G6*(t), 1611, 5881*, 1621, 1622*, KT63(f), 6F6G, 6F6GT	6SA7	- 5961, 6SB7Y
6F7	- 6F7S	6SB7Y	- 6SA7, 5961
6F8	- 6C8*	6SD7	- 6AB7*, 6AC7*, 6SS7*, 6SE7, 6SJ7, 6SK7, 5693, 1852*, 1853*
6G5	- 6E5, 6T5, 6U5, 6AB5*	6SE7	- 6AB7*, 6AC7*, 6SS7*, 6SD7, 6SJ7, 6SK7, 5693, 1852*, 1853*
6G6	- 6F6, 6K6, 6V6	6SF7	- 6SV7
6H5	- 6U5, 6G5	6SG7	- 6AB7*, 6AC7*, 6006, 6SG7GT
6H6	- EB34(f), D63(f), 6H6GT	6SH7	- 6AB7*, 6AC7*, 6SG7, 6SG7GT, 6SJ7, 6SK7, 6SH7GT
6J4	- 6J4WA	6SJ7	- 5693, 6SK7, 6SS7*, 6SJ7WGT, 6006, 6SJ7GT
6J5	- 6AD5, 6AE5, 6AF5, 6C5, 6L5*, 6P5, 6J5GT, 6J5 WGT, L63(f)	6SK7	- 6AB7*, 6AC7*, 6SG7, 6SH7, 6SJ7, 6SS7*, 6L3Z, 6006
6J6	- 5964, 6101, 6J6A	6SL7	- 6SL7WGT, 6113, 6SN7*, 6SU7, 5691*, 5692(t), 6SL7GT, 6SU7GT
6J7	- 6J7GT, 6K7, 6S7*, 6U7, 6W7* 6J7G, 7000, 1223, 1620	6SN7	- 6BL7*, 6BX7*, 6SL7*, 6SL7GT*, 6SN7GT, (Cont'd)
6J8	- 6A8, 6D8*, 6K8		
6K4	- 6AD4		
6K6	- 6F6*, 6L6*, 6U6*, 6V6*, 6G6*(t)*, 1621*, 5871		
6K7	- 6J7, 6S7*, 6U7, 6W7*, 5732, 6K7G, 6K7GT		

Tube	Substitute	Tube	Substitute
6SN7	- (Cont'd) <u>6SN7WGT</u> , <u>6SN7GTA</u> , <u>6SN7GTB</u> , 5692, 6180, 5691(t), B65(f), ECC33*(f)	6X5	- (Cont'd) <u>6X5WGT</u> , <u>EZ35(f)</u> , U147(f), U70(f), <u>6X5GT</u>
6SQ7	- <u>6SR7</u> , 6ST7*, <u>6SZ7*</u> , <u>6SQ7G</u>	6X8	- <u>6X8A</u>
6SR7	- <u>6SQ7</u> , <u>6SZ7*</u> , 6ST7*, <u>6SR7GT</u>	6Y5	- <u>6Z5</u> (6-volt use only)
6SS7	- 6SJ7*, 6SK7*, <u>6SS7GT</u>	6Y6	- <u>6K6*</u> , <u>6L6*</u> , <u>6U6*</u> , <u>6V6*</u> , <u>6G6*(t)</u> , <u>6Y6G</u> , <u>6Y6GA</u> , <u>6Y6GT</u>
6ST7	- 6SQ7*, 6SR7*	6Y7	- 6N7*, 6Z7*, <u>1635</u>
6SU7	- <u>6SL7</u> , 6SN7(t), <u>6113</u>	6Z3	- <u>1V</u>
6SV7	- 6SF7	6Z5	- <u>6V5</u> (6-volt use only)
6SZ7	- 6SQ7*, 6SR7*, 6ST7	6Z7	- 6N7*, 6Y7*
6T4	- 6AN4, 6AF4	6ZY5	- 6AX5*, 6W5*, 6X5*, 1274
6T5	- 6AB5*, 6E5, 6U5, 6G5, <u>6N5</u>	7A4	- 7B4, <u>XXL</u>
6T7	- 6B6*, 6Q7*, 6R7*, 6V7*	7A5	- 7B5*, 7C5*
6T8	- 6R8, 6AK8, EABC80(f) <u>6T8A</u>	7A7	- 7H7, 7L7, 7B7*, 7C7*
6U3	- <u>EY80(f)</u>	7A8	- 7B8*, 7J8*, 7S7*
6U4GT	- 6AX4GT, 6DA4, <u>6W4</u>	7AB7	- <u>1204</u>
6U5	- <u>6G5</u> , 6AB5*, <u>6E5*</u> , <u>6N5*</u> , <u>Y61(f)</u>	7AD7	- 7AG7*(t), 7AH7*(t), 7AJ7*(t), 7AK7*(t), 7B7*(t) 7C7*(t), 7G7*(t), 7H7*(t) 7L7*(t), 7T7*(t), 7V7*(t)
6U6	- 6F6*, 6G6*(t), 6K6*, 6L6*(t), 6V6*, 6W6*(t), 5881*	7AF7	- 7F7, 7N7*
6U7	- 6K7, 5732, 6J7	7AG7	- 7AH7, 7B7(t), 7C7(t), 7AJ7*(t), 7AK7*(t), 7G7*, 7H7*, 7L7*, 7T7*, 7V7*
6U8	- 6AX8, <u>6U8A</u> , <u>ECFR2(f)</u>	7AH7	- 7AG7, 7B7(t), 7C7(t), 7AJ7*, 7AK7*(t), 7G7*(t), 7H7*(t), 7L7*(t), 7T7*(t), 7V7*(t)
6V3	- <u>6V3A</u>	7AJ7	- 7AH7*, 7AK7*(t), 7B7*(t), 7C7*(t), 7G7*(t), 7V7*(t), 7H7, 7L7, 7T7
6V4	- <u>EZ80(f)</u>	7AK7	- 7AH7*(t), 7AJ7*(t), 7B7*(t), 7C7*(t), 7G7*(t), 7H7*(t), 7L7*(t), 7T7*(t), 7V7*(t)
6V6	- 6F6*, 6G6*(t), 6K6, 6L6*, 6U6*, 6W6*, 6V6*, 1621*, 1622*, <u>58Z1</u> , <u>5922</u> , <u>6Y6GTA</u> , <u>6Y6GT</u>	7AN7	- <u>PCC84(f)</u> , B319(f), 30L1(f)
6V7	- 6R7, 6T7*	7B4	- 7A4, <u>XXL</u>
6W2	- 6X2	7B5	- 7A5*, 7C5*
6W4	- <u>6AX4</u> , <u>6U4</u> , <u>6DA4</u>	7B6	- 7E6
6W5	- 6AX5*, 6X5*, 6ZY5*	7B7	- 7AH7, 7C7, 7H7*, W149(f)
6W6	- 6G6*, 6L6*, 5881*, 6F6*(t), 6K6*, 6U6*, 6V6*, 6Y6G, 6Y6GA, 6Y6GT	7B8	- 7A8*, 7J7, 7S7
6W7	- 6J7*, 6K7*, 6U7*, 6S7	7C4	- <u>1203A</u>
6X2	- <u>6W2</u> , <u>EY51(f)</u>	7C5	- 7A5*, 7B5*
6X4	- <u>6X4W</u> , 6BX4, <u>6AV4*</u> , <u>6063</u> , 6202, <u>EZ20(f)</u> , <u>U78(f)</u>	7C6	- 7B6*, DH149(f)
6X5	- 6AX5*, 6W5*, 6ZY5*, 1274*, (Cont'd)	7C7	- 7B7, 7H7
		7E5	- <u>1201</u>

Tube	Substitute	Tube	Substitute
7F7	- 7AF7, 7N7*	12AK7	- 12AZ7*, <u>12AXZ</u> , 12AY7, 12AD7
7F8	- <u>ZF8W</u>	12AT6	- 12AV6, 12BK6, 12BF6(t), 12BT6(t), 12BU6(t), <u>HBC90(f)</u>
7G7	- 7A7*, 7B7*, 7C7*, 7H7*, 7L7*, 7V7, <u>1232*</u>	12AT7	- <u>12AT7WA</u> , <u>6060</u> , <u>6201</u> , <u>6679</u> , 12AU7, 12AV7*, 12AX7, 12AY7, 12AZ7*, ECC31(f), B309(f), B152(f)
7G8	- <u>1206</u>	12AU6	- 12BA6, 12BD6, <u>B329(f)</u> , <u>ECC82(f)</u> , HF94(f)
7H7	- 7A7, 7B7*, 7C7*, 7L7, 7T7, 7V7*, 1273	12AU7	- <u>12AU7WA</u> , <u>5814</u> , <u>5814A</u> , <u>606Z</u> , <u>6189</u> , <u>6680</u> , 5963, 12AZ7*(t), <u>12AU7A</u> , 12AT7, 12AX7, 12AY7, 12AV7*
7J7	- 7B8, 7S7	12AV6	- 12AT6, 12BK6, 12BT6, 12BU6, 12BF6(t), HBC91(f)
7L7	- 7A7, 7G7*, 7H7, 7T7, 7V7*	12AV7	- 5965, <u>12AZZ</u> , 12AT7*, 12AU7*, 12AX7*, 12AY7*, 12BH7*
7N7	- 7AF7*, 7F7*	12AX4GT-	<u>12AX4GTA</u>
7R7	- 7E7	12AX7	- 12AT7, 12AU7, 12AY7, 12AV7*, 12BH7*, 12AZ7*, <u>12AD7</u> , <u>5751</u> , <u>605Z</u> , <u>6681</u> , <u>ECC83(f)</u>
7S7	- 7B8, 7J7, X81(f), X148(f)	12AY7	- 12AT7, 12AU7, 12AV7*, 12AX7, 12BH7*, <u>60Z2</u>
7T7	- 7A7, 7B7*, 7C7*, 7G7*, 7H7, 7L7, 7V7, 1231*, 1273	12AZ7	- 12AT7, 12BH7, 12AU7(t), 12AX7(t), 12AY7(t), <u>12AVZ</u>
7V7	- 7B7*, 7C7*, 7G7, 1232	12B4	- 12A4, <u>12B4A</u>
7X7	- <u>XXFM</u>	12B7	- <u>14A7</u>
7Y4	- 7Z4*	12BA6	- 12AU6, 12BD6, <u>HF93(f)</u>
7Z4	- 7Y4	12BD6	- 12AU6, 12BA6
8A8	- L2319(f), PCF80(f), 30C1(f)	12BE6	- <u>HK90(f)</u>
8AU8	- 8AW8, 8BA8, 8BH8, <u>8AU8A</u>	12BF6	- 12BU6, 12AT6(t), 12AV6(t), 12BK6, 12BT6
8AW8	- 8AU8, 8BH8	12BH7	- 12AT7*, 12AU7*, <u>12BHZA</u> , 12AV7*, 12AX7*, 12AY7*, 12AZ7*
8BA8	- 8AU8, 8AW8	12BK6	- 12BU6, 12BT6, 12AT6, 12AV6, 12BF6(t)
8BH8	- 8AU8, 8AW8	12BQ6	- <u>12BQ6GA</u> , <u>12BQ6GTA</u> , <u>12BQ6GTB</u> , <u>12C06</u> , <u>12D06</u> , 12CH6
9A8	- <u>PCF80(f)</u>	12BT6	- 12AT6, 12AV6, 12BK6, 12BU6, 12BF6(t)
9AK8	- <u>PABC80(f)</u>	12BU6	- 12BF6, 12AT6(t), 12AV6(t), 12BK6(t), 12BT6(t)
9A08	- PCC85(f)		
9U8	- <u>PCF82(f)</u> , <u>9U8A</u>		
10	- <u>10Y</u> , <u>RK10</u> , 50, <u>210</u> , <u>310</u>		
10Y	-- <u>10</u> , RK10, 50, <u>210</u> , <u>310</u>		
12A	- 71A		
12A4	- 12B4		
12A8	- 12K8		
12AC5-	<u>UF41(f)</u>		
12AC6-	12AF6		
12AD6-	12AG6		
12AD7-	<u>12AXZ*</u>		
12AE6-	12AT6, 12AV6		
12AF6-	12AC6		
12AG6-	12AD6		

Tube	Substitute	Tube	Substitute
12BV7	- <u>12BYZ</u> , <u>12BYZA</u>	14C5	- 14A5*
12BY7	- <u>12BYZA</u> , <u>12BYZ</u>	14C7	- <u>14BZ</u> , <u>1284</u> , 14A7, 14H7, 1280
12BZ7	- 12AX7*	14E6	- 14B6
12C5	- 12CA5, <u>12CU5</u>	14E7	- 14K7
12CA5	- 12C5	14F7	- 14K7, 14AF7/XXD
12CU5	- <u>12C5</u>	14H7	- 14A7, 14C7, 1280, 1284
12CU6	- <u>12BQ6</u> , <u>12DQ6</u>	14J7	- 14B8, 14S7
12D4	- 12AX4, 12AX4GTA	14K7	- <u>UCH42(f)</u>
12DQ6	- 12BQ6, 12BQ6GA, 12BQ6GTA, 12BQ6GTB, 12CU6, 12CH6	14L7	- <u>URC41(f)</u>
12DT7	- <u>7025</u>	14N7	- 14AF7/XX2*
12E5	- 1626*, 12J5, 12J5GT, 12J5WGT	14R7	- 14E7
12J5	- 1626*, 12E5, <u>12J5GT</u> , <u>12J5WGT</u>	14S7	- 14B8, 14J7
12J7	- 12K7	14W7	- 12B7, 14A7, 14C7, 14H7, 1280, 1284
12K7	- 12J7	15A6	- <u>PL83(f)</u>
12K8	- 12A8	16A5	- <u>PL82(f)</u> , N329(f)
12L6	- <u>12W6</u> , 1632	17DQ6	- <u>17DQ6GA</u> , <u>17DQ6A</u>
12L8	- 1644	17Z3	- <u>PY81(f)</u>
12SA7	- <u>12SYZ</u>	19A05	- <u>HL90(f)</u>
12SC7	- 1634	19AU4	- <u>19AU4GTA</u>
12SG7	- 12SH7, 12SJ7, 12SK7	19B66	- <u>19B66G</u> , <u>19B66GA</u>
12SH7	- 12SG7, 12SJ7, 12SK7	19C8	- 19T8
12SJ7GT	- <u>12SJ7</u>	19T8	- 19C8
12SK7	- 12SG7, 12SH7, 12SJ7, <u>12SK7GT</u>	19X3	- <u>19Y3</u>
12SL7	- <u>2C52*</u>	19Y3	- <u>19X3</u> , U154(f), <u>PY82(f)</u> , U319(f)
12SN7	- 12SX7, 12SL7*(t), 12X7, 12SN7GT, 12SN7GTA, B36(f)	20	- X99*(f)
12SQ7	- 12SR7, 12SW7(t)	21A6	- <u>PL81(f)</u> , N152(f), N359(f)
12SR7	- 12SQ7, 12SW7, <u>12SR7GT</u> ,	24A	- 35/51(t)
12SW7	- 12SQ7(t), 12SR7	25A6	- 25B6, 25C6, 25L6, 5824
12SX7	- 12SN7, 12SL7*(t)	25A7	- <u>32L7</u>
12SY7	- 12SA7	25AV5GT	- <u>25AV5GA</u>
12W6	- <u>12L6</u> , 1632	25AX4	- 25U4, 25W4
14A7/12BH7	- 1280, 1284, 14C7, 14H7	25B5	- 43
14AF7/XXD	- 14F7, 14N7*	25B6	- 25A6, 25G6, 25L6, 25N6, 5824
14B6	- 14E6	25BQ6	- <u>25BQ6GT</u> , <u>25BQ6GA</u> , <u>25BQ6GTB</u> , 25CU6, 25DQ6
14B8	- 14J7, 14S7	25BQ6GA	- <u>25BQ6GTB</u> , 25CU6, 25DQ6
		25BQ6GT	- <u>25BQ6GA</u> , <u>25BQ6GTB</u> , (Cont'd.)

Tube	Substitute	Tube	Substitute
25BQ6GT	- (Cont'd) 25CU6, 25DQ6	39/44	- 36
25C5	- 25CA5	40	- 00A, 01A, 12A
25C6	- 25A6, 25B6, 25L6, 25N6, 5824	40A1	- 40B2
25CA5	- 25C5	40B2	- 40A1
25CD6	- 25DN6	41	- 42
25CU6	- <u>25BQ6</u> , <u>25DQ6</u> , <u>25BQ6G</u> , <u>25BQ6GA</u> , <u>25BQ6GT</u> , <u>25BQ6GTB</u>	42	- 6B5, 41
25DN6	- 25CD6	45	- 2A3
25DQ6	- <u>25BQ6</u> , <u>25BQ6G</u> , <u>25BQ6GT</u> , <u>25BQ6GTB</u> , <u>25CU6</u> , <u>25BQ6GA</u>	45Z5	- 35Z5 (series fil.)
25L6	- 6046, 25A6; 25B6, 25C6, 25N6, 5824, KT32(f)	50	- 10
25S	- 1B5	50AX6	- 50Z6
25U4	- <u>25AX4</u> , <u>25W4</u>	50C5	- <u>HL22(f)</u>
25W4	- 25U4, 25AX4	50C6	- 50L6
25Y5	- <u>25Z5</u>	50L6	- 50C6
25Z5	- <u>25Y5</u>	50Y7	- 50Z7
25Z6	- <u>25Z6GT</u> , <u>25Z6WGT</u> , 35Z6(t)	50Z6	- 50AX6
26A6	- 26CG6	50Z7	- 50Y7
26BK6	- 26C6(t)	53	- <u>5608-A</u>
26C6	- 26BK6(t)	55	- <u>2A6</u>
26CG6	- 26A6	55S	- <u>2A6</u> , <u>55</u>
27	- 56	56	- 27, 485
28D7	- <u>28D7W</u> , 1238	56AS	- <u>37*</u> , <u>76*</u>
28D7W	- <u>28DZ</u> , 1238	56S	- <u>27</u> , <u>56</u>
30	- 31*	57	- 58
31	- 30*	57AS	- <u>6C6*</u> , <u>77*</u>
32	- 1A4, 1B4, 951	57S	- 57, 58
32L7	- 25A7	58	- 57(t)
33	- 1F4*, 950*	58AS	- <u>6D6*</u> , <u>78*</u>
34	- 1A4, 1B4, 32, 951	58S	- <u>57</u> , <u>58</u>
35/51	- 24A	71A	- 482, 483
35A5	- 50A5 (series fil.)	75	- 6C6(t), 85(t)
35B5	- 50B5 (series fil.)	76	- <u>37</u>
35Z6	- 50Z6 (series fil.)	77	- <u>6C6</u> , <u>1221</u>
35L6	- 50C6, 50L6	78	- <u>6D6</u>
35Z5	- 45Z5 (series fil.)	80	- 83V, 83, 5Z3
36	- 39/44	81	- 10(t), 50(t)
37	- 76	82	- 2A3(t), 45(t)
		83	- 5Z3
		83V	- 5Z3, 80, 83
		85	- 75
		85AS	- <u>85</u>
		89	- 89Y
		117L7GT	- <u>117L7</u> / <u>N7GT</u>

Tube	Substitution	Tube	Substitution
117L7/M7GT	- 117L7GT	1622	- <u>6L6</u> , 6F6*, 6V6*, 5881
117N7GT	- 117P7GT	1626	- 12E5*, 12J5*
117P7GT	- 117N7GT	1632	- <u>12L6</u> , <u>12W6</u>
182B/482B	- <u>Z1A</u> , <u>183/483</u>	1634	- 125C7
183/483	- <u>Z1A</u> , 182B/482B	1635	- 6V7, 6N7*
807	- <u>5933</u> , QV05-25(f), 807W	1639	- EBC33(f)
807W	- <u>5933</u> , 807, QV05-25(f)	1644	- 12L8
884	- 6Q5	2050	- <u>2051</u>
950	- 1F4, 33*	2051	- <u>2050</u>
954	- <u>956</u>	5517	- <u>CK1013</u>
955	- 5731(t)	5590	- 6BC5*, 5591, 9001, 9003, 6AG5*(t)
956	- <u>954</u>	5591	- 5590, 9001, 9003, 6AG5*, 6BC5*(t), 6AK5, 5654, 6CF6*
957	- 958A*	5608A-	<u>53</u>
958A	- 957*	5610	- 6C4
1005/CK1005	- 0Y4, 0Z4A	5633	- <u>5634</u>
1201	- <u>7E5</u>	5634	- <u>5633</u>
1203	- <u>7C4</u>	5641	- EY70(f)
1204	- <u>7AB7</u>	5651	- 0A3
1206	- <u>7G8</u>	5654	- 6AJ5, 6AK5, <u>6096</u> , 5591
1221	- <u>6C6</u> , <u>ZZ</u>	5670	- <u>5670WA</u> , 2C51
1223	- <u>6JZ</u>	5670WA	- 5670, 2C51
1229	- <u>1A4</u> , <u>1B4</u> , <u>32</u> , <u>951</u>	5672	- 5678
1230	- <u>30</u>	5676	- 5677*
1231	- <u>7G7</u> , 7V7	5677	- 5676*
1232	- <u>7G7</u>	5678	- 5672
1238	- 28D7	5691	- 6SL7*, 6SN7(t)
1266	- 0B3	5692	- 6SN7, <u>6180</u>
1267	- 0A4	5693	- <u>6SJZ</u>
1273	- <u>7A7</u> , 7AJ7, 7H7, 7L7, 7T7	5702	- 5784
1274	- 6AX5*, 6W5*, 6ZV5*, <u>6X5</u>	5718	- EC70(f)
1275	- <u>5Z3</u> , 5X3, 80, 83, 83V	5725	- <u>6AS6W</u> , 6AS6, 6187
1280	- 12B7, 1284	5726	- <u>6AL5W</u> , 6AL5, 6058, 6097
1284	- 12B7, 1280	5727	- <u>2D21W</u> , 2D21
1291	- <u>3BZ</u>	5732	- 6K7
1293	- 11E3*	5749	- <u>6BA6W</u> , 6BA6
1294	- <u>1R4</u>	5750	- 6BE6, 6BE6W
1299	- <u>3D6</u>	5751	- <u>5751WA</u> , 12AX7, 6057
1612	- <u>6LZ</u>	5751WA	- 12AX7, 6057, 5751
1614	- <u>6L6</u> , <u>5881</u>	5812	- 2E30
1620	- <u>6JZ</u>	5814	- 12AU7, 5814WA, 12AU7A
1621	- 6F6, <u>5881</u> , 6K6*, 6L6*, 6V6*		

Tube	Substitute	Tube	Substitute
5814A-	12AU7, 5814, <u>5814WA</u> , 12AU7A	6097 -	6AL5, 5726
5824 -	25B6, 25L6	6100 -	6C4
5838 -	5839 *	6101 -	6J6
5839 -	5838 *	6113 -	6SL7
5840 -	5899, 5900, 5901	6132 -	6CH6
5861 -	TD03-10 (f)	6134 -	6AC7
5871 -	6V6, 5992	6135 -	6C5
5881 -	1622, 5932, 1621*, 6K6(t), 6F6(t), 6U6(t), 6V6(t)	6136 -	6AU6, 6AU6WA, 6AU6WB
5899 -	5840, 5900, 5901	6137 -	6SK7
5900 -	5840, 5899, 5901	6180 -	5692 , 6SN7
5901 -	5840, 5899, 5900	6186 -	6AG5
5910 -	1U4	6187 -	6AS6W , 6AS6, <u>5725</u>
5915 -	6BY6, <u>6BE6</u>	6189 -	<u>12AU7WA</u> , 12AU7
5930 -	2A3	6201 -	12AT7, 6060
5931 -	<u>5U4GB</u>	6202 -	6X4
5932 -	6L6, 5881	6252 -	QQV03-28(f)
5933 -	807	6265 -	6BH6
5961 -	6SA7	6267 -	EF86 (f)
5963 -	12AU7	6360 -	QQV03-10(f)
5964 -	6J6	6373 -	EL70(f)
5965 -	12AV7, <u>6829</u>	6374 -	<u>EY84</u> (f)
5992 -	6V6, 5871*	6375 -	DC70(f)
5998 -	6AS7*	6485 -	6AH6
6005 -	<u>6AQ5W</u> , 6AQ5, <u>6095</u>	6487 -	EF70(f)
6006 -	6SG7	6488 -	EF73 (f)
6046 -	25L6, 5824	6489 -	EA76 (f)
6057 -	12AX7, 5751	6550 -	6L6
6058 -	6AL5, 5726	6661 -	6BH6
6060 -	12AT7, 6201	6662 -	6BJ6
6063 -	6X4	6663 -	6AL5
6064 -	6AM6	6669 -	6AQ5
6066 -	6AT6	6677 -	6CL6
6067 -	5814 * 12AU7	6679 -	12AT7
6072 -	12AY7	6680 -	12AU7
6073 -	0A2	6681 -	12AX7
6074 -	0B2	6688 -	E180F(f)
6080 -	6AS7	6779 -	Z803U(f)
6087 -	5Y3GT	6829 -	5965
6095 -	<u>6AQ5W</u> , 6AQ5, 6005	6922 -	E88CC(f)
6096 -	<u>6AK5</u> , 5654	7000 -	<u>6JZ</u>
		7700 -	6C6 , 1603
		8016 -	<u>1B3</u>

Tube	Substitute	Tube	Substitute
9001 - 5590, 5591, 9003(t)		X155 - 6BZ8 , 6BC8,	
9003 - 5590, 9001		6BE7, 6B07,	
CK1013 - 5517		6BS8, 6BZ7	
VI52 - 10*(t), 50*(t)		XXFM - 7XZ	
X99 - 20*		XXL - 7A4	

Every effort has been made to make this replacement guide complete and accurate. Nevertheless, there is always the possibility of a few errors of omission or commission. For this reason, the publisher assumes no responsibility in connection with substitutions made in accordance with this guide.

If the tube for which a substitute is desired, is not listed, this is probably because a change in socket or wiring would be necessary in order to use a different type tube or because no suitable substitute can be obtained.

Where a tube is to be substituted in a modern series string circuit, it is important to use only that type which has controlled warm-up time. Use of a tube lacking this feature may result in premature failure. For example a 6SN7GTA tube must not be substituted in a series string circuit for a 6SN7GTB, since the former lacks the controlled warm-up feature.

SECTION 2

TV PICTURE TUBE REPLACEMENT GUIDE

Newer Models

How to Select Picture Tubes Suitable for Substitution

1. Use Index "A" to find tube to be replaced. If not found in this index, it may be listed below in the index of older tubes, Index "B".
2. Refer to the Code Letter in Index "A", which appears at the right of the tube type to be replaced. This is the Code Letter of the Replacement Group.
3. Next, refer to this Code Letter in the Replacement Group Table. All tubes having the same Group Code Letter have identical basing connections. These groups have also been arranged so that round tubes are grouped only with other round tubes and rectangular tubes are found only in the same groups as other rectangular tubes. Tubes of similar deflection angles are grouped together. Tubes of similar maximum anode voltage ratings are also grouped together. It is undesirable to substitute a tube of lower maximum voltage rating in the place of one having a higher maximum anode voltage rating.

No effort has been made to segregate tubes having external conductive coating from those without such coating. When a tube with external conductive coating is used to replace one without such coating, the external coating must be grounded to the chassis. When a tube without external coating is used to replace one with this coating, it is necessary to connect a suitable special high-voltage condenser between the anode connection and the chassis. Required condenser values range from 400 MMF minimum to 3000 MMF maximum. Best values may be determined by trial. Suggested minimum and maximum values in MMF are given in the last column of the Table of Replacement Groups. The condenser is generally installed close to the high voltage rectifier.

4. Having located the particular GROUP you must use, in the REPLACEMENT GROUP TABLE, the next step is to select as your first choice a picture tube which most closely fits the specifications of the original tube as to deflection angle, maximum anode voltage, type of ion trap, method of focus and dimensions.

Some of the picture tubes listed use a single field ion trap; others require a double field ion trap. Still others need no ion trap. Various types will be found in the same group, since it is a simple matter to dispense with the ion trap if not required with the substitute tube, or to substitute a single magnet ion trap for a double magnet one, or vice versa. If a different ion trap is specified for the substitute tube, this should be installed.

Single field ion traps are coded "S" in the Replacement Group Table. Double field ion traps are coded "D". If no ion trap is required, code letter "N" is used.

5. If the tube selected cannot be obtained, make a second selection from the same group. In this case it may be necessary to select a tube having a different type of ion trap or possibly one using a different method of focusing. Methods of focusing include High Voltage Electrostatic focusing, Low-Voltage Electrostatic focusing, Automatic Electrostatic focusing (self-focusing) and Magnetic focusing.

Following coding is used in the Focus Column of the Replacement Tube Table:

High Electrostatic Focusing --	HE
Low Electrostatic Focusing --	LE
Automatic -----	A
Magnetic Focusing -----	M

When substituting a self-focusing tube for a magnetically focused tube, remove the focus coil from the tube neck and mount it in the cabinet as far from the new tube as possible. It will usually be necessary to install a magnetic centering device. The focus coil should not be disconnected from the circuit unless it is replaced by an equivalent inductance or focus resistance.

When substituting an automatic electrostatic focus tube for an electrostatic focus tube, no change in socket wiring is necessary and it is unnecessary to remove the focus electrode lead from the socket.

To avoid the necessity of wiring changes, magnetic focus tubes have not been grouped with electrostatic focus tubes. When replacing a high voltage electrostatic focus tube with a low voltage electrostatic focus tube or an automatic focus tube, it is best to remove the focus rectifier.

6. If a substitute tube is selected which has a different nominal length, make sure that the new tube will fit into the space formerly occupied by the original tube. If the curvature of the face plate is different, a new mask may be required. Although the recessed small cavity cap is the most common type of anode connector, other types such as metal-shell lip, cone, etc. may be encountered, in which case the necessary change can be made without difficulty. Differences in face plates, such as gray filter glass, clear glass, tinted glass, frosted glass, etc. do not affect interchangeability, hence picture tubes with such differences may be found in the same groups.

Typical Example

Let us assume that it is desired to find a substitute picture tube for a 17BRP4 tube. Referring to the Index "A" we find that this belongs in the "S" Group. Next, referring to the Table of Replacement Groups, it is immediately apparent that the closest replacement is the 17CKP4. However, any of the other tubes listed in the "S" group may be substituted for the 17BRP4 even though the maximum anode voltage rating of these other tubes is 17.6 KV, since these tubes will operate well at 14 KV, which is a typical operating voltage for the 17BRP4. If any of these other tubes is substituted, ion trap must not be used.

INDEX A

Plx Tube Type -- Replacement Group Code Letter

9QP4	-- A	14QP4 A	-- K	17CWP4	-- S	21DLP4	-- W
9QP4A	-- A	14RP4	-- L	17CXP4	-- U	21DMP4	-- X
10ABP4	-- B	14RP4A	-- L	17CYP4	-- U	21DNP4	-- W
10ABP4A	-- B	14SP4	-- L	17CZP4	-- U	21DQP4	-- W
10ABP4B	-- B	14WP4	-- L	17DCP4	-- U	21DRP4	-- W
10ABP4C	-- B	14ZP4	-- L	17DJP4	-- U	21DSP4	-- W
10ADP4	-- B	15CP4	-- M	21ACP4	-- V	21DVP4	-- W
10AEP4	-- B	15DP4	-- M	21ACP4A	-- V	21DWP4	-- X
10BP4	-- C	15DP4A	-- M	21ALP4	-- W	21ELP4	-- W
10BP4A	-- C	16KP4	-- N	21ALP4A	-- W	21EMP4	-- X
10BP4C	-- C	16KP4A	-- N	21ALP4B	-- W	21ENP4	-- W
10BP4D	-- C	16RP4	-- N	21AMP4	-- V	21EQP4	-- Z
10FP4	-- C	16RP4A	-- N	21AMP4A	-- V	21ERP4	-- Z
10FP4A	-- C	16SP4	-- O	21ATP4	-- W	24ADP4	-- AA
12LP4	-- D	16SP4A	-- O	21ATP4A	-- W	24AEP4	-- AB
12LP4A	-- D	16YP4	-- O	21BAP4	-- W	24AHP4	-- AC
12LP4C	-- D	17ATP4	-- P	21BNP4	-- W	24AJP4	-- AB
12QP4	-- E	17ATP4A	-- P	21BSP4	-- V	24ALP4	-- AC
12QP4A	-- E	17AVP4	-- P	21BTP4	-- W	24ANP4	-- AB
12RP4	-- E	17AVP4A	-- P	21CBP4	-- W	24AQP4	-- AC
12TP4	-- E	17BP4	-- R	21CBP4A	-- W	24ASP4	-- AB
12UP4	-- E	17BJP4	-- P	21CBP4B	-- W	24ATP4	-- AB
12UP4A	-- E	17BKP4	-- P	21CDP4	-- W	24AUP4	-- AB
12UP4B	-- E	17BKP4A	-- P	21CDP4A	-- W	24AWP4	-- AC
12YP4	-- D	17BMP4	-- Q	21CEP4	-- X	24AXP4	-- AC
12ZP4	-- F	17BNP4	-- Q	21CEP4A	-- X	24CP4	-- AA
12ZP4A	-- F	17BRP4	-- S	21CGP4	-- W	24CP4A	-- AA
14ACP4	-- G	17BUP4	-- Q	21CHP4	-- W	24DP4	-- AB
14AEP4	-- G	17BVP4	-- T	21CKP4	-- W	24DP4A	-- AB
14AJP4	-- H	17BWP4	-- T	21CMP4	-- W	24QP4	-- AA
14ARP4	-- G	17BYP4	-- T	21CQP4	-- Y	24TP4	-- AA
14ASP4	-- H	17BZP4	-- S	21CSP4	-- Y	24VP4	-- AA
14ATP4	-- G	17CAP4	-- S	21CUP4	-- V	24VP4A	-- AA
14AUP4	-- G	17CDP4	-- S	21CVP4	-- W	24YP4	-- AB
14AVP4	-- H	17CP4, A	-- R	21CWP4	-- W	24ZP4	-- AB
14AWP4	-- G	17CBP4	-- Q	21CXP4	-- W	27EP4	-- AD
14BP4	-- I	17CKP4	-- S	21CZR4	-- X	27GP4	-- AD
14BP4A	-- I	17CMP4	-- U	21DAP4	-- X	27LP4	-- AE
14CP4	-- J	17CNP4	-- U	21DEP4	-- X	27MP4	-- AD
14CP4A	-- J	17CRP4	-- U	21DEP4A	-- X	27NP4	-- AE
14EP4	-- J	17CSP4	-- T	21DFP4	-- X	27RP4	-- AE
14GP4	-- K	17CTP4	-- S	21DHP4	-- X	27SP4	-- AF
14HP4	-- K	17CUP4	-- U	21DJP4	-- W	27UP4	-- AF
14QP4	-- K	17CVP4	-- S	21DKP4	-- X	27VP4	-- AF

REPLACEMENT GROUP TABLE

Group	Tube Type	Def. Angle in Degrees	Max. Anode Volts in KV	Approx. Length in Inches	Ion Trap	Focus	Min/Max Condenser Value in MMF.
A	9QP4	70	7.4	12 3/4	S	LE	None
A	9QP4A	70	7.48	12 3/4	S	LE	None
B	10ABF4	90	13.2	11 7/8	S	LE	400/850
B	10ABF4A	90	13.2	11 7/8	S	LE	400/850
B	10ABF4B	90	13.2	11 7/8	S	LE	400/850
B	10ABF4C	90	13.2	11 7/8	S	LE	400/850
B	10ADP4	90	13.2	11 7/8	S	LE	400/850
B	10AEP4	90	13.2	11 7/8	S	LE	400/850
C	10BP4	50	11	17 5/8	D	M	500/2500
C	10BF4A	50	11	17 5/8	D	M	500/2500
C	10BF4C	50	11	17 5/8	S	M	500/2500
C	10BP4D	50	11	17 5/8	S	M	500/2500

C	10FP4	50	11	17 5/8	N	M	500/2500
C	10FP4A	50	13.2	17 5/8	N	M	500/2500
D	12LP4	54	13.2	18 3/4	D	M	750/3000
D	12LP4A	54	13.2	18 3/4	D	M	750/3000
D	12LP4C	54	13.2	18 3/4	D	M	750/3000
D	12YP4	54	13.2	18 3/4	S	A	750/3000
E	12QP4	54	13.2	17 1/2	S	M	None
E	12QP4A	54	13.2	17 1/2	S	M	None
E	12RP4	50	13.2	17 1/2	S	M	None
E	12TP4	54	13.2	18 3/4	D	M	None
E	12UP4	54	13.2	18 3/4	S	M	None
E	12UP4A	54	13.2	18 3/4	S	M	None
E	12UP4B	54	13.2	18 3/4	S	M	None
F	12ZP4	54	13.2	17 5/8	S	M	500/2500
F	12ZP4A	54	13.2	17 5/8	S	M	500/2500

Group	Tube Type	Def. Angle in Degrees	Max Anode Volts in KV	Approx. Length in Inches	Ion Trap	Focus	MIn/Max Condenser Value in MMF.
G	14ACP4	90	15.4	14 3/16	S	LE	800/1200
G	14AEP4	90	15.4	13 3/16	N	LE	800/1200
G	14ARP4	90	15.4	13 3/16	N	LE	800/1200
G	14ATP4	90	15.4	13 3/16	N	LE	500/1000
G	14AJP4	90	16.5	13 3/16	N	LE	1000/1500
G	14AW4	90	15.4	13 3/16	N	LE	800/1200
H	14AJP4	110	12.1	11 7/16	S	LE	500/850
H	14ASP4	110	15.4	11 3/8	N	LE	500/850
H	14AVP4	110	15.4	11/38	N	LE	450/700
I	14BP4	70	13.2	16 3/16	S	M	500/2000
I	14BP4A	70	13.2	16 13/16	S	M	500/2000
J	14CP4	70	15.4	16 3/4	S	M	750/2000
J	14CP4A	70	15.4	16 3/4	S	M	750/2000
J	14EP4	70	15.4	16 1/2	S	M	125/1250

K	14GP4	70	15.4	16 13/16	S	HE	750/2000
K	14HP4	70	15.4	16 13/16	S	LE	750/2000
K	14QP4	70	12.1	16 5/32	S	LE	600/1000
K	14QP4A	70	12.1	16 5/32	S	LE	600/1000
L	14RP4	90	15.4	14 3/16	S	LE	800/1200
L	14RP4A	90	15.4	14 3/16	S	LE	800/1200
L	14SP4	90	15.4	14 3/16	S	LE	900/1200
L	14WP4	90	15.4	13 3/16	N	LE	800/1200
L	14ZP4	90	15.4	13 3/16	N	LE	800/1200
M	15CP4	52	16.5	21 1/2	D	M	None
M	15DP4	57	16.5	20 1/2	S	M	None
M	15DP4A	57	16.5	20 1/2	S	M	None
N	16KP4	70	17.6	18 3/4	S	M	750/1500
N	16KP4A	70	17.6	18 3/4	S	M	750/1500
N	16RP4	70	17.6	18 3/4	S	M	750/1500
N	16RP4A	70	17.6	18 3/4	S	M	750/1500

Group	Tube Type	Def. Angle in Degrees	Max Anode Volts in KV	Approx Length in Inches	Ion Trap	Focus	Min/Max Condenser Value in MMF.
O	16SP4	70	15.4	17 5/16	D	M	1500/3500
O	16SP4A	70	15.4	17 5/16	D	M	1500/3500
O	16YP4	70	15.4	17 5/16	S	M	750/2000
P	17AT7P4	90	17.6	15 9/16	S	LE	750/1500
P	17ATP4A	90	17.6	15 9/16	S	LE	750/1500
P	17AVP4	90	17.6	15 5/8	S	LE	1000/1500
P	17AVP4A	90	17.6	15 5/8	S	LE	1000/1500
P	17BJP4	90	17.6	14 5/8	N	LE	1000/1500
P	17BKP4	90	17.6	15 5/8	S	LE	1200/1500
P	17BKP4A	90	17.6	15 5/8	S	LE	1200/1500
Q	17EMP4	90	19.8	15 5/8	S	LE	750/1500
Q	17ENP4	90	19.8	14 5/8	N	LE	750/1500
Q	17BUP4	90	19.8	15 1/4	S	LE	1200/1500
Q	17CBP4	90	19.8	15 1/4	S	LE	1000/1500

R	17BP4	70	17.6		19 1/4	S	M	None
R	17CP4	70	17.6		18 5/8	S	M	None
R	17CP4A	70	17.6		18 5/8	S	M	None
S	17BRP4	110	16.5		12 9/16	S	LE	1000/1500
S	17BZP4	110	17.6		12 9/16	N	LE	1000/1500
S	17CAP4	110	17.6		12 9/16	N	LE	1000/1500
S	17CDP4	110	17.6		12 9/16	N	LE	800/1500
S	17CKP4	110	16.5		12 9/16	S	LE	1000/1500
S	17CTP4	110	17.6		12 9/16	N	LE	1000/1500
S	17CVP4	110	17.6		12 9/16	N	LE	1000/1500
S	17CWP4	110	17.6		11 5/8	N	LE	1000/1500
T	17BVP4	110	17.6		13 1/4	S	LE	1000/1500
T	17BWP4	110	17.6		12 5/16	N	LE	1000/1500
T	17BYP4	110	17.6		12 5/16	N	LE	1000/1500
T	17CSP4	110	17.6		12 5/8	N	LE	900/1400

Group	Tube Type	Def. Angle in Degrees	Max. Anode Volts in KV	Approx. Length in Inches	Ion Trap	Focus	Min/Max Condenser Value in MMF
U	17CMP4	90	17.6	15	N	LE	1200/1500
U	17CNP4	90	17.6	14 5/8	N	LE	1200/1500
U	17CRP4	90	17.6	14 5/8	N	LE	1700/2200
U	17CUP4	90	17.6	15	N	LE	1000/1500
U	17CXP4	90	17.6	14 5/8	N	LE	1000/1500
U	17CYP4	90	17.6	14	N	LE	1000/1500
U	17CZP4	90	17.6	13 5/8	N	LE	1000/1500
U	17DCP4	90	17.6	14 5/8	N	LE	1000/1500
U	17DJP4	90	17.6	15 5/8	S	LE	1000/1500
V	21ACP4	90	22	20	S	M	2000/2500
V	21ACP4A	90	22	20	S	M	2000/2500
V	21AMP4	90	19.8	20	S	M	2000/2500
V	21AMP4A	90	19.8	20	S	M	2000/2500
V	21BSP4	90	22	20	S	M	2000/2500
V	21CUP4	90	22	20	S	M	2000/2500

W	21ALP4	90	19.8	20	S	LE	500/750
W	21A LP4	90	19.8	20	S	LE	500/750
W	21ALP4B	90	22	20	S	LE	500/750
W	21ATP4	90	19.8	20	S	LE	1200/1500
W	21ATP4A	90	22	20	S	LE	1200/1500
W	21BAP4	90	22	20	N	LE	2000/2500
W	21BNP4	90	22	20	N	LE	2000/2500
W	21BTP4	90	22	20	S	LE	2000/2500
W	21CBP4	90	19.8	18	N	LE	2000/2500
W	21CBP4A	90	22	18	N	LE	2000/2500
W	21CBP4B	90	22	18	N	LE	2000/2500
W	21CDP4	90	22	20 3/8	S	LE	2000/2500
W	21CDP4A	90	22	20 3/8	S	LE	2000/2500
W	21CGP4	90	22	20	S	LE	2000/2500
W	21CHP4	90	22	18	N	LE	2000/2500
W	21CKP4	90	22	18	N	LE	2000/2500
W	21CMP4	90	22	19	S	LE	2000/2500

Group	Tube Type	Def. Angle in Degrees	Max. Anode Volts in KV	Approx. Length in Inches	Ion Trap	Focus	Min/Max Condenser Value in MMF
W	21CVP4	90	22	20	N	LE	2000/2500
W	21CWP4	90	22	20	S	LE	2000/2500
W	21CXP4	90	22	18	N	LE	2000/2500
W	21DJP4	90	22	18	N	LE	2000/2500
W	21DLP4	90	22	17	N	LE	2000/2500
W	21DNP4	90	22	19	S	LE	1200/1500
W	21DQP4	90	20	17 1/2	N	LE	2000/2500
W	21DRP4	90	22	18 1/4	N	LE	2000/2500
W	21DSP4	90	22	18	N	LE	2000/2500
W	21DVP4	90	22	20	S	LE	500/750
W	21ELP4	90	22	19	N	LE	2000/2500
W	21ENP4	90	20	19	S	LE	2000/2500
X	21CEP4	110	19.8	14 7/8	N	LE	2000/2500
X	21CEP4A	110	22	14 7/16	N	LE	2000/2500
X	21CZP4	110	19.8	14 11/16	S	LE	2000/2500

X	21DAP4	110	19.8	14 11/16	N	LE	2000/2500
X	21DEP4	110	19.8	14 11/16	N	LE	2000/2500
X	21DEP4A	110	22	14 11/16	N	LE	2000/2500
X	21DFP4	110	19.8	14 7/16	N	LE	1500/2200
X	21DHP4	110	19.8	14 11/16	N	LE	1700/2500
X	21DKP4	110	19.8	14 11/16	N	LE	1700/2500
X	21DMP4	110	22	13 3/4	N	LE	2000/2500
X	21DWP4	110	19.8	14 7/16	N	LE	2000/2500
X	21EMP4	110	19.8	13 3/16	N	LE	2000/2500
Y	21CQP4	110	19.8	14 7/16	N	LE	2000/2500
Y	21CSP4	110	19.8	14 7/16	N	LE	2000/2500
Z	21EQP4	110	20	12 9/16	N	LE	2000/2500
Z	21ERP4	110	20	12 3/16	N	LE	1500/2000

Group	Tube Type	Def. Angle in Degrees	Max. Anode Volts in KV	Approx Length in Inches	Ion Trap	Focus	MIn/Max Condenser Value in MMF
AA	24ADP4	90	24.2	21 1/8	S	M	2000/2500
AA	24CF4	90	22	21 1/8	S	M	2000/2500
AA	24CF4A	90	22	21 1/8	S	M	2000/2500
AA	24QP4	90	19.8	21 1/8	S	M	500/750
AA	24TP4	90	22	21 1/8	S	M	250/2500
AA	24VP4	90	24.2	21 1/8	S	M	2000/2500
AA	24VP4A	90	24.2	21 1/8	S	M	2000/2500
AB	24AEP4	90	22	19 1/8	N	LE	2000/2500
AB	24AJP4	90	22	19 1/8	N	LE	2000/2500
AB	24ANP4	90	22	20 1/8	S	LE	1700/2500
AB	24ASP4	90	22	19 1/8	N	LE	1700/2500
AB	24ATP4	90	22	19 1/8	N	LE	1700/2500
AB	24AUP4	90	22	18 1/8	N	LE	1700/2500
AB	24DP4	90	22	21 1/8	S	LE	2000/2500

AB	24DP4A	90	22	21 1/8	S	LE	2000/2500
AB	24YP4	90	22	21 1/8	S	LE	2000/2500
AB	24ZP4	90	22	21 1/8	N	LE	2000/2500
AC	24AHP4	110	22	15 7/8	N	LE	1700/2500
AC	24ALP4	110	22	15 5/8	N	LE	1700/2500
AC	24AQP4	110	22	15 7/8	N	LE	1700/2500
AC	24AWP4	110	22	14 7/8	N	LE	2000/2500
AC	24AXP4	110	22	15 7/8	N	LE	1700/2500
AD	27EP4	90	22	23 1/16	S	M	None
AD	27GP4	90	24.7	23 1/16	S	M	None
AD	27MP4	90	19.8	21 3/4	S	M	None

Group	Tube Type	Def. Angle in Degrees	Max. Anode Volts in KV	Approx Length in Inches	Ion Trap	Focus	Min/Max Condenser Value in MMF
AE	27LP4	90	24.2	24 23/64	S	M	250/400
AE	27NP4	90	19.8	23	S	M	2000/2500
AE	27RP4	90	22	23 1/16	S	M	2000/2500
AF	27SP4	90	22	23 1/16	S	LE	500/750
AF	27UP4	90	22	23 1/16	S	LE	500/750
AF	27VP4	90	19.8	21 1/16	N	LE	2000/2500

MEANING OF CODE LETTERS IN
ABOVE TABLE

Ion Traps

S - Single Field
D - Double Field
N - No Ion Trap Required

Focusing Methods

HE - High Voltage Electrostatic Focusing
LE - Low Voltage Electrostatic Focusing
A - Automatic (self) Focusing
M - Magnetic Focusing

SECTION 3

TV PICTURE TUBE REPLACEMENT GUIDE

Older Models

Picture tubes are listed in the following INDEX according to type designations, starting with 7AP4 and ending with 30BP4. Wherever substitution is possible, each type number is followed by the number of a SUBSTITUTION GROUP. Tubes in any individual substitution group are interchangeable, some directly with no changes whatsoever, while others require certain changes.

Easy as A, B, C
to Find Tubes Which Are 100% Interchangeable.

Use INDEX B to find the tube to be replaced. This will direct you to the SUBSTITUTION GROUP to which this tube belongs. Next, refer to the KEY column of this group. If tube to be replaced has an "A" in the KEY column, any other tube in this particular group with an "A" in the same column may be used as a substitute without any changes whatsoever. If tube to be replaced has a "B" in the KEY column, it can be replaced without changes, by any tube in the same group with a "B" in that column. Similarly, tubes with "C" are 100% replaceable by other tubes with "C", if in the same substitution group.

In other words, all tubes with the same letter in the KEY column in any particular substitution group are directly interchangeable, since they are identical in all essential features including basing, dimensions, external coating, type of ion trap, etc. This feature makes it as easy as A, B, C to locate a 100% interchangeable picture tube using this guide.

If no letter appears in the KEY COLUMN after any particular tube, this indicates that this tube, while interchangeable with other tubes in its group, will require changes or that it has different dimensions from the other tubes. In many instances, these changes are slight. Their extent can be determined readily by consulting the characteristics given under the other column headings.

The FACE DESCRIPTION column tells whether face of tube is clear, gray, gray frosted, etc. Differences in this column do not affect interchangeability. Treated and frosted screens reduce reflections of external light; aluminized screens give increased brightness, while gray faced tubes improve contrast.

The BASING column designations refer to the basing diagrams which follow Substitution Group 32. These show the socket wiring used with each tube. No changes in the socket wiring are needed in any individual substitution group, with the exception of Group 1. Where two different basing designations are shown with identical socket wiring such as 12L and 12M these are used merely to indicate the absence or presence of external conductive coating.

The DIMENSIONS column permits selection of a suitable substitution tube to fit the cabinet dimensions. Where the neck length of the tube to be replaced is longer than that of the replacement, there may not be sufficient room for best adjustment of the focus coil, yoke and ion trap. It is better to select a replacement tube with the same or slightly shorter neck length.

Presence or absence of EXTERNAL TUBE COATING must be taken into consideration when making picture tube substitutions. When a tube without external coating is used to replace one with this coating, it is necessary to connect a 500 MMF condenser of suitable high voltage rating between anode and chassis. When a tube with external coating is used to replace one without such coating, the external coating must be grounded to the chassis.

The ANODE CONNECTOR column shows whether ball or cavity connector is used. If the replacement tube has a different connector, the change must be made accordingly.

Note from the ION TRAP column that some replacement tubes do not require an ion trap. If a different ion trap is specified for the new tube, this should be installed.

The MAXIMUM ANODE VOLTAGE column gives the rating of each tube. If the set operating voltage is higher than the maximum rating of the tube, it is undesirable to use the tube as a replacement.

When substituting an electrostatic or self-focusing tube for a magnetically focused tube, remove the focus coil from the tube neck and mount it in the cabinet as far from the tube as possible. It should not be disconnected from the circuit unless it is replaced by an equivalent inductance or focus resistance. In substituting an automatic electrostatic focus tube for an electrostatic focus tube, no change in socket wiring is needed and it is unnecessary to remove the focus electrode lead from the socket.

How to Use the TV Picture Tube Guide to Select a Replacement Tube

- a. Carefully read the preceding instructions regarding column headings and necessary adjustments.
- b. Locate the tube you wish to replace in the following INDEX and find the substitution group for this tube.
- c. Pick a tube which is directly interchangeable by consulting the KEY column (tubes with same letters in same group are directly interchangeable). If no tube in the group is directly interchangeable, select the replacement tube which requires the least number of changes. (Different type faces such as bold, italics, regular, indicate need for changes).
- d. Note significant differences in neck length and anode voltages, checking with preceding instructions to determine whether substitution is feasible. Make sure tube selected as a replacement will fit cabinet.

EXAMPLE: To Replace a 17AP4 Tube. This tube is in SUBSTITUTION GROUP 18. Since there is no letter in the KEY column, there is no direct replacement. The 17BP4A shown in bold face is identical with the 17AP4 in every respect except in overall length and in neck length. The longer neck length will not affect the substitution. If the 17BP4A is not available, the 17BP4B or 17BP4C may be used as substitutes or the more popular 17JP4 (shown in italics). Its higher anode voltage rating of 18 KV permits it to be used in a set supplying an operating voltage of 16 KV. The most popular tubes are listed in bold faced type. Other popular tubes are shown in italics.

INDEX B

Type Number	Substitution Group	Type Number	Substitution Group	Type Number	Substitution Group	Type Number	Substitution Group
7AP4	None	14BP4A	10	16TP4	16	20CP4C	25
7CP4	1	14CP4	10	16UP4	16	20DP4	25
7DP4	1	14DP4	10	16VP4	17	20DP4A	25
7HP4	2	14EP4	10	16WP4	17	20FP4	27
7NP4	3	14FP4	10	16WP4A	17	20GP4	27
7QP4	2	14GP4	None	16XP4	16	20HP4	26
7RP4	None	14HP4	None	16YP4	17	20HP4A	26
7TP4	None	14KP4	None	16ZP4	11	20HP4B	26
7WP4	3	15AP4	11	17AP4	18	20JP4	25-26-27
8AP4	4	15CP4	11	17BP4	18	20LP4	26
8AP4A	4	15DP4	11	17BP4A	18	20MP4	26
9AP4	None	15EP4	None	17BP4B	18	21AP4	None
9CP4	None	16BP4	13-16-21	17BP4C	18	21DP4	None
10BP4	5	16ACP4	12	17CP4	20	21EP4	28
10BP4A	5	16AEP4	13	17CP4A	20	21EP4A	28
10CP4	5	16AP4	14	17FP4	21	21EP4B	28
10DP4	None	16AP4A	14	17FP4A	21	21FP4	29
10EP4	5	16AP4B	14	17GP4	None	21FP4A	29
10FP4	5	16CP4	11	17HP4	13	21JP4	None
10FP4A	5	16DP4	12	17HP4A	13	21KP4	28-29
10MP4	6	16DP4A	12	17JP4	18	21KP4A	28-29
10MP4A	6	16EP4	14	17KP4	13-18-21	21MP4	None
10RP4	None			17LP4	22	21WP4	25
10SP4	None	16EP4A	14	17LP4A	22	21XP4	26
12AP4	None	16EP4B	14	17QP4	19	21XP4A	26
12CP4	None	16FP4	12	17RP4	13	21YP4	26
12JP4	7	16GP4	15	17SP4	19-22	21ZP4	25
12KP4	7	16GP4A	15	17TP4	None	21ZP4A	25
12KP4A	7	16GP4B	15	17UP4	19	22AP4	30
12LP4	7	16GP4C	15	17VP4	22	22AP4A	30
12LP4A	7	16HP4	12	17YP4	None	24AP4	31
12QP4	7	16HP4A	12	19AP4	23	24AP4A	31
12QP4A	7	16JP4	12	19AP4A	23	24AP4B	31
12RP4	7	16JP4A	12	19AP4B	23	24BP4	None
12TP4	7	16KP4	16	19AP4C	23	24CP4	None
12UP4	8	16KP4A	16	19AP4D	23	24DP4	None
12UP4A	8	16LP4	11	19DP4	24	27AP4	None
12UP4B	8	16LP4A	11	19DP4A	24	27EP4	32
12VP4	9	16MP4	12	19EP4	25	27GP4	32
12VP4A	9	16MP4A	12	19FP4	24	27LP4	None
12WP4	None	16QP4	16	19GP4	24	27MP4	None
12XP4	None	16RP4	16	19JP4	25	27NP4	32
12YP4	7	16SP4	17	19QP4	26	27RP4	32
14BP4	10	16SP4A	17	20BP4	None	30BP4	None
				20CP4	25		
				20CP4A	25		

SUBSTITUTION GROUPS

Type Number	Key (See "Introductory Notes")	Face Description	Basing	Maximum Dimensions in Inches			External Tube Coating	Anode Connector	Ion Trap	Maximum Anode Voltage (KV)
				Over-all Length	Diameter or Height x Width	Neck Length				

GROUP 1: Glass, spherical, round, electrostatic-focus, 50° to 57° deflection angles.

7CP4		Clear		8BQ		13 $\frac{1}{16}$ "		7 $\frac{1}{8}$ "		No		Ball		None		8
7DP4		Clear		12R		14 $\frac{1}{16}$ "		7 $\frac{1}{8}$ "		Yes		Cavity		Double		8

GROUP 2: Glass, spherical, round, magnetic-focus, 50° to 52° deflection angles.

7HP4		Clear		12N		13 $\frac{3}{16}$ "		7 $\frac{1}{16}$ "		Yes		Ball		Double		8.8
7QP4		Clear		12D		13 $\frac{3}{16}$ "		7 $\frac{1}{16}$ "		No		Cavity		Single		10

GROUP 3: Glass, spherical, round, projection, magnetic-focus, 35° deflection angle.

7NP4		Clear		14N		20 $\frac{1}{16}$ "		7 $\frac{1}{16}$ "		No		Cap		None		80
7WP4		Clear		14N		20 $\frac{1}{16}$ "		7 $\frac{1}{16}$ "		Yes		Cap		None		80

GROUP 4: Metal, spherical, round, magnetic-focus, 54° deflection angle.

8AP4		Clear		12H		14 $\frac{5}{16}$ "		8 $\frac{1}{16}$ "		7 $\frac{1}{16}$ "		Cone Lip		Single		9
8AP4A		Gray		12H		14 $\frac{5}{16}$ "		8 $\frac{1}{16}$ "		7 $\frac{1}{16}$ "		Cone Lip		Single		9

GROUP 5: Glass, spherical, round, magnetic-focus, 50° to 54° deflection angles.

10BP4	A	Clear	12N	18	10%	8%	Yes	Cavity	Double	10
10BP4A	A	Gray	12N	18	10%	8%	Yes	Cavity	Double	10
10CP4		Clear	12N	17	10%	7%	Yes	Ball	Double	12
10EP4		Clear	12N	18	10%	8%	Yes	Ball	Double	12
10FP4	B	Clear, Alum.	12N	18	10%	8%	Yes	Cavity	None	12
10FP4A	B	Gray, Alum.	12N	18	10%	8%	Yes	Cavity	None	12

GROUP 6: Glass, spherical, round, magnetic-focus, 52° deflection angle.

10MP4	A	Clear	12G	17%	10%	7%	Yes	Cavity	Double	10
10MP4A	A	Gray	12G	17%	10%	7%	Yes	Cavity	Double	10

GROUP 7: Glass, spherical, round, magnetic-focus (unless otherwise indicated), 50° to 56° deflection angles.

12JP4		Clear	12D	18	12 $\frac{3}{16}$ †	7 $\frac{1}{4}$	No	Ball	None	12
12KP4	A	Clear, Alum.	12N	18	12 $\frac{3}{16}$	7 $\frac{3}{16}$	Yes	Cavity	None	12
12K1/4A	A	Gray, Alum.	12N	18	12%	7 $\frac{3}{16}$	Yes	Cavity	None	12
12LP4	B	Clear	12N	19%	12 $\frac{1}{2}$	8%	Yes	Cavity	Double	12
12LP4A	B	Gray	12N	19%	12 $\frac{1}{2}$	8 $\frac{1}{16}$	Yes	Cavity	Double	12
12QP4	C	Clear	12D	17%	12%	7 $\frac{3}{16}$	No	Ball	Single	12
12QP4A	C	Gray	12D	17%	12%	7 $\frac{3}{16}$	No	Ball	Single	12
12RP4		Clear	12D	18	12 $\frac{3}{16}$ †	7 $\frac{1}{4}$	No	Ball	Single	12
12TP4		Clear	12D	19%	12 $\frac{1}{2}$	8 $\frac{1}{16}$	No	Cavity	Double	12
12YP4*		Clear	12N	19%	12 $\frac{1}{2}$	8 $\frac{1}{16}$	Yes	Cavity	Single	12

Type Number	Key (See "Introductory Notes")	Face Description	Basing	Maximum Dimensions in Inches			External Tube Coating	Anode Connector	Ion Trap	Maximum Anode Voltage (KV)
				Over-all Length	Diameter or Height x Width	Neck Length				

GROUP 8: Metal, spherical, round, magnetic-focus, 54° deflection angle.

12UP4	A	Clear	12D	19	12½	8⅞	—	Cone Lip	Double	12
12UP4A	A	Gray	12D	19	12½	8⅞	—	Cone Lip	Double	12
12UP4B		Gray, Treated	12D	19	12½	8⅞	—	Cone Lip	Single	12

GROUP 9: Glass, spherical, round, magnetic-focus, 55° deflection angle.

12VP4	A	Clear	12G	18½	12½	7⅞	Yes	Cavity	Double	12
12VP4A	A	Gray	12G	18½	12½	7⅞	Yes	Cavity	Double	12

GROUP 10: Glass, spherical, rectangular, rectangular, magnetic-focus, 65° deflection angle.

14BP4	A	Gray	12N	17⅞	9⅞x12⅞	7⅞	Yes	Cavity	Single	14
14BP4A	A	Gray, Treated	12N	17⅞	9⅞x12⅞	7⅞	Yes	Cavity	Single	14
14CP4	A	Gray	12N	17⅞	9⅞x12⅞	7⅞	Yes	Cavity	Single	14
14DP4		Gray	12D	17⅞	9⅞x12⅞	7⅞	No	Cavity	Double	14
14EP4		Gray	12N	16⅞	9⅞x12⅞	7⅞	Yes	Cavity	Single	14
14FP4		Gray	12D	16⅞	9⅞x12⅞	7⅞	No	Cavity	Single	14

GROUP 11: Glass, spherical, round, magnetic-focus, 50° to 57° deflection angles.

15AP4		Clear	12D	20%	15⅜	7⅞	No	Ball	Note	15
15CP4		Clear	12D	21%	15⅜	8⅞	No	Cavity	Double	15
15DP4		Clear	12D	20%	15⅜	7⅞	No	Ball	Single	15
16CP4		Clear	12D	21%	15⅞	6⅞	No	Cavity	Double	15
16LP4	A	Clear	12N	22%	16	7⅞	Yes	Cavity	Double	14
16LP4A	A	Gray	12N	22%	16	7⅞	Yes	Cavity	Double	14
16ZP4		Gray	12N	22%	16	7⅞	Yes	Cavity	Double	16

GROUP 12: Glass, spherical, round, magnetic-focus (unless otherwise indicated), 60° to 62° deflection angles.

16ACP4*	Clear	12N	21 $\frac{1}{2}$	16	8 $\frac{1}{4}$	Yes	Cavity	Single	14
16DP4	Clear	12D	21	16	8 $\frac{1}{16}$	No	Cavity	Double	15
16DP4A	Gray	12D	21	16	7 $\frac{3}{4}$	No	Cavity	Double	15
16FP4	Clear	12D	20 $\frac{3}{8}$	16 $\frac{3}{8}$	7 $\frac{1}{8}$	No	Ball	Single	16
16HP4	Clear	12N	21 $\frac{1}{8}$	16	8 $\frac{1}{8}$	Yes	Cavity	Double	14
16HP4A	Gray	12N	21 $\frac{1}{8}$	16	8 $\frac{1}{16}$	Yes	Cavity	Double	14
16JRA	Clear	12N	21 $\frac{1}{8}$	16 $\frac{3}{8}$	7 $\frac{11}{16}$	Yes	Cavity	Double	14
16JP4A	Gray	12N	21 $\frac{1}{8}$	16 $\frac{3}{8}$	7 $\frac{11}{16}$	Yes	Cavity	Double	14
16MP4	Clear	12N	22 $\frac{1}{2}$	16 $\frac{3}{8}$	8 $\frac{1}{16}$	Yes	Cavity	Double	14
16MP4A	Gray	12N	22 $\frac{1}{2}$	16 $\frac{3}{8}$	8 $\frac{1}{16}$	Yes	Cavity	Double	14

GROUP 13: Glass, spherical, rectangular, low-voltage electrostatic-focus (unless otherwise indicated), 65° deflection angle.

16ABP4*	Gray	12N	19 $\frac{1}{8}$	11 $\frac{5}{8}$ x 14 $\frac{1}{8}$	7 $\frac{11}{16}$	Yes	Cavity	Single	16
16AEP4	Gray	12L	19 $\frac{1}{8}$	11 $\frac{5}{8}$ x 14 $\frac{1}{8}$	7 $\frac{11}{16}$	Yes	Cavity	Single	16
17HP4	Gray	12L	19 $\frac{1}{16}$	12 $\frac{3}{8}$ x 15 $\frac{1}{2}$	7 $\frac{11}{16}$	Yes	Cavity	Single	16
17HP4A	Gray, Treated	12L	19 $\frac{1}{16}$	12 $\frac{3}{8}$ x 15 $\frac{1}{2}$	7 $\frac{11}{16}$	Yes	Cavity	Single	16
17KP4*	Gray	12P	19 $\frac{3}{8}$	12 $\frac{3}{8}$ x 15 $\frac{1}{2}$	7 $\frac{11}{16}$	Yes	Cavity	Single	16
17RP4	Gray	12L	19 $\frac{3}{8}$	12 $\frac{3}{8}$ x 15 $\frac{1}{2}$	7 $\frac{11}{16}$	Yes	Cavity	Single	16

GROUP 14: Metal, spherical, round, magnetic-focus, 53° to 60° deflection angles.

16AP4	Clear	12D	22 $\frac{3}{8}$	16	7 $\frac{5}{8}$	—	Cone Lip	Double	14
16AP4A	Gray	12D	22 $\frac{3}{8}$	16	7 $\frac{3}{8}$	—	Cone Lip	Double	14
16AP4B	Gray, Frosted	12D	22 $\frac{3}{8}$	16	7 $\frac{3}{8}$	—	Cone Lip	Double	14
16EP4	Clear	12D	20	16	6 $\frac{9}{16}$	—	Cone Lip	Double	14
16EP4A	Gray	12D	20	16	6 $\frac{3}{16}$	—	Cone Lip	Double	14
16EP4B	Gray, Treated	12D	20	16	6 $\frac{3}{16}$	—	Cone Lip	Single	14

Type Number	Key (See "Introductory Notes")	Face Description	Basing	Maximum Dimensions in Inches			External Tube Coating	Anode Connector	Ion Trap	Maximum Anode Voltage (KV)
				Over-all Length	Diameter or Height x Width	Neck Length				

GROUP 15: Metal, spherical, round, magnetic-focus, 70° deflection angle.

16GP4	A	Gray	12D	17 ¹¹ / ₁₆	16	7	—	Cone Lip	Single	14
16GP4A	A	Clear	12D	17 ¹¹ / ₁₆	16	7	—	Cone Lip	Single	14
16GP4B	A	Gray, Frosted	12D	17 ¹¹ / ₁₆	16	7	—	Cone Lip	Single	14
16GP4C	A	Clear, Frosted	12D	17 ¹¹ / ₁₆	16	7	—	Cone Lip	Single	14

GROUP 16: Glass, spherical, rectangular, magnetic-focus (unless otherwise indicated), 65° deflection angle.

16ABP4*		Gray	12N	19 ¹ / ₈	11 ⁵ / ₈ x14 ⁷ / ₈	7 ¹¹ / ₁₆	Yes	Cavity	Single	16
16KP4	A	Gray	12N	19 ¹ / ₈	11 ⁵ / ₈ x14 ⁷ / ₈	7 ¹¹ / ₁₆	Yes	Cavity	Single	16
16KP4A	A	Gray, Alum.	12N	19 ¹ / ₈	11 ⁵ / ₈ x14 ⁷ / ₈	7 ¹¹ / ₁₆	Yes	Cavity	Single	16
16QP4		Gray	12D	19 ¹ / ₈	11 ⁵ / ₈ x14 ⁷ / ₈	8 ¹ / ₈	No	Cavity	Double	16
16RP4	A	Gray	12N	19 ¹ / ₈	11 ⁵ / ₈ x14 ⁷ / ₈	7 ¹¹ / ₁₆	Yes	Cavity	Single	16
16TP4		Gray	12N	18 ¹ / ₂	11 ⁵ / ₈ x14 ⁷ / ₈	7 ⁷ / ₈	Yes	Cavity	Single	14
16UP4		Gray	12D	18 ¹ / ₈	11 ⁵ / ₈ x14 ⁷ / ₈	7 ⁷ / ₈	No	Cavity	Single	15
16XP4		Gray	12D	19 ¹ / ₈	11 ⁵ / ₈ x14 ⁷ / ₈	7 ¹¹ / ₁₆	No	Cavity	Double	15

GROUP 17: Glass, spherical, round, magnetic-focus, 70° deflection angle.

16SP4	A	Clear	12N	17 ¹¹ / ₁₆	16	7 ⁷ / ₈	Yes	Cavity	Double	14
16SP4A	A	Gray	12N	17 ¹¹ / ₁₆	16	7 ⁷ / ₈	Yes	Cavity	Double	14
16VP4		Gray	12D	17 ⁷ / ₈	16	7 ⁷ / ₈	No	Cavity	Single	15
16WVP4		Gray	12D	18 ¹ / ₈	16	7 ⁵ / ₈	No	Cavity	Double	15
16WVP4A		Gray	12N	18 ¹ / ₈	16	7 ⁷ / ₈	Yes	Cavity	Double	16
16YP4		Gray	12N	17 ¹¹ / ₁₆	16	7 ⁷ / ₈	Yes	Cavity	Single	14

GROUP 18: Glass, spherical, rectangular, magnetic-focus (unless otherwise indicated), 65° deflection angle.

17AP4	Gray	12N	19	12 $\frac{3}{8}$ x15 $\frac{1}{2}$	7 $\frac{1}{16}$	Yes	Cavity	Single	16
17BP4	Gray	12D	19 $\frac{5}{16}$	12 $\frac{3}{8}$ x15 $\frac{1}{2}$	7 $\frac{1}{16}$	No	Cavity	Single	16
17BP4A	Gray	12N	19 $\frac{5}{16}$	12 $\frac{3}{8}$ x15 $\frac{1}{2}$	7 $\frac{1}{16}$	Yes	Cavity	Single	16
17BP4B	Gray, Alum.	12N	19 $\frac{5}{16}$	12 $\frac{3}{8}$ x15 $\frac{1}{2}$	7 $\frac{1}{16}$	Yes	Cavity	Single	16
17BP4C	Gray, Treated	12N	19 $\frac{5}{16}$	12 $\frac{3}{8}$ x15 $\frac{1}{2}$	7 $\frac{1}{16}$	Yes	Cavity	Single	16
17J1'4	Gray	12N	19 $\frac{5}{16}$	12 $\frac{3}{8}$ x15 $\frac{1}{2}$	7 $\frac{1}{16}$	Yes	Cavity	Single	18
17KP4*	Gray	12P	19 $\frac{5}{16}$	12 $\frac{3}{8}$ x15 $\frac{1}{2}$	7 $\frac{1}{16}$	Yes	Cavity	Single	16

GROUP 19: Glass, cylindrical, rectangular, magnetic-focus (unless otherwise indicated), 65° to 70° deflection angles.

17QP4	Gray	12N	19 $\frac{1}{16}$	12 $\frac{3}{8}$ x15 $\frac{1}{2}$	7 $\frac{1}{16}$	Yes	Cavity	Single	16
17SP4*	Gray	12N	19 $\frac{1}{16}$	12 $\frac{3}{8}$ x15 $\frac{1}{2}$	7 $\frac{1}{16}$	Yes	Cavity	Single	14
17UP4	Gray	12N	19 $\frac{1}{16}$	12 $\frac{3}{8}$ x15 $\frac{1}{2}$	7 $\frac{1}{16}$	Yes	Cavity	Single	14

GROUP 20: Metal, spherical, rectangular, magnetic-focus, 66° deflection angle.

17CP4	Gray, Frosted	12D	19	12 $\frac{3}{8}$ x16 $\frac{1}{16}$	7 $\frac{1}{16}$	—	Cone Lip	Single	16
17CP4A	Gray	12D	19	12 $\frac{3}{8}$ x16 $\frac{1}{16}$	7 $\frac{1}{16}$	—	Cone Lip	Single	16

GROUP 21: Glass, spherical, rectangular, high-voltage electrostatic-focus (unless otherwise indicated), 65° deflection angle.

16ABP4*	Gray	12N	19 $\frac{1}{16}$	11 $\frac{1}{8}$ x14 $\frac{3}{4}$	7 $\frac{1}{16}$	Yes	Cavity	Single	16
17FP4	Gray	12L	19 $\frac{5}{16}$	12 $\frac{3}{8}$ x15 $\frac{1}{2}$	7 $\frac{1}{16}$	Yes	Cavity	Single	18
17FP4A	Gray	12L	19 $\frac{5}{16}$	12 $\frac{3}{8}$ x15 $\frac{1}{2}$	7 $\frac{1}{16}$	Yes	Cavity	Single	18
17KP4*	Gray	12P	19 $\frac{5}{16}$	12 $\frac{3}{8}$ x15 $\frac{1}{2}$	7 $\frac{1}{16}$	Yes	Cavity	Single	16

GROUP 22: Glass, cylindrical, rectangular, low-voltage electrostatic-focus (unless otherwise indicated), 65 to 66° deflection angles.

17LP4	Gray	12L	19 $\frac{9}{16}$	12 $\frac{3}{8}$ x15 $\frac{1}{2}$	7 $\frac{1}{16}$	Yes	Cavity	Single	16
17LP4A	Gray	12L	19 $\frac{9}{16}$	12 $\frac{3}{8}$ x15 $\frac{1}{2}$	7 $\frac{1}{16}$	Yes	Cavity	Single	16
17SP4*	Gray	12N	19 $\frac{9}{16}$	12 $\frac{3}{8}$ x15 $\frac{1}{2}$	7 $\frac{1}{16}$	Yes	Cavity	Single	14
17VP4	Gray	12L	19 $\frac{9}{16}$	12 $\frac{3}{8}$ x15 $\frac{1}{2}$	7 $\frac{1}{16}$	Yes	Cavity	Single	16

Type Number	Key (See "Introductory Notes")	Face Description	Basing	Maximum Dimensions in Inches			External Tube Coating	Anode Connector	Ion Trap	Maximum Anode Voltage (KV)
				Over-all Length	Diameter or Height x Width	Neck Length				

GROUP 23: Metal, spherical, round, magnetic-focus, 66° deflection angle.

19AP4	A	Clear	12D	22	18 $\frac{3}{4}$	7 $\frac{1}{2}$	—	Cone Lip	Single	19
19AP4A	A	Gray	12D	22	18 $\frac{3}{4}$	7 $\frac{1}{2}$	—	Cone Lip	Single	19
19AP4B	A	Gray, Frosted	12D	22	18 $\frac{3}{4}$	7 $\frac{1}{2}$	—	Cone Lip	Single	19
19AP4C	A	Gray, Alum.	12D	22	18 $\frac{3}{4}$	7 $\frac{1}{2}$	—	Cone Lip	Single	19
19AP4D	A	Clear, Frosted	12D	22	18 $\frac{3}{4}$	7 $\frac{1}{2}$	—	Cone Lip	Single	19

GROUP 24: Glass, spherical, round, magnetic-focus, 66° deflection angle.

19DP4	A	Clear	12N	21 $\frac{1}{2}$	19	7 $\frac{1}{2}$	Yes	Cavity	Double	17
19DP4A	A	Gray	12N	21 $\frac{1}{2}$	19	7 $\frac{1}{2}$	Yes	Cavity	Double	17
19FP4		Gray	12D	22 $\frac{1}{2}$	19	7 $\frac{1}{2}$	No	Cavity	Double	19
19GP4		Gray	12D	21 $\frac{1}{2}$	19	7 $\frac{1}{2}$	No	Cavity	Single	19

GROUP 25: Glass, spherical, rectangular, magnetic-focus (unless otherwise indicated), 65° to 66° deflection angles.

19EP4		Gray	12D	21 $\frac{1}{2}$	13 $\frac{1}{2}$ x17 $\frac{1}{2}$	7 $\frac{1}{2}$	No	Cavity	Single	19
19JP4		Gray	12D	21 $\frac{1}{2}$	13 $\frac{1}{2}$ x17 $\frac{1}{2}$	7 $\frac{1}{2}$	No	Cavity	Single	18
20CP4	A	Gray	12D	21 $\frac{1}{2}$	15 $\frac{1}{2}$ x18 $\frac{1}{2}$	7 $\frac{1}{2}$	No	Cavity	Single	18
20CP4A		Gray	12N	21 $\frac{1}{2}$	15 $\frac{1}{2}$ x18 $\frac{1}{2}$	7 $\frac{1}{2}$	Yes	Cavity	Single	18
20CP4C		Gray, Treated	12D	21 $\frac{1}{2}$	15 $\frac{1}{2}$ x18 $\frac{1}{2}$	7 $\frac{1}{2}$	No	Cavity	Single	18
20DP4	A	Gray	12D	22 $\frac{1}{2}$	15 $\frac{1}{2}$ x18 $\frac{1}{2}$	7 $\frac{1}{2}$	No	Cavity	Single	18
20DP4A		Gray	12N	22 $\frac{1}{2}$	15 $\frac{1}{2}$ x18 $\frac{1}{2}$	7 $\frac{1}{2}$	Yes	Cavity	Single	18
20JP4*		Gray	12P	22 $\frac{1}{2}$	15 $\frac{1}{2}$ x18 $\frac{1}{2}$	7 $\frac{1}{2}$	Yes	Cavity	Single	18
21WP4		Gray	12N	22 $\frac{1}{2}$	15 $\frac{1}{2}$ x18 $\frac{1}{2}$	7 $\frac{1}{2}$	Yes	Cavity	Single	18
21ZP4		Gray	12D	23 $\frac{1}{2}$	15 $\frac{1}{2}$ x20 $\frac{1}{2}$	7 $\frac{1}{2}$	No	Cavity	Single	18
21ZP4A		Gray	12N	23 $\frac{1}{2}$	15 $\frac{1}{2}$ x20 $\frac{1}{2}$	7 $\frac{1}{2}$	Yes	Cavity	Single	18

GROUP 26: Glass, spherical, rectangular, low-voltage electrostatic-focus (unless otherwise indicated), 65° to 66° deflection angles.

19QP4	Gray	12L	21½	13½x17½	7½	Yes	Cavity	Single	18
20HP4	Gray	12M	22½	15½x18¾	7½	No	Cavity	Single	16
20HP4A	Gray	12L	22½	15½x18¾	7½	Yes	Cavity	Single	16
20HP4B	Gray, Treated	12M	22½	15½x18¾	7½	No	Cavity	Single	16
20JP4*	Gray	12P	22½	15½x18¾	7½	Yes	Cavity	Single	18
20LP4	Gray	12L	22½	15½x18¾	7½	Yes	Cavity	Single	16
20MP4	Gray	12L	22½	15½x18¾	7½	Yes	Cavity	Single	16
21XP4	Gray	12L	22½	15½x18¾	7½	Yes	Cavity	Single	18
21XP4A	Gray	12L	22½	15½x18¾	7½	Yes	Cavity	Single	18
21YP4	Gray	12L	23½	15½x20½	7½	Yes	Cavity	Single	18

GROUP 27: Glass, spherical, rectangular, high-voltage electrostatic-focus (unless otherwise indicated), 65° to 66° deflection angles.

20FP4	Gray	12M	22½	15½x18¾	7½	No	Cavity	Single	18
20GP4	Gray	12L	22½	15½x18¾	7½	Yes	Cavity	Single	18
20JP4*	Gray	12P	22½	15½x18¾	7½	Yes	Cavity	Single	18

GROUP 28: Glass, cylindrical, rectangular, magnetic-focus (unless otherwise indicated), 65° to 70° deflection angles.

21EP4	Gray	12D	23½	15½x20½	7½	No	Cavity	Single	18
21EP4A	Gray	12N	23½	15½x20½	7½	Yes	Cavity	Single	18
21EP4B	Gray, Alum.	12N	23½	15½x20½	7½	Yes	Cavity	Single	18
21KP4*	Gray	12D	23½	15½x20½	7½	No	Cavity	Single	18
21KP4A*	Gray	12P	23½	15½x20½	7½	Yes	Cavity	Single	18

GROUP 29: Glass, cylindrical, rectangular, low-voltage electrostatic-focus (unless otherwise indicated), 65° to 70° deflection angles.

21FP4	Gray	12M	22½	15½x20½	7½	No	Cavity	Single	18
21FP4A	Gray	12L	22½	15½x20½	7½	Yes	Cavity	Single	18
21KP4*	Gray	12D	23½	15½x20½	7½	No	Cavity	Single	18
21KP4A*	Gray	12P	23½	15½x20½	7½	Yes	Cavity	Single	18

Type Number	Key (See "Introductory Notes")	Face Description	Basing	Maximum Dimensions in Inches			External Tube Coating	Anode Connector	Ion Trap	Maximum Anode Voltage (KV)
				Over-all Length	Diameter or Height x Width	Neck Length				

GROUP 30: Metal, spherical, round, magnetic-focus, 70° deflection angle.

22AP4	A	Clear	12D	23%	21 $\frac{1}{4}$ %	7 $\frac{1}{4}$ %	—	Cone Lip	Single	19
22AP4A	A	Gray	12D	23%	21 $\frac{1}{4}$ %	7 $\frac{1}{4}$ %	—	Cone Lip	Single	19

GROUP 31: Metal, spherical, round, magnetic-focus, 70° deflection angle.

24AP4	A	Gray	12D	24%	24%	7 $\frac{1}{2}$ %	—	Cone Lip	Single	16
24AP4A	A	Gray, Alum.	12D	24%	24%	7 $\frac{1}{2}$ %	—	Cone Lip	Single	16
24AP4B	A	Gray, Treated	12D	24%	24%	7 $\frac{1}{2}$ %	—	Cone Lip	Single	16

GROUP 32: Glass, spherical, rectangular, magnetic-focus, 85° to 90° deflection angles.

27EP4		Gray, Alum.	12D	23%	20 $\frac{1}{2}$ x25 $\frac{1}{2}$ %	7 $\frac{1}{4}$ %	No	Cavity	Single	20
27GP4		Gray	12D	23%	20 $\frac{1}{2}$ x25 $\frac{1}{2}$ %	7 $\frac{1}{4}$ %	No	Cavity	Single	22.5
27NP4		Gray	12N	23%	20 $\frac{1}{2}$ x25 $\frac{1}{2}$ %	7 $\frac{1}{4}$ %	Yes	Cavity	Single	18
27RP4		Gray, Alum.	12N	23%	20 $\frac{1}{2}$ x25 $\frac{1}{2}$ %	7 $\frac{1}{4}$ %	Yes	Cavity	Single	20

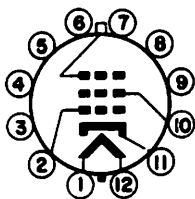
* Tube has automatic electrostatic-focus. This tube may be used as a substitute only. Replace it with other automatic electrostatic-focus tubes of the same Substitution Group.

† This tube has a face-plate radius of curvature of 20 inches. Dimension A (see Outline Drawings) of this tube is approximately half an inch larger than that of other tubes in this group. Inspect the particular mask to determine if this additional half inch can be accommodated.

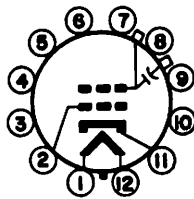
Outline and Basing Diagrams



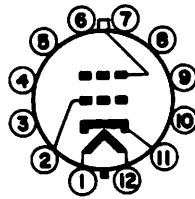
8BQ



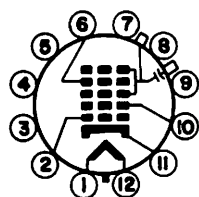
12D



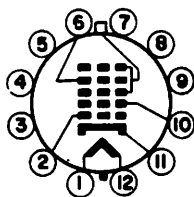
12G



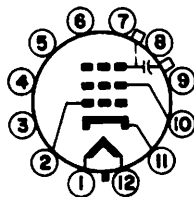
12H



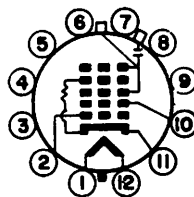
12L



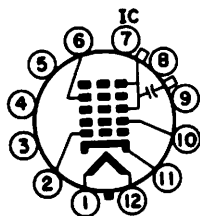
12M



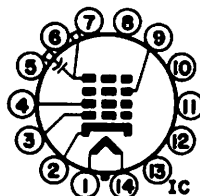
12N



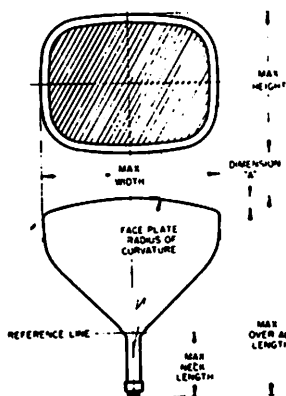
12P



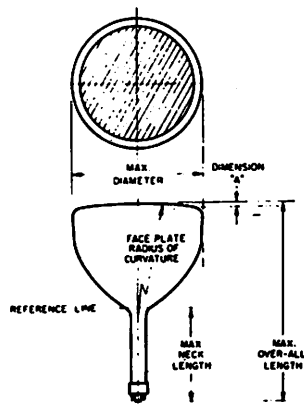
12R



14N



RECTANGULAR PICTURE TUBE



ROUND PICTURE TUBE

SECTION 4

U.S.A. SUBSTITUTES FOR FOREIGN TUBES

NOTE: Certain tube types in the list below may be substituted only in parallel connected circuits. These are indicated by an asterisk (*) after the tube designation. Some substitutes are European, now sold in U. S. A.

Tube	Substitute	Tube	Substitute
B36 - 12SN7		DK96 - 1AB6	
B65 - 6SN7		DL33 - 3Q5	
B152 - 12AT7		DL35 - 1C5	
B309 - 12AT7		DL36 - 1Q5	
B329 - 12AU7		DL91 - 1S4	
B339 - 12AX7		DL92 - 3S4	
BPM04 - 6AQ5		DL93 - 3A4	
D63 - 6H6		DL94 - 3V4	
D77 - 6AL5		DL95 - 3Q4	
D152 - 6AL5		DL96 - 3C4	
DA90 - 1A3		DL651 - CK546	
DAC32 - 1H5		DM70 - 1M3	
DAF91 - 1S5		DP61 - 6AK5	
DAF92 - 1U5		DY80 - 1X2A, 1X2B	
DAF96 - 1AH5		DY86 - 1S2, 1S2A, 1H2	
DC70 - 6375		E90CC - 5920	
DC80 - 1E3		E180F - 6688	
DCC90 - 3A5		EA76 - 6489	
DD6 - 6AL5		EAA91 - 6AL5	
DD7 - 6AL5		EAA9015 - 5726	
DF33 - 1N5		EABC80 - 6AK8, 6T8, 6R8	
DF62 - 1AD4		EB34 - 6H6*	
DF91 - 1T4		EB91 - 6AL5	
DF92 - 1L4		EBC33 - 1639	
DF96 - 1AF4, 1AJ4		EBC90 - 6AT6	
DF703 - CK5886		EBC91 - 6AV6	
DF904 - 1U4		EBF80 - 6N8	
DH63(M) - 6Q7, 6Q7GT		EBF86 - 6267	
DH77 - 6AT6		EC81 - 6R4	
DH149 - 7C6		EC90 - 6C4	
DK32 - 1A7		EC91 - 6AQ4	
DK91 - 1R5		EC90 - 6AB4	
DK92 - 1AC6		ECC33 - 6SN7*	

Tube	Substitute	Tube	Substitute
ECC35	- 6SL7*	EQ80	- 6BE7
ECC40	- 6N7*	EY51	- 6X2
ECC81	- 12AT7	EY80	- 6U3
ECC82	- 12AU7	EY86	- 6S2
ECC83	- 12AX7	EZ35	- 6X5/GT
ECC84	- 6BQ7A*	EZ80	- 6V4
ECC85	- 6AQ8	EZ81	- 6BW4*, 6AC4*
ECC91	- 6J6	EZ90	- 6X4
ECC801S	- 6201	GZ30	- 5Z4
ECF82	- 6U8	GZ32	- 5V4
ECH81	- 6AJ8	GZ34	- 5U4, 5AR4
ECL80	- 6AB8	H52	- 5U4
ECL82	- 6BM8	H63	- 6F5
EF80	- 6BX6	HABC80	- 19T8
EF85	- 6BY7	HBC90	- 12AT6
EF86	- 6DA6	HBC91	- 12AV6
EF89	- 6DA6	HCH42	- 14K7
EF91	- 6AM6	HD14	- 1H5
EF92	- 6CQ6	HD30	- 3B4
EF93	- 6BA6	HF93	- 12BA6
EF94	- 6AU6	HF94	- 12AU6
EF95	- 6AK5	HK90	- 12BE6
EF96	- 6AG5	HL90	- 19AQ5
EH90	- 6CS6	HL92	- 50 C5
EH900	- 5915	HM04	- 6BE6
EK90	- 6BE6	HY90	- 35W4
EL33	- 6M6G	KF35	- 1E5
EL34	- 6CA7	KK32	- 1C5
EL37	- 6L6	KL35	- 1F5
EL38	- 6CN6	KT32	- 25L6
EL81	- 6CJ6	KT63	- 6J7
EL83	- 6CK6	KT66	- 6L6*
EL84	- 6BQ5	KT81	- 7C5
EL85	- 6BN5	KTW63	- 6K7
EL86	- 6CW5	L63	- 6J5
EL90	- 6AQ5	L77	- 6C4
EL91	- 6AM5	LN152	- 6AB8
EL803	- 6CK6	LZ319	- 8A8, 9A8
EL821	- 6CH6	ME 1401	- ,5802
EM34	- 6CD7	MT5545	- 5545
EM35	- 6U5G	MW36-24	- 14EP4*
EM80	- 6BR5	MW43-61	- 17QP4*

Tube	Substitute	Tube	Substitute
N14	- 1C5	U154	- 19Y3
N17	- 3S4	U319	- 19Y3
N18	- 3Q4	UBC41	- 14L7
N19	- 3V4	UCH42	- 14K7
N77	- 6AM5	UF41	- 12AC5
N78	- 6BJ5	W17	- 1T4
N144	- 6AN5	W63	- 6K7
N147	- 6AG6	W77	- 60G5
N148	- 7C5	W179	- 6BY7
N152	- 21A6	X14	- 1A7
N329	- 16A5	X17	- 1R5
N709	- 6BQ5	X18	- 1AC6
N727	- 6AQ5	X63	- 6A8
PABC80	- 9AK8	X79	- 6AE8
PCC84	- 7AN7	Y61	- 6U5
PCC85	- 9AQ8	Y63	- 6U5
PCF80	- 8A8, 9A8	Z14	- 1N5
PCF82	- 9U8	Z63	- 6J7
PCL82	- 16A8	Z77	- 6AM6
PL21	- 5727	Z152	- 6BX6
PL36	- 25E5	Z719	- 6BX6
PL81	- 21A6	ZD17	- 1S5
PL82	- 16A5	1C1	- 1R5
PL83	- 15A6	1C2	- 1AC6
PM04	- 6BA6	1D13	- 1A3
PM05	- 6AK5	1F2	- 1L4
PM07	- 6AM6	1F3	- 1T4
PY81	- 17Z3	1FD9	- 1S5
PY82	- 19X3, 19Y3	1P10	- 3S4
QQV03-10	- 6360	1P11	- 3V4
QQV03-20A	- 6252	2D21	- 5727
QQV03-28	- 6252	6D2	- 6AL5
SP6	- 6AM6	6F12	- 6AM6
STV85/10	- 0G3	6M1	- 6U5G
STV108/30	- 0B2	7D9	- 6AM5
STV150/30	- 0A2	8D3	- 6AM6
U41	- 1B3	30C1	- 8A8
U50	- 5Y3	30L1	- 7AN7
U52	- 5U4	63ME	- 6U5G
U70	- 6X5	64ME	- 6CD7
U78	- 6X4	85A1	- 0E3
U147	- 6X5	85A2	- 0G3
		5881	- 6L6

SECTION 5

TRANSISTOR REPLACEMENT DATA

<p>2N34 - 2N131, 2N185, L5021, L5021L</p> <p>2N44 - 2N63</p> <p>2N63 - 2N44</p> <p>2N104 - 2N132, 2N215, R35, 310, L5022</p> <p>2N107 - CK722</p> <p>2N109 - 2N138A</p> <p>2N111 - 235, 2N135</p> <p>2N111A - 2N139, 2N218</p> <p>2N112 - 2N136, 2N140, 2N219, GT760</p> <p>2N113 - GT761, 2N137</p> <p>2N130 - 2T12</p> <p>2N131 - 2N34, 2N185, L5021, L5021L, 2N185</p> <p>2N132 - 2N104, 2N215, R35, 310, L5022</p> <p>2N133 - 2N175, 2N220</p> <p>2N135 - 2N111, 235</p> <p>2N136 - 2N112, 2N140, 2N219, GT760</p> <p>2N137 - 2N113, GT761</p> <p>2N138 - 2N189, 354, L5028</p> <p>2N138A - 2N217, 353</p> <p>2N139 - 2N111A, 2N139, 2N218</p> <p>2N140 - 2N112, 2N136, 2N140, 2N219, GT760</p>	<p>2N175 - 2N133, 2N220</p> <p>2N185 - 2N131, 2N34, L5021, L5021L</p> <p>2N189 - 2N138, 354, L5028</p> <p>2N215 - 2N132, 2N104, R35, 310, L5022</p> <p>2N217 - 2N138A, 353</p> <p>2N218 - 2N111A, 2N139</p> <p>2N219 - 2N112, 2N136, 2N140, 2N219, GT760</p> <p>2N220 - 2N133, 2N175</p> <p>2T12 - 2N130</p> <p>235 - 2N111, 2N135</p> <p>310 - 2N132, 2N104, 2N215, R35, L5022</p> <p>353 - 2N138A, 2N217</p> <p>354 - 2N138, 2N189, L5028</p> <p>GT760 - 2N112, 2N136, 2N140, 2N219</p> <p>GT761 - 2N113, 2N137</p> <p>L5021 - 2N131, L5021L, 2N34, 2N185</p> <p>L5021L - 2N131, L5021L, 2N34, 2N185</p> <p>L5022 - 2N132, 2N104, 2N215, R35, 310</p> <p>L5028 - 2N138, 2N189, 354</p> <p>R35 - 2N132, L5022, 2N104, 2N215, 310</p>
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Raytheon Subminiature Transistors

TYPE	EQUIVALENT	USE	TYPE	EQUIVALENT	USE
CK4	2N404	COMPUTER	CK81	2N481	IF and RF RADIO RECEIVER
CK25	2N425		CK82	2N482	
CK26	2N426		CK83	2N483	
CK27	2N427		CK84	2N484	
CK28	2N428		CK85	2N485	
CK22	2N422	GENERAL PURPOSE AUDIO	CK86	2N486	GENERAL PURPOSE RADIO FREQUENCY
CK64	2N464		CK87	2N487	
CK65	2N465		CK13	2N413	
CK66	2N466		CK14	2N414	
CK67	2N467		CK16	2N416	
CK34	CK734		CK17	2N417	

REPLACEMENT TRANSISTORS

For Popular Transistor Radio Sets

MANUFACTURER & MODEL	V BATT	CONVERTER	IF	IF	DET.	AF	POWER
Bulova 270C	9V	CK766 GE 2N136	2N112A 2N135	—	1N295 1N64	2N132 2N192	2N138A 2N241A
Bulova 270/277	9V	2N112 GE 2N136	2N135	—	CK706A 1N64	2N132 2N192	2N138 (2) 2N192 (2)
CBS TR 250	21V/12V	GE 2N136	2N135	2N135	4DJ1A26	—	2N44
CBS TR 260	9V	2N172 GE 2N169	2N146 2N169	2N146 2N169	1N60 1N64	310 2N192	2N189 (2) 2N189 (2)
Dewald K 701 & 702 Dewald	9V	2N112 GE 2N136	2N135	2N112 2N135	1N295 1N64	2N109 2N192	2N109 (2) 2N188 (2)
Dumont 1210	9V	2N168A GE 2N168A	2N168 2N293	2N168 2N293	Diode 1N64	CK882 2N192	CK888 (2) 2N188 (2)
Emerson 842	4V	830 GE 2N169	2N146 2N169	2N146 2N169	Diode 1N64	310 2N192	353 (2) 2N188 (2)
Emerson 855	9V	2N172 GE 2N169	2N146 2N169	2N146 2N169	1N195 1N64	2N109 2N192	2N109 (2) 2N188 (2)
GE 675 Ebony, 676 Ivory 677 Red, 678 Aqua	13½ 13½	Early Prod 2N136 Late Prod 2N135	2N137 2N135	2N135 2N135	2N78 1N87	— 2N169	2N44 2N44
GE P715 Beige, P716 Black	3V	GE 2N168A	2N169	2N169	1N87	2N192	2N241 (2)
GE P720 Ginger, P721 Champagne	6V	GE 2N168A	2N293	2N169	1N87	2N191	2N188A (2)
Halicrafters TR 88 El Diablo	6V	2N112 GE 2N136	2N112 or 2N135	2N139 2N135	None None	2N109 or 310 2N192	2N109 (2) or 352 (2) 2N188 (2)
Magnavox AM2 Companion (CR 729 AA)	4V	2N172 GE 2N169	2N146 2N169	2N146 2N169	1N295 1N64	310 2N192	353 (2) 2N188 (2)
Motorola 56 T1	9V	2N172 GE 2N169	2N146 2N169	2N146 2N169	R35 2N191	— —	354 2N188

Motorola 6 x 31	6V	GE 2N168A	2N293	2N292	Diode	2N189 or 2N190	2N186 or 2N187
Motorola 6 x 32	12V	GE 2N293	2N168A	2N169	Diode	2N191 or 2N192	2N188 or 2N241
RCA 7BT-9J	9V	235 GE 2N168A	234 2N169	234 2N169	1N295 1N64	2N109 (2) 2N192	2N109 (2) 2N188 (2)
Raytheon 8 T P 1		CK760 CK759 GE 2N136 2H135	CK760 2N135	CK760 2N135	CK721 2N191	CK721 2N191	CK721 (2) 2N188 (2)
Raytheon FM101A	6V	2N113/14 2N112/13 GE 2N136 2N135	2N112 2N135	2N112 2N135	2N112 2N135	CK721/22 2N191	CK721/22 (2) 2N188
Raytheon T-100 Series		2N112/13 GE 2N136	2N112 2N135	2N112 2N135	Diode 1N64	2N132 2N192	2N138 2N192
Regency TRL	22½	223 GE 2N169	222 2N169	222 2N169	1N69 1N64	— —	210 2N169A
Sentinel 369P	4V	2N172 GE 2N169	2N146 2N169	2N146 2N169	1N295 1N64	310 2N192	353 (2) 2N188 (2)
Sonic TR 700 Capri	9V	GE 2N168A GE 2N168A	2N168 2N293	2N169A 2N169	1N64 1N64	2N191 2N190	2N188A (2) 2N187 (2)
Traveler	13½	GE 2N136	2N135	2N135	4JD1A26	—	2N187A
Westinghouse 7	9V	2N172 GE 2N169	2N146 2N169	2N146 2N169	880 2N169	310 2N192	2N185 (2) 2N188A (2)
Zenith 500	6V	2N94 GE 2N169	2N94 2N169A	2N94 2N169A	1N295 1N64	2N35 2N169A	2N35 (2) 2N169A
Zenith 800	12V	GE 2N168A	2N168	2N169A	1N295	2N190	2N188A (2) Note 3

NOTES:

1. Remove any neutralization loops around IF circuits before operating with GE NPN transistors.
2. In some radios where the 2N146 is shown in both IF stages, one 2N145 and one 2N147 may be found instead in these stages.
3. The 2N293 may be used to replace the 2N168 in IF stages.
4. The 2N169 may be used to replace the 2N78 in AF stages.
5. The 2N186A may be used to replace the 2N44 in AF output stages.

*This list includes transistor production radios for which information is currently available. It is primarily for information and is intended only as a general guide for replacements.

The radio battery should be replaced with a fresh unit before checking transistors. If necessary to replace transistors, some selection may be necessary in order to obtain optimum performance since transistors of various manufacturers are made by slightly different processes and are not precisely interchangeable.

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