

TUBE SUBSTITUTION CHART

By RICHARD W. CRANE

• Complete data for substituting those hard-to-get tubes. A total of 362 different tube types are listed along with necessary circuit changes.

SINCE certain tubes are extremely scarce today and hard to get even with high priorities, it is becoming increasingly difficult to keep equipment operating. It is possible in many cases, though, to substitute one tube for another and the accompanying chart lists substitutions for 362 types of tubes. Some of these require no wiring alterations but others necessitate changing the socket, rewiring the present socket, using a tube shield, and/or installing a filament shunt or series resistor. It is often simpler to use an adaptor rather than change or rewire a socket and these can be obtained ready-made for some substitutions, although they can easily be made from a tube base and a socket.

The tube manual should be consulted when making a replacement since some of the tubes listed only approximate the original, and may not give satisfactory results in critical circuits. Thus, a 45 could replace a 2A3 in a single ended amplifier, but should not be used in place of one 2A3 in a push-pull circuit. Moreover, these substitutions are not necessarily reversible; a 2A3, for example, could not replace a 45 in most circuits because it would draw appreciably more plate current and filament current. In r.f. and i.f. circuits slight realignment may be required if the substitute's interelectrode capacitances differ from those of the original.

In cases of dire necessity, rather peculiar replacements can sometimes be made; for instance, a 75 tube (6.3-volt heater) will give fair results in place of a 2A6 (2.5-volt heater), a 12A8GT has been used instead of a 6A8GT, and, in general, a tube having a higher heater voltage than the original can often be used, except in the case of rectifiers and power amplifiers. The cathode emission is far below normal when a tube is operated at a low heater voltage, of course, but since a voltage amplifier utilizes only a small portion of the normal cathode emission adequate performance can frequently be obtained. In series heater circuits even better results are possible since the drop in heater voltage is distributed over all the tubes. Substituting a 45Z5 for a 35Z5 for example would cause approximately an 8% drop in the voltage across each tube and little difference would be noticed in the operation of the circuit.

Some of the substitutions listed are not in line with the best engineering practice and theory; however, in the present world situation the important thing is to keep the equipment operating with available parts.

(N.B.: For those who desire a more technical discussion on proper tube substitution or a procedure to follow in determining series or parallel filament resistors when substituting tubes, we would like to call attention to two articles published previously in RADIO NEWS: "Sourcing Hints on Tube Substitutions," July, 1945; and "Tube Substitutions for Radio Receivers," August, 1945.)

TUBE	SUBSTITUTES
OZ4	6X5 ⁴
1A4	1B4, 1D5 ³ , 34, 32
1A5	1LA4 ³ , 1LB4 ³ , 1T5
1A6	1D7 ³ , 1C6 ⁶ , 1C7G ³
1A7	1B7 ⁶ , 1LC6 ³
1B4/951	34, 32, 1A4, 1D5 ³ , 1E5 ³
1B5/255	1H6G ³
1B7	1A7 ² —28 ohms, 1LC6 ³⁻² —28 ohms
1C5	1Q5, 1T5 ² —28 ohms
1C6	1C7G ³ , 1A6 ² —33 ohms
1C7G	1C6 ³ , 1A6 ³⁻² —33 ohms
1D5	34 ³ , 1A4 ³
1D7	1A6 ³ , 1C7 ⁶ , 1C6 ³⁻⁶
1E4	1G4, 1LE3 ³
1E5	1B4 ³ , 32 ³ , 34 ³
1F4	1F5G ³ , 950
1F5G	950 ³ , 1F4 ³ , 1G5G
1F6	1F7GV ³
1F7GV	1F6 ³
1G4G	1E4, 1LE3 ³
1G5G	1F4 ³ , 1F5G, 950 ³
1H4	30 ³
1H5G	1LR4 ³
1H6G	1B5 ³
1J5G	980 ³ , 1F5G, 1F4 ³
1J6G	19 ³
1LA4	1A5 ³ , 1LB4
1LA6	1A7 ³
1LB4	1LA4, 1A5 ³
1LB6	1LC6 ⁴ , 1A7 ³ , 1LA6 ⁴
1LC5	1LNS, 1PS ³ , 1NS ³ , 1T4 ³
1LC6	1A7 ³ , 1B7 ⁶⁻³ , 1LB6 ⁴
1LD5	1SB6 ³
1LE3	1E4 ³ , 1G4 ³
1LH4	1H5 ³
1LN5	1LC5, 1PS ³ , 1NS ³ , 1SA6 ³
1NSG	1LNS ³ , 1PS, 1ES, 1SA6 ⁴
1PSG	1D5GP, 1D5GT, 1NS, 1SA6 ⁴
1Q5G	1C5, 3Q5 ⁴ , 1T5 ² —28 ohms
1SA6GT	1NS ⁴ , 1PS ⁴ , 1LNS ³
1SB6GT	1SS ³
1T5GT	1A5 ⁴ , 1LA4 ³
1V	6Z3

TUBE	SUBSTITUTES
2A3	45
2A5	47 ³ , HK17 ³
2W3	2Z2 ³
2X2	879 ⁴ , 2Y27 ⁴
2Y2	2X2 ⁴ , 879 ⁴
2Z2	2W3 ³
3B5GT	3Q5, 3C5, 3LF4 ³
3C5GT	3Q5, 1C5 ⁶⁻⁴ , 3B5, 3LF4 ³
3LE4	3C5 ³ , 3Q5 ³ , 3B5 ³ , 3LF4
3LF4	3C5 ³ , 3Q5 ³ , 3B5 ³
3Q4	3S4
3Q5GT	1Q5 ⁶⁻⁴ , 3C5, 3B5, 3LF4 ³
3S4	3Q4
ST4	SU4, 5X4 ⁴ , 83 ³ , 5Z3 ³
SU4G	5Z3 ³ , 5T4, 83 ³ , 5X4 ⁴
5V4G	5Z3 ³ , 5T4, 83 ³ , 5X4 ⁴
5W4GT	80 ³ , 5Y3, 5Y4 ⁴
5X4G	5Z3 ³ , 83 ³ , 5T4 ⁴ , SU4 ⁴
5Y3G	5Y4 ⁴ , 5Z4 ⁴ , 80 ³
5Y4G	5Y3 ⁴ , 5Z4 ⁴ , 80 ³
5Z3	5X4 ³ , 5U4 ³ , 83, 5T4 ³
5Z4	80 ³ , 5Y3 ⁴ , 5Y4 ⁴
6A3	6B4G ³ , 6A5G ³
6A4/LA	6G6 ³⁻² —42 ohms
6AB5/6N5	6U5/6G5 ⁶ , 6T5 ⁶ , 6E5 ⁶
6AB6	6AC6
6AC6	6AB6
6AC7/1852	1851 ⁴
6AD5	6F5 ⁴ , 6SF5 ⁴
6AD6	6AF6
6AF5	6AF5
6AF5	6P5, 6AE5
6AF6	6AD6
6AG6G	6M6
6A6	6N7 ³ , 6Y7 ³ , 79 ³
6A7	6A8 ³ , 6SA7 ³ , 7B8 ³ , 6D8 ³⁻² —42 ohms
6A8	6A7 ³ , 6SA7 ⁴ , 7B8 ³ , 6D8 ² —42 ohms
6B4G	6A3 ³ , 6A5G ⁴
6B5	6N6 ³
6B6	6Q7, 6SQ7 ⁴ , 75 ³
6B7	7E7 ³ , 6B8 ³
6B8	6B7 ³ , 7E7 ³
6C5, 6J5, 76 ³ , 7A4 ³ , 6L5 ² —42 ohms, 6P5	

TUBE	SUBSTITUTES
6C6	6I7 ³ , 6SJ7 ³ , 77, 6D7 ³
6C7	85AS ³
6C8	6F8 ⁶ , 7N7 ³⁻⁵ , 6J6 ³⁻⁶ , 6SN7 ⁴
6D6	6K7 ³ , 6SG7 ³ , 6SK7 ³ , 78, 6U7 ³ , 6E7 ³
6D7	77 ³⁻⁵ , 6C6 ³⁻⁵ , 6J7 ³ , 6SJ7 ³
6D8G	6A7 ⁶⁻³ , 6AB ⁶ , 6SA7 ⁶⁻⁴ , 7B8 ⁶⁻³
6E5	6T5, 6G5/6U5, 6H5
6E7	6D6 ³⁻⁵ , 6SG7 ³ , 6U7 ³⁻⁵ , 78 ³⁻⁵
6F5	6SF5 ⁴ , 7B4 ³ , 6K9 ⁴
6F6	42 ³ , 6K6, 6AD7 ⁴ , 41 ³
6F7	6P7G ³
6F8G	7N7 ³ , 6SN7 ⁴ , 6C8, 6J6 ³
6G5	See 6U5/6G5
6H4	6H6 ⁴⁻⁵ , 7A6 ³
6H5	6U5/6G5, 6E5, 6T5
6H6	7A6 ³⁻² —42 ohms
6H8	7E7 ³ , 6B7 ³
6J5	6C5, 76 ³ , 7A4 ³ , 6L5 ² —42 ohms, 6P5
6J6	6SN7 ³ , 6F8 ³ , 6C8 ³
6J7	6SJ7 ⁴ , 6C6 ³ , 77 ³
6J8G	6K8 ⁴ , 6P8 ⁴⁻⁶ , 6E8 ⁴ , 7S7 ³ , 7J7 ³
6K5G	6F5 ⁴ , 7B4 ³ , 6SF5 ⁴
6K6G	41 ³ , 7B5 ³ , 42 ³ , 6F6
6K7	39/44 ³ , 6SK7 ⁴ , 6S7 ² —42 ohms, 6S6 ⁴⁻⁶
6K8	6P8 ⁶ , 6J8 ⁴ , 6E8 ⁴ , 7S7 ³ , 7J7 ³
6L5G	6P5 ⁶ , 6C5 ⁶ , 6J5 ⁶ , 7A4 ³⁻⁶
6L6	6V6
6M6G	6AG6
6M7	6T6 ⁴⁻⁶ , 6SE7 ⁴
6N5	See 6AB5/6N5
6N6G	6B5 ³ , 6AB6
6N7	6A6 ³ , 6Y7, 79 ³
6P5G	76 ³ , 37 ³ , 6AF5, 6AE7 ⁴⁻⁶
6P7G	6F7 ³
6P8G	6K8, 6E8 ⁴ , 7S7 ³ , 7J7 ³
6Q6G	6T7 ⁴ , 6Q7 ⁴⁻⁶
6Q7G	6SQ7 ⁴ , 75 ³ , 7B6 ³ , 6T7 ² —42 ohms, 7K7 ³
6R7	6SR7 ⁴ , 85AS ³ , 85 ³ , 6V7, 6ST7 ⁴⁻² —42 ohms
6S6	7W7 ³ , 6SG7 ⁴

(Continued on page 103)

Tube Substitutions

(Continued from page 51)

6S7	6D6 ⁶⁻³ , 6SS7 ⁴ , 6SK7 ⁶⁻⁴ , 6K7 ⁶
6SA7	6A7 ³ , 6A8 ⁴ , 6D8 ⁴⁻² —42 ohms
6SC7	7F7 ³ , 6SL7 ⁴
6SD7GT	6SG7 ⁴ , 6SK7 ⁷ , 6K7 ⁴
6SE7	6T6 ⁴⁻⁶ , 6M7 ⁴ , 6SJ7
6SFS	6F5 ⁴ , 6Q7 ⁴ , 75 ³ , 6K5 ⁴
6SJ7	6J7 ⁴ , 6C6 ³ , 77 ³ , 6W7 ⁴⁻² —42 ohms
6SK7	6K7 ⁴ , 6SG7 ⁴ , 6SS7 ² —42 ohms, 78 ³
6SL7GT	6SC7 ⁴ , 7F7 ³
6SN7GT	6F8 ⁴ , 7N7 ³ , 6J6 ³⁻² —42 ohms, 6C8 ⁴⁻² —21 ohms
6SQ7	6Q7 ⁴ , 75 ³ , 6T7 ⁴⁻² —42 ohms, 7B6 ³
6SR7	6R7 ⁴ , 85 ³ , 6V7 ⁴ , 6ST7 ² —42 ohms, 6C7 ³ , 7E6 ³
6SS7	6SK7 ⁶ , 6K7 ⁶⁻⁴ , 78 ⁶⁻³ , 6D6 ⁶⁻³ , 6S7 ⁴
6T5	6U5/6G5, 6N5 ² —42 ohms
6T6	7T7 ³⁻² —42 ohms, 6SE7 ⁴⁻² —42 ohms
6T7	6Q7 ³ , 7C6 ³
6U5/6G5	6T5, 6H5, 6N5 ² —42 ohms
6U6GT	6V6
6U7G	6D6 ³ , 78 ³ , 6K7, 6SK7 ⁴ , 6SS7 ⁴⁻² —42 ohms, 6U6, 7C5 ³
6V6	85 ³
6V7G	7Z4 ³
6W5G	6Y6, 6V6
6W6GT	6J7 ⁶ , 6SJ7 ⁴⁻⁶ , 7C7 ³
6W7G	OZ4, 7Y4 ³⁻⁷
6X5	6X5 ³ , 84/6Z4 ³
6Y5	6W6, 6V6
6Y6G	79 ³ , 6Z7 ² —21 ohms
6Y7G	1V, 6ZY5 ³
6Z3	See 84/6Z4
6Z4	84/6Z4 ³⁻⁷ , 12Z5 ³
6Z5	6Y7 ⁶ , 79 ³⁻⁶
6Z7G	84/6Z4 ³⁻⁶
6ZY5G	6C5 ³ , 6I5 ³ , 76 ³
7A4	6V6 ³⁻⁶
7A5	6H6 ³⁻⁶
7A6	7H7, 7B7 ² —42 ohms, 78 ³
7A7	7B8 ⁶ , 6SA7 ³⁻⁶ , 6D8 ³
7A8	6F5 ³ , 6SF5 ³ , 6K5 ³
7B4	6K6 ³ , 41 ³
7B5	6Q7 ³ , 75 ³ , 6T7 ³⁻² —42 ohms, 7C6 ² —42 ohms
7B6	7A7 ⁶ , 6SS7 ³
7B7	7A8 ² —42 ohms, 6SA7 ³ , 6D8 ³⁻² —42 ohms
7B8	6V6 ³
7C5	6T7 ³ , 7B6 ⁶
7C6	6W7 ³ , 6J7 ⁶⁻³
7C7	7S7
7D7	6C6
7E5/1221	6R7 ³ , 6SR7 ³
7E6	6B7 ³ , 6B8 ³
7E7	6SC7 ³ , 6SL7 ³
7F7	7V7, 6T6 ³
7G7/1232	6SD7 ³ , 6SG7 ³
7H7	6K8 ³ , 6J8 ³
7J7	7B6 ⁴ , 7C6 ⁴⁻² —42 ohms
7K7	7G7/1232 ⁶ , 7T7
7L7	6SN7 ³
7N7	6A7 ³ , 6A8 ³ , 6SA7 ³
7Q7	7E7 ⁴ , 6B7 ³ , 6B8 ³
7R7	7D7 ⁶ , 7J7
7S7	7V7 ⁶ , 7G7/1232 ⁶ , 6SH7 ³
7T7	7G7/1232
7V7	6S6 ³ , 6SG7 ³
7W7	6X5 ³ , OZ4 ³ , 84/6Z4 ³⁻⁷ , 6Z5 ³
7Y4	7Y4 ⁷ , 6X5 ³⁻⁷ , 6W5 ³
7Z4	6F6 ⁶⁻³
12A5	12SA7 ⁴ , 6D8 ¹ —42 ohms
12A8	12Q7 ⁴ , 12SQ7 ⁴
12B6M	See 14A7/12B7
12B7	14E7 ³
12C8	12J5, 14A4 ³
12E5	12J5, 14A4 ³
12F5	12SF5 ⁴ , 12Q7 ⁴ , 12SQ7 ⁴
12G7	12Q7 ⁴ , 12SQ7 ⁴
12H6	12Q7 ⁴ , 12SQ7 ⁴ , 14E6 ³
12J5	14A4 ³ , 12E5
12J7	12SJ7 ⁴ , 14C7 ³
12K7	12SG7 ⁴ , 12SK7 ⁴ , 14A7/12B7 ³
12K8	14J7 ³

12Q7	12SQ7 ⁴ , 14B6 ³ , 12G7
12SA7	12A8 ⁴ , 14Q7 ³ , 6D8 ⁴⁻¹ —42 ohms
12SC7	14F7 ³ , 12SL7 ⁴
12SF5	12F5 ⁴ , 12SQ7 ⁴ , 12SL7 ⁴
12SG7	12K7 ⁴ , 12SK7 ⁴ , 14A7/12B7 ³ , 14W7 ³⁻⁶
12SJ7	12J7 ⁴ , 14C7 ³
12SK7	12K7 ⁴ , 12SG7 ⁴ , 14A7/12B7 ³
12SL7GT	14F7 ³
12SN7GT	14AF7 ³⁻² —84 ohms, 14N7 ³⁻² —84 ohms
12SQ7	12Q7 ⁴ , 14B6 ³ , 12G7 ⁴
12SR7	14E6 ³
12Z3	14Z3, 12Z5 ³
12Z5	6Z5/12Z5 ³ , 14Y4 ³ (except when used as voltage doubler)
14A4	12E5 ³ , 12J5 ³
14A5	12A6 ³
14A7/12B7	12SG7 ³ , 14H7, 12SK7 ³
14B6	12SQ7 ³ , 12Q7 ³
14B8	12SA7 ³ , 12A8 ³
14C5	14A5
14C7	12J7 ³ , 12SJ7 ³
14E6	12SR7 ³
14E7	12C8 ³
14F7	12SC7 ³
14H7	14A7/12B7, 12SG7 ³
14J7	12K8 ³
14N7	12SN7 ³⁻⁶ , 14AF7
14Q7	12SA7 ³ , 12A8 ³
14R7	14E7, 12C8 ³
14S7	14J7 ⁴
14W7	12SG7 ³ , 14H7 ⁴
14Y4	12Z5 ³⁻³
14Z3	12Z3, 12Z5 ³
15	32 ³⁻⁶
17	6P5 ³⁻¹ —27 ohms, 76 ¹ —27 ohms
18	12A5 ³
19	1J6G ³
20J8GM	21A7 ³ , 14S7 ³⁻¹ —50 ohms
21A7	20J8 ³ , 14J7 ¹ —44 ohms
24A	57 ³
25A6	25B6, 25C6, 25L6, 43 ³
25A7	32L7
25B5	25N6 ³
25B6	25A6, 25C6, 25L6, 43 ³
25L6	25A6, 25B6, 25C6, 43 ³
25N6	25B5 ³
25S	See 1B5/25S
25Y4	25X6 ⁴
25Y5	25Z5, 25Z6 ³
25Z3	25Z4 ³ , 25Y5 ³
25Z4	25Z3 ³⁻⁷ , 25Z5 ³
25Z5	25Z6 ³
25Z6	25Z5 ³
27	56, 484, 485
30	1H4G ³
31	49 ³ (grid #2 tied to plate)
32	1B4 ³
32L7	25A7 ¹ —25 ohms, 3 watts
34	1A4
35/51	58 ³
35A5	35L6 ³
35L6	35A5 ³ , 50L6, 6G6 ¹ —200 ohms, 5 watts
35Y4	35Z5 ⁴ , 35Z4 ⁴ , 35Z3 ³
35Z3	35Y4 ³ , 35Z4 ³ , 35Z5 ³
35Z4	35Z5 ⁴ , 35Z3 ³ , 35Y4 ⁴
35Z5	45Z5, 35Z3 ³ , 35Z4 ⁴
35Z6G	25Z6 ¹ —33 ohms, 5 watts, 25Z5 ³⁻¹ —33 ohms, 5 watts
36	77 ³ , 6C6 ³
37	76
38	6K6 ³ , 89 ³⁻⁶ , 6A4 ⁴
39/44	6K7 ³ , 6SK7 ³ , 78 ³ , 6D6 ³
40Z5/45Z5	35Z5 ¹ —67 ohms
41	6K6 ³ , 42
42	6K6 ³ , 41
43	25A6 ³ , 25B6 ³ , 25L6 ³
44	See 39/44
45	46 ³ (grid #2 tied to plate)
46	RK15 ³ (if grids 1 & 2 are tied together), 45 ³ (if grid #2 is tied to plate)
47	2A5 ³
50A5	50C6 ³ , 50L6 ³
50C6G	50A5 ³ , 50L6
50L6GT	50C6, 50A5 ³
50Y6GT	50Z74-7
50Z6G	50Y6 ⁷⁻² —333 ohms, 10 watts, 35Z6 ⁷⁻¹ —50 ohms, 5 watts

50Z7G	50Y6 ⁴
51	See 35/51
56	27, 484, 485
56AS	76
57	24A ³
57AS	77
58	35/51 ³
58AS	78
59	2A5 ³ , 47 ³ , RK16 ³ (if grids 2 & 3 tie to plate)
70A7GT	70L7 ⁴
70L7GT	70A7 ⁴
71A	182A
75	6Q7 ³ , 6SQ7 ³
76	37, 6P5 ³
77	6C6, 6J7 ³ , 6SJ7 ³
78	6D6, 6K7 ³ , 6SK7 ³
79	6Y7 ³ , 6Z7 ³⁻² —21 ohms
80	5Y3 ³ , 5Y4 ³
83	5U4 ³ , 5T4 ³ , 5V4 ³
84/6Z4	KR98, 6K5 ³
85	6V7 ³ , 6R7 ³
85AS	6R7 ³ , 6SR7 ³
88	83V, 5V4 ³
89	7B5 ³ , 41 ³ , 38 ³
95	2A5, 47 ³
KR98	84/6Z4
117L7/M7	117N7 ⁴ , 117P7 ⁴
117N7	117P7, 117L7/M7 ⁴
117P7	117N7, 117L7/M7 ⁴
117Z4GT	117Z6GT ⁴
117Z6GT	117Z4GT ⁴ (if used as half wave rectifier)
182A	71A
182B	483
183	483
213	80
216	81
482A	71A
482B	483
483	182B, 482B
484	485, 27, 56
485	484, 27, 56
585	50
586	50
P861	84/6Z4
879	2X2 ⁴
950	1F4, 1F5G ³
951	See 1B4/951
986	83
1223	6C6 ³
1232	See 7G7/1232
1603	6C6
1611	6F6
1620	6J7
1633	14N7 ³⁻¹ —83 ohms
1634	12SC7
1851	6AC7/1852 ⁴
7000	6J7
7700	6C6
AD	1V
AF	82
AG	83
AX	01A
D ^{1/2}	81
DI	80
DEI	27
E	20
G	40
H	01A
KR98	84/6Z4
LA	See 6A4/LA
PZ	47
PZH	2A5
RK15	46 ³ (grids 1 & 2 tied together)
RK16	59 ³ (grids 2 & 3 tied to plate)
RK17	2A5 ³
RK42	1G4G ³

FOOTNOTES

1. Filament series resistor.
2. Filament shunt resistor (not necessary if filaments are in parallel).
3. Use adaptor or install new socket.
4. Use adaptor or rewire existing socket.
5. Use close fitting shield.
6. Can only be used if filaments are in parallel.
7. Can be used if d.c. load current is less than the maximum allowable for the substitute.