

SYLVANIA

Aids To

War-Time Servicing

Compiled by
SYLVANIA COMMERCIAL ENGINEERING DEPT.

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SYLVANIA ELECTRIC PRODUCTS INC. - EMPORIUM, PENNA.

SYLVANIA TUBE SUBSTITUTION CHARTS

CIRCUIT MODIFICATIONS REQUIRING ADDITIONAL RESISTORS

SYLVANIA SUBSTITUTE TUBE CHARTS

These charts are Sylvania's contribution to assist servicemen and dealers in meeting the present acute shortage of many tube types. This list is intended to be more convenient, complete and reliable than most of those available but should not be followed blindly as many unusual circuits may be found which do not respond to any general treatment. There is still no substitute for experience in handling the tricky circuits. The commonest changes are indicated by letters the meaning of which is explained at the top of the table and in greater detail in the notes below. The numbered notes are to help when slightly more complicated changes may be necessary, or to indicate conditions under which it must be left to the serviceman's judgment as to whether the change will be satisfactory for his particular set, customer, and location.

In general we have tried to list all the possible simple substitutions but experienced servicemen could work out others requiring more extensive modifications, such as changing from transformer to resistance coupled amplification in order to use a high- μ tube for an unobtainable low- μ type.

One of the biggest problems is finding a substitute which will fit mechanically into the space available. This must be found by trial for each job. Sylvania Lock-In types are shown as replacements whenever possible so that advantage can be taken of their small size. In many cases a Lock-In tube plus an adaptor will take up no more space than the original type.

THE following article explains one of the ways in which a 150 ma. tube may be used to replace a 300 ma. tube in a receiver and also indicates a method for the substitution of a 300 ma. type for a 150 ma. tube. The tube types shown have simply been chosen as examples and do not indicate any specific equipment. The principles involved, however, are essentially the same regardless of tube types.

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

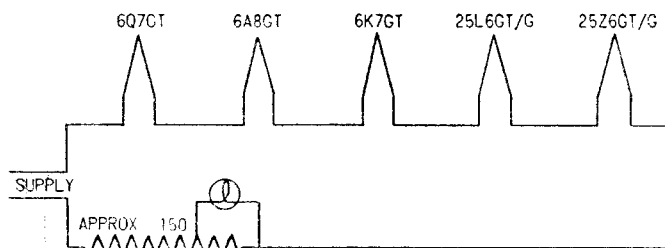


FIG. 1

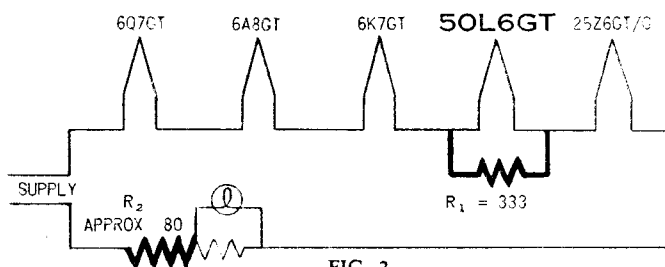


FIG. 2

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

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

resistor since in many cases ballast resistors with the tap 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. As you no doubt have learned, this is probably the most difficult

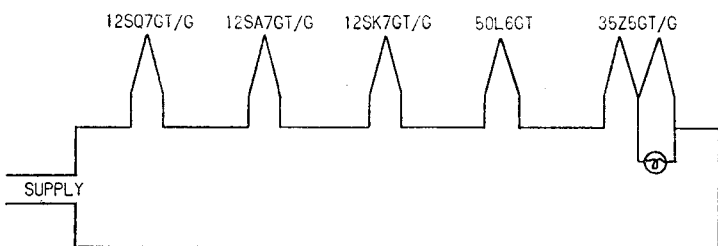


FIG. 3

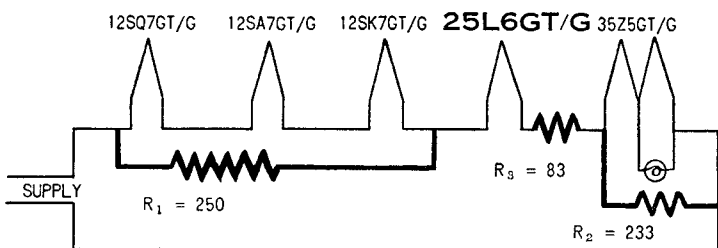


FIG. 4

$$R_1 \text{ or } R_2 = \frac{\text{Sum of tube voltages across resistor}}{.150}$$

$$R_3 = \frac{\text{Old tube volts—new tube volts}}{.300}$$

type of tube to obtain. You find, however, that the jobber does have some 25L6GT/G tubes and assume they are the only power output tubes he has available for series receivers. This tube requires 300 ma. 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.

TUBE SUBSTITUTION CHARTS

For details of changes indicated See page 6		NO CHANGES FIL. VOLTS FIL. CURRENT REWIRE SOCKET CHANGE SOCKET REALIGN CAB. CONNECTION RES. CONNECTION Q. PLATE TOP VOLTS R. SOCKET CAP CAB. CONNECTION CHANGE WTS. NOTE NO.									
REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K	
1A4 (P or T)	1A4 (P or T)	A									
	1D5G					E	F				
	1E5G (P)					E	F				
	1LN5	B	C			E	F	H			1
	1N5GT/G*	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/G*	1LA4					E					8
	1LB4					E					K
	1N6G				D						K
	1C5G*										K
	1Q5G*		C								2
	3Q5GT*		C	D							2
	3D6/1299		C			E					2
	3S4		C			E					2
	1S4		C			E					2
	3Q4		C			E					2
	3LF4		C			E					2
1A6	1C6			C			F				
	1D7G					E	F				
	1C7G			C		E	F				
	1A7G*		B	C		E	F	H	K		
	1LA6		B	C		E	F	H	K		
	1LC6		B	C		E	F	H	K		
1A7GT*	1LC6					E	F	H			6
	1LA6					E	F	H			
	1B7G*			C			F				
	1D8GT			C	D		F				9
	3A8GT			C	D		F				9
	1R5					E	F				8
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			
	1N5G*					E	F				
	1P5G*					E	F				
1B7GT*	1A7G			C			F				
	1LC6			C		E	F				6
	1LA6			C		E	F				
	3A8GT			D			F				9
1C5GT*	1LB4			C		E					2
	1A5GT*			C			K				2
	1LA4			C		E					2
	1Q5GT*						K				
	3Q5GT*				D		K				
	3D6/1299			C		E					K
	3S4					B					K
	1S4			C		E					K
	3Q4					E					K
	3LF4			C		E					K
1C6	1A6			C			F				
	1C7G					E	F				
	1D7G			C		E	F				
	1A7GT*		B	C		E	F	H	K		
	1LA6		B	C		E	F	H	K		
	1B7GT*		B	C		E	F	H	K		
	1LC6		B	C		E	F	H	K		6

For details of changes indicated See page 6		NO CHANGES FIL. VOLTS FIL. CURRENT REWIRE SOCKET CHANGE SOCKET REALIGN CAB. CONNECTION RES. CONNECTION Q. PLATE TOP VOLTS R. SOCKET CAP CAB. CONNECTION CHANGE WTS. NOTE NO.									
REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K	
1C7G	1A6					C		E	F		
	1C6							E	F		
	1D7G					C		F			
	1A7GT*		B	C				F			K
	1LA6		B	C				E	F		K
	1B7GT*		B	C				F			K
	1LC6		B	C				E	F		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							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	Requires both 1N6G and 1E4G or 1LB4 and 1LH4.										
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 or 1F4—No single tube										
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
	3D6/1299		B	C				E			K 2
	3LF4		B	C				E			K 2
1F5G	1F4						E				
	33						E				
	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
	3D6/1299		B	C				E			K 2
	1J5G							E			K
	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

FOR BATTERY TUBE TYPES

TUBE SUBSTITUTION CHART

For details of changes indicated See page 6		NO CHANGES										NOTE NO.
REQUIRED TYPE	POSSIBLE REPLACEMENTS	NO CHANGES										NOTE NO.
		A	B	C	D	E	F	G	H	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					K	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
	3D6/1299	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							
	3B7/1291	B	C		E							
1H4G	30				E							
	1E4G	B	C								K	
	1G4GT*	B	C								K	
	1LE3	B	C		E						K	
1H5GT*	1B5	B	C		E						K	
	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	
	3D6/1299	B	C		E						K	2
	1D8GT	B	C								K	9
	1T5GT*	B	C								K	
	1J6G	19				E						
1G6G		B	C									
3B7/1291		B	C		E							
1LA4	1A5GT*				E							
	1C5GT*			C	E						K	2
	1Q5GT*			C	E						2	
	1D8GT			C	E						K	9-2
	3D6/1299			C	E						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	

For details of changes indicated See page 6		NO CHANGES										NOTE NO.	
REQUIRED TYPE	POSSIBLE REPLACEMENTS	NO CHANGES										NOTE NO.	
		A	B	C	D	E	F	G	H	K			
1LB4	1LA4											K	2
	3D6/1299				C	D						K	
	3LE4				C	D						2	
	3LF4				C	D						K	2
	1T5GT*					E						K	
1G4GT*	1A5GT*					E							
	1C5GT*				C	E					K	2	
	1S4				C	E					K	2	
	1LC5				C	E					K	2	
1LC5	1LN5						F				K		
	1L4					E	F						
	1N5GT*					E	F					7	
	3A8GT				C	E	F					9-7	
1LC6	1A7GT					E	F					7	
	1LA6						F					7	
	3A8GT				C	E	F	G				9	
1LD5	1S5						E	F					
	1D8GT				C	E	F				K	9-7	
	1N6G						E	F			K	7	
	3A8GT				C	E	F				K	9-7	
1LE3	1G4GT*					E					K		
	1E4G					E							
	1D8GT					E					K	9	
1LH4	1H5GT*					E							
	3A8GT					E						9	
	1LN5					D						3	
1LN5	1N5GT*					E	F						
	1LC5						F					6	
	3A8GT				C	E	F					9	
1N5GT*	1T4					E	F	H					
	1LN5					E	F	H				8	
	1LC5					E	F	H				6	
	3A8GT				D		F					9	
1N6G	1D8GT				C	D						9	
1P5GT*	1N5GT*						F					1	
	1LN5					E	F					1	
	1LC5					E	F					1-6	
	1T4					E	F					6	
	3A8GT				D		F					9-1	
1Q5GT*	1T5GT*				C						K	2	
	1C5GT*										K		
	1A5GT*				C							2	
	1D8GT				C						K	9-2	
	3D6/1299				C	E						2	
	1LA4				C	E						2	
	1LB4					E					K	2	
	1S4					E						6	
3LF4					E								
1R5	1LA6					E	F					8	
	1LC6					E	F					8	
	1A7G					E	F						
1S4	3S4				D								
	1LB4				C	E					K	2	
	1LA4				C	E					K	2	
	1A5GT*				C	E					K	2	
	3Q4				D						K		
1S5	1LD5					E						6	
	3A8GT				C	E	G						

FOR BATTERY TUBE TYPES

TUBE SUBSTITUTION CHARTS

For details of changes indicated See page 6		NO CHANGES FIL. VOLTS FIL. CURRENT REWIRE SOCKET CHANGE SOCKET REALIGN ADD CONNECTION REMOVE CONNECTION OR PLATE TOP VOLTS CHANGE BIAS VOLTS NOTE NO.									
REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K	
1T4	1LN5					E					1-7
	1LC5					E					1-6
	1P5GT*					E		G			7
1T5GT*	1A5GT*									K	2
	1Q5GT*		C							K	2
	1C5GT*		C							K	2
	1D8GT		C							K	9
	1LA4					E				K	2
	1LB4					E				K	2
	3D6/1299					E				K	2
	3LF4					E				K	2
3A8GT	No single tube 1LH4 and 1LN5 or 1H5G and 1N5G										
3Q5GT*	1Q5GT*				D						
(At 1.4 Volts)	1C5GT*				D					K	
	1T5GT*				D					K	2
	3D6/1299		C		E						
	1A5GT*		C	D						K	2
	3LF4					E					
	1D8GT				D					K	9-2
	1LA4		C		E					K	2
	1LB4		C		E					K	2
	3S4				E					K	6
(At 2.8 Volts)	3LF4					E					
	3S4					E				K	6
	3Q4					E					2
3S4	3Q4									K	7
At 1.4 Volts	1Q5GT*					E				K	7
	1S4				D						
	3D6/1299		C		E					K	

For details of changes indicated See page 6		NO CHANGES FIL. VOLTS FIL. CURRENT REWIRE SOCKET CHANGE SOCKET REALIGN ADD CONNECTION REMOVE CONNECTION OR PLATE TOP VOLTS CHANGE BIAS VOLTS NOTE NO.									
REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K	
	1C5GT*					E					7
	3LF4					E				K	
	1LB4			C		E				K	2-7
At 2.8 Volts	3Q4									K	7
	3LF4					E				K	
	3Q5GT*					E				K	7
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
	3A						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						F				1
	32						F				1
	1E5 (G or P)					E	F				1

For 117V types sometimes used with battery tubes see page 15.

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 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 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) This substitution usable only if tube is used as a single diode.
 - (6) If voltage at screen is greater than 45 volts it should be reduced to rated voltage.
 - (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.
- *The G, GT, or GT/G types may be used interchangeably where space permits.

TUBE SUBSTITUTION CHARTS

For details of changes indicated See page 10		NO CHANGES FIL. VOLTS FIL. CURRENT REWIRE SOCKET CHANGE SOCKET REALIGN ADD CONNECTION CAP. TO TOP CAP OR PLATE TOP CHANGE BIAS NOTE NO.									
REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K	
6D8G	7A8					E	F		H		
	14J7		B			E	F		H		
	14S7		B			E	F		H		
	14B8		B			E	F		H		
	12A8G*		B				F				
	12K8G*		B				F				
	25B8G		B		D		F				
	For 300 ma. types see type 6A8G and for procedure see article on page 2.										
6G6G	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 2.										
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 2.										
6S7G*	6SS7G*					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		3
	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 2.										
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						3
	For 300 ma. types see type 6Q7G* and for procedure see article on page 2.										
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 6J7G and for procedure see article on page 2. For use as audio amplifiers types under 6S7G may also be used.										
7A6	12H6G*		B			E					
	14F7		B		D						4
	12SL7GT*		B			E					4

For details of changes indicated See page 10		NO CHANGES FIL. VOLTS FIL. CURRENT REWIRE SOCKET CHANGE SOCKET REALIGN ADD CONNECTION CAP. TO TOP CAP OR PLATE TOP CHANGE BIAS NOTE NO.									
REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K	
7A6	XXD		B		D						4
(Continued)	14AF7		B		D						4
	For 300 ma. types see 6H6G and for procedure see article on page 2.										
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	
	For 300 ma. types see 6A8G and for procedure see article on page 2.										
7B7	14A7/12B7		B						F		
	14H7		B						F		6
	6S7G*					E	F		G		
	6SS7G*					E	F				
	12SG7		B			E	F				6
	12SK7G*		B			E	F				
	12K7GT*		B			E	F		G		
	For 300 ma. types see 6K7G and for procedure see article on page 2. See also types under 7C7 and note 1.										
7C6	14B6		B								
	6T7G					E			G		
	12Q7GT*		B			E			G		
	12SQ7GT*		B			E					
	For 300 ma. types see 6Q7G and for procedure see article on page 2.										
7C7	14C7		B								
	12J7GT*		B						E	G	
	12SJ7GT*		B						E		
	12SH7G*		B						E		6
	6W7G					E			G		
	12C8		B			E			G		9
	14R7		B		D						9
	For 300 ma. types see 6J7G and for procedure see article on page 2. For use in audio amplifiers types under 7B7 may also be used.										
12A8GT*	7A8		B			E	F		H		8
	12K8GT*						F				
	6D8G		B				F				
	14B8					E	F		H		8
	14J7					E	F		H		8
	14S7					E	F		H		8
	25B8GT		B		D		F				8
	For 300 ma. types see 6A8G and for procedure see article on page 2.										
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 2.										
12F5GT*	12SF5GT*					D			H		
	12SL7GT*		D						H		9
	6T7G		B		D						9
	12Q7GT*					D					9
	12SQ7GT*		D						H		9
	7C6		B			E			H		9
	14B6					E			H		9
	For 300 ma. types see 6F5GT and for procedure see article on page 2.										

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

TUBE SUBSTITUTION CHARTS

For details of changes indicated See page 10.		NO CHANGES	FILE VOLTS	FILE CURRENT	CHANGE SOCKET	REALIGN	200 CONNECTION	OR OVER TOP CONNECTION	CHANGE BITS	NOTE NO.
REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K
14A7/12B7... (Continued)	12SG7..... 12K7GT*.....					E F				6
	For 300 ma. types see type 6K7G and for procedure see article on page 2.									
14B6.....	7C6..... 6T7G..... 12SQ7GT*..... 12Q7GT*..... 12SF7..... 12C8.....		B			E		G		
	For 300 ma. types see type 6Q7G and for procedure see article on page 2.									
14B8.....	7A8..... 14J7..... 14S7..... 12A8GT*..... 12K8GT..... 25B8GT*..... 6D8G.....		B			F				
	For 300 ma. types see type 6A8G and for procedure see article on page 2.									
14C7.....	7C7..... 6W7G..... 12SJ7GT*..... 12J7GT*..... 12SH7.....		B			E		G		
	For use as audio amplifiers see also types under 14A7. For 300 ma. types see type 6J7G and for procedure see article on page 2.									
14E6.....	12SR7..... 6ST7..... 12SF7..... 12C8.....					E				4
	For 300 ma. types see type 6V7G and for procedure see article on page 2.									
14J7.....	14B8..... 14S7..... 7A8..... 6D8G..... 12A8GT*..... 12K8GT*..... 12B8GT*.....					F				
	For 300 ma. types see type 6A8G and for procedure see article on page 2.									
14Q7.....	12SA7GT*..... 14B8..... 14J7..... 14S7..... 12A8GT*..... 6D8G..... 7A8..... 12K8GT*.....					E F				
	For 300 ma. types see type 6SA7 and for procedure see article on page 2.									
14R7.....	14E7..... 12SF7..... 12C8.....									K
	For 300 ma. types see type 6B8G and for procedure see article on page 2.									

For details of changes indicated See page 10.		NO CHANGES	FILE VOLTS	FILE CURRENT	CHANGE SOCKET	REALIGN	200 CONNECTION	OR OVER TOP CONNECTION	CHANGE BITS	NOTE NO.
REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K
25B8GT*.....	No good single tube; Types 12SF5 and 12K7G together.									
	12B8GT*..... 6P7G..... 6F7.....					B C		F		
	For 300 ma. types see type 25L6G and for procedure see article on page 2.									
35A5.....	50A5..... 14A5..... 12A6..... 50C6G..... 35L6GT*..... 50L6GT*..... 70L7GT.....		B							
	For 300 ma. types see type 25L6G and for procedure see article on page 2.									
35L6GT*.....	50L6GT*..... 70L7GT*..... 50C6G..... 12A6..... 14A5..... 35A5..... 50A5.....		B			D				9
	For 300 ma. types see type 25L6G and for procedure see article on page 2.									
35Y4.....	35Z5GT*..... 35Z3..... 45Z5GT*..... 50Y6GT*..... 50Z7G..... 40Z5..... 45Z3..... 70L7GT..... 35Z4GT*.....					E				10
	For 300 ma. types see type 12Z3 and for procedure see article on page 2.									
35Z3.....	35Y4..... 35Z5GT*..... 45Z5GT*..... 50Y6GT..... 50Z7GT..... 40Z5..... 45Z3..... 70L7GT..... 35Z4GT*.....					D				
	For 300 ma. types see type 12Z3 and for procedure see article on page 2.									
35Z4GT*.....	35Z5GT*..... 45Z5GT*..... 35Z3..... 35Y4..... 50Y6GT..... 50Z7GT..... 40Z5..... 45Z5G*..... 70L7GT..... 45Z3.....					D				
	For 300 ma. types see type 12Z3 and for procedure see article on page 2.									
35Z5GT*.....	45Z5GT*..... 35Z4GT*..... 35Z3..... 35Y4..... 50Y6GT..... 50Z7GT..... 40Z5..... 45Z3..... 70L7GT.....					B				10
	For 300 ma. types see type 12Z3 and for procedure see article on page 2.									

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 150 MA. TYPES

TUBE SUBSTITUTION CHARTS

For details of changes indicated See page 10

REQUIRED TYPE	POSSIBLE REPLACEMENTS	CHANGES												
		A	B	C	D	E	F	G	H	K	NOTE NO.			
45Z5GT*	40Z5	A												
	35Z5GT*		B											
	35Z3		B			E							10	
	35Y4		B			E								
	35Z4GT*		B			D							10	
	50Y6GT		B			D							10	
	50Z7GT		B			D							10	
	45Z3			C		E							10	
	70L7GT		B			D							10	
50A5	35A5		B											
	14A5		B										K	
	12A6		B			E							K	
	50C6G					E								
	35L6GT*		B			E								
	50L6GT*					E								
	70L7GT*		B			E							10	
For 300 ma. types see type 25L6G and for procedure see article on page 2.														
50C6G	35L6GT*		B										K	
	50L6GT*												K	
	70L7GT*		B			D							K	10
	12A6		B										K	
	14A5		B			E							K	
	35A5		B			E							K	
	50A5					E							K	
For 300 ma. types see type 25C6G and for procedure see article on page 2.														
50L6GT*	50C6G												K	
	35L6GT*		B											
	70L7GT*		B			D								
	12A6		B										K	2

For details of changes indicated See page 10

REQUIRED TYPE	POSSIBLE REPLACEMENTS	CHANGES												
		A	B	C	D	E	F	G	H	K	NOTE NO.			
50L6GT*	14A5		B			E								2
(Continued)	35A5		B			E								
	50A5					E								8
For 300 ma. types see type 25L6GT and for procedure see article on page 2.														
50Y6GT	117Z6GT*		B	C										
	50Z7G					D								
	70L7G					D								4
For 300 ma. types see type 25Z6 and for procedure see article on page 2.														
When used as a half-wave rectifier the following will substitute, if load is not too great.														
	35Z3		B			E								
	35Z4GT*		B			D								
	35Z5GT*		B			D								
	45Z5GT*					D								
	35Y4		B			E								
	70L7GT*		B			D								9
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									2
	117N7GT*		B	C	D									2
	117L7/M7GT		B	C	D									2
XXD	14AF7		A											
	14F7													K
	12SL7GT					E								K
	12AH7GT					E								K
	12SC7					E								K

NOTES FOR 150 AND 300 Ma. AC-DC 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 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.
 - 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 2.
 - 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) This substitute satisfactory only if cathodes of the two diodes are tied together.
 - (6) Screen voltage should be decreased to prevent oscillation with this higher gm tube.
 - (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.
- *The G, GT, GT/G or metal types may be used interchangeably where space and shielding requirements permit. Realignment may be required to allow for differences in capacity.

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.

TUBE SUBSTITUTION CHARTS

For details of changes indicated See page 10		NO CHANGES FIL. VOLTS FIL. CURRENT REWIRE SOCKET CHANGE SOCKET REALIGN ADD CONNECTION REMOVE CONNECTION CHANGE PLATE TOP VOLTS CHANGE PLATE BOTTOM VOLTS NOTE NO.									
REQUIRED TYPE	POSSIBLE REPLACEMENTS	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 2.)											
6A7	6A8GT*					E	F				8
	6J8G					E	F				8
	6K8G*					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 2.)											
6A8G*	6J8G						F				
	6K8G*						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 2.)											
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 2.) 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 ma. chart may be used with simple resistor changes. (See article on Page 2.)											
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 2.)											
6C5GT*	7A4					E					8
	6J5GT*		A								
	6AF5G										K
	76					E					K
	6P5GT*										K
	37					E					K
	6AE5G										K

For details of changes indicated See page 10		NO CHANGES FIL. VOLTS FIL. CURRENT REWIRE SOCKET CHANGE SOCKET REALIGN ADD CONNECTION REMOVE CONNECTION CHANGE PLATE TOP VOLTS CHANGE PLATE BOTTOM VOLTS NOTE NO.									
REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K	
6C5GT*	6V7G					D					K
(Continued)	85					E					K
	6R7G*					D					
	6SR7G*					D					
Any type listed under 6L5G in 150 ma. chart may be used with simple resistor changes. (See article on Page 2.)											
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
	7G7-1232					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 2.)											
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 2.)											
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					
	7B6					E					8-9
Any type listed under 12F5G in 150 ma. chart may be used with simple resistor changes. (See article on Page 2.)											
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
	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 2.)											
6J5GT*	6C5GT*		A								
See also 6C5GT in this table.											

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 300 MA. SERIES TYPES

TUBE SUBSTITUTION CHARTS

For details of changes indicated See page 10		NO. CHANGES										NOTE NO.
		NO. CHANGES	FIL. VOLTS	FIL. CURRENT	CHANGE SOCKET	REALIGN	CAP. CONNECTION	REWORK CONNECTION	OR PLATE TOP	CHANGE BIAS	VOLTS	
REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K		
6J7GT*	7L7					E	F		H		6-8	
	6SJ7				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 2.)											
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 2.)											
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 2.)											
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 2.)											
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	
	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 2.)											

For details of changes indicated See page 10		NO. CHANGES										NOTE NO.
		NO. CHANGES	FIL. VOLTS	FIL. CURRENT	CHANGE SOCKET	REALIGN	CAP. CONNECTION	REWORK CONNECTION	OR PLATE TOP	CHANGE BIAS	VOLTS	
REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K		
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	
	Any type listed under 6ST7 in 150 ma. chart may be used with simple resistor changes. (See article on Page 2.)											
6SA7GT*	6A8GT*				D			G			8	
	6J8G				D			G			8	
	6K8GT*				D			G			8	
	7B8					E					8	
	7Q7					E					8	
	7J7					E					8	
	7S7					E					8	
	Any type listed under 12SA7GT in 150 ma. chart may be used with simple resistor changes. (See article on Page 2.)											
6U7G	6K7GT*							F		K		
	6SK7GT*				D		F	H	K			
	6SD7				D		F	H		6		
	39/44					E	F					
	78					E	F		K			
	6D6					E	F					
	7A7					E	F		H			
	6B7					E	F				9	
	6B8G			D							9	
	6SF7			D				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 2.)											
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 2.)											
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 2.)											
12B8GT	6F7					B				K		
	6P7G					B				K		
	25B8GT		B	C								

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.

TUBE SUBSTITUTION CHARTS

For details of changes indicated See page 10		NO CHANGES FIL. VOLTS FIL. CURRENT REWIRE SOCKET CHANGE SOCKET REALIGN ADD CONNECTION OR REMOVE CONNECTION CHANGE BIAS OR PLATE VOLTS										NOTE NO.
REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K		
12Z3	1V		B									
	12A7					E		G			4	
	76		B			E					4	
	37		B			E					4	
	6J5G		B			E					4	
	14Y4					E					4	
	28Z5		B	C		E						
Any type listed under 35Z3 in 150 ma. chart may be used with simple resistor changes. (See article on page 2.)												
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	
Any type listed under 35A5 in 150 ma. chart may be used with simple resistor changes. (See article on page 2.)												
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 2.)												
25AC5GT*	Same types as 25A6GT. (Driver no longer required.)											
25B6G	25N6G										K	2
	25L6GT*										K	2
	25C6G										K	2
	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	2	
	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 2.)												
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		K	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 2.)												
25L6GT/G*	14C5		B	C		E					8	
	25N6G										K	2
	25A6GT*										K	2
	25B6G										K	2

For details of changes indicated See page 10		NO CHANGES FIL. VOLTS FIL. CURRENT REWIRE SOCKET CHANGE SOCKET REALIGN ADD CONNECTION OR REMOVE CONNECTION CHANGE BIAS OR PLATE VOLTS										NOTE NO.
REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K		
25L6GT/G*	25C6G										K	2
(Continued)	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	2
Any type listed under 35L6GT in 150 ma. chart may be used with simple resistor changes. (See article on page 2.)												
25Y5	25Z5		A									
	25Z6GT*							B				
	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.												
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
	6SJ7G*					E	F	H				6
	7L7					E	F	H				6
	7H7					E	F	H				6
	7G7/1232					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 2.)												
37	76		A									
Also types shown under 6C5GT, add note E.												
38	12A7					E						9
Also types shown under type 12A5.												
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.												

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 TRANSFORMER AND AUTO TYPES

TUBE SUBSTITUTION CHARTS

For details of changes indicated See page 10		NO CHANGES FIL. VOLTS FIL. CURRENT REWIRE SOCKET CHANGE SOCKET REALIGN 2P. CONNECTION CAP. CONNECTION REPLACE TOP OR BOTTOM CAP CHANGE BIP'S OR BIPAL VOLT'S										NOTE NO.
REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K		
OZ4 (G)	84		B			E						
	6X5		B		D							
	7Y4		B		E							
											(Sometimes already wired)	
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	5V4G				D							
	5W4G	A										
	5Z4				D							
	80					E						
	83V					E						
	5Y4G				D							
	80					E						
	83V					E						
5Y4G—Same as 5Y3G above. (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							

For details of changes indicated See page 10		NO CHANGES FIL. VOLTS FIL. CURRENT REWIRE SOCKET CHANGE SOCKET REALIGN 2P. CONNECTION CAP. CONNECTION REPLACE TOP OR BOTTOM CAP CHANGE BIP'S OR BIPAL VOLT'S										NOTE NO.
REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K		
6B5	6N6G					E						
	42										K	
	6F6					E					K	
	41					E					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/G*			C							K	
	6F6G*			C							K	
	6U6GT			C							K	
	7A5			C		E					K	
	7B5					E					K	
	7C5			C		E					K	
	42			C		E					K 8	
	41					E					K 8	
	6B5			C		E					K	
											See also 6-volt types under 38 in 300 ma. table	
6L6G*	6L6GA	A										
	6AH5G				D							
	6F6G*			C							K 2	
	42			C		E					K 2	
6N6G	6B5					E						
	42					E					K	
	6F6					E					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/G*	6ZY5G			C							2	
	84					E					8	
	6Z5				D							
	7Y4					E					8	
	6Y5			C		E						
7B5	6V6GT/G*			C		E					K 2	
	6K6GT					E					K	
	6F6G*					E					K	
	6U6GT			C		E					K 2	
	7C5			C		E					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.

FOR TRANSFORMER AND AUTO TYPES

TUBE SUBSTITUTION CHARTS

For details of changes indicated See page 10		NO CHANGES FIL. VOLTS FIL. CURRENT REWIRE SOCKET CHANGE SOCKET REALIGN ADD TOP CAP OR REMOVE TOP CAP OR REMOVE TOP CAP OR REMOVE TOP CAP OR REMOVE TOP CAP NOTE NO.									
REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K	
7C5	6V6GT/G*					E					
	6K6GT			C		E					2
	6F6G*			C		E					2
	6U6GT			C		E					2
	7B5			C		E					2
	41			C		E					2
	42			C		E					2
7N7	6N7G*			C		E					
	6F8G					E					
	6C8G			C		E		G			K
	6SN7GT*					E					
12A	01A										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					2
	6B5			C							K
	6N6G			C		E					K
	7A5			C		E					2
	7B5			C		E					8
	7C5			C		E					K
	6V6GT			C		E					K
42	41			C							K
	6K6G			C		E					K
	6F6G			C		E					
	6U6GT			C		E					2
	6B5			C							K
	6N6G			C		E					K
	7A5			C		E					2
	7B5			C		E					8
	7C5			C		E					2
	6V6GT			C		E					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
	47 When used as pen.			C		E					K
	45 When used as tri.			C		E					K
71A	182B			C							K
	183			C							K
	12A										K

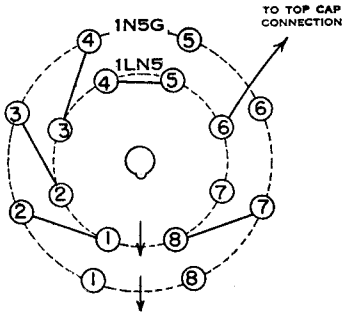
For details of changes indicated See page 10		NO CHANGES FIL. VOLTS FIL. CURRENT REWIRE SOCKET CHANGE SOCKET REALIGN ADD TOP CAP OR REMOVE TOP CAP OR REMOVE TOP CAP OR REMOVE TOP CAP NOTE NO.									
REQUIRED TYPE	POSSIBLE REPLACEMENTS	A	B	C	D	E	F	G	H	K	
80	5Y4G					E					
	5Y3GT/G*					E					
	5W4GT/G*			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	41				D						K
	6K6G					E					K
117L7/ M7GT	117N7GT				D						K
	117P7GT					D					
	70L7GT		B	C	D						2
	70A7GT		B	C	D						2
117N7GT	117L7/M7GT				D						K
	117P7GT					D					K
	70L7GT		B	C	D						2
	70A7GT		B	C	D						2
117P7GT	117L7/M7GT				D						
	117N7GT										K
	70L7GT		B	C	D						2
	70A7GT		B	C	D						2
117Z6GT/G	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, on page 10.											
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.

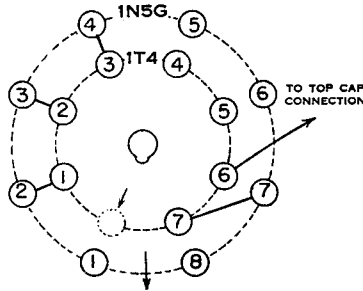
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AMPLIFIERS

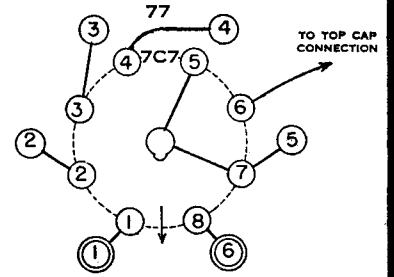
TYPE 1LN5 REPLACING TYPE 1N5G



TYPE 1T4 REPLACING TYPE 1N5G

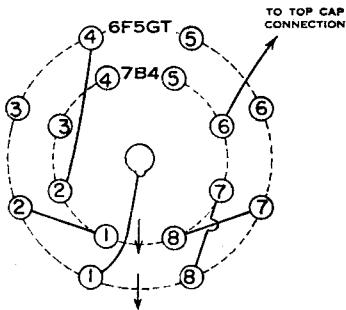


TYPE 7C7* REPLACING TYPE $\begin{cases} 77 \\ 6C6 \end{cases}$
 TYPE $\begin{cases} 7A7 \\ 7B7* \end{cases}$ REPLACING TYPE $\begin{cases} 78 \\ 6D6 \end{cases}$

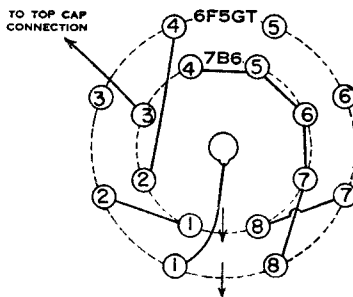


* REQUIRES 42 TO 50 OHMS ACROSS HEATERS IN AC-DC SETS.

TYPE 7B4 REPLACING TYPE 6F5GT

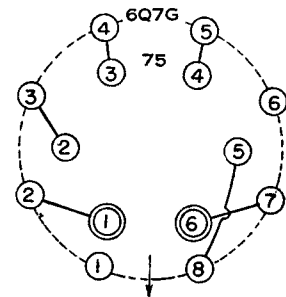


TYPE $\begin{cases} 7B6 \\ 7C6* \end{cases}$ REPLACING TYPE 6F5GT

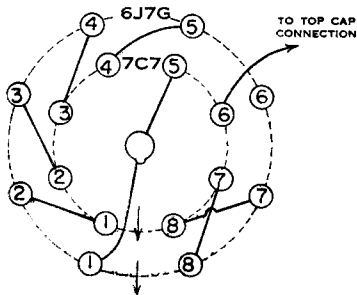


* REQUIRES 42 TO 50 OHMS ACROSS HEATERS IN AC-DC SETS.

TYPE 75 REPLACING TYPE 6Q7G
 TYPE 43 REPLACING TYPE 25L6
 TYPE $\begin{cases} 41 \\ 42 \end{cases}$ REPLACING TYPE $\begin{cases} 6F6 \\ 6K6 \\ 6U6 \\ 6V6 \end{cases}$

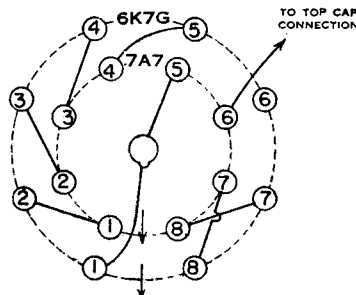


TYPE $\begin{cases} 7C7* \\ 7L7 \end{cases}$ REPLACING TYPE 6J7GT
 TYPE $\begin{cases} 14C7 \\ 7C7 \end{cases}$ REPLACING TYPE 12J7GT

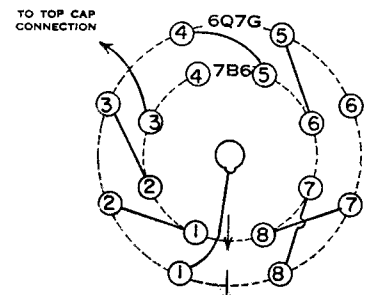


* REQUIRES 42 TO 50 OHMS ACROSS HEATERS IN AC-DC SETS.

TYPE $\begin{cases} 7H7 \\ 7A7 \end{cases}$ REPLACING TYPE 6K7GT
 TYPE $\begin{cases} 14H7 \\ 14A7 \end{cases}$ REPLACING TYPE 12K7GT



TYPE $\begin{cases} 7B6 \\ 7C6* \end{cases}$ REPLACING TYPE 6Q7GT
 TYPE $\begin{cases} 7C6 \\ 14B6 \end{cases}$ REPLACING TYPE 12Q7GT



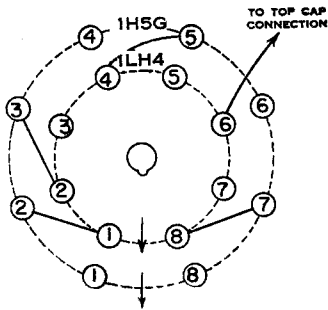
* REQUIRES 42 TO 50 OHMS ACROSS HEATERS IN AC-DC SETS.

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.

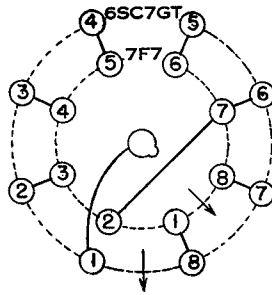
ADAPTOR CIRCUITS COMMONLY REQUIRED

AMPLIFIERS CONT'D

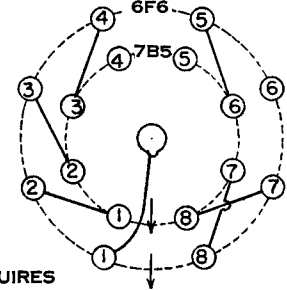
TYPE 1LH4 REPLACING TYPE 1H5GT



TYPE 7F7 REPLACING TYPE 6SC7GT

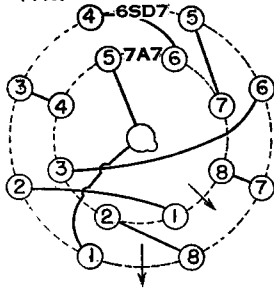


TYPE 1LA4 REPLACING TYPE 1A5G
 TYPE 35A5 REPLACING TYPE 35L6
 TYPE 50A5 REPLACING TYPE 50L6GT
 TYPE 14C5* REPLACING TYPE { 25L6G
 25A6G
 TYPE { 7A4 REPLACING TYPE 6C5GT
 XXL
 TYPE 7B5 REPLACING TYPE { 6F6
 6K6
 6U6
 6V6



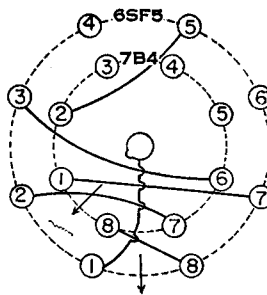
* REQUIRES
 175 OHMS ACROSS HEATERS IN AC-DC
 SETS AND 42 OHMS IN SERIES STRING.

TYPE { 7C7 REPLACING TYPE { 12SJ7GT
 14C7 6SJ7GT*
 TYPE { 14H7 REPLACING TYPE 12SK7GT
 14A7
 TYPE { 7A7 REPLACING TYPE { 6SD7GT
 7H7 6SK7GT

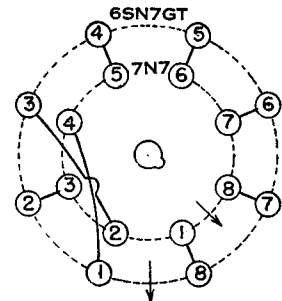


* REQUIRES 42 TO 50 OHMS ACROSS
 HEATERS IN AC-DC SETS.

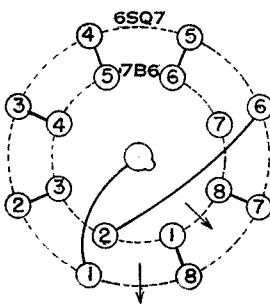
TYPE 7B4 REPLACING TYPE 6SF5



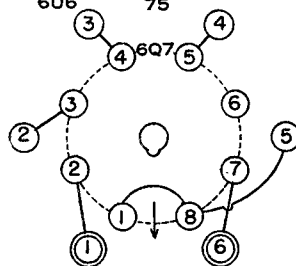
TYPE 7N7 REPLACING TYPE 6SN7GT



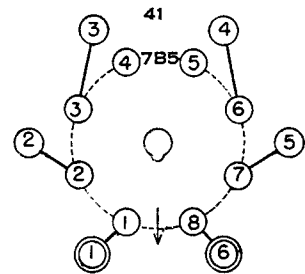
TYPE 7B6 REPLACING TYPE 6SQ7
 TYPE 14B6 REPLACING TYPE 12SQ7



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



TYPE 7B5 REPLACING TYPE { 41
 42

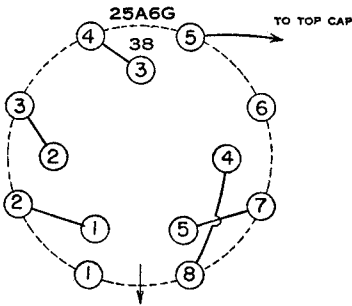


INNER CIRCLES REPRESENT THE PINS OF THE TYPE OF TUBE AVAILABLE FOR USE IN THE
 SOCKET WIRED FOR THE TYPE SHOWN AS THE OUTER CIRCLE. THE SOLID LINES SHOW THE
 WIRING FOR EITHER AN ADAPTOR OR FOR RECONNECTING TO THE SAME OR TO DIFFERENT SOCKETS.

ADAPTOR CIRCUITS COMMONLY REQUIRED

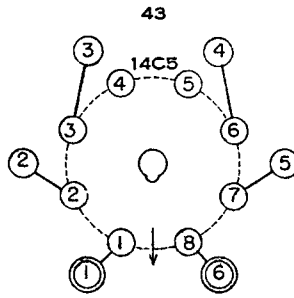
AMPLIFIERS CONT'D

TYPE 38 REPLACING TYPE 25A6G



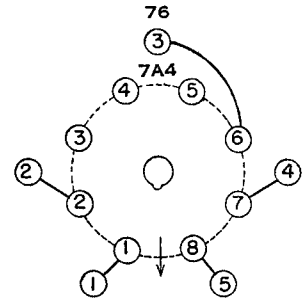
ADD 70 OHMS IN SERIES WITH HEATER IN AC-DC SETS.

TYPE 14C5 REPLACING TYPE 43



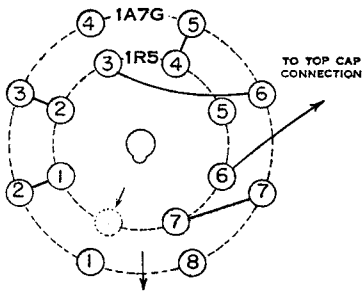
REQUIRES
175 OHMS ACROSS HEATERS IN AC-DC SETS AND 42 OHMS IN SERIES STRING.

TYPE { 7A4
XXL REPLACING TYPE 76



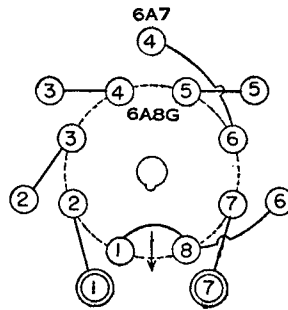
CONVERTERS

TYPE 1R5 REPLACING TYPE 1A7G

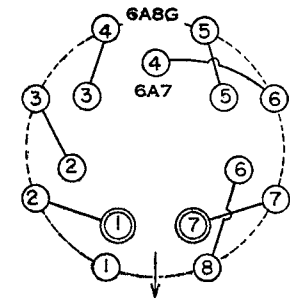


IN SOME LOCATIONS SENSITIVITY MAY BE TOO LOW FOR AVAILABLE SIGNAL STRENGTH.

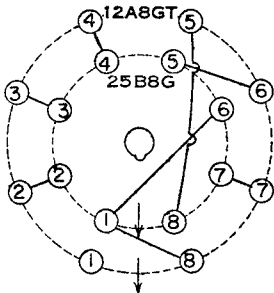
TYPE { 6K8G
6J8G REPLACING TYPE 6A7
6A8G



TYPE 6A7 REPLACING TYPE 6A8G

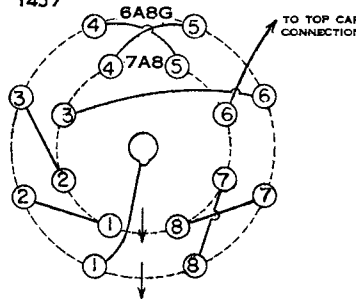


TYPE 25B8GT REPLACING TYPE 12A8GT
TYPE 12B8GT REPLACING TYPE 6A8G



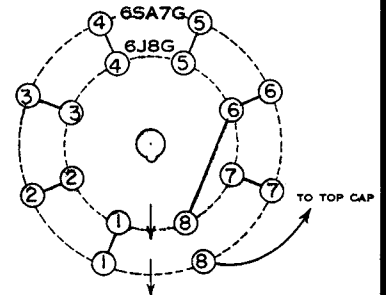
TYPE { 7B8
7A8* REPLACING TYPE { 6A8G
6J8G
7J7 6K8G

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



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

TYPE { 6J8G
6A8G REPLACING TYPE 6SA7GT
TYPE 12K8G REPLACING TYPE 12SA7GT

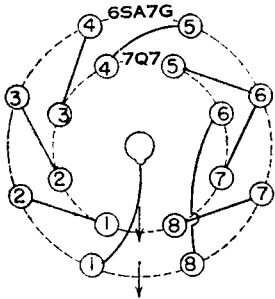


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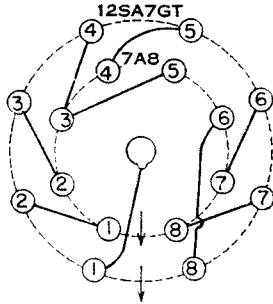
ADAPTOR CIRCUITS COMMONLY REQUIRED

CONVERTERS CONT'D

TYPE 7Q7 REPLACING TYPE 6SA7GT
 TYPE 14Q7 REPLACING TYPE 12SA7

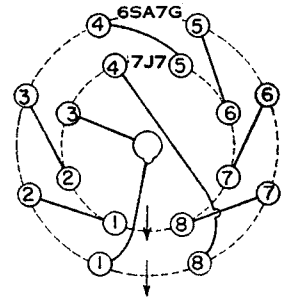


TYPE { 7A8
 14B8 } REPLACING TYPE 12SA7GT
 TYPE { 7B8
 7A8 * } REPLACING TYPE 6SA7GT



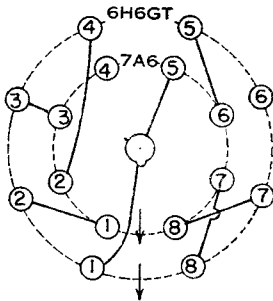
* REQUIRES 42 TO 50 OHMS ACROSS HEATERS IN AC-DC SETS.

TYPE { 14S7
 14J7 } REPLACING TYPE 12SA7GT
 TYPE { 7S7
 7J7 } REPLACING TYPE 6SA7GT



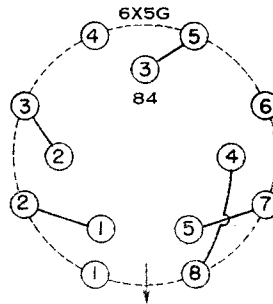
RECTIFIERS

TYPE 7A6 REPLACING TYPE 6H6GT

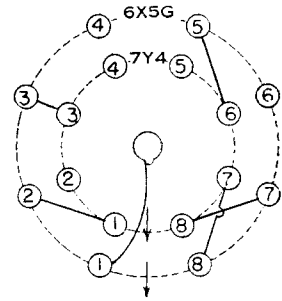


REQUIRES 42 TO 50 OHMS ACROSS HEATERS IN AC-DC SETS.

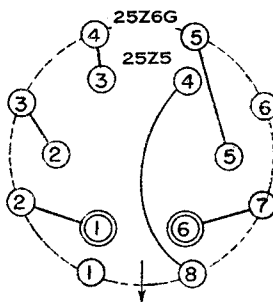
TYPE 84 REPLACING TYPE 6X5G



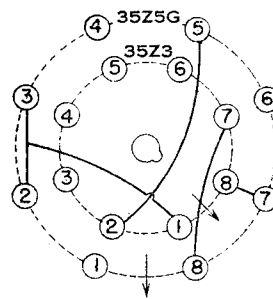
TYPE 7Y4 REPLACING TYPE 6X5G



TYPE 25Z5 REPLACING TYPE 25Z6G

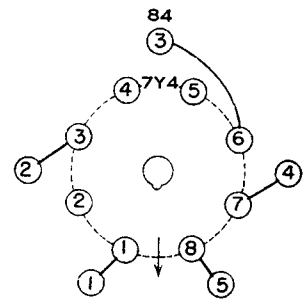


TYPE 35Z3 REPLACING TYPE 35Z5GT/G



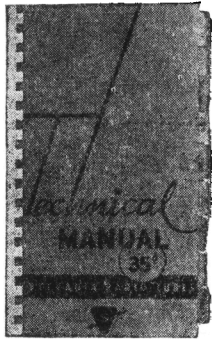
OTHER PROVISION NECESSARY FOR PILOT LAMP.

TYPE 7Y4 REPLACING TYPE 84



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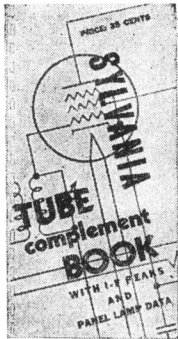


TECHNICAL MANUAL

Essential tube data and circuit information in a convenient reference form:—

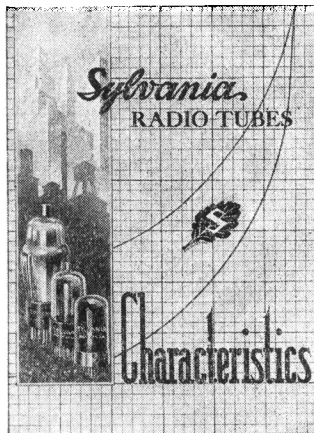
1. Fundamental properties of Vacuum Tubes.
2. General Tube and Circuit information.
3. Characteristics of Sylvania Receiving Tubes.
4. Typical Radio and Receiver and Amplifier Circuits.

35 cents



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Characteristics of Sylvania tubes and panel lamps with tube base views. Free.



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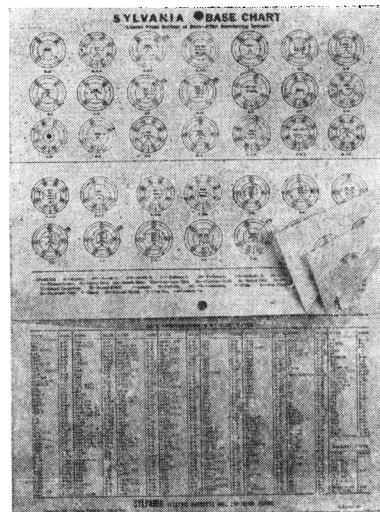
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