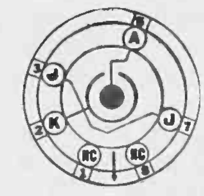
JAN.-FEB., 1943 EMPORIUM, PENNA. Vol. 10, No. 2

Voltage Regulator Tubes



Sylvania Types 0B3/VR90 and 0D3/VR150

Two well-known Sylvania voltage regulator tubes, Type VR-90 and Type VR-150, have recently been assigned regular RMA numbers and are now designated as Type 0B3/VR90 and Type 0D3/VR150 respectively. The double branding assists in recognizing the tube type, especially in view of the long usage of the older designations.

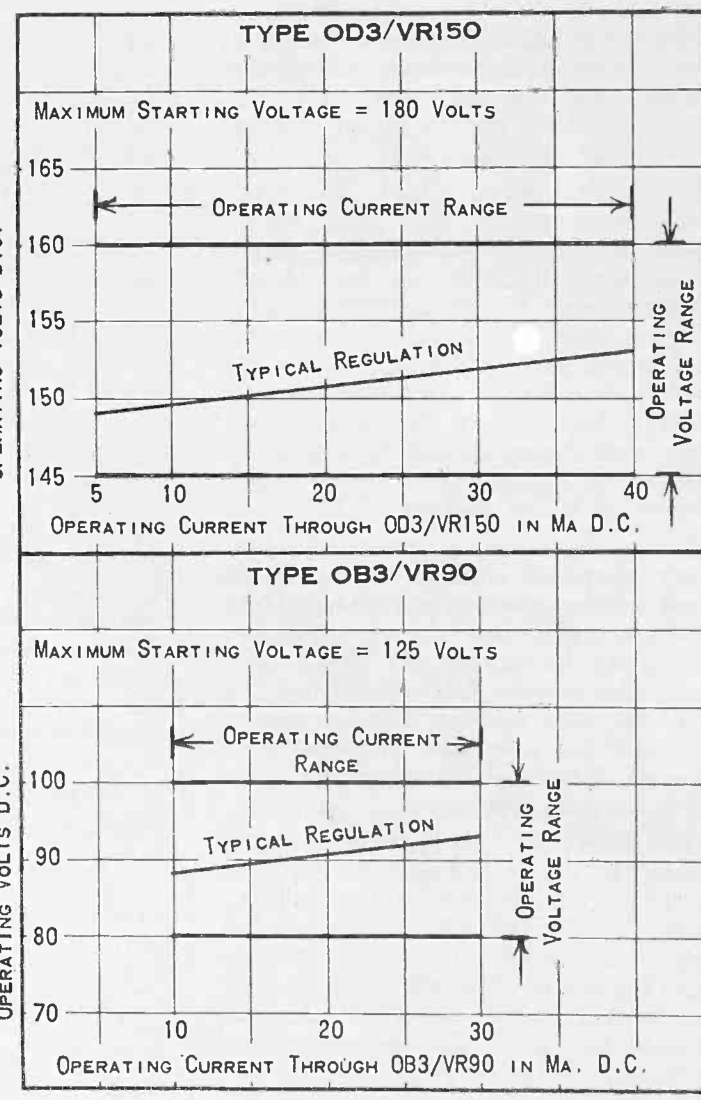
It has been apparent in many instances that some misunderstandings have existed regarding the operation of these regulators, particularly the operation limits and regulation characteristics. The following descriptions and explanation may help to clarify the general applications of these regulators.

CHARACTERISTICS

	0B3/VR90	0D3/VR150
No Heater Voltage Required		
Starting Supply Voltage	125 Volts Min.	180 Volts Min.
Operating Voltage (Design Center)	90 Volts	150 Volts
Operating Current Range*	10 Ma. Min. 30 Ma. Max.	5 Ma. Min. 40 Ma. Max.
Regulation over Operating Current Range†	6 Volts Max.	7.5 Volts Max.

*Adequate resistance required in series with tube to limit tube current to maximum values specified.

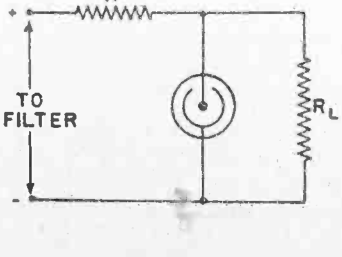
†Refer to text and curves.

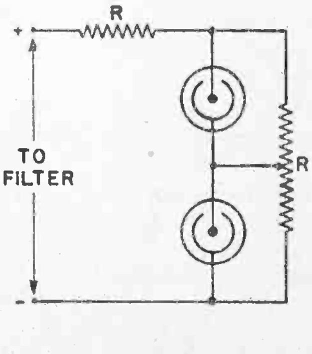


Types 0B3/VR90 and 0D3/VR150 are gas filled, cold cathode regulator tubes. They are characterized by a practically constant internal voltage drop across which a load requiring good voltage regulation may be connected.

Both types are mounted in ST-12 bulbs with the standard small 6-pin octal base. The outside, cylindrical electrode is the cathode and is connected to base pin No. 2. The inner electrode is the anode and is connected to pin No. 5. The jumper within the base serves as a switch to open the power supply circuit when the regulator tube is removed from its socket, providing the proper socket connections are employed.

As indicated in the accompanying diagram, a current limiting resistor should always be used in series with the regulator tube and the supply voltage. The amount of current drawn by the load will of course determine the size of this resistor, but it should be such as never to allow an operating current of more than 30 ma. to flow through the 0B3/VR90, or more than 40 ma. to flow through the 0D3/VR150, in case the load is disconnected.





To start the tube operating some definite d-c voltage must be applied to ionize the gas in the tube. For Type 0B3/VR90 this voltage is approximately 115 volts but should never require more than 125 volts. Once started, the 0B3/VR90 continues to operate at some voltage within the operating range of 80 to 100 volts. For the 0D3/VR150 the starting voltage is approximately 165 volts but should never require more than 180 volts and once started the 0D3/VR150 continues to operate at some voltage within its operating range of

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Plate and Screen Dissipation Ratings

Their Relation to Tube Performance and Life

Editor's Note: Numerous requests have been received for information concerning dissipation ratings. It is hoped that this article will provide helpful information on this subject and that it will encourage attention to and respect for published tube ratings.

Vacuum tube ratings provide an accurate guide to assist the engineer or serviceman in securing efficient tube performance. The use of this information, coupled with careful attention to circuit considerations and proper installations will generally pay dividends in acceptable operating efficiency. Among the important factors included in tube data are the ratings of maximum plate and maximum screen dissipations. The discussion which follows deals primarily with dissipation considerations.

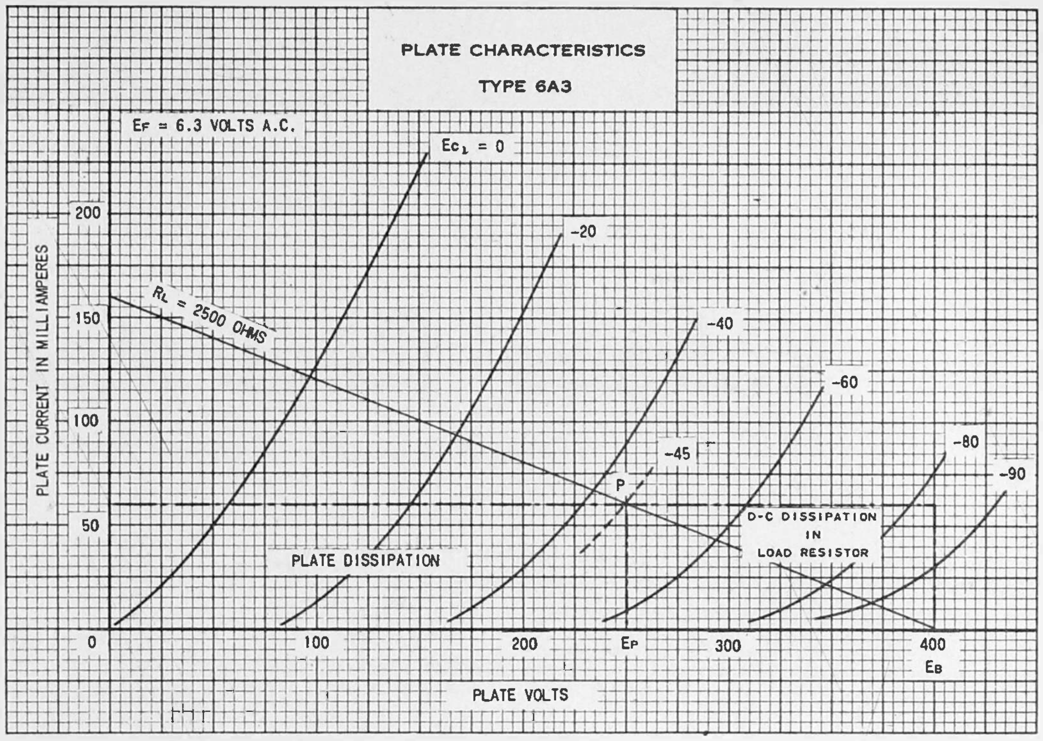
The interpretation of tube ratings published in the Sylvania Technical Manual and other Sylvania technical literature are in accordance with RMA standards and the conditions outlined in the introductory section of the manual for the plate and screen are:

A-C or D-C Power Line: The maximum ratings of plate and screen voltages and dissipations given on the tube type data sheets are Design Maximums. For equipment designed for use in the United States on nominal power-line services of 105 to 125 volts, satisfactory performance and serviceability may be anticipated, provided the equipment is designed so as not to exceed these Design Maximums at a line voltage of 117 volts.

Storage Batteries: Automobile battery operated equipment should be designed so that when the battery voltage is 6.6 volts, the plate voltage, the plate dissipation, the screen voltage, the screen dissipation, and the rectifier load current will not exceed 90% of the respective recommended Design Maximum values given in the data for each tube type.

"B" Batteries: Equipment operated from "B" batteries should be designed so that under no condition of battery voltage will the plate voltage, the plate dissipation, the screen voltage, and the screen dissipation ever exceed the recommended respective maximum values shown in the data for each type by more than 10%.

In general, electrode dissipation is the power dissipated in the form of heat by an electrode as a result of electron and/or ion bombardment. Each tube type must have maximum ratings assigned, these being dependent upon the tube design, its component parts and the kind of service it is to perform. Experience has shown that when maximum ratings are exceeded, particularly for an appreciable time, the performance capabilities may be impaired and the tube life shortened.



The total power dissipated by the tube consists of plate and grid losses plus the power used in heating the cathode. All of this heat must be carried away from the tube, principally through the envelope of the tube. A major proportion of the energy which is dissipated in tubes having glass bulbs is produced at the plate of the tube. Consequently, the plate has to be capable of radiating all the heat generated at its surface, and also the heat radiated to the plate by the cathode and other elements, without damage or adverse results. Any excessive heat, above that stipulated by the maximum dissipation ratings, can produce very detrimental effects. These will be covered in more detail later.

Triode Class A Power Amplifiers

As a first example, consider a triode power amplifier such as a Type 6A3, operated resistance-coupled, under the rated Class A conditions. The accompanying plate characteristic indicates that with 250 volts applied to the plate, -45 volts grid bias and the recommended load of 2500 ohms, the rated plate current is 60 ma. This requires a plate supply voltage of 400 volts for with 60 ma. flowing through the load resistor of 2500 ohms there will be a voltage drop across R_L of 0.06 ma. x 2500 ohms or 150 volts, and hence an applied voltage of 250 volts. The d-c power dissipated in the load resistor will be $I^2 R_L$ or $(E_b - E_p)I$ watts. Using the latter expression this gives 150 volts x 0.06 ampere or 9 watts, and this power is represented on the diagram by the rectangle at the right. The plate dissipation of the tube will be EpI or 250 volts x 0.06 ampere which equals 15 watts. This is represented by the rectangle at the left as designated. These values only apply when no input signal is applied to the grid.

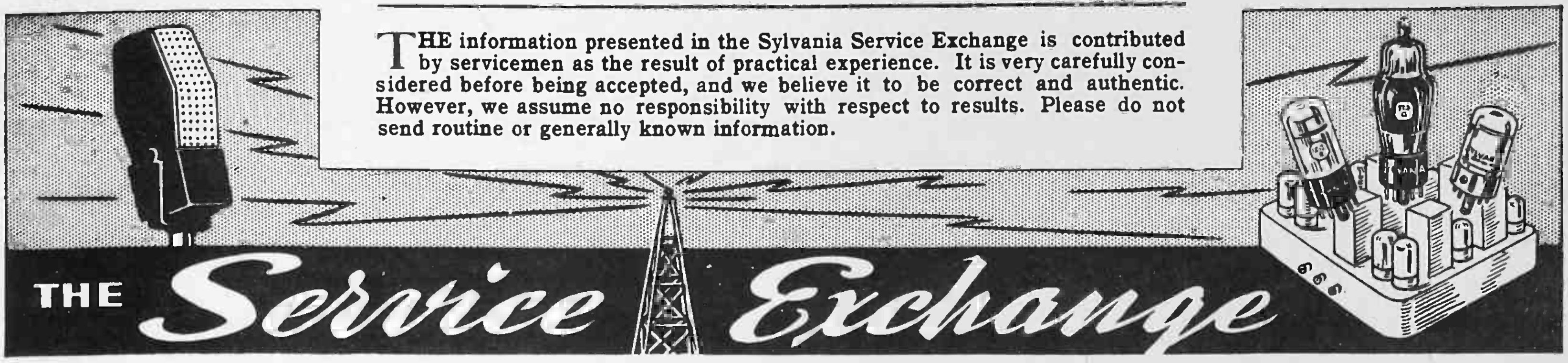
When an alternating voltage is impressed on the grid, the voltage at the plate of the tube will also fluctuate since it will differ from the supply voltage by the drop in the load impedance. With the signal on the positive half cycle, the plate current will increase, this causing a larger drop in R_L so that the plate potential will be less than its value at the operating point. On the negative half cycle the instantaneous grid voltage will be more negative than -45 volts, the instantaneous plate current will be less than the average value and the drop in R_L will be reduced. Consequently the instantaneous plate voltage is higher during the negative half cycle.

With an impressed input signal whose peak voltage equals the bias voltage, the a-c power developed in the load is rated at 3.2 watts. This a-c power is dissipated in R_L in addition to the d-c power dissipation of 9 watts mentioned above. The plate dissipation is therefore reduced by the amount of the power output. This decrease in plate dissipation under dynamic operating conditions is a characteristic of all class A amplifiers. Hence, Class A power amplifiers should be so designed that the dissipation under static conditions will not be exceeded.

The RMA ratings for Type 6A3 specify a maximum plate voltage of 325 volts and a maximum plate dissipation of 15 watts. Since a plate current of 60 ma. is obtained when 250 volts are applied to the plate with a grid bias of -45 volts, it is apparent that if a higher plate voltage is employed, the maximum

(Continued on page 4, column 1)

THE information presented in the Sylvania Service Exchange is contributed by servicemen as the result of practical experience. It is very carefully considered before being accepted, and we believe it to be correct and authentic. However, we assume no responsibility with respect to results. Please do not send routine or generally known information.



Philco 53 and 59. Watch for shorted filter condenser caused by pressure of i-f trimmer condenser plate being pressed against terminal during adjustment, causing short to ground.—William Anderson, Bronx, New York.

* * *

Philco 112X. This receiver when playing would play fine for periods of 15 to 30 minutes after which it would fade and the customer would have to turn the dial to catch up with the station. Tubes found OK, and upon examination and checking for voltage it also was as per voltage measurement by Philco. But the R-51 (value is 15,000 ohm 5 watt) unit, after disconnecting, was found to measure 2000 ohms and this is a big change in resistance. Replace with a new unit 15,000 ohms, but make sure you replace with a wire-wound resistor instead of carbon. Also replace C-42 with any reliable condenser rated .02 mfd. 600 volts. This set is playing fine and the customer is more than satisfied.—Stephen M. Skovran, N. S. Pittsburgh, Pa.

* * *

Arvin #518. Tubes all light up but no reception. Replace the C-8 coupling condenser between 41 tube grid and 76 plate. This condenser was open but make sure that it is replaced with a 600 volt unit instead of the 400 volts.—Stephen M. Skovran, N. S. Pittsburgh, Pa.

* * *

Buick Sonomatic. If you can tune this set with the push buttons but not with the manual control when the set is on, look for a broken spring on the right hand side of the condenser push button assembly. Look real close because the spring is small and is very easily missed. This spring is supposed to kick back the rocker arm with the return of the push button when it is used. This rocker arm has a switch on the right side of it, which it opens and closes each time it swings back and forth. The switch in turn controls a relay which releases the manual control from the condenser when the push buttons are used. If the spring is broken the rocker arm does not return back to the position in which it should be and the switch on the side stays closed. Therefore, the manual control is released from the condenser and you are unable to tune with it. To remedy put a new spring in the set. In order to do this the condenser and push button assembly must be pulled out of the set.—Michael Yurkovich, Highland Park, Mich.

THANK YOU

Our announcement in the last issue of the NEWS that it is no longer possible to give tubes as awards for material submitted for this section has not slowed up the incoming mail one bit. We greatly appreciate the patriotic endeavor of all of you who are continuing to share your valuable knowledge with other servicemen.

Loss of Sensitivity. When the set will play weakly and all voltages and tubes check OK, take your signal generator, set it for the i-f frequency and send a signal thru the first detector. If you find that there is not as much volume with the generator connected to the detector as there is with it connected to the first i-f and loosening of the transformer adjustments tends to bring the signal up, examination of the i-f padders will probably show that they are either wet or have been wet. Replace the mica between the plates, adjust the i-f padders and you will find your gain is OK. The mica kits Sylvania sells so reasonably will furnish mica for jobs of this type for several years. Now that we are unable to get many types of parts it is our duty to conserve and repair all of those that we know can be repaired and will still give service.—J. W. Brewer, Jr., Sinton, Texas.

* * *

Delco R-1130. No control of volume regardless of the setting. Upon checking found a leaky condenser C-29 (10 mfd. 25 volts) in the a-v-c circuit. Replace with a new unit of 10 mfds. and the voltage should be at least 35 or 50 volts.—Stephen M. Skrovan. N. S. Pittsburgh, Pa.

SALVAGE SUGGESTION

If you servicemen will go over your accumulation of old trade-ins, which have been collecting dust and taking up room, you can help the good old U.S.A. two ways. Just jerk out the old tubes and sell the chassis and power packs for junk. With the money you obtain buy Bonds and Stamps. By doing this you are supplying needed metals and helping finance the cost to "Keep Em Rolling". You don't even have to reach in your "jeans". It will only take a couple hours of your time. Come on boys! We can do it, can't we?—Oliver F. Klein, Milwaukee, Wisconsin.

* * *

Emerson 462 Combination. On a complaint of very low volume similar to an open voice coil, check the 2.2 megohm 0.1 watt 6SJ7 a-f screen resistor for an open. It is also advisable to check the 0.05 mfd. 400 volt bypass condenser at the screen terminal.

When replacing the 0.1 watt resistor a slightly larger unit is recommended, such as a ½ watt resistor.—Joseph S. Napora, Uniontown, Pa.

* * *

Truetone Model D-715. Intermittent Service-Cutting Off when tilting. Space and adjust throwout switch contact points back of push button tuning motor so that contact is made only while motor is in operation. Bendix button in motor does not draw back into motor sufficiently to release contact points, but appears to do so.—Walter Reynolds, Jr., Hattiesburg, Mississippi.

* * *

Wurlitzer Multi - Selector. Record stops playing during normal running operation. Open back of cabinet and locate large fiber gear and small worm gear combination. Examination may disclose that some teeth are worn, thus allowing worm to be disengaged with the result that record stops after one revolution. To repair, note that worm gear is on a separate carriage. Four nuts hold carriage to top of board. Loosen nuts and insert small thin shims of sufficient thickness to insure that gear teeth engage worm when nuts are again tightened. This repair job was done in half an hour and the set works as good as new. (A previous estimate by the company for necessary repairs was $25.00). I hope this may help some other serviceman.—W. J. Dingwell, Port Monmouth, New Jersey.

* * *

Silvertone Models. In Silvertones and other similar receivers I find that the plate voltage exceeds the manufacturer's tube ratings, especially on output tubes. Sometimes a new tube will act the same. I find that lowering the plate voltage 10 to 25 volts makes for better performance, thus saving critical material. The little difference in volume can usually be made up by a tune-up which will also eliminate further troubles when high line voltage occurs.—James DiChiera, Westernport, Md.

PLATE AND SCREEN DISSIPATION RATINGS
THEIR RELATION TO TUBE PERFORMANCE AND LIFE

(Continued from page 2)

plate dissipation will be exceeded unless more bias is provided to reduce the plate current to a safe value. In general, the allowable plate dissipation will determine the maximum operating plate current for a given plate voltage. For some tube types the allowable dissipation may be high enough so that the operating point and load resistance may be based upon considerations of distortion, flow of grid current and desired power output.

Pentodes And Beam Tubes

With pentodes and beam tubes additional factors must be taken into consideration. The total B-supply input power will be the power in the plate circuit plus the power dissipated in the screen circuit. With an input signal whose peak voltage equals the bias, the power delivered to the plate circuit is the product of the maximum signal plate current and the corresponding plate voltage. The heat dissipated by the plate will be the power supplied to the plate circuit less the power delivered to the load.

Screen dissipation increases quite rapidly with applied signal voltage and may be several times greater at the maximum signal condition than when the signal is zero. The increase in d-c screen current with signal occurs because of the influencing effect of plate potential on screen current and is particularly noticeable when a high value of load resistance is employed. This condition should be avoided, not only to maintain the screen dissipation within limits but also to keep the distortion at an acceptable value.

Typical Example

As a second illustration of zero-output and rated-output screen and plate conditions we will survey the ratings for Type 7C5, or the octal-based equivalent Type 6V6GT/G, when employed as a single-ended Class A amplifier. Maximum ratings are:

Plate Voltage	315 Volts
Screen Voltage	250 Volts
Plate Dissipation	12 Watts
Screen Dissipation	2 Watts

Recommended operating conditions are:

Heater Voltage	6.3	6.3	Volts
Plate Voltage	250	315	Volts
Screen Voltage	250	225	Volts
Grid Voltage	−12.5	−13	Volts
Peak Input Signal	12.5	13	Volts
Plate Current (Zero Signal)	45	34	Ma.
Plate Current (Max. Signal)	47	35	Ma.
Screen Current (Zero Signal)	4.5	2.2	Ma.
Screen Current (Max. Signal)	7.0	6.0	Ma.
Load Resistance	5000	8000	Ohms
Power Output	4.5	5.5	Watts
Total Distortion	8	12	Per Cent

For the 250 volt condition the dissipation values computed from the above figures show:

Zero output plate dissipation is $250 \times 0.045 = 11.25$ Watts
Zero output screen dissipation is $250 \times 0.0045 = 1.125$ Watts
Full output plate dissipation is $(250 \times 0.047) - 4.5 = 7.25$ Watts
Full output screen dissipation is $250 \times 0.007 = 1.75$ Watts

We see, therefore, that as the output goes from zero to 4.5 watts the plate dissipation drops from 11.25 watts to 7.25 watts while the screen dissipation increases 0.625 watt.

Similar computations could be made for the 315 volt condition. It is to be noted that the recommended operating conditions have been designated so as not to exceed the maximum dissipation ratings. One should bear in mind that published ratings represent average tubes and that any particular tube when measured may differ to some extent from these figures for plate and screen values, power output and distortion.

Special Precautions

It has been pointed out that because of the reduction of minimum plate voltage which occurs with increase in load, the average and maximum values of screen current increase with load resistance. Hence, permissible screen dissipation limits the maximum load that can be employed. This justifies the precaution that the load should never be removed from the output transformer secondary of a pentode or beam tube since the effective load impedance will increase and the resulting excessive screen dissipation will damage the tube.

Removing the plate voltage, without also removing the screen voltage, gives rise to abnormally high screen currents even though rated screen voltage and rated bias are normal. This means excessive screen dissipation will be encountered and the tube soon ruined if operation continues.

Dissipations higher than the specified maximum values generally result in detrimental effects such as secondary emission, high gas currents, warpage of tube elements and actual tube destruction.

A recent issue of Sylvania News (Vol. 9 No. 10 June 1942) carried an article entitled "Tracking Down Grid Emission" in which appeared the precaution that excessive heat is the factor that must be avoided to prevent grid emission troubles. It is suggested that you review that article since it contains valuable information which is closely related to the present subject.

VOLTAGE REGULATOR TUBES
Sylvania Tubes 0B3/VR90 and 0D3/VR150

(Continued from page 1)

145 to 160 volts. For either type of tube the operating voltage will be less than that required for breakdown.

Regulation Characteristic

The operating voltages are also dependent upon the current passing through the tube, generally being several volts higher at high current drains than at low values of current. This difference in operating voltage on any **particular** tube is a measure of the regulation for **that** tube. For Type 0B3/VR90 the maximum regulation is 6 volts over the operating range of 10 to 30 ma. For Type 0D3/VR150 the maximum regulation is 7.5 volts over the operating current range of 5 to 40 ma. On an ideal tube the regulation would have a zero slope and for such a case the operating voltage would be constant over the operating current range. This condition is rarely obtained in actual practice. The regulation tends to improve during the life of a tube.

Possible Tube-To-Tube Differences

One very important factor which should be noted is that individual tubes may not deliver identical voltages to the load. For example, if a given 0B3/VR90 tube is checked and found to deliver 88 volts to the load and this tube is replaced with another 0B3/VR90 this tube might deliver 92 volts or some other voltage to the load. Nevertheless, the voltage should always be within the specified limits for operating voltage which would be 80 to 100 volts for the 0B3/VR90, and the regulation 6 volts or less; while for the 0D3/VR150 the voltage will be between 145 volts and 160 volts and the regulation would be 7.5 volts or less.

Series Operation

Two or more regulator tubes of the same type may be connected in series to obtain higher voltages which are multiples of the drop for a single tube. Voltage taps may be taken from the junction points of the regulator tubes as indicated in the circuit diagram. A Type 0B3/VR90 and an 0D3/VR150 cannot be used in series principally because of the difference in breakdown voltage required and because of the differences which exist in the operating ranges for the two regulator tubes.

Old Tubes for New

A rule requiring owners of radio sets to turn in their old tubes when they buy new ones is being worked out by the WPB and will probably go into effect soon. The tube turn-in regulation is intended to control the number of tubes distributed. It also will permit the salvaging of tube bases which, in some cases, can be refabricated. Watch our next issue for more information.

TECHNICAL SECTION

Sylvania News

MARCH, 1943 EMPORIUM, PENNA. Vol. 10, No. 3

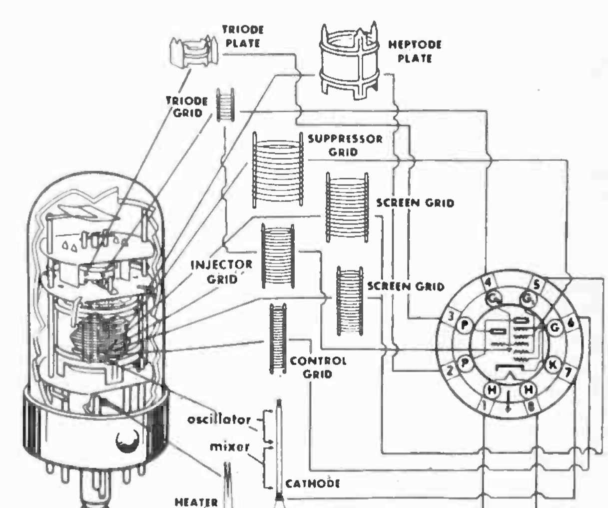
Converter Tube Design Features

Service problems related to converter tubes may often be clarified through knowledge of the tube design of the particular type in question. Numerous converter tube types have been employed in superheterodyne receivers. Five principal designs are in general use and these will be briefly described as to their constructional features and the functions associated with the various grid structures. Several typical performance curves are also discussed.

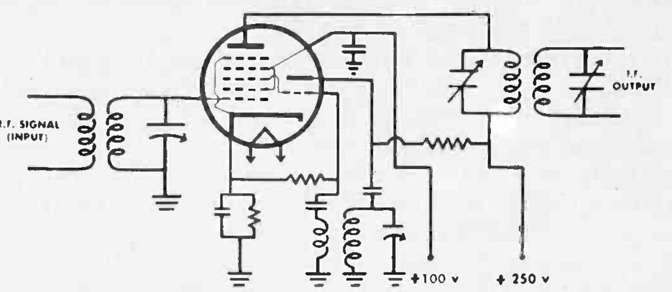
TRIODE-HEPTODE CONVERTERS

Types 7J7, 7S7, 14J7, 14S7, 6J8G

The superheterodyne receiver requires a converter tube whose function is to mix or beat (heterodyne) the incoming signal frequency with a locally generated frequency to obtain an intermediate frequency. If the output from a conventional triode oscillator is suitably coupled to a tuned r-f voltage amplifier, the pentode plate circuit will contain four frequencies: the signal frequency, the oscillator frequency, and the sum and the difference frequencies of these two. The latter are obtained by beating the first two frequencies mentioned. Since more gain is secured at lower frequencies in the i-f amplifier stages, the difference frequency (called the i-f frequency) is the one desired. This can be obtained when the tuned circuits in the pentode plate are designed to resonate at the i-f frequency, in which case they will reject the other three frequencies.



Such a circuit can be simplified considerably by combining the triode oscillator with the mixer tube in one bulb. Furthermore, improved efficiency and stability can be secured by adding an injector grid in the mixer section which is connected directly to the grid of the oscillator section, thereby permitting both the mixer control grid and the injector grid to control the electron stream. This provides true electron coupling. An illustration of such a tube is the **triode-heptode** Type 7J7 shown above. The diagram indicates that the cathode is common to both units, the upper portion being associated with the triode oscillator and the lower section with the heptode mixer. A typical circuit diagram is shown wherein plate-tuning of the oscillator is indicated. Grid-circuit tuning is also widely employed with triode-heptode tubes, in which case the oscillator circuit resembles that shown for the pentagrid converter described below.



THE PENTAGRID CONVERTER

Types 1LA6, 1A7GT/G, 7A8, 7B8, 6A8G, and others

Pentagrid Converter is the name applied to a tube having five grids in addition to the cathode and plate and intended for frequency conversion in superheterodyne radio receivers. Such tubes combine the functions of oscillator, mixer and amplifier within one structure. The No. 1 and No. 2 grids are used as the oscillator grid and oscillator plate respectively. Electrons passing through grids No. 1 and No. 2 are further controlled by the signal input grid No. 4. This grid is shielded from the oscillator section by grid No. 3 and from interaction with the plate by grid No. 5. Screen grids No. 3 and No. 5 are connected together internally. The circuit on the next page illustrates the use of the pentagrid converter, such as Type 7B8. Voltages of signal and oscillator frequency reaching the plate are bypassed to ground, since the tuned circuit in the plate is resonant only to the beat or intermediate frequency (I.F.) which is to be further amplified.

The pentagrid converter may be considered as operating very much like a conventional variable-mu tetrode first detector with an associated triode oscillator, except that the oscillator triode grid is located next to the cathode which is common to both the first detector variable-mu tetrode and the oscillator triode. Electrons emitted from the cathode surface are influenced by the various grid and plate voltages and divide up so that grid No. 1 receives about 3 to 6 per cent of the electrons, the oscillator anode receives about 40 per cent of electrons, grids 3 and 5 (screen grid) receive about 25 to 30 per cent of the electrons, and the plate receives the remaining electrons emitted. Because of the oscillator grid's strategic position next to the cathode, any

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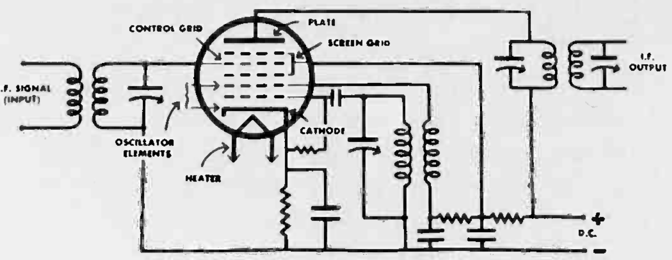
Converter Tube Design Features

(Continued from previous page)

oscillator voltage on this grid will modulate the entire electron stream regardless of the ultimate destination of the electrons. Referring to the diagram, it is interesting to observe the action that takes place within the tube when it and the associated circuit components are operating normally. When the set is first turned on, the No. 1 grid is at zero potential because it is tied to the cathode by the 50,000 ohm grid leak. As the cathode heats up and starts to emit electrons, the feedback between oscillator anode and grid causes regeneration which immediately starts the triode circuit to oscillating. When the oscillator circuit is oscillating, the No. 1 grid is driven alternately positive and negative. While the grid is positive, grid current flows through the grid leak in such a direction as to make the No. 1 grid negative with respect to the cathode. This grid swing may



make the grid negative by as much as 30 to 40 volts, and this becomes the grid bias point about which the grid varies in amplitude alternately in a positive and then a negative direction under the influence of plate circuit feedback. From this it can be seen that the maximum instantaneous negative voltage on the No. 1 grid may be 60 to 80 volts.

Electrons from the cathode are accelerated through the No. 1 grid by the positive oscillator plate and the positive screen grid. The oscillator plate actually consists of a pair of side rods but no grid wires are strung on these rods. Many of the electrons approaching the oscillator plate possess high velocities so that they shoot past the oscillator plate and for the most part through the screen grid No. 3 and approach grid No. 4. The No. 4 grid has a negative potential which therefore retards the oncoming electron stream. This cloud of retarded electrons between grids No. 3 and No. 4 constitute a virtual cathode for the tetrode section of the tube. Electrons may be drawn away from this source (virtual cathode) in a manner quite analogous to that by which they were originally accelerated away from the regular cathode.

If grid No. 1 is only slightly negative or even somewhat positive, then the virtual cathode has an ample electron supply for the tetrode section of the tube. Whenever grid No. 1 swings to more negative values, the number of electrons arriving at the tetrode plate is temporarily reduced or possibly cut off. Pulses of current are therefore supplied to the tetrode section at oscillator frequency and the electron stream to the tetrode plate is modulated by the r-f signal voltage on the grid No. 4. Thus, the oscillator can modulate the signal in the tetrode section and produce the i-f beat note in the plate circuit of the tetrode section.

The current necessary to have sustained oscillations is controlled by the oscillator grid and not by the signal grid, the latter being incapable of producing cutoff in the oscillator section. The gain of the tube can be controlled over a considerable range by a variable negative bias on grid No. 4 without substantially affecting the oscillator section.

THE PENTAGRID MIXER

Types 6L7 and 6L7G

Type 6L7G pentagrid mixer used with a separate oscillator tube. Type 6L7G has the No. 1 grid as the signal grid, grids No. 2 and No. 4 connected internally as screen grids, grid No. 3 as the oscillator injector grid and the No. 5 grid as the suppressor (connected internally to cathode). Thus, the 6L7G is quite similar to the mixer section of Type 7J7.

THE TRIODE-HEXODE

Types 6K8, 6K8G and 6K8GT

Such converters have a rather unconventional structure. The oscillator plate is so located that it is completely removed from the cathode to mixer plate electron stream. The oscillator plate and mixer plate are on opposite sides of the cathode. Grid No. 1 completely surrounds the cathode so that the side towards the oscillator plate acts as the oscillator grid, while the other side is associated with the mixer and modulates the cathode to mixer plate electron stream at oscillator frequency. With this construction a single grid suffices to screen the oscillator grid from the signal grid as well as to screen the signal grid from the mixer plate. The signal control grid is made in the form of a flat wound grid with one-half of the windings (those facing the oscillator plate) removed. Specially designed metal shields suitably connected to the cathode prevent stray electrons from producing undesirable couplings and also serve to isolate the oscillator and mixer sections. In addition, they cause a potential minimum to exist between the screen and plate. Sufficiently high plate resistance is obtained so that a suppressor grid is not required.

THE PENTAGRID 6SA7 TYPE

Types 6SA7, 6SA7GT/G, 7Q7, 12SA7GT/G, 14Q7

This construction, as exemplified by Types 6SA7, 6SA7GT/G and 7Q7, is somewhat like 6L7G except that the functions of grids No. 1 and No. 3 are interchanged. Grid No. 1 is the oscillator grid and grid No. 3 is the signal grid, the latter having a remote cutoff characteristic. The side rods for grid No. 3 are located 90° from the plane of the other side rod supports and are therefore directly in the center of the electron stream. The negative voltage on the signal grid repels some of the electrons traveling to the plate back towards the cathode. However, these electrons will not affect the space charge near the cathode since most of the electrons turned back are intercepted by collector plates fastened to the side rods of the No. 2 screen grid. Hence, the collector plates of the screen provide isolation of the cathode space charge and the signal grid so that changes in signal grid voltage produce little change in the cathode current. Any changes in plate current due to signal grid voltage changes are offset by opposite and nearly equivalent changes in screen current. Screen grids No. 2 and No. 4 are connected internally. Grid No. 5 is the suppressor and serves to increase the plate resistance of the converter.

DEFINITIONS

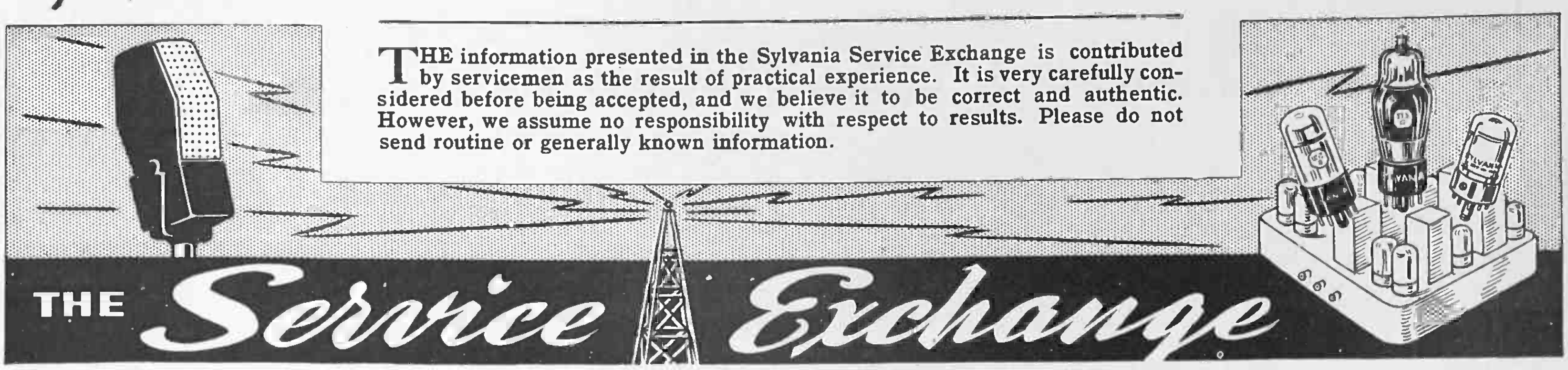
Conversion Conductance (g_c) is defined as the ratio of the intermediate frequency component of the plate or output current of the converter tube in a superheterodyne receiver to the radio frequency component of the signal voltage applied to the control grid. The value is expressed in micromhos. With reference to the performance of a frequency converter, it is employed in the same manner as mutual conductance is used in single frequency amplifier computations.

(Continued on page 4)

CORRECTION

In the last issue (Vol. 10, No. 2) there appeared an incomplete statement regarding the use of voltage regulator tubes in series. The final sentence of that article (P. 4) indicated that a Type OB3/VR-90 and a Type OD3/VR-150 could not be used in series. This was incorrect, as such an arrangement can be employed if the operating conditions do not exceed the specified values for each type. The statement as it appeared should have been clarified to indicate that it is not practical to manufacture a combination regulator consisting of these two structures in a single envelope.

THE information presented in the Sylvania Service Exchange is contributed by servicemen as the result of practical experience. It is very carefully considered before being accepted, and we believe it to be correct and authentic. However, we assume no responsibility with respect to results. Please do not send routine or generally known information.



THE Service Exchange

Slipping Drive Cables. For dial drives that have a tendency to slip, we use a mixture of Fuller's Earth and shellac, about 1/3 Fuller's Earth and 2/3 shellac and a small amount of resin. This brushed lightly on the drive cable only and left to dry for an hour or so, will make it taunt and ready to drive the condenser. A small brush of the camel's hair type is just the thing. The solution should be well shaken and very sparingly used.—Ben's Radio, Boston, Mass.

* * *

Repair Cement. I find that common fingernail polish is fine for repairing plastic cabinets, speaker cones, to hold dial cables, etc. Laurel color sticks best in my brand. You may have better luck with different shades in different brands. —Oscar's Radio Service, Merrill, Iowa.

* * *

Setting Push Buttons. In setting push buttons on sets without tuning indicators, first adjust oscillator trimmer to proper station, then de-tune this condenser a trifle. Adjust r-f trimmer condenser for maximum output from speaker. Readjust oscillator trimmer for maximum output. Set other stations the same way. Due to a-v-c action it is impossible to peak up the r-f trimmer satisfactorily when the oscillator trimmer is in tune.—Neupauer Radio, Cleveland, Ohio.

* * *

AC-DC Sets. These sets have a habit of burning tubes out in different locations where the line voltage has a tendency to go up. The sets in mind have 6 tubes, four 12-volt types and two 35-volt types. Thisadds up to 118 volts. I have checked linevoltageashigh as 123 volts. These sets come in often so I have asked the customer if he has trouble with tubes right along. If he does I install in place of the 35L6GT powertubea50L6GT tubewhich does the trick. This does not affect the set if you balance the set after installing the 50L6GT tube. This will work on any ac-dc set using 35L6GT power tubes.— Oliver Nicholas, Olean, N. Y.

* * *

Majestic 300. Lack of plate voltage on Type 58 tubes is usually due to burned out coil which is choke in dial light circuit. This coil carries plate current for 58 type tubes. If replacement choke is not available, this choke may be bridged across with a 500 ohm resistor. Be sure to replace a .25 mfd. condenser bypassing plate circuit, as this unit is usually shorted, and caused the original trouble.—W. H. Updegrove, Carterville, Missouri.

Clough-Brengle CRA Oscilloscope. If the vertical control has no effect on the image, or if the sensitivity of the vertical amplifier is low, it may be due to a change in resistance value of the 100,000 ohm 1/2 watt plate load resistor of the Type 57 vertical amplifier tube.

In a recent experience, the original unit changed value from 100,000 to 750,000 ohms.—Joseph S. Napora, Uniontown, Pa.

* * *

Philco Mystery Control Console Radios. Mystery control does not work. Open mystery control box, and check loop which acts as primary for 30 oscillator tube. Usually open and best bet to replace even if good to avoid repeat call. —Vito F. Daidone, Newark, New Jersey.

* * *

Temporary Tube Salvage. In repairing AC-DC sets using the 35Z5GT/G rectifier it is possible to connect a resistor from pins 2 to 3 and to restore service in those cases where the tapped part of the heater has burned out. I have been using a 50 ohm resistor and leaving the dial light out of the socket. The sets seem to work as well as ever. Of course this will be changed back as soon as new tubes become available—Wm. G. Austgen, Dyer, Indiana.

* * *

Philco PT-25 Code #121. Heavy a-c hum, sound indicated open filter condenser or possible open grid. Test showed that neither of these were the cause. Trouble was located in resistor #29 (see Riders 12-4 under Philco). This dual resistor is in the filament circuit and has a resistance of 53 and 175 ohms, and was grounded to the chassis, thereby feeding raw AC to the grids through several condensers. The cure—replace it. Or I have found that the ground very seldom affects the resistance in which case insulate it from the chassis.—R. R. Harris, Ojus, Florida.

* * *

Emerson AX-211, AX-212 ETC. If the sensitivity of this model is low, and if the antenna trimmer on the condenser gang will not resonate, also if the wavetrap will not tune to resonance, the probable cause is a broken lead to the ground lug of the antenna coil.

To repair, remove the coil and carefully scrape away black pitch near the ground lug, also clean the enamel insulation off the wire, then resolder. Install the coil and realign in the conventional manner.—Joseph S. Napora, Uniontown, Pa.

Aetna AC-DC Sets. When these sets are operative on 500 to 650 kc. only, look for open in coil in pentagrid converter circuit, (6A7 or 6A8) especially when the station which is heard on this frequency tunes very broad.—W. H. Updegrove, Carterville, Missouri.

* * *

Phono Pickups—Crystal or Magnetic. Pickup used either on radio phono combination or in a public address system. No phono operation, although you hear the vibration of pickup needle in record grooves. To definitely ascertain whether pickup head is defective, as it usually is, disconnect pickup. Place a pair of good crystal headphones to the pickup leads. If the pickup is OK, you will hear the recording in the headphones while playing, otherwise, pickup is defective.—Vito F. Daidone, Newark, New Jersey.

* * *

Amrad 81. This model has r-f choke in detector circuit. An open in this choke causes set to be inoperative. This type of choke, if not available, can be satisfactorily replaced with resistor 1000 to 2000 ohms.—W. H. Updegrove, Carterville, Missouri.

* * *

Grounding Clips. To make the foil-lined tube shield serviceable when substituting GT tubes for metal or G type tubes, particularly in the growing number of instances where bakelite is being substituted for the metal base, we are finding it convenient to slip a grounding clip over the shield prong and octal base center lug; then bend it up and slip the foil-lined tube shield over it. In those cases where a G type tube has formerly been used, and the tube shield base is attached to the chassis, we have found it necessary to drill out the rivets and remove the manufacturers tube shield base so as to permit insertion of the slightly larger diameter GT tube base. The socket may be refastened with nuts and bolts or riveted in place. In those cases where no provision has been made for grounding the shield pin underneath the chassis and the shield pin clip has been omitted from the tube socket, a second grounding clip fitted over the octal base pin and tube pin underneath the chassis forms a convenient lug to which to solder a wire, grounding the other end on some nearby ground contact point in the chassis. Philco Type 38-7 or 8 are cases in point. Grounding clips have been advertised in several parts catalogs.—LeRoy Brown, Rhinebeck, New York.

Converter Tube Design Features

(Continued from page 2)

Conversion Gain is the ratio of the intermediate frequency voltage developed across the load to the radio frequency voltage applied to the control grid. When tube and circuit constants are known the conversion gain may be computed from the formula:

$$\text{Conversion Gain} = \frac{g_c\, r_p\, R_L}{r_p + R_L}$$

Where g_c is the conversion conductance, r_p the plate resistance and R_L the resonant impedance of the i-f transformer measured across the primary terminals.

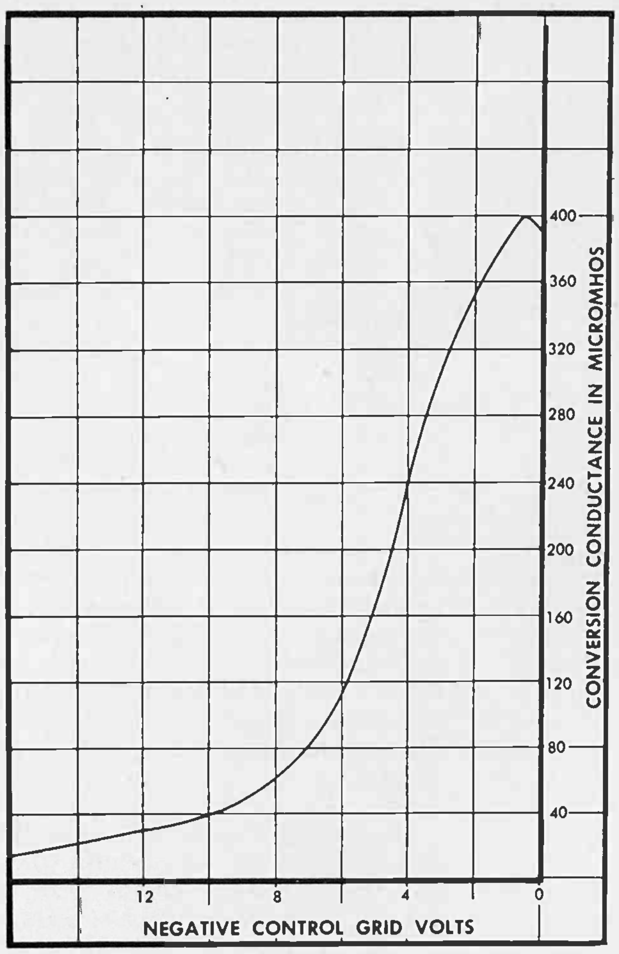


Fig. A

Several curves may prove helpful in illustrating performance characteristics of converters. Fig. A shows how the conversion conductance for a typical triode-heptode converter varies with the negative control grid (heptode) voltage. The recommended control grid voltage would be approximately −3 volts, under which conditions the tube has a conversion conductance of about 300 micromhos. The curve also indicates the cutoff characteristic, since the conversion conductance is reduced to only a few micromhos when the control grid voltage reaches −16 volts.

TECHNICAL MANUAL

A few typographical errors have been found in the latest edition (1942) of the Sylvania Technical Manual. We regret that these were not discovered soon enough to change the final copy before printing. It is our hope that any which exist will not cause serious confusion. Should you discover any errors, the Editor will appreciate having them called to his attention.

Please make the following notations in your copy: Page 148—Change heading from 7O7 to 7Q7. Page 219—Change base view designation for Type 117L7/M-7GT from 8-AD to 8-AO.

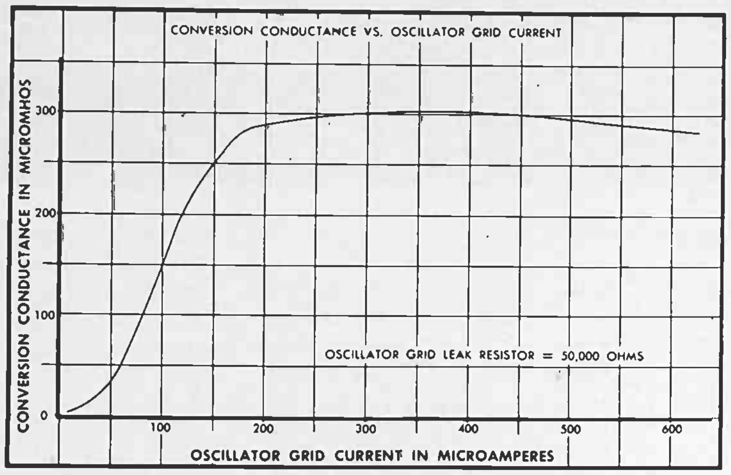


Fig. B

For optimum receiver performance too much emphasis cannot be placed on the curve of Fig. B. This gives the variation in conversion conductance for oscillator grid current thru a specified grid leak resistance. It shows how important it is to keep the minimum oscillator strength above the "knee" of the curve. Attention is called to the fact that beyond the knee of the curve the uniformity is excellent over a wide range of oscillator voltage. The developed oscillator voltage is given by the product of the oscillator grid current and the grid leak resistance. For example, 200 microamperes through 50,000 ohms gives a developed oscillator voltage of 10 volts.

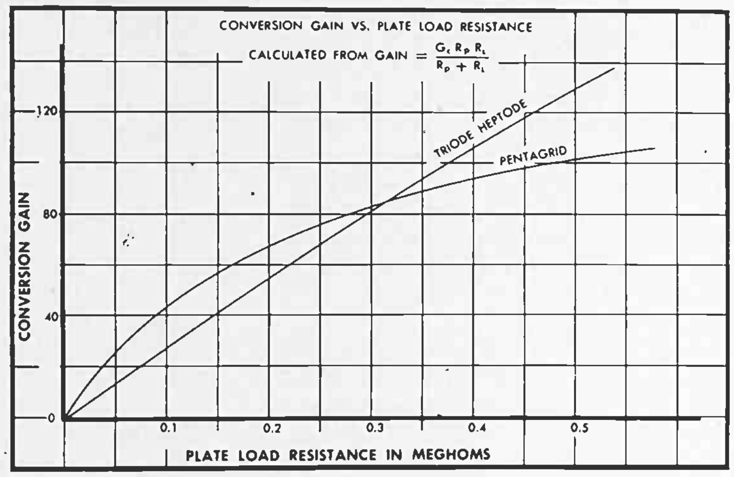


Fig. C

Since converter tubes of different constructions, such as those already discussed, have different ratings and electrical characteristics it is natural that performance characteristics also differ from type to type. Although conversion gain is a function of conversion conductance, the gain also depends upon the load impedance (R_L) of the converter section. For example, a pentagrid converter may have a higher rated conversion conductance than a triode-heptode converter, but if due consideration is given to the load impedance the conversion gain of the triode heptode will not be reduced in the ratio of the respective conversion conductances of the types involved. Considering that the rated oscillator voltage is obtained from each type, Fig. C shows gain curves calculated for both types using the gain formula specified. Verification of the performance characteristics mentioned above is indicated by these curves.

Sylvania News

APRIL, 1943 EMPORIUM, PENNA. Vol. 10, No. 4

SUBSTITUTION CHART FOR BATTERY TUBE TYPES

The difficulty in obtaining replacement tube types has been acute in most sections of the country. Recognizing that the use of substitute types often requires set modifications, the editors of Sylvania News have prepared the following chart to assist servicemen, dealers and distributors in ascertaining quickly the principal changes involved in order to utilize a substitute type. For convenience, the changes are designated by letters. These refer to the specific changes listed at the top of the chart.

The present list is confined to types employed in battery operated receivers. According to the WPB civilian radio tube program, 18 battery types are to be manufactured. Some types occurring in Column 2 are marked with an asterisk indicating that they appear on the WPB list. Since every type on the WPB list may not always be available in any given locality, the use of an alternate type may be necessary. A limited number of battery types, particularly miniatures, have not been included in Column 2 since space limitations generally prohibit the substitution of a type having larger physical dimensions.

COLUMN 1	COLUMN 2	CHANGES REQUIRED										
Types on WPB List	Use to Replace	No Change	Fil. Volts	Fil. Current	Rewire Socket	Change Socket	Realign	Add Top Cap Connection	Remove Top Cap. Conn.	Reduce Bias	Increase Bias	Change Oper. Voltg.
		A	B	C	D	E	F	G	H	K	L	M
1A5GT/G	1A5G	A										
	1A5GT	A										
	1F4		B	C		E					L	
	1F5G		B	C							L	
	*1LA4					E						
	*1LB4					E				K		
1A7GT/G	1A7G	A										
	1A7GT	A										
	1B7G			C			F					
	1B7GT			C			F					
	1C7G		B	C			F					M
	1D7G		B	C			F					M
	1A6		B	C		E	F					M
	1C6		B	C		E	F					M
	1LA6					E	F	G				
	*1LC6					E	F	G				
1C5GT/G	1C5G	A										
	1C5GT	A										
	1G5G		B	C								M
	1G5GT		B	C								M
	1G5GT/G		B	C								M
1H5GT/G	1H5G	A										
	1H5GT	A										
	1B5/25S		B	C		E						M
	1H6G		B	C	D			G				M
	*1LH4					E		G				
1LA4	1A5G					E			H			
	1A5GT					E			H			
	*1A5GT/G					E			H			
	1F4		B	C		E			H		L	
	1F5G		B	C		E			H		L	
	*1LB4									K		
1LB4	*1LA4										L	
	1A5G					E					L	
	1A5GT					E					L	

*On WPB list.

TYPES ON WPB LIST	USE TO REPLACE	CHANGES REQUIRED										
		A	B	C	D	E	F	G	H	K	L	M
1LB4 (Continued)	*1A5GT/G					E					L	
	1F4		B	C		E					L	M
	1F5G		B	C		E					L	M
	*1T5GT					E					L	
1LC6	1LA6						F					M
	1A7G					E	F		H			M
	1A7GT					E	F		H			M
	*1A7GT/G					E	F		H			M
	1B7G			C		E	F		H			M
	1B7GT			C		E	F		H			M
	1C7G		B	C		E	F		H			M
	1D7G		B	C		E	F		H			M
	1A6		B	C		E	F		H			M
	1C6		B	C		E	F		H			M
1LD5	1F6		B	C		E	F		H			M
	1F7G		B	C		E	F		H			M
1LE3	1E4G					E	F					
	1G4G					E	F			K		
	1G4GT					E	F			K		
	1G4GT/G					E	F			K		
	1H4G		B	C		E	F			K		M
	*30		B	C		E	F			K		M
1LH4	1H5G					E			H			
	1H5GT					E			H			
	*1H5GT/G					E			H			
	1B5/25S		B	C		E						M
	1H6G		B	C		E						M
1LN5	1LC5						F					M
	1N5G					E	F		H			
	1N5GT					E	F		H			
	*1N5GT/G					E	F		H			
	1A4P		B	C		E	F		H			M
	1A4T		B	C		E	F		H			M
	1B4P		B	C		E	F		H			M
	1D5G		B	C		E	F		H			M
	1D5GP		B	C		E	F		H			M
	1D5GT		B	C		E	F		H			M
	1E5G		B	C		E	F		H			M
	1E5GP		B	C		E	F		H			M
	1E5GT		B	C		E	F		H			M
1N5GT/G	1N5G	A					F					
	1N5GT	A					F					
	1A4P		B	C		E	F					M
	1A4T		B	C		E	F					M
	1B4P		B	C		E	F					M
	1D5G		B	C			F					M
	1D5GP		B	C			F					M
	1D5GT		B	C			F					M
	1E5G		B	C			F					M
	1E5GP		B	C			F					M
	1E5GT		B	C			F					M
	*1LN5					E	F	G				
	1LC5					E	F	G				M
1P5GT/G	1P5G	A					F					
	1P5GT	A					F					
1Q5GT/G	1Q5G	A										
	1Q5GT	A										
	3Q5G				D							
	3Q5GT				D							
	*3Q5GT/G				D							
1T5GT	1A5G		B	C								M
	1F4		B	C		E						M
	*1LB4					E				K		
3Q5GT/G	3Q5G	A										
	3Q5GT	A										
	1Q5G				D							
	1Q5GT				D							
	*1Q5GT/G				D							
30	1G4G		B	C		E				K		
	1G4GT		B	C		E				K		
	1G4GT/G		B	C		E				K		
	1H4G					E						
	1E4G		B	C		E					L	
	*1LE3		B	C		E					L	
34	32	A										

*On WPB list.

Cross Index of Signal Corps and Commercial Vacuum Tube Types With Cathode Ratings

Many servicemen and dealers, as well as radio mechanics now serving in the armed forces, are somewhat familiar with the type designations for vacuum tubes as used by the army. Because commercial type numbers are usually better known, and since more published data have been made available on tubes as designated by their commercial type numbers, it has become apparent that a cross index would be very useful in conjunction with tube testing and servicing work on government communications equipment.

Radio tubes procured by the army, under Signal Corps specifications have been marked with a VT designation. In the case of GT tubes, some commercial types are branded GT/G rather than GT as shown in the commercial listing. The listing of tube types on this page is given according to consecutive VT numbers. The tabulation on the next page is based upon the commercial type number sequence and cross reference given for the Signal Corps designations.

Army Number	Commercial Number	Type	Cathode Volts	Amps
VT-1	WE-203-A	Fil.	3.6	1.1
VT-2	205-B	Fil.	7.0	1.35
VT-4-B	211	Fil.	10.0	3.25
VT-4-C	211 Special	Fil.	10.0	3.25
VT-5	215-A	Fil.	1.0	0.25
VT-6	212-A (obsolete)			
VT-7	WX-12	Fil.	1.1	0.25
VT-17	860	Fil.	10.0	3.25
VT-19	861	Fil.	11.0	10.0
VT-22	204-A	Fil.	11.0	3.85
VT-24	864	Fil.	1.1	0.25
VT-25	10	Fil.	7.5	1.25
VT-25-A	10 Special	Fil.	7.0	1.18
VT-26	22	Fil.	3.3	0.132
VT-27	30	Fil.	2.0	0.06
VT-28	24, 24A	Htr.	2.5	1.75
VT-29	27	Htr.	2.5	1.75
VT-30	01, 01-A	Fil.	5.0	0.25
VT-31	31	Fil.	2.0	0.13
VT-33	33	Fil.	2.0	0.26
VT-34	207	Fil.	22.0	52.0
VT-35	35/51	Htr.	2.5	1.75
VT-36	36	Htr.	6.3	0.3
VT-37	37	Htr.	6.3	0.3
VT-38	38	Htr.	6.3	0.3
VT-39-A	869-A	Fil.	5.0	18.0
VT-40	40	Fil.	5.0	0.25
VT-41	851	Fil.	11.0	15.5
VT-42-A	872-A	Fil.	5.0	6.75
VT-43	845	Fil.	10.0	3.25
VT-44	32	Fil.	2.0	0.06
VT-45	45	Fil.	2.5	1.5
VT-46-A	866A	Fil.	2.5	5.0
VT-47	47	Fil.	2.5	1.75
VT-48	41	Htr.	6.3	0.4
VT-49	39/44	Htr.	6.3	0.3
VT-50	50	Fil.	7.5	1.25
VT-51	841	Fil.	7.5	1.25
VT-52	45 Special	Fil.	7.0	1.18
VT-53	Superseded by VT-42-A			
VT-54	34	Fil.	2.0	0.06
VT-55	865	Fil.	7.5	2.0
VT-56	56	Htr.	2.5	1.0
VT-57	57	Htr.	2.5	1.0
VT-58	58	Htr.	2.5	1.0
VT-60	850	Fil.	10.0	3.25
VT-62	801, 801A	Fil.	7.5	1.25
VT-63	46	Fil.	2.5	1.75
VT-64	800	Fil.	7.5	3.25
VT-65	6C5	Htr.	6.3	0.3
VT-65-A	6C5G	Htr.	6.3	0.3
VT-66	6F6	Htr.	6.3	0.7
VT-66-A	6F6G	Htr.	6.3	0.7
VT-67	30 Special	Fil.	2.0	0.13
VT-68	6B7	Htr.	6.3	0.3
VT-69	6D6	Htr.	6.3	0.3
VT-70	6F7	Htr.	6.3	0.3
VT-72	842	Fil.	7.5	1.25
VT-73	843	Htr.	2.5	2.5
VT-74	5Z4	Htr.	5.0	2.0
VT-75	75	Htr.	6.3	0.3
VT-76	76	Htr.	6.3	0.3
VT-77	77	Htr.	6.3	0.3
VT-78	78	Htr.	6.3	0.3
VT-80	80	Fil.	5.0	2.0
VT-83	83	Fil.	5.0	3.0
VT-84	84/6Z4	Htr.	6.3	0.5
VT-86	6K7	Htr.	6.3	0.3
VT-86-A	6K7G	Htr.	6.3	0.3
VT-86-B	6K7GT	Htr.	6.3	0.3
VT-87	6L7	Htr.	6.3	0.3
VT-87-A	6L7G	Htr.	6.3	0.3
VT-88	6R7	Htr.	6.3	0.3
VT-88-A	6R7G	Htr.	6.3	0.3
VT-88-B	6R7GT	Htr.	6.3	0.3
VT-89	89	Htr.	6.3	0.4
VT-90	6H6	Htr.	6.3	0.3
VT-90-A	6H6GT	Htr.	6.3	0.3
VT-91	6J7	Htr.	6.3	0.3
VT-91-A	6J7GT	Htr.	6.3	0.3
VT-92	6Q7	Htr.	6.3	0.3
VT-92-A	6Q7G	Htr.	6.3	0.3
VT-93	6B8	Htr.	6.3	0.3
VT-93-A	6B8G	Htr.	6.3	0.3
VT-94	6J5	Htr.	6.3	0.3
VT-94-A	6J5G	Htr.	6.3	0.3
VT-94-B	6J5 Special	Htr.	6.3	0.3
VT-94-C	6J5G Spec'l.	Htr.	6.3	0.3
VT-94-D	6J5GT	Htr.	6.3	0.3
VT-95	2A3	Fil.	2.5	2.5
VT-96	6N7	Htr.	6.3	0.8
VT-96-B	6N7 Special	Htr.	6.3	0.8
VT-97	5W4	Fil.	5.0	1.5
VT-98	6U5/6G5	Htr.	6.3	0.3
VT-99	6F8G	Htr.	6.3	0.6
VT-100	807	Htr.	6.3	0.9
VT-100-A	807 Modif'd	Htr.	6.3	0.9
VT-101	837	Htr.	12.6	0.7
VT-103	6SQ7	Htr.	6.3	0.3
VT-104	12SQ7	Htr.	12.6	0.15
VT-105	6SC7	Htr.	6.3	0.3
VT-106	803	Fil.	10.0	5.0
VT-107	6V6	Htr.	6.3	0.45
VT-107-A	6V6GT	Htr.	6.3	0.45
VT-107-B	6V6G	Htr.	6.3	0.45
VT-108	450-TH	Fil.	7.5	12.0
VT-109	2051	Htr.	6.3	0.6
VT-111	5BP4	Htr.	6.3	0.6
VT-112	6AC7/1852	Htr.	6.3	0.45
VT-114	5T4	Fil.	5.0	2.0
VT-115	6L6	Htr.	6.3	0.9
VT-115-A	6L6G	Htr.	6.3	0.9
VT-116	6SJ7	Htr.	6.3	0.3
VT-116-A	6SJ7GT	Htr.	6.3	0.3
VT-116-B	6SJ7 Spec'l.	Htr.	6.3	0.3
VT-117	6SK7	Htr.	6.3	0.3
VT-117-A	6SK7GT	Htr.	6.3	0.3
VT-118	832	Htr.	6.3 12.6	1.6 0.8
VT-119	2X2/879	Htr.	2.5	1.75
VT-120	954	Htr.	6.3	0.15
VT-121	955	Htr.	6.3	0.15
VT-123	A-5586 (Superseded by VT-128)			
VT-124	1A5GT	Fil.	1.4	0.05
VT-125	1C5GT	Fil.	1.4	0.1
VT-126	6X5	Htr.	6.3	0.6
VT-126-A	6X5G	Htr.	6.3	0.6
VT-126-B	6X5GT	Htr.	6.3	0.6
VT-128	1630	Htr.	6.3	0.3
VT-129	304-TL	Htr.	5.0 10.0	26.0 13.0
VT-130	250-TL	Fil.	5.0	10.5
VT-131	12SK7	Htr.	12.6	0.15
VT-132	12K8 Spec'l.	Htr.	12.6	0.15
VT-133	12SR7	Htr.	12.6	0.15
VT-134	12A6	Htr.	12.6	0.15
VT-135	12J5GT	Htr.	12.6	0.15
VT-135-A	12J5	Htr.	12.6	0.15
VT-136	1625	Htr.	12.6	0.45
VT-137	1626	Htr.	12.6	0.25
VT-138	1629	Htr.	12.6	0.15
VT-139	VR-150/30	Cold Cathode		
VT-143	805	Fil.	10.0	3.25
VT-144	813	Fil.	10.0	5.0
VT-145	5Z3	Fil.	5.0	2.0
VT-146	1N5GT	Fil.	1.4	0.05
VT-147	1A7GT	Fil.	1.4	0.05
VT-148	1D8GT	Fil.	1.4	0.1
VT-149	3A8GT	Fil.	2.8	0.05
VT-150	6SA7	Htr.	6.3	0.3
VT-150-A	6SA7GT	Htr.	6.3	0.3
VT-151	6A8G	Htr.	6.3	0.3
VT-151-B	6A8GT	Htr.	6.3	0.3
VT-152	6K6GT	Htr.	6.3	0.4
VT-152-A	6K6G	Htr.	6.3	0.4
VT-153	12C8 Spec'l.	Htr.	12.6	0.15
VT-154	814	Fil.	10.0	3.25
VT-161	12SA7	Htr.	12.6	0.15
VT-162	12SJ7	Htr.	12.6	0.15
VT-163	6C8G	Htr.	6.3	0.3
VT-164	1619	Fil.	2.5	2.0
VT-165	1624	Fil.	2.5	2.0
VT-166	371-A	Fil.	5.0	10.0
VT-167	6K8	Htr.	6.3	0.3
VT-167-A	6K8G	Htr.	6.3	0.3
VT-168-A	6Y6G	Htr.	6.3	1.25
VT-169	12C8	Htr.	12.6	0.15
VT-170	1E5GP	Fil.	2.0	0.06
VT-171	1R5	Fil.	1.4	0.05
VT-172	1S5	Fil.	1.4	0.05
VT-173	1T4	Fil.	1.4	0.05
VT-174	3S4	Fil.	2.8	0.05
VT-175	1613	Htr.	6.3	0.7
VT-176	6AB7/1853	Htr.	6.3	0.45
VT-177	1LH4	Fil.	1.4	0.05
VT-178	1LC6	Fil.	1.4	0.05
VT-179	1LN5	Fil.	1.4	0.05
VT-181	7Z4	Htr.	6.3	0.9
VT-182	3B7/1291	Fil.	2.8	0.11
VT-183	1R4/1294	Htr.	1.4	0.15
VT-184	VR-90/30	Cold Cathode		
VT-185	3D6/1299	Fil.	2.8	0.11
VT-187	575-A	Fil.	5.0	10.0
VT-188	7E6	Htr.	6.3	0.3
VT-189	7F7	Htr.	6.3	0.3
VT-190	7H7	Htr.	6.3	0.3
VT-191	316-A	Fil.	2.0	3.65
VT-192	7A4	Htr.	6.3	0.3
VT-193	7C7	Htr.	6.3	0.15
VT-194	7J7	Htr.	6.3	0.3
VT-195	CK-1005	Fil.	6.3	0.1
VT-196	6W5G	Htr.	6.3	0.9
VT-197-A	5Y3GT/G	Fil.	5.0	2.0
VT-198-A	6G6G	Htr.	6.3	0.15
VT-199	6SS7	Htr.	6.3	0.15
VT-200	VR-105/30	Cold Cathode		
VT-201	25L6	Htr.	25.0	0.3
VT-201-C	25L6GT	Htr.	25.0	0.3
VT-202	9002	Htr.	6.3	0.15
VT-203	9003	Htr.	6.3	0.15
VT-204	HK-24-G	Fil.	6.3	3.0
VT-205	6ST7	Htr.	6.3	0.15
VT-206-A	5V4G	Htr.	5.0	2.0
VT-207	12AH7GT	Htr.	12.6	0.15
VT-208	7B8	Htr.	6.3	0.3
VT-209	12SG7	Htr.	12.6	0.15
VT-210	1S4	Fil.	1.4	0.1
VT-211	6SG7	Htr.	6.3	0.3
VT-212	958	Fil.	1.25	0.1
VT-213-A	6L5G	Htr.	6.3	0.15
VT-214	12H6	Htr.	12.6	0.15
VT-215	6E5	Htr.	6.3	0.3
VT-216	816	Fil.	2.5	2.0
VT-217	811	Fil.	6.3	4.0
VT-218	100-TH	Fil.	5.0	6.5
VT-220	250-TH	Fil.	5.0	10.5
VT-221	3Q5GT	Fil.	2.8	0.05
VT-222	884	Htr.	6.3	0.6
VT-223	1H5GT	Fil.	1.4	0.05
VT-224	RK-34	Htr.	6.3	0.8
VT-225	307-A	Fil.	5.5	1.0
VT-226	3EP1/1806-P1	Htr.	6.3	0.6
VT-227	7184	Fil.	6.3	0.45
VT-228	8012	Fil.	6.3	2.0
VT-229	6SL7GT	Htr.	6.3	0.3
VT-230	350-A	Htr.	6.3	1.6
VT-231	6SN7GT	Htr.	6.3	0.6
VT-232	HY-E-1148			
VT-233	6SR7	Htr.	6.3	0.3
VT-234	HY-114-B	Fil.	1.45	0.145
VT-235	HY-615	Htr.	6.3	0.17
VT-236	836	Htr.	2.5	5.0
VT-237	957	Fil.	1.25	0.05
VT-238	956	Htr.	6.3	0.15
VT-239	1LE3	Fil.	1.4	0.05
VT-241	7E5/1201	Htr.	6.3	0.15
VT-243	7C4/1203A	Htr.	6.3	0.15
VT-244	5U4G	Fil.	5.0	3.0
VT-245	2050	Htr.	6.3	0.6
VT-246	918 (Photo Tube)			
VT-247	6AG7	Htr.	6.3	0.65
VT-249	CK-1006	Fil.	1.75	0.2
VT-250	EF-50	Htr.	6.3	0.3
VT-252	923 (Photo Tube)			
VT-254	304-TH	Htr.	5.0 10.0	26.0 13.0
VT-255	705-A	Fil.	5.0	5.0
VT-259	829	Htr.	12.6 6.3	1.125 2.25
VT-260	VR-75/30	Cold Cathode		
VT-264	3Q4	Fil.	2.8	0.05
VT-266	1616	Fil.	2.5	5.0
VT-267	WL-578			
VT-268	12SC7	Htr.	12.6	0.15
VT-269	717-A	Htr.	6.3	0.15
VT-286	832-A	Htr.	6.3 12.6	1.6 0.8
VT-287	815	Htr.	6.3	0.8
VT-288	12SH7	Htr.	12.6	0.15
VT-289	12SL7GT	Htr.	12.6	0.15

Cross Index of Commercial and Signal Corps Vacuum Tube Types—Also Some Navy Types

In supplying these tube tabulations it is not to be inferred that Sylvania Electric Products Inc. will furnish complete tube data on all types listed. Technical information, including basing diagrams, tube dimensions, ratings and typical operating conditions has been made available on a large majority of the commercial types in Sylvania Technical Manuals, Characteristic Charts, Sylvania News Technical Sections and other Sylvania literature. These publications should be consulted for required details.

Tubes procured by the Navy under Navy specifications have been marked USN or US Navy, followed by the manufacturer's code letters and Navy type number, which (under the new Navy type number system) is in most cases identical to the commercial number. Because of the similarity in type numbers, a complete cross reference listing is not required. However, the necessary information regarding Navy types will be found in the extreme right column on this page.

Commercial Number	Army Number
01, 01A	VT-30
1A5GT	VT-124
1A7GT	VT-147
1C5GT	VT-125
1D8GT	VT-148
1E5GP	VT-170
1H5GT	VT-223
1LC6	VT-178
1LE3	VT-239
1LH4	VT-177
1LN5	VT-179
1N5GT	VT-146
1R5	VT-171
1S4	VT-210
1S5	VT-172
1T4	VT-173
2A3	VT-95
2X2/879	VT-119
3A8GT	VT-149
3EP1/1806-P1	VT-226
3Q4	VT-264
3Q5GT	VT-221
3S4	VT-174
5BP4/1802-P4	VT-111
5T4	VT-114
5U4G	VT-244
5V4G	VT-206-A
5W4	VT-97
5Y3GT/5Y3G	VT-197-A
5Z3	VT-145
5Z4	VT-74
6A8G	VT-151
6A8GT	VT-151-B
6AB7/1853	VT-176
6AC7/1852	VT-112
6AG7	VT-247
6B7	VT-68
6B8	VT-93
6B8G	VT-93-A
6C5	VT-65
6C5G	VT-65-A
6C8G	VT-163
6D6	VT-69
6E5	VT-215
6F6	VT-66
6F6G	VT-66-A
6F7	VT-70
6F8G	VT-99
6G6G	VT-198-A
6H6	VT-90
6H6GT	VT-90-A
6J5	VT-94
6J5G	VT-94-A
6J5 Special	VT-94-B
6J5G Special	VT-94-C
6J5GT	VT-94-D
6J7	VT-91
6J7GT	VT-91-A
6K6G	VT-152-A
6K6GT	VT-152
6K7	VT-86
6K7G	VT-86-A
6K7GT	VT-86-B
6K8	VT-167
6K8G	VT-167-A
6L5G	VT-213-A
6L6	VT-115
6L6G	VT-115-A
6L7	VT-87
6L7G	VT-87-A
6N7	VT-96
6N7 Special	VT-96-B
6Q7	VT-92
6Q7G	VT-92-A
6R7	VT-88
6R7G	VT-88-A
6R7GT	VT-88-B
6SA7	VT-150
6SA7GT	VT-150-A
6SC7	VT-105
6SG7	VT-211
6SJ7	VT-116
6SJ7GT	VT-116-A
6SJ7 Special	VT-116-B
6SK7	VT-117
6SK7GT/G	VT-117-A
6SL7GT	VT-229

Commercial Number	Army Number
6SN7GT	VT-231
6SQ7	VT-103
6SR7	VT-233
6SS7	VT-199
6ST7	VT-205
6U5/6G5	VT-98
6V6	VT-107
6V6G	VT-107-B
6V6GT	VT-107-A
6W5G	VT-196
6X5	VT-126
6X5G	VT-126-A
6X5GT	VT-126-B
6Y6G	VT-168-A
6Z4	VT-84
7A4	VT-192
7B8	VT-208
7C7	VT-193
7E6	VT-188
7F7	VT-189
7H7	VT-190
7J7	VT-194
7Z4	VT-181
10	VT-25
10 Special	VT-25-A
WX-12	VT-7
12A6	VT-134
12AH7GT	VT-207
12C8	VT-169
12C8 Special	VT-153
12H6	VT-214
12J5	VT-135-A
12J5GT	VT-135
12K8 Special	VT-132
12SA7	VT-161
12SC7	VT-268
12SG7	VT-209
12SH7	VT-288
12SJ7	VT-162
12SK7	VT-131
12SL7GT	VT-289
12SQ7	VT-104
12SR7	VT-133
22	VT-26
24, 24A	VT-28
HK-24-G	VT-204
25L6	VT-201
25L6GT	VT-201-C
27	VT-29
30	VT-27
30 Special	VT-67
31	VT-31
32	VT-44
33	VT-33
34	VT-54
RK-34	VT-224
35/51	VT-35
36	VT-36
37	VT-37
38	VT-38
39/44	VT-49
40	VT-40
41	VT-48
44	VT-49
45	VT-45
45 Special	VT-52
46	VT-63
47	VT-47
50	VT-50
EF-50	VT-250
51	VT-35
56	VT-56
57	VT-57
58	VT-58
75	VT-75
VR-75/30	VT-260
76	VT-76
77	VT-77
78	VT-78
80	VT-80
83	VT-83
84/6Z4	VT-84
89	VT-89
VR-90/30	VT-184
100-TH	VT-218
VR-105/30	VT-200
HY-114B	VT-234

Commercial Number	Army Number
VR-150/30	VT-139
WE-203-A	VT-1
204-A	VT-22
205-B	VT-2
207	VT-34
211	VT-4-B
211 Special	VT-4-C
212-A	VT-6
215-A	VT-5
250-TH	VT-220
250-TL	VT-130
304-TH	VT-254
304-TL	VT-129
307-A	VT-225
316-A	VT-191
350-A	VT-230
371-A	VT-166
450-TH	VT-108
575-A	VT-187
WL-578	VT-267
HY-615	VT-235
705-A	VT-255
717-A	VT-269
800	VT-64
801, 801-A	VT-62
803	VT-106
805	VT-143
807	VT-100
807 Modified	VT-100-A
811	VT-217
813	VT-144
814	VT-154
815	VT-287
816	VT-216
829	VT-259
832	VT-118
832-A	VT-286
836	VT-236
837	VT-101
841	VT-51
842	VT-72
843	VT-73
845	VT-43
850	VT-60
851	VT-41
860	VT-17
861	VT-19
864	VT-24
865	VT-55
866A	VT-46-A
869-A	VT-39-A
872-A	VT-42-A
879	VT-119
884	VT-222
918	VT-246
923	VT-252
954	VT-120
955	VT-121
956	VT-238
957	VT-237
958	VT-212
CK1005	VT-195
CK1006	VT-249
HY-E-1148	VT-232
1201, 7E5/1201	VT-241
1203A, 7C4/1203A	VT-243
1291, 3B7/1291	VT-182
1294, 1R4/1294	VT-183
1299, 3D6/1299	VT-185
1613	VT-175
1616	VT-266
1619	VT-164
1624	VT-165
1625	VT-136
1626	VT-137
1629	VT-138
1630	VT-128
2050	VT-245
2051	VT-109
A5586	*VT-123
7184	VT-227
8012	VT-228
9002	VT-202
9003	VT-203

*Superseded by VT-128

Cross Reference List Navy Types

A complete listing of Navy vacuum tube types vs commercial type numbers is of little value because the Navy has adopted the procedure of employing the commercial designations instead of specifying an entirely different number. It is not to be inferred that every existing commercial type would occur in a complete listing of Navy types. In fact there are many commercial types not now utilized. When additional Navy types are required, such tubes will be designated according to commercial nomenclature, thus eliminating the necessity for any cross index.

There are a limited number of exceptions occasioned by previous assignment of a 38,000 series number to certain types which have been utilized by the Navy. Correlation of such types with commercial numbers is given by the following tabulation.

Old Navy Number	Commercial Number
38015	Obsolete
38111-A	None
38112	212-E
38116	4B26
38120	Obsolete
38142	None
38205	VR-105/30
38217 (0517)	Obsolete
38220	120
38222	3B23
38233	2C21
38250	VR-150/30
38275	VR-75/30
38278	Obsolete
38282	282-B
38290	VR-90/30
38401	3B21
38402	4B22
38403	4B23
38404	4B24
38405	3B22
38412	312-A
38674	Obsolete
38674-A	4B25
38897	4B27

Eight of the twenty-five types shown above have very recently been assigned new commercial numbers. To assist in identifying these types, the list below indicates the old commercial numbers by which these were formerly designated.

New Commercial Number	Old Commercial Number
3B22	EL-1C
4B24	EL-3C
3B21	EL-302.5
4B22	EL-5B2.5
4B23	EL-5B-HD
4B25	EL-6C
3B23	RK-22
2C21	RK-33

These tabulations of tube types have been compiled by SYLVANIA ELECTRIC PRODUCTS Inc. from approved Government data.

April 24, 1943
Extra copies available upon request.

THE information presented in the Sylvania Service Exchange is contributed by servicemen as the result of practical experience. It is very carefully considered before being accepted, and we believe it to be correct and authentic. However, we assume no responsibility with respect to results. Please do not send routine or generally known information.

Lafayette C31. Had considerable trouble locating an intermittent short. Every time the set stopped playing, and I put it on the bench for a test, it tested OK and would play for a considerable period. Finally located the trouble. The wires running from the volume control to the back of set are single rubber covered wire, enclosed in braided metal sheath. This metal sheath was soldered to the chassis in two places, and the heat from the soldering had deteriorated the rubber so that it broke and allowed the wire to short to ground. So I replaced these with a heavier insulated wire. Also replaced all grid leads which are sheathed and soldered to chassis. Since then I have had other Lafayettes and a couple of other sets using same kind of wire, same ailment, but have been able to locate the trouble and fix the set to the owner's satisfaction by replacing all sheathed single rubber covered wire.—Charles A. Johnson, Republic, Mich.

* * *

Stromberg Carlson FM-515. If speaker field is hot and voltage is low (below 225 V.) change all .05 plate filter (dual) condensers to standard single units separately to get normal voltage of 250 V.—Mesmer Radio Service, Ottumwa, Iowa.

* * *

Battery Portables. Since I've been here, I find about ninety percent of the personnel have portables using the 1.4 volt tube series. Often the pentagrid converter (1A7GT/G) fails to oscillate. After "sweating" many cases, I found some manufacturers use a series resistor to the screen grid, ranging from 10,000 to 50,000 ohms. Usually by replacing with a 100,000 ohm unit, the original tube works satisfactorily.—Pvt. Clayton Miller, Army Air Forces Navigation School, Hondo, Texas.

* * *

G. E.—E101, E105, E106. In some cases these sets are distorted or inoperative on broadcast, but work perfectly on the short wave bands, due to the fact that the 6L6 grid is coupled through an .05 and an .005 condenser in series; the latter is shorted out by the bandswitch for better bass response in B. C. position. If the .05 condenser shorts, distortion results on short wave, 6L6 grid is isolated from 6F5 plate voltage by the .005 condenser, even if .05 condenser shorts.—Clifford Stout, Muskegon Radio Service, R#5 Muskegon, Michigan.

THANK YOU, MR. HUTTON

"During the tube shortage, there have been calls for tubes that I could not get from my jobber, so I have studied my Sylvania Technical Manual very closely and have found that I could substitute many different type tubes. Some I had only to change the tube base, others I changed the circuit; but with the help of the tube manual every set that I have changed has worked 100%.

"I could not get along without my Sylvania tube manual. If other servicemen would read their manual and not just look at it they will find that it will be a great help to them in these war torn times."—J. B. Hutton, Hutton Radio and Electric Service, Dermott, Arkansas.

Gloritone Model 99. When this radio does not operate at the low frequency end of the dial, look for a defective 3,000 ohm resistor or a .01 uf condenser in the cathode circuit of the first detector-oscillator circuit.—Marion L. Rhodes, Knightstown, Ind.

* * *

Philco Model 37-611 (Code 121). To eliminate oscillation below 550 KC connect a resistor 1000 ohms in series with the red lead of the 2nd i-f transformer (#23) also connect a condenser .05 mfd. 400 v. from the red lead to ground.—M. S. Planovsky, Cleveland, Ohio.

* * *

Philco Mo Par 800-1941. Complaint of jerky reception or no reception. Take lid off radio and examine push button assembly closely. Bottom lead of push buttons is so close to chassis that it invariably grounds. Wedge a screw driver in between and place a piece of good adhesive tape or equivalent between push button assembly and receiver.—Vito F. Daidone, Newark, New Jersey.

* * *

RCA Model R-28. The bleeder resistors R9 and R10 through volume control to ground often change value. This change will affect the volume control action and will ruin the volume control as the resistance lowers, thus drawing too much current. Always measure the resistor values as it will save time in locating the trouble in these sets. You will find similar bleeder arrangement on RCA #80 and 82.—C. A. Vaughn, Los Angeles, Calif.

Airline 93WG-1000. Oscillation after set warms up—Tighten coil shields, change 17,000 ohm (R2) decoupling resistor.—Henry D. Morse, Homer, N.Y.

* * *

Truetone D920. Loud hum—Filters check OK—change volume control.—Henry D. Morse, Homer, N. Y.

* * *

Truetone Model D-705. This radio was terribly distorted when connected to an antenna, but when not loaded, reception was quite clear. From all indications this would mean overloading the second detector or possibly the audio stage, excessive a-v-c action, or incorrect time constant or possibly poor filtering of carriers in demodulator. However, it was nothing of this nature. After replacing all tubes, aligning the set, checking each bias voltage, everything was found normal except for distortion. The trouble was found in the second i-f transformer having high resistance leakage between turns on the secondary winding. A new transformer cleared the trouble entirely. This should be checked on similar sets.—T. Leslie Lindsey, Richmond, Va.

* * *

Philco Model 39-25T. The light brown, live rubber covered high voltage leads from the power transformer often short to the case, resulting in overloading and eventual burnout of the 70 ohm 0.5 watt carbon, and 280 ohm 1.0 watt wire-wound bias resistors, located in the negative side of the rectifier circuit.

Replace both resistors, and install oversize spaghetti insulation over the high voltage leads, pushing same well into the case to prevent future shorting of the high voltage leads.—Joseph S. Napora, Uniontown, Penna.

* * *

Admiral Model B-125. Abnormal a-c hum may be due to the output transformer picking up hum from the power transformer field. To remedy, remove the output transformer from the speaker and mount it under the chassis in front of the 75 tube socket.—Mr. James H. Johnston, Lakewood, New Jersey.

* * *

RCA Victor Model K-60. Intermittent cut-off at low frequency end of dial. This trouble was found to be caused by a defective 6000 $\mu\mu f.$ condenser connected between stationary section of oscillator tuning condenser and the wave-band switch. The trouble was cleared by a new 6000 $\mu\mu f.$ fixed condenser.—L. W. Steuerwald, Dover, N.H.

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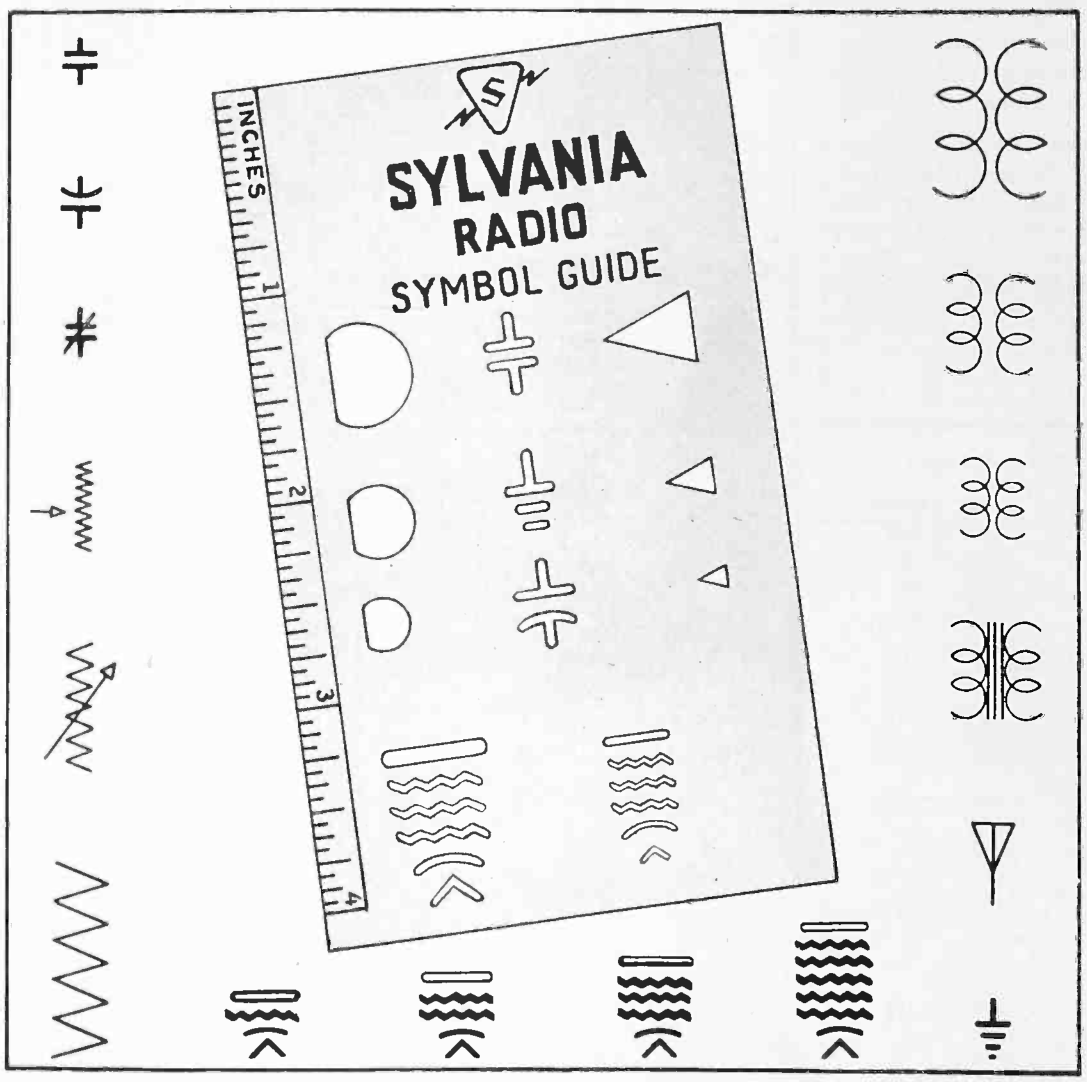
A NEW SYMBOL GUIDE FOR YOUR CONVENIENCE



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Former Technical Editor Now An Army Captain

Ralph Merkle, former Technical Editor of Sylvania News, has recently been appointed to a captaincy in the U. S. Army. Captain Merkle has been in the office of the Chief Signal Officer, Washington, D. C., with a first lieutenant's commission for the past several months. He received a leave of absence from Sylvania last June to enter the Armed Forces.

Ralph was a valuable member of Sylvania's Commercial Engineering Department, and devoted much time and effort to the preparation of various technical publications which have been so popular with dealers and servicemen. In his present work he is applying his knowledge to our government's remarkable war-time communications developments. We all join in wishing him continued success.

Cross Reference Charts of Army, Navy and Commercial tube types published in the last issue of the News are still available on request.

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Substitution Charts for 150 Milliampere AC-DC Receiver Tubes

The necessity for using substitute tube types has been most pronounced in connection with servicing ac-dc receivers. In practically all cases receiver modifications are required. The changes involved are generally the important factors governing the cost and time for the conversion so as to maintain receiver operation. To quickly ascertain the principal changes to be made data have been prepared in chart form, similar to the one for battery types published in the April issue of Sylvania News. In the present issue only types having 150 milliampere heater ratings are listed. The 300 milliampere types will be covered in the next issue.

Chart 1 gives the 150 milliampere types which are not on the WPB list and indicates possible replacements. Among the first and second choices, those preceded by an asterisk (*) occur on the WPB list and will be found in Column 1 on Chart 2. Reference to Chart 2 under the type or types involved will furnish the changes required by the substitution. For convenience, the changes are designated by letters. These refer to the specific changes listed at the top of Chart 2.

According to the WPB Civilian Radio Tube Program twenty 150 milliampere tube types are to be manufactured. In addition to these twenty types, two 117-volt tubes are also shown in Column 1, Chart 2 since one or the other often occurs in the receiver tube complement under consideration. Many types in Column 2 carry reference symbols and numbers. Explanations are given in the footnotes at the end of the chart.

CHART 1

150 ma. Types not On WPB List	Possible Replacements	
	1st Choice	2nd Choice
6D8G	*7A8	*12A8GT/G†
6G6G	*35A5	*35L6GT/G†
6L5G	*12J5GT/G	14A4
6S7†	*7B7	*14A7
6SS7	*7B7	*12SK7GT/G†
6ST7	▲	12SR7
12A8G†	*12A8GT/G†	*7A8
12C8	▲	6SF7
12F5GT	*12SQ7GT/G†	*12Q7GT/G†
12J7GT†	*12SJ7GT†	6W7G
12K7G†	*12K7GT/G†	*12SK7GT/G†
12K8†	*12A8GT/G†	14J7
12Q7G†	*12Q7GT/G†	*12SQ7GT/G†
12SA7†	*12SA7GT/G†	14Q7
12SC7	▲	12SL7GT
12SF5†	*12Q7GT/G†	*12SQ7GT/G†
12SF7	▲	12C8
12SJ7	*12SJ7TG†	14C7
12SK7†	*12SK7GT/G†	*14A7
12SL7GT	▲	12SC7
12SN7GT	▲	14N7
12SQ7†	*12SQ7GT/G†	12Q7GT/G†
12SR7	▲	14E6
14A4	*12J5GT†	14E6
14B6	*7C6	*12SQ7GT/G†
14B8	*7A8	*12A8GT/G†
14C7	*7C7	*12SJ7GT†
14E6	▲	12SR7
14F7	▲	12SL7GT†
14H7	*12SK7GT/G†	14W7
14J7	*12A8GT/G†	14B8
14N7	▲	12SL7GT
14Q7	*12SA7GT/G	14B8
14S7	*12A8GT/G†	*7A8
35L6G†	*35L6GT/G	*50L•GT
35Y4	*35Z3	*35Z5GT/G
35Z4GT	*35Z5GT/G	*50Y6GT/G
35Z5G†	*35Z5GT/G	*50Y6GT/G
40Z5/45Z5GT	*35Z5GT/G	*50Y6GT/G
50A5	*35A5	*35L6GT/G
50C6G	*50L6GT	*35L6GT/G
50Y6G	*50Y6GT/G	*117Z6GT/G
50Z7G	*50Y6GT/G	*117Z6GT/G
70A7GT	*70L7GT	*117L7/M7GT

CHART 2

COLUMN 1	COLUMN 2	CHANGES REQUIRED										
150 ma. Types on WPB List	Use to Replace	No Change	Fil. Volts	Fil. Current	Rewire Socket	Change Socket	Realign	Add Top Cap Connection	Remove Top Cap. Conn.	Change Bias	Add Parallel Resistor	Change Series Resistor
		A	B	C	D	E	F	G	H	K	L	M
7A8	*6A7			C		E	F		H		L	
	6A8†			C		E	F		H		L	
	6J8G			C		E	F		H		L	
	6K8†			C		E	F		H		L	
	6D8G					E	F		H			
	12A8G†		B			E	F		H			M
	14J7		B				F					M
	14B8		B									M
	14S7		B				F					M
	7S7			C			F				L	
	*7J7			C			F				L	
	12K8†		B			E	F		H			M
7B7	7A7			C							L	
	6SK7†			C		E	F				L	
	6K7†			C		E	F		H		L	
	6E7			C		E	F		H		L	
	6U7G			C		E	F		H		L	
	*78			C		E	F		H		L	
	6D6			C		E	F		H		L	
	*39/44			C		E	F		H		L	
	6S7†					E	F		H			
	6SS7					E	F					
	12B7		B									M
	14A7		B									M
	12K7G†		B			E	F		H			M
	12SK7†		B			E	F					M
7C6	7B6			C							L	
	14B6		B									M
	6T7G					E			H			
	6Q7†			C		E			H		L	
	6SQ7†			C		E					L	
	*75			C		E			H		L	
	7B4			C							L	
	6K5G†			C		E			H		L	
	6F5†			C		E			H		L	
	12Q7G†		B			E			H			M
	12SQ7G†		B			E						M
	12SF5		B			E						M
7C7	14C7		B									M
	6J7†			C		E	F		H		L	
	6SJ7†			C		E	F				L	
	6C6			C		E	F		H		L	
	*77			C		E	F		H		L	
	*36			C		E	F		H		L	
	12J7G†		B			E	F		H			M
	12SJ7†		B			E	F					M
	6W7G					E	F		H			
12A8GT/G	12A8G†	A†										
	14J7					E	F	G				
	14B8					E	F	G				
	*7A8		B			E	F	G				M
	6D8G		B									M
	6A8†		B	C			F				L	M
	*6A7		B	C		E	F				L	M
	6J8G		B	C			F				L	M
	12K8G†						F					
	6K8†		B	C			F				L	M
	14S7					E	F	G				
	7S7		B	C		E	F	G			L	M
	*7J7		B	C		E	F	G			L	M
12J5GT	6J5†		B	C							L	M
	6AF5G		B	C	D					K	L	M
	*76		B	C		E				K	L	M
	6P5G		B	C						K	L	M
	*37		B	C		E				K	L	M
	6C5†		B	C							L	M
	6L5G		B									M
	*7A4		B	C		E					L	M
	14A4					E						
	XXL		B	C		E					L	M
12K7GT/G	12K7G†	A										
	12SK7†				D		F	G				
	12B7					E	F	G				
	*14A7					E	F	G				
	7A7		B	C		E	F	G			L	M
	*7B7		B			E	F	G				M
	6SS7		B		D		F	G				M
	6K7†		B	C			F				L	M
	6SL7†		B	C	D		F	G			L	M
	6U7G		B	C			F				L	M
	*78		B	C		E	F				L	M

CHART 2—(continued)

150 ma. Types on WPB List	Use to Replace	CHANGES REQUIRED										
		A	B	C	D	E	F	G	H	K	L	M
12K7GT/G (continued)	6D6		B	C		E	F				L	M
	*39/44		B	C		E	F				L	M
	6S7†		B				F					M
12Q7GT/G	12Q7G†	A										
	12SQ7†				D			G				
	6Q7†		B	C							L	M
	6SQ7†		B	C	D			G			L	M
	6T7G		B									M
	*75		B	C		E					L	M
	7B6		B	C		E		G			L	M
	*7C6		B			E		G				M
	7K7		B	C		E		G			L	M
	14B6					E		G				
	6ST7		B		D			G				M
	XXFM		B	C		E		G			L	M
	7B4		B	C		E		G			L	M
	12F5G†				D							
	12SF5†				D			G				
12SA7GT/G	12SA7†	A										
	6SA7†		B	C			F				L	M
	7Q7		B	C		E	F				L	M
	14Q7					E	F					
12SJ7GT	12SJ7†	A										
	12J7†				D		F		H			
	6SJ7†		B	C			F				L	M
	6J7†		B	C	D		F		H		L	M
	6C6		B	C		E	F		H		L	M
	*77		B	C		E	F		H		L	M
	6D7		B	C		E	F		H		L	M
	6W7G		B		D		F		H			M
	*7C7		B			E	F					M
	14C7					E	F					
12SK7GT/G	12SK7†	A										
	12K7G†				D		F		H			
	6K7†		B	C	D		F		H		L	M
	6SK7†		B	C							L	M
	6U7G		B	C	D		F		H		L	M
	*78		B	C		E	F		H		L	M
	6D6		B	C		E	F		H		L	M
	*39/44		B	C		E	F		H		L	M
	6S7		B		D		F		H			M
	12B7					E	F					
	*14A7					E	F					
	7A7		B	C		E	F				L	M
	*7B7		B			E	F					M
	6SS7		B				F					M
	14H7					E	F			K		
12SQ7GT/G	12SQ7†	A										
	6SQ7†		B	C							L	M
	12Q7GT†				D				H			
	6Q7†		B	C	D				H		L	M
	*75		B	C		E			H		L	M
	7B6		B	C		E					L	M
	6T7G		B		D				H			M
	14B6					E						
	*7C6		B			E						M
	7K7		B	C		E					L	M
	6ST7		B								L	
	XXFM		B	C		E					L	M
	7B4		B	C		E					L	M
	12F5GT†				D				H			
	12SF5†				D							
14A7/12B7	*14A7	A										
	12B7	A										
	7A7		B	C							L	M
	*7B7		B									M
	6SK7†		B	C		E	F				L	M
	6K7†		B	C		E	F		H		L	M
	6E7		B	C		E	F		H		L	M
	6U7G		B	C		E	F		H		L	M
	*78		B	C		E	F		H		L	M
	6D6		B	C		E	F		H		L	M
	*39/44		B	C		E	F		H		L	M
	6S7		B			E	F		H			M
	6ST7G		B			E	F					M
	12K7G†					E	F		H			
	12SK7†					E	F					
	6SS7		B			E	F					M
	14H7						F			K		
35A5	*35L6GT/G					E						
	14A5		B									M
	50A5		B									M
	50C6G		B			E						M
	*50L6GT		B			E						M
	6G6G		B			E				K		M
	25A6†		B	C		E				K	L	M
	25B6G		B	C		E				K	L	M
	12A5		B	C		E				K	L	M
	25L6†		B	C		E					L	M
35L6GT/G	*35A5					E						
	14A5		B			E						M
	50A5		B			E						M
35L6GT/G (continued)	50C6G		B							K		M
	*50L6GT		B									M
	6G6G		B							K		M
	25A6†		B	C						K	L	M
	25B6G		B	C						K	L	M
	25C6G		B	C						K	L	M
	25L6†		B	C							L	M
35Z3	35Z5G† [1]					E						
	35Y4 [1]				D							
	25Z5 [2]		B	C		E					L	M
	25Z6† [2]		B	C		E					L	M
	45Z5GT [1]		B			E						M
	*50Y6GT [2]		B			E						M
	50Z7GT [1,2]		B			E						M
	25Y5 [2]		B	C		E					L	M
	40Z5 [1]		B			E						M
	12Z3		B	C		E					L	M
35Z5GT/G	*35Z3					E						
	35Y4					E						
	25Z5 [2]		B	C							L	M
	25Z6† [2]		B	C							L	M
	45Z5GT		B									M
	*50Y6GT [2]		B									M
	50Z7GT [2]		B									M
	25Y5 [2]		B	C							L	M
	40Z5		B									M
	35Z4GT					E						
	12Z3		B	C		E					L	M
50L6GT	*35A5		B			E						M
	50A5					E						
	50C6G									K		
	*35L6GT/G†		B									M
	6G6G		B							K		M
	25A6†		B	C						K	L	M
	25B6G		B	C						K	L	M
	25C6G		B	C						K	L	M
	25L6†		B	C							L	M
50Y6GT/G	*35Z3		B			E						M
	35Y4 [1]		B			E						M
	25Z5		B	C		E					L	M
	25Z6†		B	C	D						L	M
	45Z5GT [1]		B		D							M
	35Z5G† [1]		B		D							M
	50Z7GT [1]				D							
	25Y5		B	C		E					L	M
	40Z5 [1]		B		D							M
	35Z4GT		B									M
	*117Z6GT/G		B	C							L	M
70L7GT	*35A5		B									M
	12A5		B	C		E				K	L	M
	50A5		B			E						M
	50C6G		B		D					K		M
	*35L6GT/G		B		D							M
	50L6GT		B		D							M
	25A6†		B	C	D					K	L	M
	25B6G		B	C	D					K	L	M
	25C6G		B	C	D					K	L	M
	25L6†		B	C	D						L	M
	25A7G†		B	C	D					K	L	M
	12A7		B	C		E					L	M
	*117L7/M7GT		B	C	D					K	L	M
	117P7GT		B	C	D					K	L	M
	117N7GT		B	C	D					K	L	M
	70A7GT [1]				D							
117Z6GT/G	*35Z3		B	C		E					L	M
	35Y4 [1]		B	C		E					L	M
	25Z5		B	C		E					L	M
	25Z6†		B	C							L	M
	45Z5GT [1]		B	C	D						L	M
	*35Z5GT/G† [1]		B	C	D						L	M
	50Z7GT [1]		B	C	D						L	M
	25Y5		B	C		E					L	M
	40Z5 [1]		B	C	D						L	M
	35Z4GT		B	C	D						L	M
	*50Y6GT†		B	C							L	M
117L7/M7GT	117P7GT				D							
	117N7GT				D							
	70L7GT		B	C	D						L	M
	25A7GT†		B	C	D					K	L	M
	70A7GT		B	C	D						L	M
	50C6G		B	C	D					K	L	M
	50A5		B	C		E					L	M
	50L6G		B	C	D						L	M

NOTES:

* These types appear on latest WPB list.
▲ No WPB type.
† Indicates that the corresponding metal, G, GT, or GT/G types may be employed if space permits. Shielding may be required in some cases.
[1] If pilot lamp is required other provision must be made.
[2] This substitution possible if tube is used as a half-wave rectifier and if the load current does not exceed the rating of the WPB tube.

THE information presented in the Sylvania Service Exchange is contributed by servicemen as the result of practical experience. It is very carefully considered before being accepted, and we believe it to be correct and authentic. However, we assume no responsibility with respect to results. Please do not send routine or generally known information.

THE Service Exchange

GE LB530. If rectifier step down transformer T3 gets very hot when on charging position, check copper oxide rectifier. One or both discs may be defective and they can be replaced. Also, acid from battery may have spilled on transformer which will cause windings to become shorted.—Henry Hudson.

* * *

Philco Models 37-10, 37-11. To improve the operation of the discriminator circuit, the transformer #48 wiring to the 6H6G is changed as follows (use 6H6G socket for reference). Interchange P1 and K1, interchange P2 and K2. Also interchange the wires of resistors #65 and #66 on the terminal panel which is attached to condenser #63. The 6A8G tube is changed to self biasing as follows: a resistor of 100 ohms is connected in series with the 6A8G cathode and a condenser .01 mfd. is used to bypass the resistor. To prevent audio interference, remove the green and white wire of audio switch #37 from the volume control center contact and connect it to the high side of volume control, that is, the contact which is connected to condenser #58. Correction: the a-v-c bias contacts of the r-f transformers shown as connected to D4 should be D3. Lead #4 of r-f transformer #33 is connected to the three contacts at D11 instead of one only. The above hints apply to Run #1, 2, 3 and 4 of the above models specifically.—M. Planovsky, Cleveland, Ohio.

* * *

GE LC758 & LC768. A very noisy tone control may be due to a leaky tone condenser (C32), a .005 mfd. 600-volt unit.—Henry Hudson.

* * *

Zenith Receivers. When tuning in one direction only, trouble is noticeable that sounds like a shorted plate in the tuning gang. Actually the flywheel or driving pulley on the tuning shaft, when rotated in one direction, catches on one of the tuning eye leads, twists the lead part way around and binds enough to wear and cut the insulation, thus grounding to chassis the eye lead. When rotated in the other direction this does not happen. It cannot be seen as the break rolls back under and out of sight. Slip spaghetti over the injured lead. Pull all eye leads up through the chassis grommet and slide the clip down to hold the leads snugly thus eliminating further occurances of wear on the wires.—Earl L. Pittsley, Binghamton, N. Y.

THANK YOU, CORP. WAND

We have received a number of compliments on our Cross Reference Lists of Army, Navy and Commercial Tube Types published in our last issue. The following letter from Corp. Stanley Wand of Boca Raton Field, Florida, is particularly gratifying:

"I want to thank you for your courtesy in sending me an interesting issue of "Sylvania News". I had tried for several months to obtain a VT cross index with commercial types through official channels without obtaining anything complete. I have been using a makeshift of about 40 or 50 of the common types, which I compiled myself.

As a former radio serviceman in civilian life I read with interest some of the material pertaining to civilian radio. I recall buying Sylvania tubes from Dale Radio, New Haven, Conn. as I worked for a large Waterbury radio store at the time I was drafted into Army life. I fix a radio now and then just to keep my hand in.

If it would not be asking too much of you, I would appreciate your sending me "Sylvania News" regularly to keep us informed about civilian radio. When it is all over, and I hope that will be soon, I intend to take up radio where I left off, and that means I will be back in Connecticut in radio again. With a multitude of types and applications, I know I can depend upon Sylvania to keep ahead with the latest developments that are everyday work to us here."

All Wurlitzer 1940-41 Models. When these phonographs refuse to trip a record after inserting coin (5, 10 or 25) take out the electric coin selector mechanism. Take the covers off and polish all the relay points by using carbona cleaner. Ordinary cleaning will not do. Do not use too much lubricant as this seems to be the original cause of the above trouble. —B. Waters, Oneida, Tenn.

* * *

U. S. Radio & Television Corp. Model 46 & 47. No control of volume and low voltages on screens of 24 tubes due to a very leaky 0.5 mfd. 400-volt condenser in screen grid circuit of 24 tubes.—Henry Hudson.

* * *

Philco Model 37-600. To increase sensitivity at the low frequency end of the BC band, change resistor #7, from 200 ohms to 300 ohms and remove the suppressor wire of the 6J7G i-f tube from the cathode terminal of the tube and connect it to the lug of the sensitivity control to which the secondary lead of the i-f transformer is connected.—M. S. Planovsky, Cleveland, Ohio.

Zenith Models 7S363, 9S367. The complaint was a rumbling and cracking noise at the slightest jar when automatic tuning was used, but set worked OK on manual tuning. Make sure that the front of the automatic unit is set in the groove on the bottom and that the nut on top fastening to the front of the cabinet is tight. Tighten chassis bolts enough to keep the bottom of the automatic unit from touching the top of the chassis. If the noise continues after doing this, proceed as follows: Take a piece of corrugated cardboard about 3"x8" and fold to triple thickness. Lift the back of the automatic unit as much as possible and slip the cardboard between the bottom of the unit and top of the chassis. Make a tight fit. This will eliminate the noise completely.—Meyer and Johnson, Rochester, New York.

* * *

Tube Substitution. Substitute 12A8-GT/G for 12SA7 or 12SA7GT. Take lead off #8 grid prong of 12SA7 socket. Run it to grid top cap of 12A8GT/G. Disconnect all leads from #6 prong of 12SA7 socket and connect to #8 prong. Leave #6 prong blank. Realign the i.f. or use a tube shield or both. This change-over has worked 100% in every case.—W. G. Auringer, San Diego, Calif.

"I suppose the war precludes the possibility of my getting a double electrode phanatron gaseous discharge rectifier tube, having an ambient temperature range of between 15 and 50?"

Radio Retailing Today

TECHNICAL SECTION

JULY, 1943 EMPORIUM, PENNA. Vol. 10, No. 6

AC-DC RECEIVER CIRCUIT MODIFICATIONS

TUBE SUBSTITUTIONS REQUIRE CAREFUL ANALYSIS OF HEATER CIRCUITS

The past two issues of Sylvania News have covered substitutions which might be made when battery tubes and 150 ma. tubes had to be replaced in existing equipment where only certain types might be available on the jobbers' shelves. This issue takes up the substitution of tubes for 300 ma. filament drain.

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.

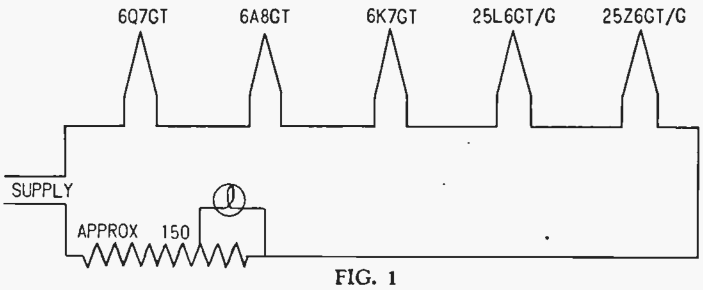


FIG. 1

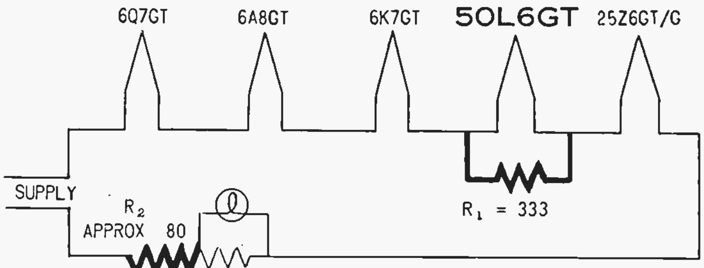


FIG. 2

Fig. 1 shows a typical 300 ma. filament string including a series resistance of approximately 150 ohms exclusive of the tapped section. The resistor is shown as a tapped resistor since in many cases ballast resistors with the tap 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. The series resistor must be located in such a place so that the added heat will not cause trouble. (Actually the total wattage dissipated in the entire series resistor system will be only about half what it was before.)

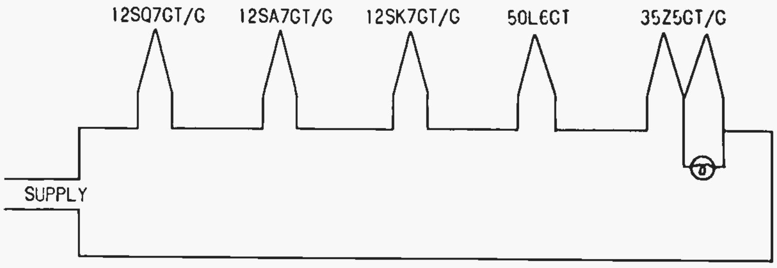


FIG. 3

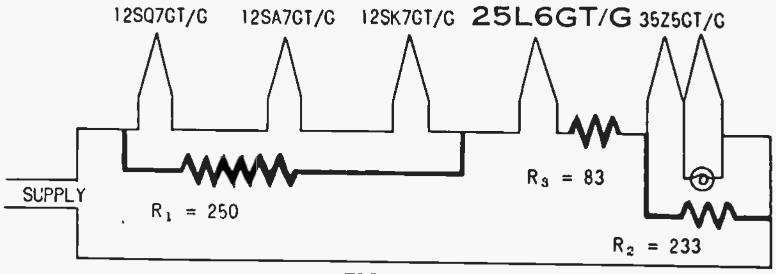


FIG. 4

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.

(Continued on page 3, column 1)

Substitution Charts for 300 Milliampere AC-DC Receiver Tubes

As indicated in the May-June issue, charts covering substitutions for 300 milliampere types have been prepared. The forms are similar to those for the 150 milliampere tubes. Chart 1 gives the 300 milliampere types which are not on the WPB list and possible replacements. Among the first and second choices, those preceded by an asterisk (*) occur on the WPB list and will be found in Column 1 on Chart 2. By reference to Chart 2, under the type or types involved, one can readily ascertain the principal changes required by the substitution. For convenience, changes are designated by letters which refer to the specific modifications listed at the top of the chart.

The WPB Civilian Radio Tube Program calls for the manufacture of 32 types having a 300 milliampere heater rating. Since all of these types may not be universally available one may find it necessary to use a similar type with a 150 milliampere heater. In this event note the added reference given under each type in Column 1, Chart 2 and refer to the type indicated in the 150 milliampere Substitution Chart published last month.

Prepared primarily for ac-dc applications these charts provide useful information in cases where substitutions are made in transformer operated sets. For such cases disregard changes B, L and M which are not applicable since heater voltages must correspond with transfer voltages existing in the receiver. Adherence to a given heater current rating is not essential if the power transformer has adequate current carrying capacity.

CHART 1

300 ma. Types not On WPB List	Possible Replacements: 1st Choice	Possible Replacements: 2nd Choice
1-V	*35Z3	12Z3
6A4/LA	*38	*12A5
6AE5GT	*76	6P5GT †
6AF5G	*35L6GT/G*†	*37
6A8†	*6A8GT†	6J8G
6B8	*6B8G	*6B7
6C5	*6C5GT/G†	*6J5GT/G†
6C6	*77	*6J7GT†
6D6	*78	6U7G
6D7	*77	6C6
6F5†	*6F5GT/G†	*6Q7GT†
6F7	▲	6P7G
6H6†	*6H6GT/G†	*7A6
6J5†	*6J5GT/G†	*6C5GT/G†
6J7†	*6J7GT†	*6SJ7GT†
6J8G	*6A8GT†	*7J7
6K5G†	*6K5GT†	*6F5GT/G†
6K7†	*6K7GT†	*6SK7GT/G†
6K8†	*6K8GT†	*6A8GT†
6P5G†	*76	*6J5GT/G†
6P7G	▲	6F7
6Q7	*6Q7GT†	*75
6R7†	*6R7GT/G†	85
6SA7†	*6SA7GT/G†	7Q7
6SF5†	*6F5GT/G†	*6K5GT†
6SJ7†	*6SJ7GT†	*7C7
6SK7†	*6SK7GT/G†	*7B7
6SQ7	*6SQ7GT/G†	*7C6
6U7G	*6K7GT†	*6SK7GT/G†
6V7G	*6R7GT/G†	85
6ZY5G	*25Z6GT/G†	12Z3
7A7	*7B7	*6SK7GT/G†
7B6	*7C6	*6SQ7GT/G†
7B8	*7A8	*6A8GT†
7Q7	*6SA7GT/G†	*12SA7GT/G†
12A5	*25L6GT/G†	25A7G†
12A7	*70L7GT	25A7G†
12Z3	*35Z3	*25Z5
25A6†	*25L6GT/G†	25A7G†
25A7G†	*70L7GT	12A5
25AC5GT/G†	*35L6GT/G*†	25L6GT/G*†
25B5	*25L6GT/G†	25B6G
25B6G	*25L6GT/G†	25B5
25C6G	*25L6GT/G†	*35L6GT/G†
25L6†	*25L6GT/G†	*35L6GT/G†
25N6G	*25L6GT/G†	25B6G
25Y5	*25Z5	*25Z6GT/G†
25Z6†	*25Z6GT/G†	25Z5
32L7GT	*70L7GT	*117L7M7GT
85	*6R7GT/G†	6V7G
XXFM	*7C6	7B6
XXL	*6J5GT/G†	*7A4

CHART 2

COLUMN 1: 300 ma. Types on WPB List	COLUMN 2: Use to Replace	No Change (A)	Fil. Volts (B)	Fil. Current (C)	Rewire Socket (D)	Change Socket (E)	Realign (F)	Add Top Cap Connection (G)	Remove Top Cap. Conn. (H)	Change Bias (K)	Add Parallel Resistor (L)	Change Series Resistor (M)
6A7	*6A8GT†					E	F					
	7B8					E	F	G				
	6J8G					E	F					
(7A8)°	*7J7					E	F	G				
	*6K8GT†					E	F					
	7S7					E	F	G				
6A8GT	*6A7					E						
	7B8					E	F	G				
	6J8G	A					F					
(7A8)°	*7J7					E	F	G				
	7S7					E	F	G				
	*6K8GT†	A					F					
6B7	6B7S	A					F					
(12SF7)°	*6B8G†					E	F					
6B8G	*6B7					E	F					
	6SF7				D			G		K		
(12SF7)°	7E7					E	F	G		K		
	7R7					E	F	G		K		
6C5GT/G	6C5†	A										
	6AF5G									K		
	6AE5GT									K		
(12J5GT)°	*6J5GT/G†	A										
	6P5G†									K		
	*7A4					E						
	37					E				K		
	76					E				K		
6F5GT/G	6F5†	A										
	6SF5†				D			G				
(7C6)°	*6K5GT†				D					K		
	7B4					E		G				
6H6GT/G	6H6†	A										
6J5GT/G	6J5†	A										
	*6C5GT/G	A										
	6AF5G									K		
	6AE5GT									K		
(12J5GT)°	6P5G†									K		
	*7A4					E						
	37					E				K		
	76					E				K		
	XXL					E						
6J7GT	6J7†	A					F					
	6C6					E	F					
	*77					E	F					
(7C7)°	6D7					E	F					
	*6SJ7GT†				D		F	G				
	1223						F					
6K5GT/G	6K5G†	A										
	6F5†				D					K		
(7C6)°	6SF5†				D			G		K		
	7B4					E		G		K		
6K7GT	6K7†	A					F					
	*6SK7GT/G†				D		F	G				
	6U7G	A					F					
(7B7)°	*78					E	F					
	6D6					E	F					
	7A7					E	F	G				
	*39/44					E	F					
	6E7				D		F					
6K8GT	6K8†	A					F					
	*6A8GT†	A					F					
	6J8G	A					F					
(7A8)°	*6A7					E	F					
	*7J7					E	F	G				
	7S7					E	F	G				
6Q7GT	6Q7†	A										
	*75					E						
(7C6)°	7B6					E		G				
	*6SQ7GT/G†				D			G				
	*6F5GT/G				D					K		
6R7GT/G	6R7†	A										
	6V7G									K		
(12SR7)°	85					E				K		
	6SR7				D			G				
	7E6					E		G				
	6C7					E				K		

CHART 2—(continued)

300 ma. Types on WPB List	Use to Replace	A	B	C	D	E	F	G	H	K	L	M
6SA7GT/G	6SA7†	A					F					
(12SA7GT)°	7Q7					E	F					
6SJ7GT	6SJ7	A					F					
	*6J7GT†				D		F	G				
	6C6					E	F	G				
(7C7)°	*77					E	F	G				
	6D7					E	F	G				
	1223					E	F	G				
6SK7GT/G	6SK7†	A					F					
	*6K7GT†				D		F		H			
	6U7G				D		F		H			
(7B7)°	*78					E	F		H			
	6D6					E	F		H			
	7A7					E	F					
	*39/44					E	F		H			
6SQ7GT/G	6SQ7†	A										
	7B6					E						
(7C6)°	*6Q7GT†				D				H			
	*75					E			H			
7A4	76					E						
	37					E						
(12J5GT)°	*6J5GT/G†					E				K		
	6P5G†					E				K		
	*6C5GT/G†					E						
	6AF5G					E				K		
	6AE5GT					E				K		
7F7	\6C8G					E			H	K		
	14N7		B							K		M
7J7	7B8	A					F					
	*6A7					E	F	G				
	*6A8GT†					E	F	G				
(12A8GT)°	6J8G					E	F	G				
	7S7	A					F					
	*6K8GT†					E	F	G				
25L6GT/G	25L6†	A										
	25A6									K		
	25B6G									K		
(35L6GT/G)°	12A5		B			E				K		
	25AC5GT/G⋆†				D					K		
	25B5					E				K		
	25C6G									K		
	25N6G				D					K		
25Z5	25Z6GT/G†					E						
(35Z5GT/G)°	25Y5	A										
25Z6GT/G	6ZY5G		B		D							M
	25Z6†	A										
	12Z3		B			E						
(35Z5GT/G)°	*25Z5					E						
	25Y5					E						
	14Y4		B			E						
36	6C6					E						
	*77					E						
(7C7)°	*6J7GT†					E						
	*6SJ7GT†					E						
37	76									K		
	*6J5GT/G†					E				K		
	6AF5G					E				K		
(12J5GT)°	6P5G					E				K		
	*6C5GT/G					E				K		
	*7A4					E				K		
	XXL					E				K		
38	12A5		B			E		G		K		M
(35A5)°	6A4/LA				D			G		K		
39/44	6K7†					E	F					
	*6SK7GT/G†					E	F	G				
	6U7G					E	F					
(7B7)°	*78					E	F					
	6D6					E	F					
	7A7					E	F	G				
75	*6Q7GT†					E						
	*6SQ7GT/G†					E		G				
(7C6)°	7B6					E		G				
	XXFM					E		G				
76	*6C5GT/G†					E				K		
	6AF5G					E				K		
(12J5GT)°	6AE5GT					E				K		
	*6J5GT/G†					E				K		
	6P5G†					E						
	*7A4					E				K		
	*37									K		
77	1221	A					F					
	*6J7GT†					E	F					
(7C7)°	6C6	A					F					
	6D7					E	F					
	*6SJ7GT†					E	F	G				
	*36					E	F					
78	*6K7GT†					E	F					
	*6SK7GT/G†					E	F	G				
	7A7					E	F	G				
(7B7)°	6E7					E	F					
	6U7G					E	F					
	6D6	A					F					
	*39/44					E	F					

NOTES:

* These types appear on latest WPB list.

▲ No WPB type.

† Indicates that the corresponding metal, G, GT, or GT/G types may be employed if space permits. Shielding may be required in some cases.

° Listed in 150 ma. chart; May-June Issue Sylvania News.

⋆ 35L6GT/G replaces both 25AC5G and 6AF5G.

CIRCUIT MODIFICATIONS

(*Continued from page 1*)

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 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.

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.

THE information presented in the Sylvania Service Exchange is contributed by servicemen as the result of practical experience. It is very carefully considered before being accepted, and we believe it to be correct and authentic. However, we assume no responsibility with respect to results. Please do not send routine or generally known information.

THE Service Exchange

GE HJ905A. On this model the main trouble is continual burn-out of the 19-ohm section in ballast tube. This section takes the full load of the two strings of filaments in this 9 tube set. The best remedy is to install a 20-ohm 25-watt wire wound resistor across this section at ballast tube terminals.—Henry Hudson.

* * *

Philco Model 60. While working on a Philco 60 table model and using the Rider Book "Aligning Philco Receivers," I found that there was a mistake in the book or that the code number was not included. After trying to align this set from the data book, I traced the various padders. I found that this set does not have an L. F. police padder (5). This set has both sides of the i-f transformers tuned and the sequence is (1) second i-f secondary, (2) second i-f primary, (3) first i-f secondary, (4) first i-f primary (5) 600 Kc padder.

Naturally, this change in position will throw many servicemen off trying to align one of these sets and I believe this experience of mine should prove interesting to other servicemen working on these receivers. —Chas. Hackenyos, Philadelphia, Pa.

* * *

Packard Bell Model 5 Kompak. Motorboating at the low end of the dial is quite usual in these models. At high volume settings it also cuts the signal. To cure examine the set carefully and replace the grid leads to the grid caps of the 6J7 and 6K7 tubes with shielded wire and ground the shields carefully. This will eliminate the motorboating entirely. —M. Margossian, Oakland, California.

* * *

Zenith 1939 Models (Automatic Tuning). In Zenith models which use the 1939 circuit in their switching from automatic to manual, you will find a small mica condenser, usually 0.0005; this condenser intermittently shorts to ground and causes the automatic button to fail to work.—Martin L. Pitts, Terrell, Texas.

* * *

Pontiac 1940 Custom Built Delco Auto Radio. Complaint of distortion and low volume. Removing one output tube has no change in volume. Replace open 0.05 condenser between driver tube and 6V6 output tubes used in inverse feedback fashion.—Vito F. Daidone, Newark, New Jersey.

J. S. REED WRITES:

"I am enclosing a P.O. money order for a copy of your binder complete with file of Technical Sections of Sylvania News.

I wish to express my appreciation of the fine service you have been rendering servicemen and experimenters in furnishing up-to-date technical information on radio tubes. I especially like the tube design features you have been carrying recently. The service exchange is especially valuable and has helped me in more than one case to solve a vexatious radio repair problem. Keep up the good work! Yours very truly," J. S. Reed, Jr., Lincoln, Nebraska.

Coronado Model 777. Motorboating. Add 0.01 mfd. condenser from plate of r-f tube to ground.—Clifton S. Krumling Blue Earth, Minn.

* * *

Ford Zenith Model 6MF490. Receiver dead. High voltage on control grid of 7B8. Coupling condenser in wave trap assembly shorted. Replace mica or use small 0.100 $\mu\mu$f. (original 0.115 $\mu\mu$f.) mica condenser. This condenser is a trimmer type but there is not provision (no hole) for adjusting.—Clifton S. Krumling, Blue Earth, Minn.

* * *

G. E. Models LF-115, 116; L.F.C.-1118, 1128, 1228. Am a reader of Sylvania News and I would like to make a suggestion on some sets I have repaired.

On these models I found that in each case the set was dead on standard broadcast and short wave bands but was ok on the f-m band.

By checking the sets I found that resistor #9 (1200 ohms) and resistor #11 (2200 ohms) were open.

In testing the condensers in this set I noticed failure usually started with condenser #31, which is a 0.02 mfd. 400 v. dc. Now when condenser #31 was replaced and resistors #9 and #11 were replaced, the set would work for awhile and then C-32, C-14 or C-40 would go. When trouble of this sort occurs, I replace C-14, C-31, C-32, C-40 using a 0.02 mfd. 600 v.d.c. and this usually does the trick.

It is better to replace all four condensers and play safe, than to replace one at a time and have the same trouble happen again.—S. J. Battory, North Adams, Mass.

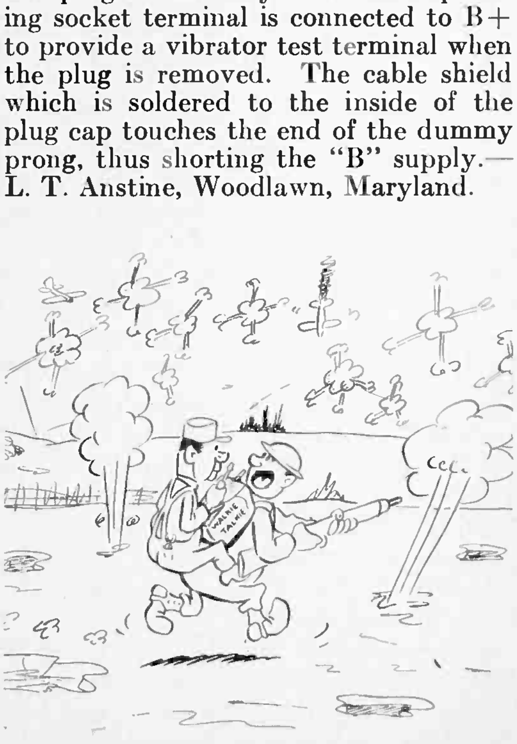
Philco Model 38-12. The frequent complaint on this set is that when it is tuned to a strong station and the volume control is suddenly advanced the set goes dead for a few seconds before coming up to the desired volume. There is a 4 megohm resistor which is connected from one of the volume control terminals to the large terminal strip at the center of the chassis. This resistor probably has increased in resistance or opened completely. It may be replaced by a 3 or even 2 megohm resistor without any noticeable change in performance.—J. Moller, Cincinnati, Ohio.

* * *

Wurlitzer Model 24. Very often these machines have to be serviced for the complaint of fading. The quick relay will deliver the normal 9.75 volts during the warm-up period, but as soon as it clicks it drops to zero, which it should not do. This is caused by no contact between the relay armature and the 6.3 volt winding, causing the heater voltage to see-saw between 9.75 volts and zero, each time the relay clicks causing fading. To remedy, carefully re-adjust and clean the relay points and replace if necessary. —M. L. Rhodes, Knightstown, Ind.

* * *

Ford Philco 1937. If this set is noisy or intermittent in operation, look for a short circuit from B+ to ground inside of the speaker cable plug. One prong of this plug is a dummy. The corresponding socket terminal is connected to B+ to provide a vibrator test terminal when the plug is removed. The cable shield which is soldered to the inside of the plug cap touches the end of the dummy prong, thus shorting the "B" supply.—L. T. Anstine, Woodlawn, Maryland.



You'll have to fix it on the run, I haven't time to stop. *Radio Retailing Today.*

Sylvania News

August-September, 1943 EMPORIUM, PENNA. Vol. 10, No. 7

Operating Conditions and Characteristics

RESISTANCE COUPLED AMPLIFIER CLASS A_2
(Per Section except heater)

	Self Bias	Fixed Bias
Heater Voltage	28.0	28.0 Volts
Heater Current	0.400	0.400 Ampere
Plate Voltage	28.0	28.0 Volts
Screen Voltage	28.0	28.0 Volts
Grid Voltage	.....	−3.5 Volts
Cathode Bias Resistor	390	..... Ohms
Zero Signal Plate Current	9.0	12.5 Ma.
Zero Signal Screen Current	0.7	1.0 Ma.
Maximum Signal Plate Current	6.5	8.1 Ma.
Maximum Signal Screen Current	1.6	1.9 Ma.
Plate Resistance	.....	4200 Ohms
Transconductance	.....	3400 μmhos
Peak A-F Signal Voltage	4.9	4.9 Volts
Control Grid Resistor per Section	0.5	0.2 Megohm
Load Resistance	4000	4000 Ohms
Power Output	80	100 Mw.
Total Harmonic Distortion	10	10 Percent

PUSH-PULL OPERATION—RESISTANCE COUPLED CLASS A_2
(Values are for both sections)

	Self Bias	Fixed Bias
Heater Voltage	28.0	28.0 Volts
Plate Voltage	28.0	28.0 Volts
Screen Voltage	28.0	28.0 Volts
Grid Voltage	.....	−3.5 Volts
Cathode Bias Resistor	180	..... Ohms
Zero Signal Plate Current	18.5	25.0 Ma.
Zero Signal Screen Current	1.2	2.0 Ma.
Maximum Signal Plate Current	14.5	19.0 Ma.
Maximum Signal Screen Current	2.5	3.0 Ma.
Peak A-F Signal Voltage (Grid to Grid)	9.8	9.8 Volts
Control Grid Resistor per Section	0.5	0.2 Megohm
Load Resistance (Plate to Plate)	6000	6000 Ohms
Total Harmonic Distortion	2.5	2.0 Percent
Power Output	175	225 Mw.

PARALLEL OPERATION—RESISTANCE COUPLED CLASS A_2
(Values are for both sections)

	Self Bias	Fixed Bias
Heater Voltage	28.0	28.0 Volts
Plate Voltage	28.0	28.0 Volts
Screen Voltage	28.0	28.0 Volts
Grid Voltage	.....	−3.5 Volts
Cathode Bias Resistor	180	..... Ohms
Zero Signal Plate Current	18.5	25.0 Ma.
Zero Signal Screen Current	1.3	2.0 Ma.
Maximum Signal Plate Current	13.1	16.0 Ma.
Maximum Signal Screen Current	2.8	3.5 Ma.
Peak A-F Signal Voltage	4.9	4.9 Volts
Control Grid Resistor (both sections)	0.2	0.1 Megohm
Load Resistance	2000	2000 Ohms
Total Harmonic Distortion	9.5	8.0 Percent
Power Output	160	200 Mw.

PUSH-PULL OPERATION TRANSFORMER COUPLED CLASS A_2
(Values are for both sections)

Heater Voltage	28.0 Volts
Plate Voltage	28.0 Volts
Screen Voltage	28.0 Volts
Grid Voltage	0 Volts
Cathode Bias Resistor	0 Ohms
Zero Signal Plate Current	64.0 Ma.
Zero Signal Screen Current	4.0 Ma.
Maximum Signal Plate Current	58.0 Ma.
Maximum Signal Screen Current	17.0 Ma.
Peak A-F Signal Voltage (Grid to Grid)	12.6 Volts
Load Resistance (Plate to Plate)	1500 Ohms
Total Harmonic Distortion	11.0 Percent
Power Output	600 Mw.

NOTE:—The above characteristics may be realized provided the d-c plate circuit resistance does not exceed 50 ohms per section.

SYLVANIA TYPE 28D7

Double Beam Power Amplifier For 28-Volt Operation

No formal announcement has heretofore been made in Sylvania News regarding Type 28D7. This tube was designed and developed by Sylvania some months ago to fulfill a need for an output tube which would deliver sufficient power at low operating voltages and thereby eliminate the need for auxiliary high voltage power supplies. Of primary importance in aircraft applications, the principal usage at present is confined to military requirements. Subsequent use in commercial equipment and perhaps in farm radios is anticipated.

It was found that certain other existing commercial tube types can be employed in 28 volt operated devices. A suitable output tube was not available prior to the release of Type 28D7. In order that you may become familiar with the characteristics of this new tube, pertinent data and circuit information have been prepared for this issue.

Sylvania Type 28D7 is a Lock-In output tube designed especially for operation directly from a 28-volt battery without requiring any auxiliary high voltage power supply. It consists of two beam power amplifier units in the same bulb. The control grid and plate of each section are brought out to separate pins; a common connection is used for the cathodes and likewise there is a common terminal for the screen grids. The heaters are connected in series internally, and the cathodes are not tied to either heater terminal.

The two sections of the tube may be operated separately, they may be connected in parallel, or they may be employed in a push-pull circuit. Two different recommended loads per section are specified, the choice depending on whether both sections are to function as single-ended amplifiers or whether the two sections are to operate in push-pull. Where each section is used as a single-ended amplifier, the load per section should be 4000 ohms, to insure reasonably low second and third harmonics. If the two sections operate in parallel, the load would be approximately half this value.

(Continued on page 2)

RATINGS

Heater Voltage	28.0 Volts
Heater Current	0.400 Ampere
Maximum Plate Voltage (Per Section)	100 Volts
Maximum Screen Voltage (Per Section)	67.5 Volts
Maximum Plate Dissipation (Per Section)	3.0 Watts
Maximum Screen Dissipation (Per Section)	0.5 Watt

PHYSICAL SPECIFICATIONS

Style	Lock-In
Base	Lock-In 8-Pin
Bulb	T-9
Diameter	1-3/16" Max.
Overall Length	3-5/32" Max.
Seated Height	2-5/8" Max.

BASE PIN CONNECTIONS

	Section
Pin 1—Heater	
Pin 2—Control Grid	2
Pin 3—Screen Grid	1 & 2
Pin 4—Plate	2
Pin 5—Plate	1
Pin 6—Cathode & BCP	1 & 2
Pin 7—Control Grid	1
Pin 8—Heater	
RMA Basing No.	8BS-L-O

SYLVANIA TYPE 28D7—(*Continued from page 1*)

For push-pull operation the load per section should be 3000 ohms since with this value the third harmonic is low and the second harmonic, although high, will cancel due to the push-pull circuit. A plate-to-plate load of 6000 ohms should therefore be employed.

In general, self bias will probably be employed and under such conditions power outputs exceeding 150 milliwatts can readily be obtained from a single tube operating in push-pull from a resistance coupled driver. If a separate bias voltage supply can be provided, fixed bias operation will furnish additional power output since it permits utilization of the total supply voltage. An increase in effective B voltage of about 3.5 volts is an important factor at low voltage operation. In some applications bias voltage may be obtained from an oscillator, thus making it unnecessary to provide a separate battery for grid bias and also permitting the use of the total plate supply voltage. The d-c resistance of the output transformer plate winding should be as low as possible to minimize the voltage drop to the plates.

Type 28D7 is designed to furnish comparatively large amounts of power at low plate voltages. The cathode power is proportionately higher than usually used in power output tubes. The precautions customarily recommended for satisfactory performance of output stages are particularly important with Type 28D7 tubes. In resistance coupled applications the grid resistor should not exceed 0.5 megohm per grid under self-bias conditions and 0.2 megohm per grid for fixed-bias conditions to minimize the effects of grid current. A low mu driver tube having an amplification factor of 20 or less is more satisfactory for driving the Type 28D7 tube to maximum output at low distortion.

SUITABLE DRIVER TUBES

Several methods of driving the Type 28D7 tube are very satisfactory for applications where a 28-volt power supply is the only source of operating voltage. Data are given to show the performance characteristics of a number of resistance coupled circuits and a transformer coupled circuit.

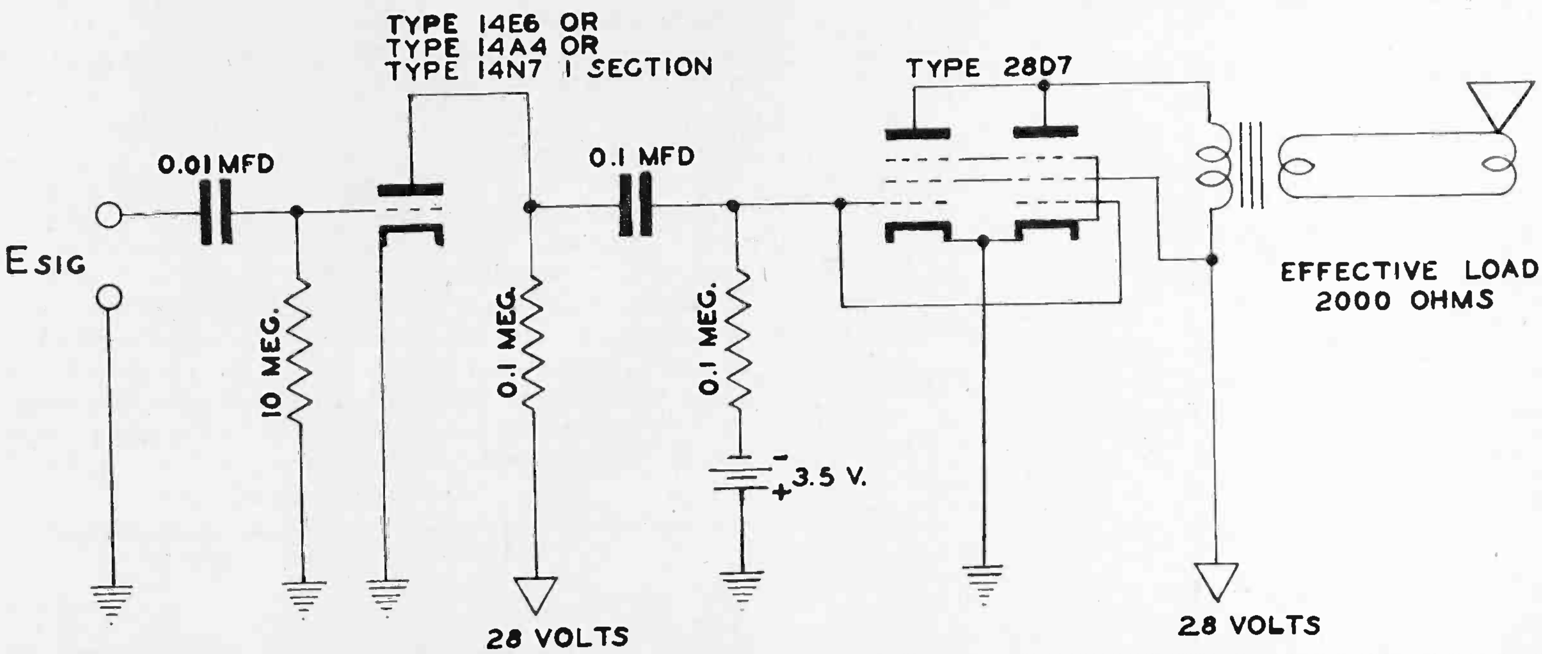
A number of low mu triode tubes using resistance coupling, such as Types 14N7, 14E6 and 14A4, are available to drive the Type 28D7 to rated power output under low voltage conditions. Pentodes having characteristics similar to Type 14R7 are also adaptable for this application. The load shunting the plate resistor of the driver tube consists of the following grid resistor and the grid-cathode resistance of the Type 28D7 tube in parallel. The latter is an important consideration of the circuit as the Type 28D7 tube is driven to grid current at the higher signal levels.

Considerably higher power outputs are possible with push-pull transformer drive when another Type 28D7 is employed as a driver with both sections connected in parallel. At 500 milliwatts output the driving power is less than 45 milliwatts and the grid-to-grid signal on the output tube is approximately 10.5 r-m-s volts. At 600 milliwatts output these figures are 80 milliwatts and 12.8 volts respectively.

The performance characteristics of these various circuits are given in the following tables and the circuit constants employed are shown on the schematic diagrams.

The power output of a Type 28D7 is very flat over a wide range of heater voltage. There is a drop in power output of approximately 3% with a heater voltage change from 32 volts to 17.5 volts.

LOW MU TRIODE DRIVERS FOR TYPE 28D7



TYPE 14E6 DRIVING A TYPE 28D7 (RESISTANCE COUPLED)

Esig to Driver	Power Output	% 2nd	% 3rd	Total Distortion
0.10 Volt	26.6 Mw.	4.8%	2.4%	5.4%
0.20	117.0	0.4	2.0	2.0
0.30	192.0	5.0	4.0	6.4
0.35	216.0	6.7	5.9	9.0
0.40	240.0	8.2	8.3	11.6

For Circuit Above

TYPE 14N7 (SINGLE SECTION) OR TYPE 14A4 DRIVING TYPE 28D7 (RESISTANCE COUPLED)

Esig to Driver	Power Output	% 2nd	% 3rd	Total Distortion
0.10 Volt	50.0 Mw.	1.9%	3.8%	4.3%
0.15	112.0	1.9	3.1	3.6
0.20	169.0	3.8	2.7	4.6
0.25	217.0	6.7	6.4	9.3
0.30	248.0	8.9	9.0	12.6

For Circuit Above

TYPE 14R7 DRIVING TYPE 28D7 (RESISTANCE COUPLED)

Esig to Driver	Power Output	% 2nd	% 3rd	Total Distortion
0.02 Volt	14.0 Mw.	3.3%	1.0%	3.4%
0.04	45.0	3.0	2.1	3.7
0.06	96.0	2.7	2.4	3.6
0.08	148.0	5.6	2.4	6.1
0.10	188.0	9.7	5.2	11.0
0.12	224.0	12.3	7.3	14.3

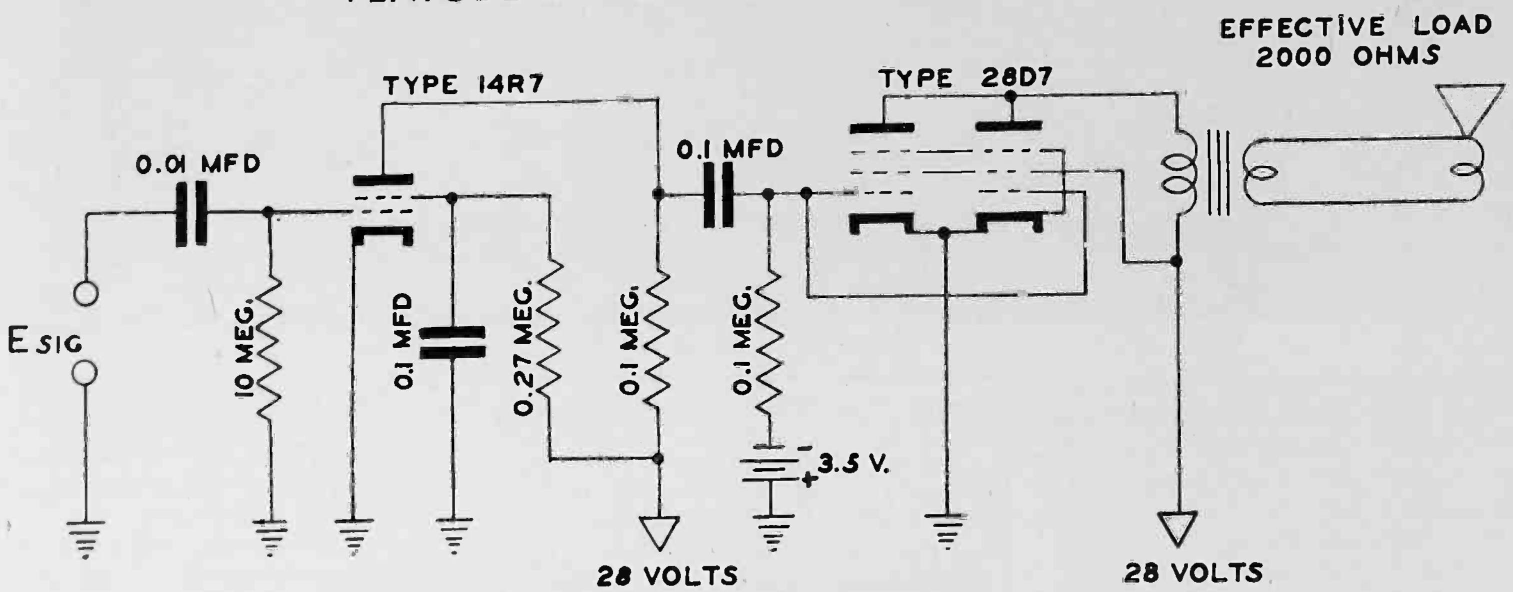
For Circuit on Next Page

TYPE 28D7 DRIVING A TYPE 28D7 (TRANSFORMER COUPLED)

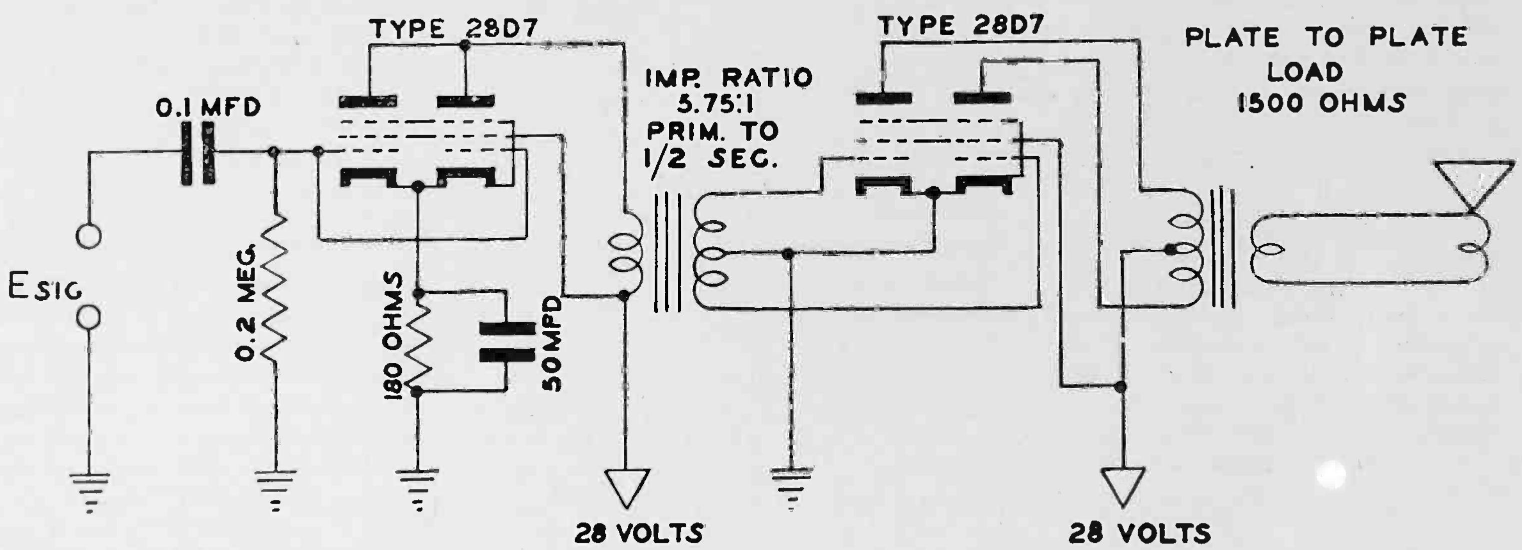
0.25 Volts	22.3 Mw.	3.8%	2.9%	4.8%
0.50	93.6	4.5	1.0	4.6
0.75	196.0	3.7	1.5	4.0
1.00	300.0	1.7	1.9	2.6
1.25	421.0	1.7	4.0	4.4
1.50	520.0	1.4	7.0	7.1
1.75	600.0	1.0	10.5	10.6
2.00	652.0	0.8	13.5	13.5
2.15	682.0	0.8	15.7	15.7

For Circuit on Next Page

PENTODE DRIVER - RESISTANCE COUPLED



TRANSFORMER COUPLED DRIVER



TYPE 28D7 PERFORMANCE WITH AIRCRAFT VOLTAGE SUPPLIES

The use of radio tubes operated with the plate and screen voltages obtained from the 28-volt storage battery in a plane is becoming rather commonplace for aircraft equipment. Inasmuch as the plate, screen and filament supply of the equipment will be subjected to whatever voltage variations occur in the supply voltage, it is important to know how the performance will be affected by such changes. The operating supply voltage during flight will vary from 27.5 to 28.5 volts. When the plane is grounded, the supply voltage may drop to as low as 22 volts. In some instances a gasoline driven generator may be connected to the supply source while the plane is grounded which may raise the voltage to 32 volts.

Power output and distortion data on Type 28D7 are given in the following table with the heater, plate and screen voltages varied from 22 volts to 30 volts under fixed and self-bias conditions. Values shown are for resistance coupled operation with both sections connected in parallel.

$R_L = 2000$ ohms, Esig = 3.5 V. r.m.s.

Fixed Bias
$R_g = 100{,}000$ ohms, $E_{c_1} = -3.5$ volts

$E_h = E_b = E_{c_2}$	P. O.	% Distortion
22 volts	112 mw.	15
24	135	12
26	170	10
28	200	8
30	235	8

Self-Bias
$R_g = 200{,}000$ ohms, $R_k = 180$ ohms, $R_c = 10$ μf

$E_h = E_b = E_{c_2}$	P. O.	% Distortion
22 volts	90 mw.	16
24	109	14
26	130	12
28	160	10
30	175	9

In applications where the tube is required to operate for any extended period at heater voltages in excess of 28 volts, a resistor should be inserted in series with the heater supply voltage and the heater. The following data give the performance characteristics of a Type 28D7 under conditions simulating voltage supply variations from 22 volts to 32 volts with a 10 ohm resistor in series with the heater voltage supply and the heater.

$R_L = 2000$ ohms, Esig = 3.5 V. r.m.s.

Fixed Bias
$R_g = 100{,}000$ ohms, $E_{c_1} = -3.5$ volts

E_h	$E_b = E_{c_2}$	P. O.	% Distortion
18.8 volts	22 vol s	107 mw.	16
20.7	24	135	13
22.5	26	170	10
24.3	28	200	8
26.1	30	235	8
28.0	32	260	8

Self Bias
$R_g = 200{,}000$ ohms, $R_k = 180$ ohms, $R_c = 10$ μf

E_h	$E_b = E_{c_2}$	P. O.	% Distortion
18.8 volts	22 volts	87 mw.	17
20.7	24	107	15
22.5	26	130	13
24.3	28	160	12
26.1	30	175	10
28.0	32	195	10

The operating temperature of Type 28D7 is quite high. This fact should be taken into account when selecting sockets and also in locating parts with respect to the tube.

THE information presented in the Sylvania Service Exchange is contributed by servicemen as the result of practical experience. It is very carefully considered before being accepted, and we believe it to be correct and authentic. However, we assume no responsibility for results. Please do not send routine or generally known information.

THE Service Exchange

Improving Tone Quality. Have had many auto sets, as well as 6-volt battery sets, where the owners complained of mushy, almost unintelligible tone. By replacing the 0.05 mfd. 150-volt condensers in the 6-volt circuit in vibrator compartment with the same size 200-volt condensers, the trouble was cleared up. Sometimes the leak in these condensers won't show without a very high ohmmeter setting, (such as 20 megohms). Also, have cleared up the tone on battery sets, (same complaint) by installing a new "A" battery.—Charles A. Johnson, Republic, Mich.

* * *

Philco Model 651. Annoying oscillation was traced to the i-f unit of this model. To eliminate same the i-f transformer leads should be separated from each other as far as possible, that includes separation of 1st i-f leads as much as possible. To cure any cause of motorboating at about 540 KC. the B minus lead from the suppressor plate terminal of the 78 tube (RF) to the wiring panel mounted on condenser #72 should be run close to the chassis and away from the wave trap coil.—M. S. Planovsky, Cleveland, Ohio.

* * *

RCA U-123 Chassis RC-421. Signal cut-off, on short wave band only, caused by intermittent 5600 $\mu\mu f$ tubular condenser, (C-9), No. 13895. If exact duplicate is unavailable, use a standard tubular condenser of 0.005 μf capacity. —Joseph S. Napora, Uniontown, Pa.

MORE SERVICE HINTS, PLEASE

We appreciate the cooperation of those of you who have been submitting Service Hints for these columns; and feel that the information they carry is especially helpful under today's conditions of war-time servicing. Many of you who haven't been contributing regularly undoubtedly know some "tricks-of-the-trade" that would be of value to other servicemen. We ask that you please send them to us, so that we may continue to publish all suitable material.

Farnsworth AC55. The following is an unusual service problem which I encountered that might be of interest to others.

Recently a Farnsworth AC55 was brought in with the complaint of a loud hum. The filters with the exception of No. 30, on the diagram checked O.K. Replacing this condenser did not help any. On checking further I found that some of the electrolyte from the condenser No. 30 had seeped through the coiled wire shield and impregnated a spot on the wire connecting the center tap of the volume control and condenser No. 18. This wire picked up the hum from the shield and fed it to the grid of the 6SQ7 tube. To repair simply replace wire and dress condenser away from the shield.—Henry D. Morse, Homer, N. Y.

RCA 26X4 and Similar Models

SYMPTONS. Weak, and hiss at times on stations and may even require an external aerial to get suitable reception, yet everything checks OK.

CURE. Dress filter leads away from i-f leads and terminal strip under center of chassis. Insulate carefully and realign.

EXPLANATION. Filter leads are cotton covered—sometimes are saturated with electrolyte and then dry out. Close proximity of even the merest threads of cotton affect the i-f gain without apparently affecting the i-f peaking. Results are well worth the effort.—Harry Isaacson, Rochester, N. Y.

* * *

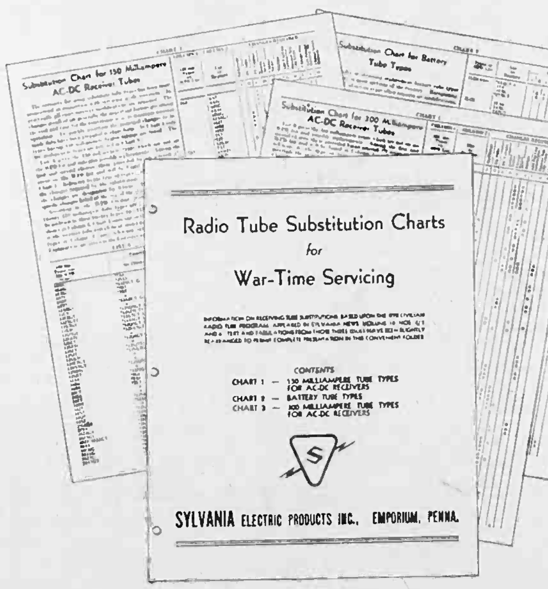
WAR TIME EMERGENCY HINTS

Battery Treatment. During the present battery shortage I have been using a Veterinarian's hypodermic needle and injecting hot water into each cell of the A and B batteries with surprisingly good results. Of course this is for batteries on which the zinc is still intact. Takes a little time and trouble, but the radio is brought back to life for a few weeks.—M. J. Edwards, Shreveport, La.

* * *

Tube Substitution. Type 6H6 tubes are hard to get here so we decided to use as a substitute a Type 6X5GT rectifier tube. Both cathode prongs on the 6H6 socket should be tied together. The sets in which this has been done work fine.—Wentworth's Radio Service, So. Berwick, Maine.

RADIO TUBE SUBSTITUTION CHARTS FOR WAR-TIME SERVICING



Because of popular demand, the Radio Tube Substitution Charts appearing in the past three issues of Sylvania News have now been combined in a convenient folder. These charts contain vital information for every radio man, and should be put to use immediately. Their preparation is added proof of Sylvania's sincere desire to constantly help servicemen face the problems of these hectic times.

Your Sylvania Distributor will supply you with reasonable quantities without charge on request. If it is more convenient, write directly to us.

"Send a radio repairman to fix Corporal Swanson's radio, and maybe you'd better send a doctor with him!"

Radio Retailing Today

Sylvania News

October, 1943 EMPORIUM, PENNA. Vol. 10, No. 8

TUBE SUBSTITUTIONS AND SOCKET ADAPTORS

The Sylvania Tube Substitution Charts* have been of real assistance to servicemen and dealers in selecting workable substitutes for many of the unobtainable tube types. For each case the tabulated changes were based on the assumption that the appropriate socket would be provided for the substitute type. However, we realize that occasions arise when objections are made to proposed receiver alterations. The customer may prefer to have the original wiring remain essentially intact or the serviceman may conclude that the super-compactness of the receiver precludes satisfactory remodeling. These situations suggest the possible use of adaptors.

There is no hard and fast rule for adaptor usage. No set instructions for making adaptors can be given although numerous suggestions and precautions are worthy of careful consideration.

Analyze Space Limitations

Perhaps the first condition to be analyzed is space limitation. The adaptor itself definitely adds to the effective overall length. Whenever space is at a premium the comparatively short overall length of Lock-In types may permit their use whereas G or GT constructions could not be utilized. This is especially true where Lock-In types are substituted for regular or GT designs involving top cap connections since the Lock-In versions are all of single ended construction and therefore shorter in length. In general, tube diameters are not as critical a dimension as the overall length. Exceptions would be encountered on substitutes for miniature types.

Extra Capacitances

Let us assume that a socket change is not made and that space does permit using an adaptor. What difficulties are most likely to be experienced that could be attributed to the adaptor itself? First is the extra capacitances introduced, particularly the grid-to-plate value. The r-f, i-f and converter tubes will be most critical in this respect and careful realignment will be necessary even though the substitute tube has the same capacitance ratings as the original type. A second source of trouble may be hum pick-up introduced by the extra length of grid lead required on oscillators and amplifiers. In making an adaptor to use one of the single-ended tubes having the control grid brought out at a tube base pin, in place of a top-cap style, a suggested method is to fasten an old top cap to the side of the adaptor. Generally this will not introduce too much additional capacity. Should the reverse situation exist, that is, the use of a tube with top-cap connection in place of a single-ended style, it would be best to run the grid lead in shielded wire outside the socket and make no connections to it in the adaptor because special shielding of the grid lead is incorporated within the tube base. There is no easy way of continuing this shielding through an adaptor.

Another precaution, easily overlooked, is that of employing suitable insulation for any crossed leads present within the adaptor. The use of a good grade of spaghetti is emphasized because some of the new synthetic types are not too satisfactory.

*These are still available on request.

Using Salvaged Bases

Perhaps the easiest way to make up adaptors is to use the base from a burned out or otherwise defective tube. First ascertain that the base is equipped with the required number of pins and also that all pins present are in the proper positions. Bear in mind that every tube base does not necessarily contain eight pins. Many octal bases, whether on metal, G or GT tube types may have only 5, 6 or 7 pins as the normal number instead of eight. The metal shell base employed on numerous GT tube types may be somewhat simpler to handle than the bakelite style although the latter will suffice if adequate care is used in drilling any additional holes that are found necessary. In case the adaptor must be made sufficiently small in diameter so that a tube shield will fit over the tube and adaptor, the mounting projections of the socket can be cut off. An alternative is to use a style of socket which normally would be fastened to the chassis by a locking ring. Wires about three inches long are soldered to the socket terminals and then arranged in the proper order to permit threading into the pins of the old base. Determine which leads, if any, will require insulation. Next, see that the old tube base is properly cleaned out and the pins entirely open to admit the wire connectors.

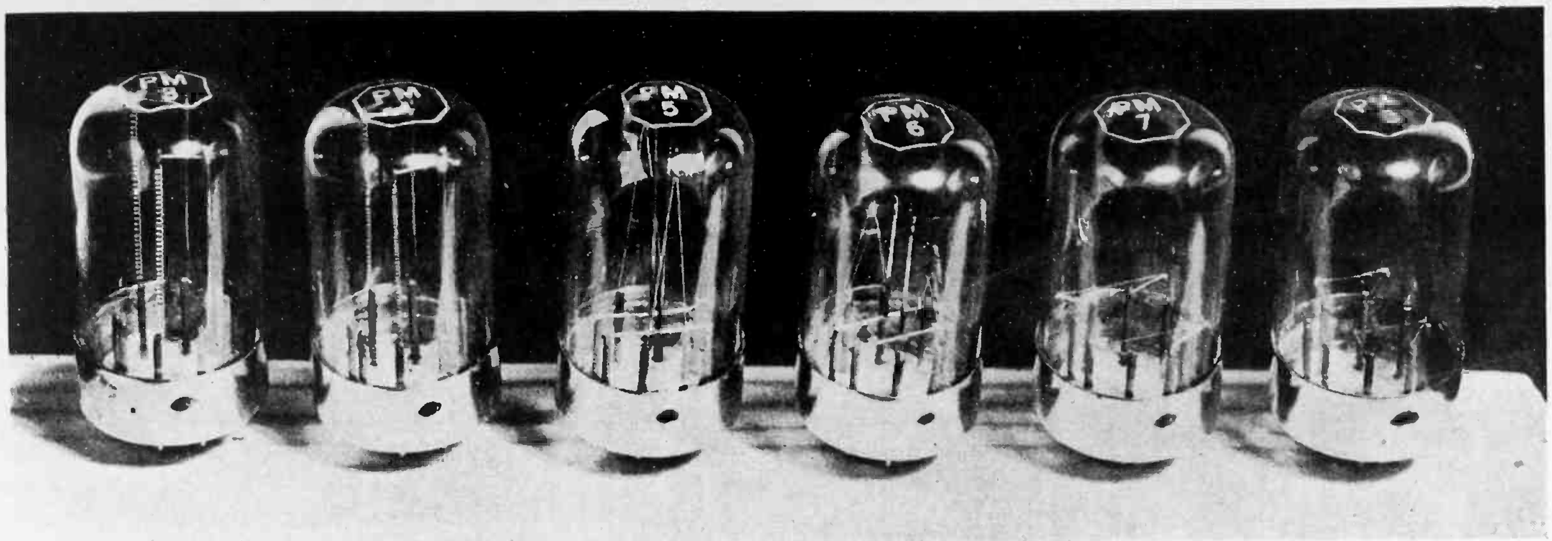
No specific instructions are being suggested for fastening the base and socket together since the procedure is largely governed by the style of base and socket combination. The socket should provide some bearing surface on the top of the base to withstand the pressure exerted when a tube is inserted in the adaptor. With reasonable care in inserting and removing the adaptor no mechanical connection other than the wires themselves would have to be provided if fairly heavy wires are used as connectors. Now thread the wires into the base pins, pull up tight and bend each wire over the end of the pin. At this point a few extra moments spent in checking connections with a continuity meter to make certain each wire is correctly terminated will often save time and material. Recheck against base and socket diagrams. This done, the wires can be soldered and the excess wire clipped off close to the pin. Solder carefully and avoid applying solder to the sides of the pins. If chunks of solder remain on the pin walls tube insertion will be more difficult and the socket contacts in the receiver proper may be permanently sprung and result in faulty performance.

Tracing Hum

In case it is necessary to use an adaptor in a first audio stage or in a P. A. system hum may be traceable to an unshielded grid lead running parallel to the heater wires in the adaptor. The obvious cure is to shield the lead and ground the shield. This might require an extra lead direct to ground.

These notes are intended to "hit the high spots" relating to tube adaptors, recognizing that their use in servicing receivers is principally a war-time expediency and not a practice that is to be recommended if repairs can readily be done in the orthodox manner.

SYLVANIA POWER MEASUREMENT LAMPS



A MEANS OF MEASURING HIGH FREQUENCY POWER OUTPUT OF RADIO EQUIPMENT

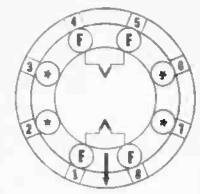
Many items now being made by Sylvania cannot be discussed in these pages but the recently developed Sylvania Power Measurement Lamps are not restricted and many experimenters should find them quite useful.

The accurate measurement of radio frequency power has always been somewhat of a problem. Even the use of good thermocouple milliammeters in series with an incandescent lamp is not too satisfactory because neither the lamp resistance nor the voltage are generally known. Vacuum tube voltmeters, if available, offer some help but in many cases the extra capacity, resistance and inductance introduced into the circuit being measured change the conditions so much that the results are not too reliable.

The Sylvania Power Measurement Lamps provide a simple and accurate means for measuring r-f power. There are six "lamps" in the series at present, with resistances from 40 to 310 ohms over the useful ranges of the curves. Power measurements from 0.05 watt to 25 watts can be measured directly and accurately with a PM Lamp and meters readily available to most radio experimenters.

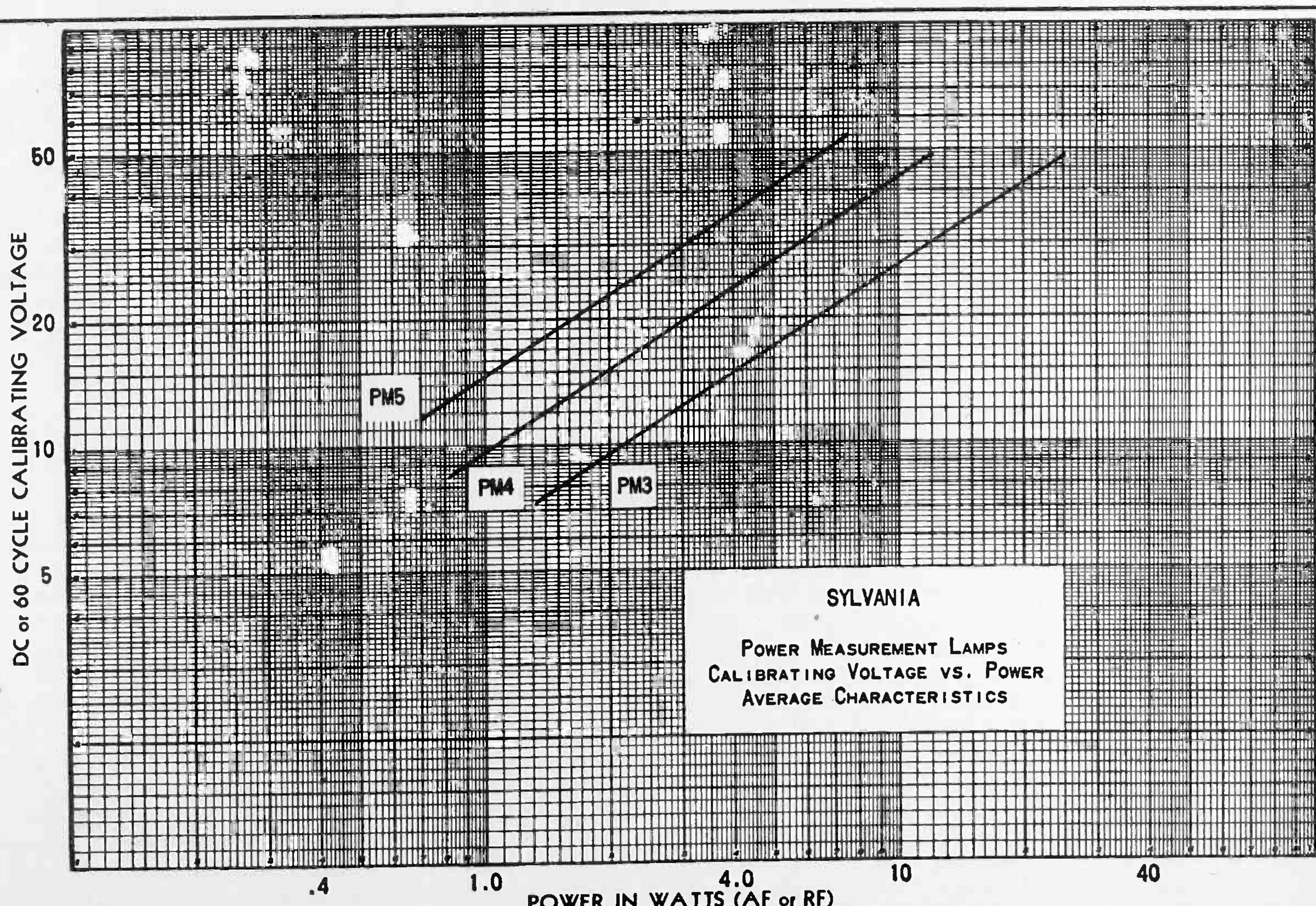
These lamps consist of two identical filaments in the same bulb. Their small

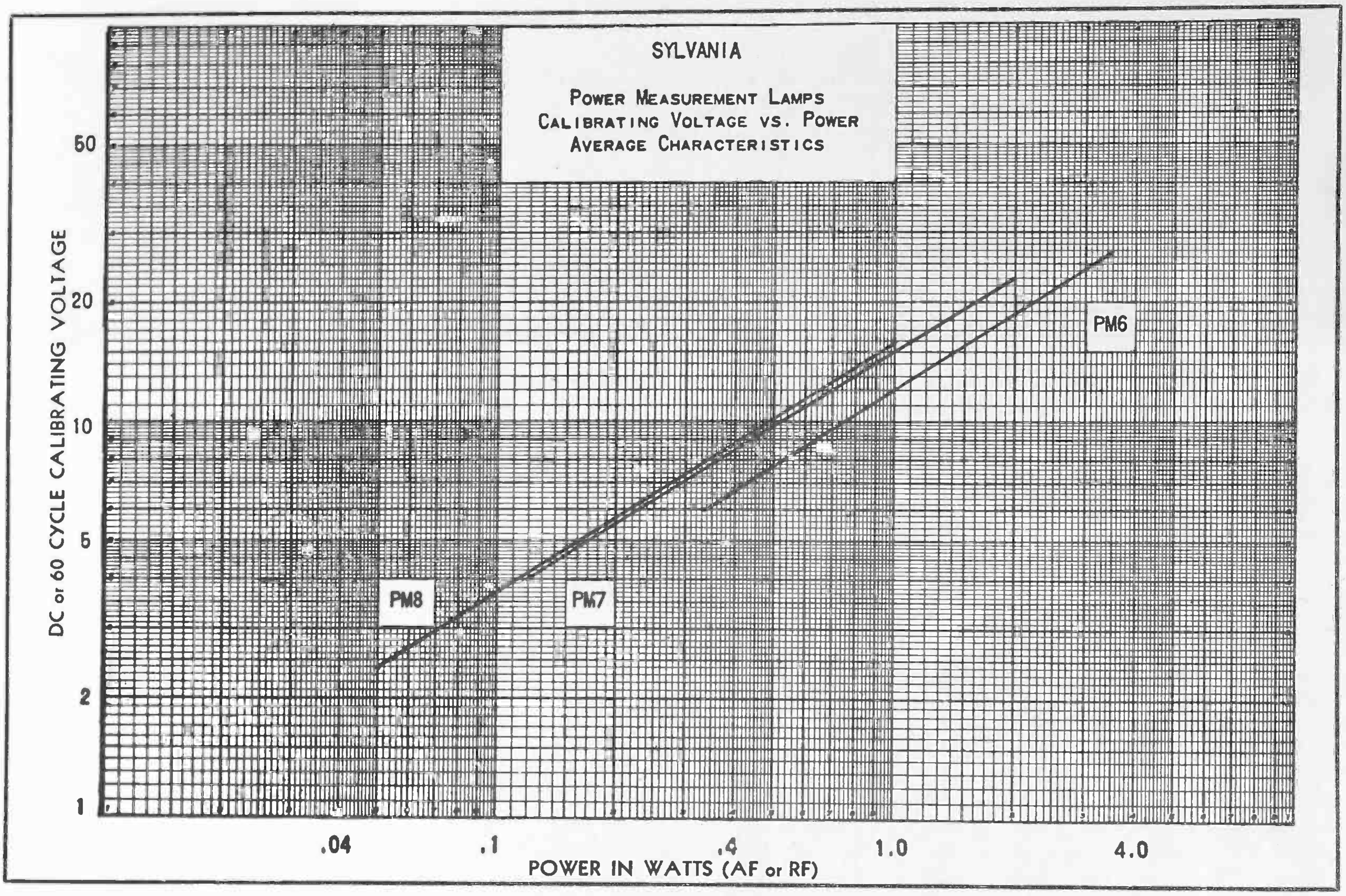
BASE CHART AND CONNECTIONS



Pin 1.....F1	Pin 5.....F2
Pin 2.....*	Pin 6.....*
Pin 3.....*	Pin 7.....*
Pin 4.....F2	Pin 8.....F1

*External connections should not be made to these pins.





size and direct connections enable one filament to be placed in one of the leads of the high frequency circuit being investigated. The other filament is connected to a variable a-c or d-c power source of which the voltage is measured with an ordinary meter and this is varied until the brightness of the two filaments are equal. The accuracy of measurement is 5 per cent without special calibration of both filaments, but this can be bettered by averaging two readings using the filaments reversed. If more accurate results are desired the lamps can be calibrated by either impressing a voltage or measuring the current in the calibration side, applying a voltage to the load side and measuring the load input when the two sides match for brightness. The power in the load side is then known in terms of voltage or current in the calibration side, and the accuracy will be independent of any difference between the two filaments.

Extending Useful Range

The range may be extended into the higher power region by using a dark glass filter for visual comparison of filament brightness. If a suitable photocell detector is available the useful range can be still further extended. It would not be advisable to operate above the maximum power or voltage listed since a permanent sag may be put in the filament if these values are exceeded.

Because of the high heat conductivity and small diameter of the filament material, the temperature and color will be constant for a given quantity of energy dissipated, regardless of whether the heat is liberated uniformly throughout the cross section as with D. C. or non-uniformly due to skin effect at ultra high frequencies. Power can be measured at any frequency at which it is possible to couple the energy into the lamp filament. (Series tuning capacitance or resonant lines may be required).

The high frequency resistance of the power lamps does not differ appreciably from the d-c resistance up to the frequencies given in the characteristics, for due to the small wire size the depth of penetration is greater, or at least equal, to the wire radius. When the lamps are used at a higher frequency where skin effect becomes a factor, the resistive component increases; but the power will be correctly indicated as the r-f current will be less than the d-c current, resulting in equal r-f and d-c I^2R products (power values) and equal filament brightness.

RATINGS AND CHARACTERISTICS

	TYPES					
	PM3	PM4	PM5	PM6	PM7	PM8
*Maximum Frequency for Z=R	15	15	25	25	30	55 Mc.
Maximum Frequency for $R_{ac}=R_{dc}$	100	100	150	200	400	900 Mc.
Inductive Reactance at 55 Mc	125	100	225	140	120	** Ohms
Inductive Reactance at 110 Mc	300	275	450	250	200	90 Ohms
Normal Power (Min.)	1.35	0.8	0.7	0.33	0.12	0.05 Watts
Normal Power (Max.)	10.00	5.5	3.8	1.75	0.95	0.41 Watts
Resistance at Normal Power (Min.)	40	90	190	110	130	110 Ohms
Resistance at Normal Power (Max.)	70	150	310	175	220	195 Ohms
Power Dissipation (Max.)	25.0	12.0	7.5	3.5	2.0	1.0 Watts
Applied D-C Volts (Max.)	48	48	55	28	24	16 Volts

*Lamps may be used for voltage calibration or standardization up to these frequencies.

**Reactance is negligible compared to the resistance.

THE information presented in the Sylvania Service Exchange is contributed by servicemen as the result of practical experience. It is very carefully considered before being accepted, and we believe it to be correct and authentic. However, we assume no responsibility for results. Please do not send routine or generally known information.

Emerson Model 108 LW. Set plays normally and then suddenly drops in volume. Trouble may be caused by the oscillator coil which is located beneath the chassis. The connections make and break contact at the lugs when the set warms up. To make the set show up this trouble quickly, place the chassis into an empty shoe box where the accumulation of heat will hasten the breakdown.—Harold D Millen, Boston, Mass.

* * *

RCA Model 46X11. Distortion and a marked decrease in volume were traced to the output beam power tube which checked OK on the tester. When the voltages were checked it was found that the screen voltage was below normal although all parts checked perfect. Replacing the output tube with another tube cured the trouble.—Harold D. Millen, Boston, Mass.

* * *

Crosley Model 170. When this set is brought in for repairs with the complaint that there is no reception over the entire dial, although the set still seems to have a live sound coming from the speaker, the trouble nine times out of ten will be caused by the breakdown of one section of the dual unit condenser which is listed as part #W27204. The section which connects to the 10,000 ohm resistor is the one that always breaks down. For a permanent cure, replace with a 0.02—600 volt unit. Another frequent complaint in this model receiver is the breakdown of the dual resistor unit #W28471. Quite often either one or both of these resistors open and are generally replaced with regular single units mounted on the defective resistor lugs. When this is the case, the replacement units generally develop quite a bit of heat which invariably causes the before-mentioned oscillator plate coil condenser to break down. It is a good policy after replacing the defective resistors to slip a small piece of asbestos paper under them and thereby protect any condensers which are mounted close to the resistors.—D. Cunicky, Belle Vernon, Pa.

* * *

Philco Model 38-7. Intermittent weak signals. Replace the filter condenser on the set side of the choke. This condenser also acts as an audio by-pass.—Daniels Brothers, Everett, Penna.

Motorola Custom Deluxe (For Dodge 1940). This set came in with the following symptoms: Very poor selectivity, low volume on other than local stations and poor sensitivity. This would appear at all times except on a rainy day. After checking all grounds plus routine checks on tubes and circuit alignment, I finally found the trouble. This set came through with a small antenna matching unit located in the base of the antenna. An ohmmeter reading showed several megohms resistance from the tip of antenna to end of lead-in at the set. Upon taking apart the base of antenna (which must be done with extreme care to avoid breaking the bakelite base), I found the matching coil full of corrosion. The supposedly water and weather proof connections were not so. The weather had been getting in, and in time the corrosion had created a high resistance joint. Upon wetting the coil, I found the resistance had dropped to about eight thousand ohms, instead of the megohm reading when dry. Remedy: Take out coil, unwind the wire from the form and solder a jumper across the two ends of form and replace. Realign the antenna circuit and set is perfect.—Frank Sikonski, Central Falls, R. I.

* * *

Detrola Battery Radios. On several of these models and other such sets using a vibrator power supply, the filter choke has a bad habit of "going open". This unit can be repaired without disassembling the entire power unit, by shunting a 350 ohm, 5 or 10 watt resistor across the open choke. The filter action is, seemingly, just as good. This is a quick, cheap and serviceable repair.—D. J. Shinn, Elgin, Kansas.

* * *

General Electric G-50. Fading and distortion with indications of a poor connection in the speaker cable. This is caused by changes in capacity between the wires of the speaker cable as they are moved.

To remedy, connect a 0.05 μf condenser from the screen of the 41 output tube to chassis, right at the socket. The factory depended upon the capacity between the wires of the speaker cable, which become separated.—Albert Van Nest, Orlando, Fla.

RCA Model M-101. Time and again this set would play when pulled from a car and placed on the bench, but would not play in car more than a few miles; and then it would be the same thing all over again. Trouble was in the black wire where it enters into the special aerial transmission matching box. This set has a special aerial lead-in setup to reduce noise which consists of a black wire and a red wire covered by shielding. —T. Henshaw, Marysville, Kans.

* * *

Philco Model 39-85 (Battery). No signals, or intermittent. Replace the small control grid condenser in the oscillator section of the 1A7G. This condenser is mounted on the wave band switch, the only number on it is Type 0. We found that in several of these sets, this condenser developed a high resistance leak, sometimes enough to put a positive bias on the oscillator control grid.—Daniels Brothers, Everett, Penna.

* * *

Reducing Microphonic Hum. On sets using the 1.4 volt tubes and where the speakers are mounted directly on chassis, there often exists microphonic hum. This can be cured by inserting rubber spacing washers between points touching chassis and also where speakers are mounted on cabinet, install rubber spacers between baffle and speaker.—J. Leo Robey, Waldorf, Md.

* * *

Auto Radio Installation. Those "T" and "J" bolts used to hold auto radios to bulkheads can waste a lot of your time. Try this method. Loosen the nuts to within a quarter of an inch of the bolt ends—remove and repair the radio—and hook it to the bolts you left hanging in the bulkhead. Now, from the motor side, grasp one bolt end with a pair of pliers. Hold it firmly to prevent it from twisting out of the slot in the radio and pull one end of the radio up snugly to the bulkhead. Now you can spin the nut clear up to the hilt with the fingers of your other hand. Do the same with the other bolt then a few tightening turns with your wrench will finish the job quicker than I can tell it. Saves a lot of wear and tear on your helper, as well.—Don Blair, Franklin, Pa.

Sylvania News

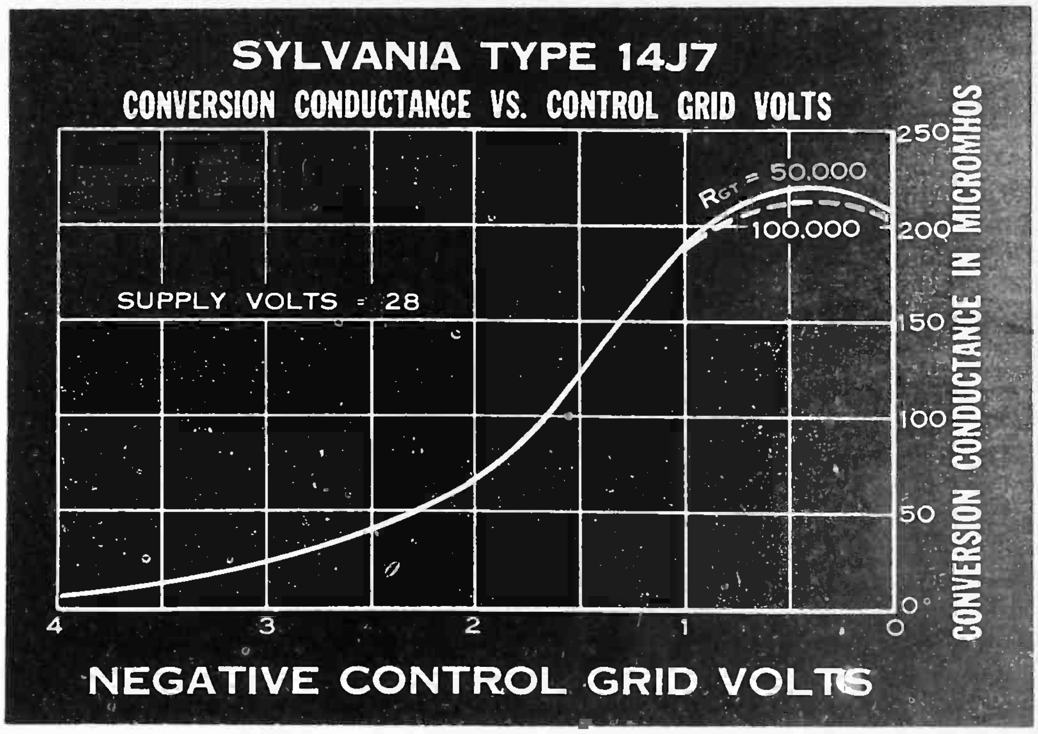
November, 1943 EMPORIUM, PENNA. Vol. 10, No. 9

28-Volt Operation of Standard Radio Receiving Tubes

The August-September issue of Sylvania News contained an article on Type 28D7. Because of the growing interest in low voltage operation further information is now presented on other tube types. Only a limited number of existing types happen to have design characteristics such that they may also be operated from a 28-volt supply and still provide acceptable performance. Ratings on several recommended types appear in the present issue.

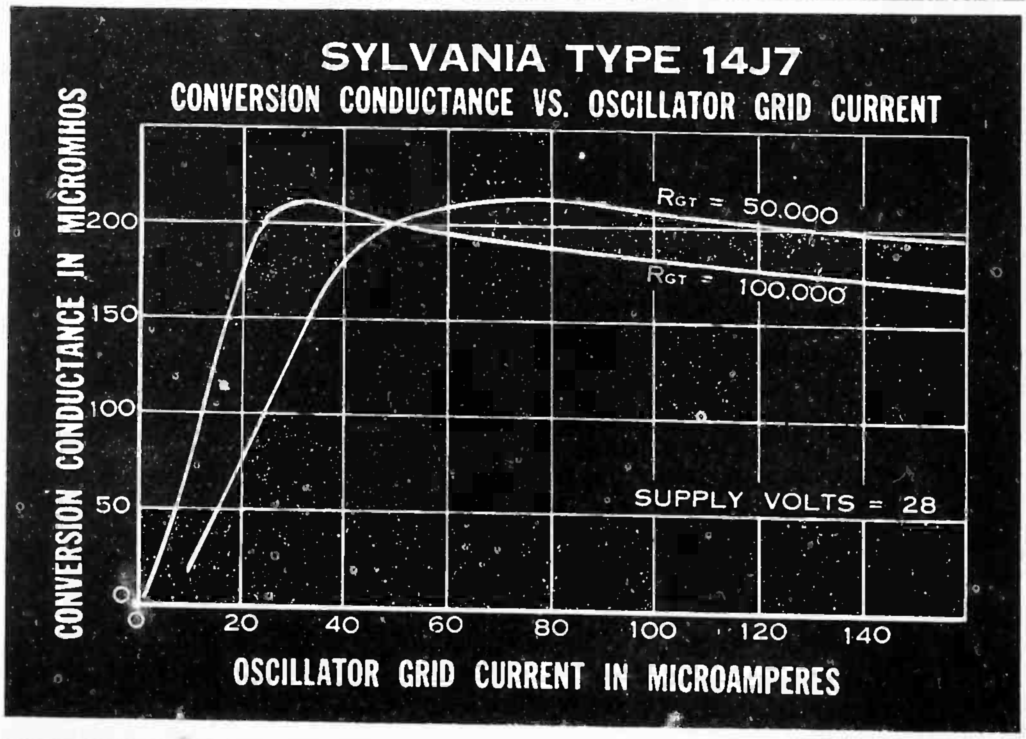
There is considerable interest at present in the application of radio tubes in equipment designed for operation from 28 volt d-c supply sources. The information given here was obtained to show the performance to be expected when using standard tube types at this voltage. The operating characteristics of a complete complement of tubes, except for the output tube, are described. The performance of equipment employing such a complement should be very acceptable over a frequency range extending from the broadcast band to frequencies above 100 mc. The Type 28D7 power output tube designed for use with a 28-volt supply was discussed in Sylvania News Volume 10, Number 7.

Grid current considerations are important when operating at these voltages. Unless the tubes are operated in circuits designed with this in mind the input resistance will be very low.



CONVERTER

Type 14J7 was selected as the best type of converter for use under 28 volt conditions. The frequency stability of the triode heptode is well known and is especially useful where oscillator amplitude and frequency shifts with other types would cause trouble.



Type 14H7, which has a mutual conductance of 3800 micromhos under 250 volt operating conditions shows a mutual conductance of 2000 with 28 volt plate supply. This performance is more favorable than that obtained with most other pentodes having either higher or lower mutual under rated conditions.

Type 14R7 which has a mutual conductance of 3200 micromhos under 250 volt operating conditions, shows a mutual conductance of 1500 with 28 volt plate supply. This performance is better than that obtainable with any other diode pentode tube which is regularly available.

TRIODE DRIVERS

When triodes are used to drive the grid of the Type 28D7 for 28 volt operation low mu rather than high mu types are more useful since the grid of the Type 27D8 may be driven to grid current and requires some power. The Type 14E6 is recommended when a diode triode is needed, while Type 14N7 is most useful when a double triode is necessary.

The tabulated ratings on pages 2 and 3, together with the curves, indicate that excellent operating characteristics may be obtained under 28 volt operating conditions. The Type 28D7 ratings and performance data appeared in a previous issue.

28 VOLT SUPPLY OPERATING CONDITIONS AND CHARACTERISTICS

(*Continued from page 1*)

SYLVANIA TYPE 14J7

Heater Voltage	14.0	14.0 Volts
Heater Current	0.16	0.16 Ampere
Heptode Plate Voltage	28.0	28.0 Volts
Heptode Screen Voltage	28.0	28.0 Volts
Heptode Control Grid Voltage	−0.75	−0.75 Volt
Heptode Plate Current	0.41	0.40 Ma.
Heptode Screen Current	0.56	0.55 Ma.
Heptode Plate Resistance	0.25	0.25 Megohm
Heptode Mutual Conductance	370	370 Micromhos
Conversion Conductance	215	205 Micromhos
Triode Plate Voltage	28.0	28.0 Volts
Triode Grid Resistor	50,000	100,000 Ohms
Triode Grid Current	80	40 Microamps
Triode Plate Current	0.46	0.50 Ma.
Conversion Conductance at Heptode Grid Bias of −5 Volts	3	3 Micromhos

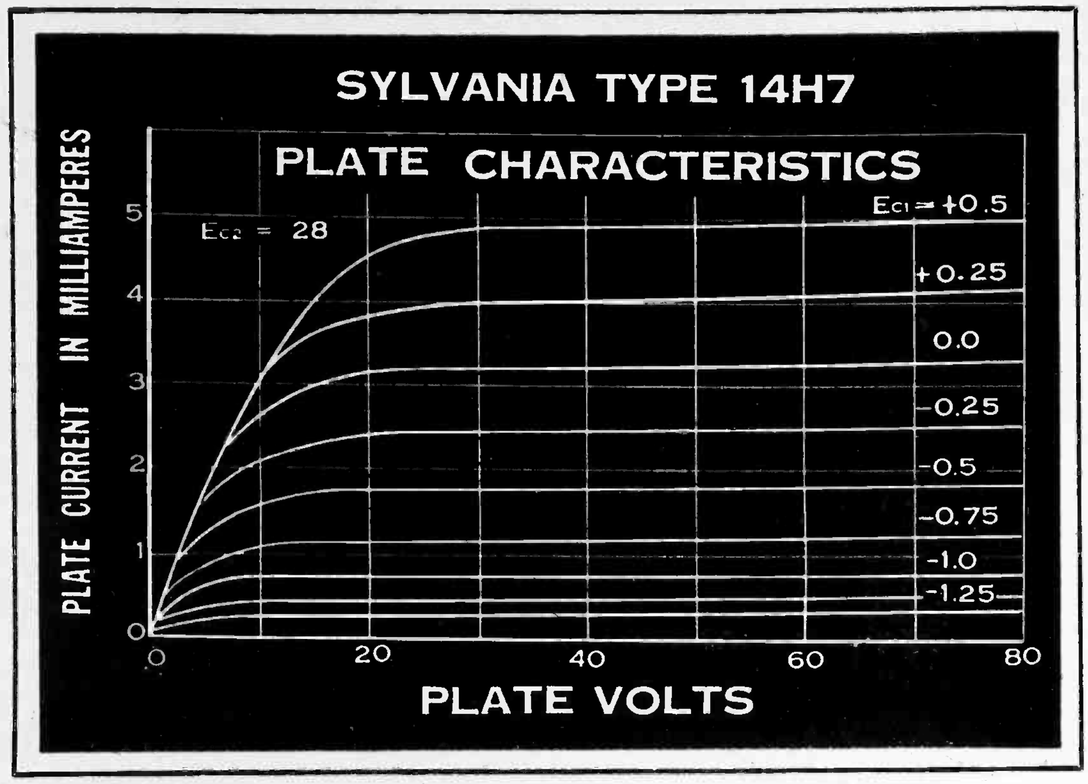
SYLVANIA TYPE 14H7

Heater Voltage	14.0 Volts
Heater Current	0.16 Ampere
Plate Voltage	28.0 Volts
Screen Voltage	28.0 Volts
Grid Voltage	−0.75 Volt
Suppressor and Pin #5	0 Volt
Plate Current	1.20 Ma.
Screen Current	0.45 Ma.
Plate Resistance	0.4 Megohm
Mutual Conductance	2050 Micromhos
Grid Voltage for Mutual Conductance of 35 μmhos	−4.0 Volts

SYLVANIA TYPE 14R7

Pentode Section as I-F Amplifier

Heater Voltage	14.0 Volts
Heater Current	0.16 Ampere
Plate Voltage	28.0 Volts
Screen Voltage	28.0 Volts
Grid Voltage	−0.75 Volt
Plate Current	0.85 Ma.
Screen Current	0.30 Ma.
Plate Resistance	0.40 Megohm



TYPE 14R7—(*Continued*)

Mutual Conductance	1500 Micromhos
Grid Voltage for Mutual Conductance of 35 μmhos	−3.0 Volts

Typical Operation as a Resistance Coupled Audio Amplifier

Plate Supply Voltage	28.0 Volts
Screen Supply Voltage	28.0 Volts
Grid Voltage*	0 Volt
Plate Current	0.15 Ma.
Screen Current	0.05 Ma.
Plate Load Resistor	0.10 Megohm
Grid Resistor of Following Stage	0.22 Megohm
Screen Resistor	0.27 Megohm
Voltage Gain	30
Maximum Output Voltage (R.M.S.) At 5% Distortion	2.4 Volts

*Grid Resistor=10 Megohms

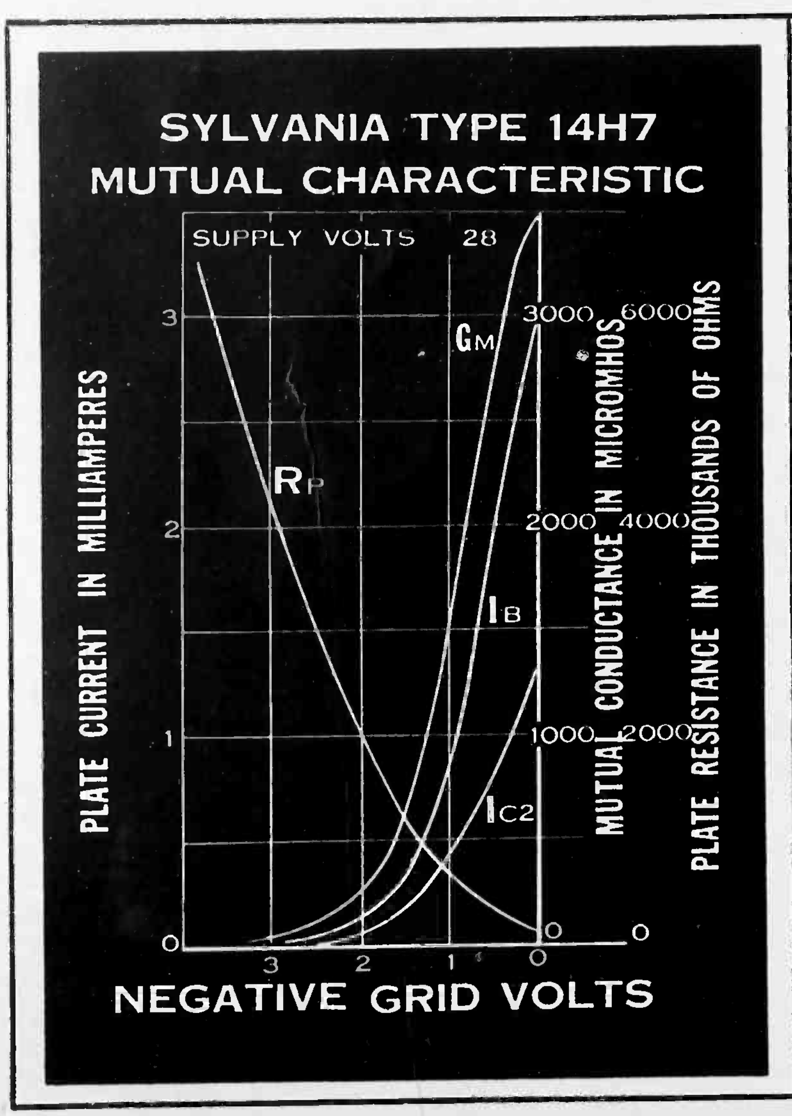
SYLVANIA TYPE 14E6

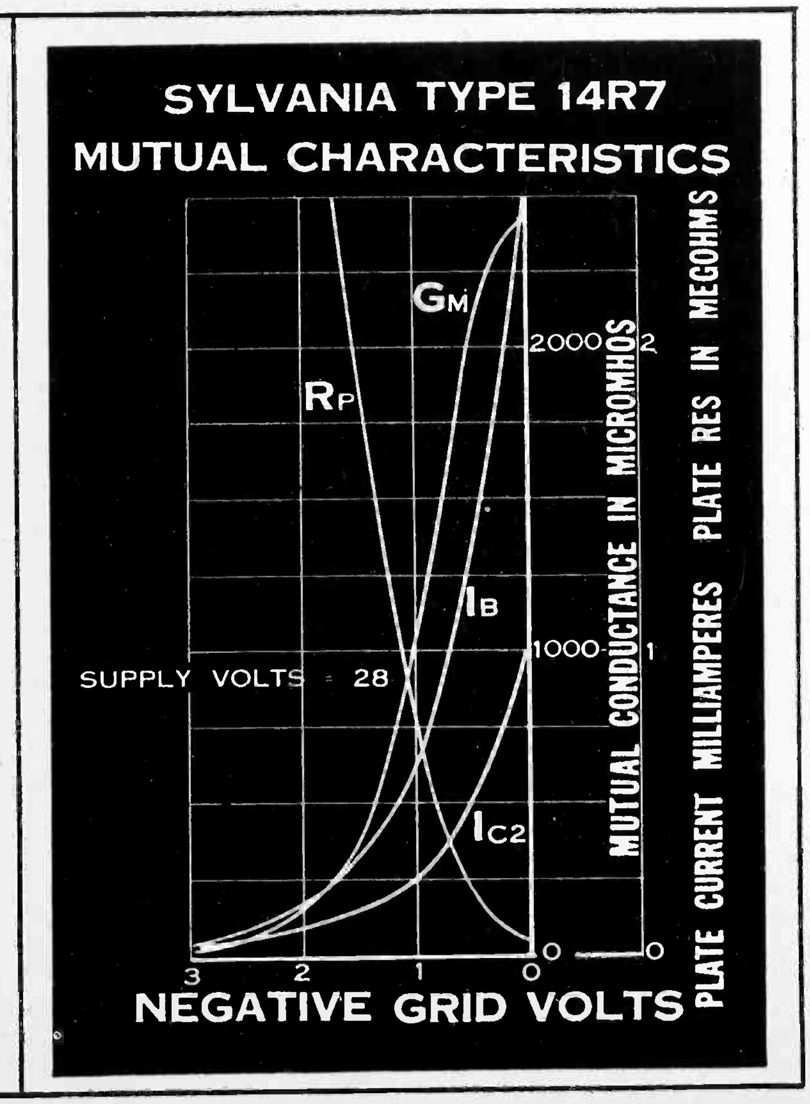
Transformer or Choke Coupled A-F Amplifier

Heater Voltage	14.0	14.0 Volts
Heater Current	0.16	0.16 Ampere
Plate Voltage	28.0	28.0 Volts
Grid Voltage	0*	−1.0 Volt
Plate Current	2.0	0.9 Ma.
Plate Resistance	12,200	16,000 Ohms
Amplification Factor	15.0	17.7

Resistance Coupled A-F Amplifier

Plate Supply Voltage	28.0	28.0 Volts
Grid Voltage*	0	0 Volt
Plate Current	0.08	0.14 Ma.
Plate Load Resistor	0.22	0.10 Megohm
Grid Resistor of Following Stage	1.0	0.22 Megohm





TYPE 14E6—(*Continued*)

Voltage Gain	9.8	9.3
Maximum Output Voltage (R.M.S.) At 5% Distortion	4.0	3.7 Volts

*Grid Resistor=10 Megohms

SYLVANIA TYPE 14N7 (SINGLE SECTION) OR TYPE 14A4

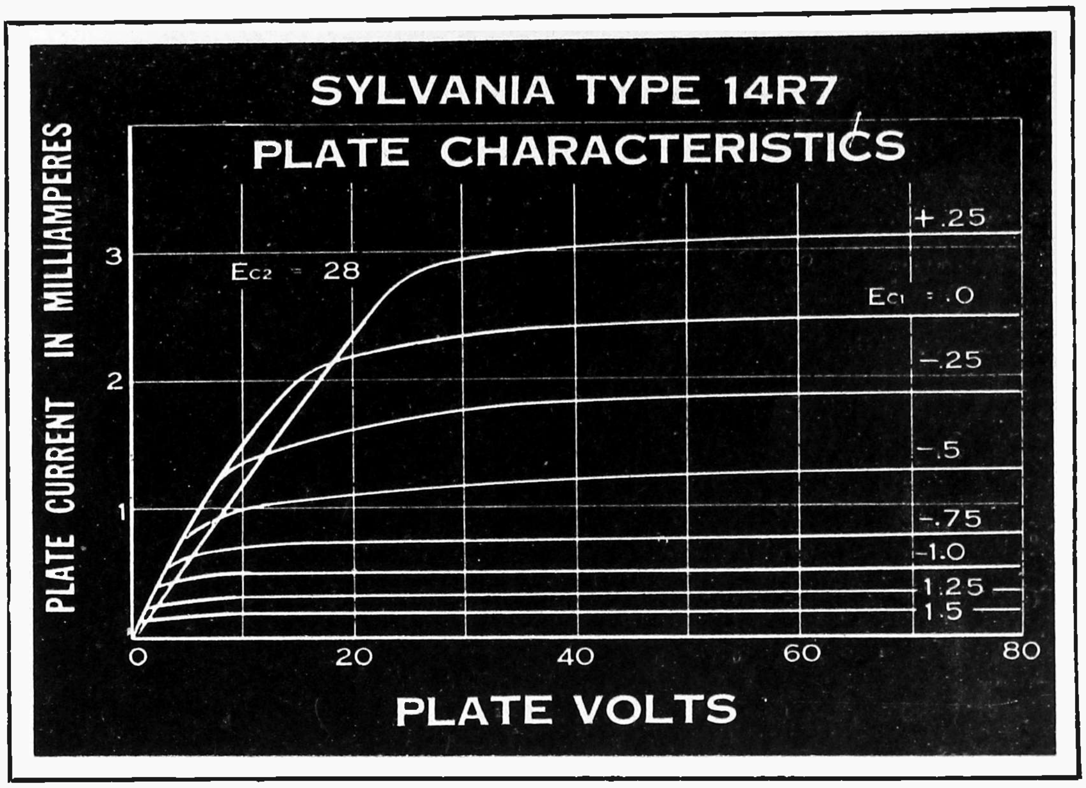
Transformer or Choke Coupled A-F Amplifier

Heater Voltage	14.0	14.0 Volts
Heater Current†	0.16	0.16 Ampere
Plate Voltage	28.0	28.0 Volts
Grid Voltage	0*	−1.0 Volt
Plate Current	2.9	1.0 Ma.
Plate Resistance	9,000	13,000 Ohms
Amplification Factor	16	20

Resistance Coupled A-F Amplifier

Plate Supply Voltage	28.0	28.0 Volts
Grid Voltage*	0	0 Volt
Plate Current	0.07	0.12 Ma.
Plate Load Resistor	0.22	0.10 Megohm
Grid Resistor of Following Stage	1.0	0.22 Megohm
Voltage Gain	13.4	12.0
Maximum Output Voltage (R.M.S.) At 5% Distortion	4.0	3.6 Volts

†For Type 14N7 value is 0.32 ampere.
*Grid Resistor=10 Megohms.



BUILD PRESTIGE—SAVE TIME—CREATE REPEAT BUSINESS

Use *Sylvania's New*

WARNING CARD

With so many circuit changes and other unorthodox methods being used in radio repairing today many receivers now differ considerably from their original design. And, too, most of these emergency repairs are made with no record or indication of what has been done to the set. This means that on the next service job on that particular radio it will be necessary for you or some other serviceman to analyze previous changes before proceeding.

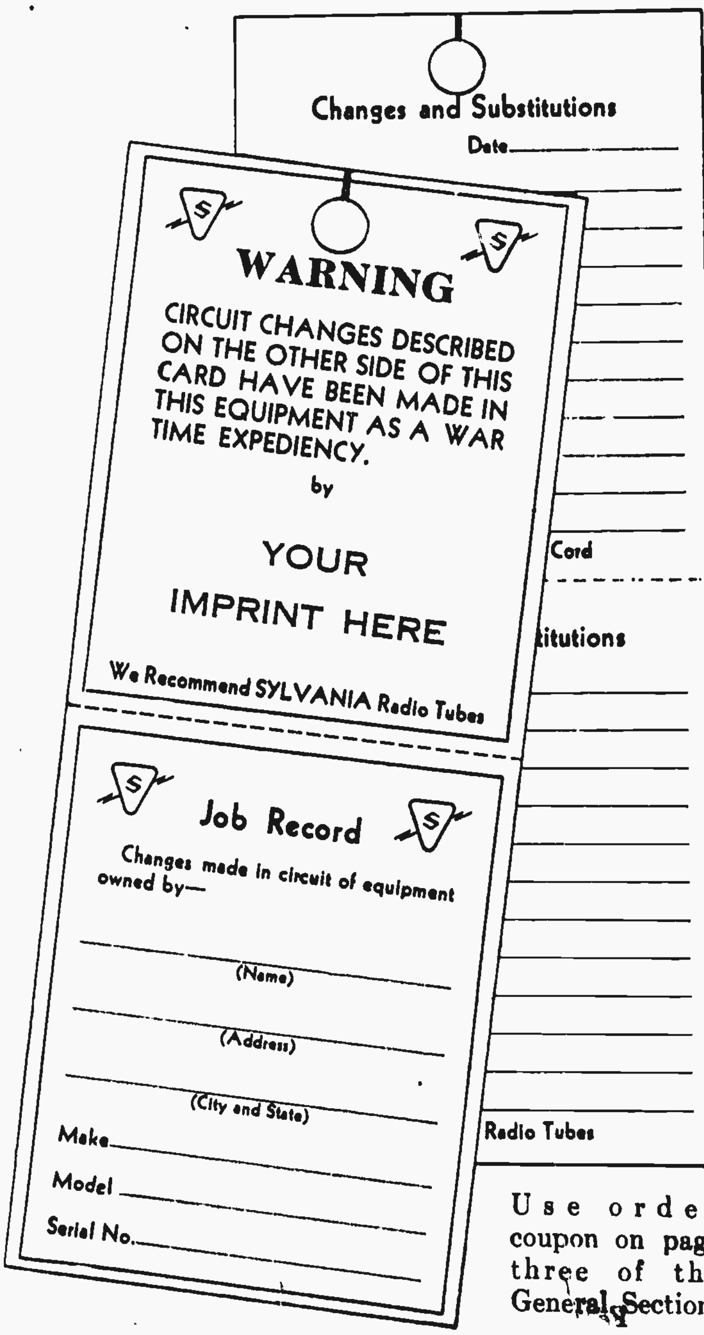
The Sylvania WARNING CARD will correct that situation if you faithfully attach one to each job, noting on it any unusual changes you have made and filing the stub for future reference. Aside from giving a record of the work done, the card with its word WARNING in big red letters will have the psychological effect of making the owners feel you are the one to whom their set should be sent when additional repairs become needed. They will think of you as an "up-to-the-minute" radio technician and businessman when you use this means of protecting their set.

Furthermore, many of your customers will want their radio restored to normal when the war is over—what better way to bring those sets back to you than your big imprint on a card, attached to the set, which tells at a glance the war-time changes you had to make? Or, being more aggressive, you could use the card stubs as the basis of an excellent list to which to send post-war reminders that you are then able to restore radios to original designs.

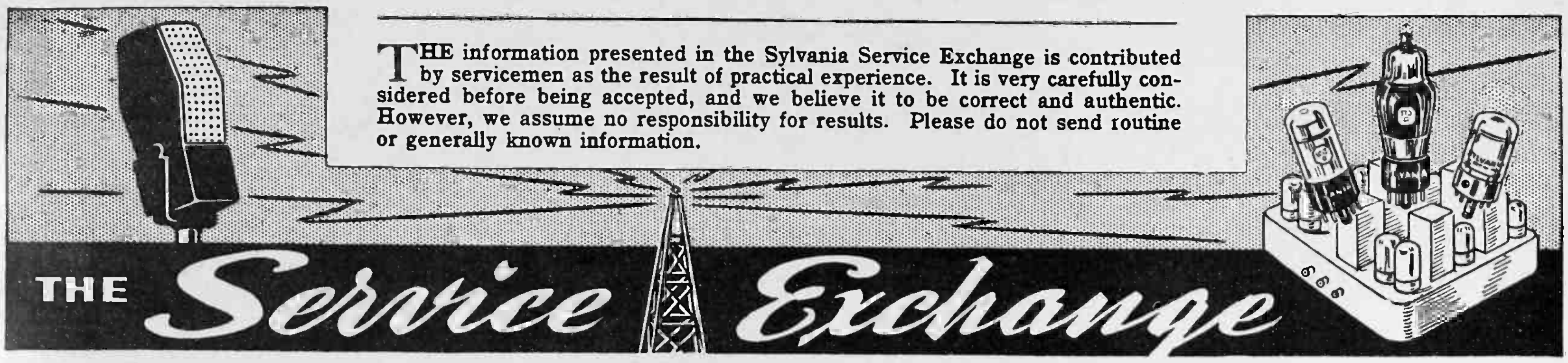
The WARNING CARD is attractively finished in red and black ink on a heavy cardboard stock measuring 3″x 7¾″. The punch-hole is slotted for ease in attaching. The back is ruled to carry your notations, and a perforation through the center facilitates quick handling. The customer's section contains your imprint, the warning notice, and list of changes; your section has the customer's name, set data, and list of changes.

The cards, complete with imprint, carry Sylvania's usual low prices:

100	$1.00
250	1.75
500	3.00
1000	5.00



Use order coupon on page three of the General Section.



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Philco Model 1908 (Mopar 801). When distortion develops in this receiver it may be due to the opening of the ¼ watt, 220,000 ohm cathode resistor of the 7A4. Replace with a ½ watt resistor of the same resistance. I have found this defect a rather common occurrence in this model.—D. B. Hanel, Martinsville, Va.

* * *

Motorola Model 50 Auto Radio. Recently I received one of these sets for repair and found that the volume control cable was completely twisted off and unraveled. Since I was unable to procure a replacement I made repairs in the following manner: Unsoldered the old wires going to the control, took out the volume control and mounted it in the control head of the radio. This was easily done since all that was necessary was to take out the cable housing and shaft, inserting the volume control and fastening same with the set screw that formerly held the cable housing. Lead wires about 2 feet in length were then connected between the volume control and the original terminals in the receiver and the set works as good as ever.—Richard Wolf, Wishek, N. Dak.

* * *

General Electric Models E-81 and E-86. When noisy operation, fading and frequent burnout on Type 6L6 are experienced, check the 0.01, 1000 volt plate bypass condenser C-45. Sometimes this condenser is actually missing in the receiver. I had this trouble twice and now I make sure that the condenser is present when checking complaints on this particular model. The condenser is connected from the plate of the 6L6 tube to the ground. Replace the faulty condenser with one having a 1500 volt rating. — Henry Bollmann, Berkeley Heights, N. J.

* * *

Tube Substitution. I had been holding four receivers waiting for 6H6 tubes. The owners got worried, so I tried substituting 6ZY5G by tying the cathodes together at the socket. The sets have worked OK ever since.—John Stine, Jersey Shore, Pa.

* * *

Emerson EA-357. This set would not play on a power line supply due to the fact that the filter choke was open. Either replace choke or repair break which usually occurs at connections.—Fred J. Ferrero, Kensington, Ky.

Transformer Insulation—1940 Models. (Philco). If the set is dead or weak, check the leads from the output transformer. Sometimes these stick to the chassis, the insulation melts and grounding results. I have found both primary leads in this condition on one set and on another set, the secondary lead had grounded. In making repairs, additional insulation should be provided.—Fred J. Ferrero, Kensington, Ky.

* * *

Philco 38-16. Intermittent signal would come and go as dial knob was moved. I found that the wire soldered to the bottom of the gang oscillator section was loose. A careful job of resoldering corrected the trouble.—Fred J. Ferrero, Kensington, Ky.

* * *

Zenith Model 8S-154. I have had a few of these sets come into my shop with the complaint of sharp whistle on the near-by stations while the rest of the stations seemed to come in OK. The trouble was traced to the 2 and 8μf electrolytic condensers which were open. These two condensers were in one unit, Zenith part No. 22-491-F. Replace with new condensers of same capacity and correct the trouble.—A. C. Hulsizer, Plains, Pa.

* * *

Line Isolation Transformer. An efficient A-C line isolation transformer can be made by following the schematic of Fig. 1. This unit is particularly useful for alignment of "AC-DC" receivers.

The two transformers should be alike, (from the electrical characteristic point of view). If the transformers selected

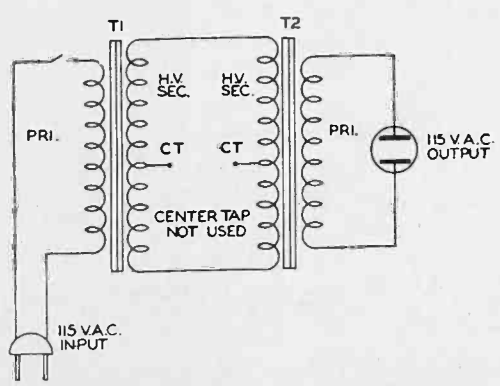


FIG. 1

have tapped primaries, a switching arrangement could be provided to vary the output voltage.—Joseph S. Napora, Dayton, Ohio.

Insulation Repair. We are all troubled with the insulation on battery plugs and built-in antennae pushing back from the plug and the wires shorting together. Push the insulation close to the plug, wrap tightly with a strong thread, then apply some cement. They never slip again.—C. A. Vaughn, Los Angeles, Calif.

* * *

Voice Coils. A quick check for continuity without unsoldering. Use a low range ohm-meter (1 to 100 ohms) scale. Put the prods on the voice-coil terminals and move the cone with your finger. Provided it is a PM speaker or a dynamic with the proper field current flowing, a plainly evident reaction will be noted on the meter scale following each movement of the cone. Ditto, if the coil is open—no deflection will be seen as the cone is moved. The meter will, of course, indicate a close to zero ohms reading through the output transformer secondary. Also, if a speaker has a signal present, the needle will attempt to follow it. All these reactions will be plainly recognizable after a few moments experimenting and altogether give you a quick, easy and accurate check on the whole speaker circuit. You might say that this proves that an electric current is generated by moving a coil through a magnetic field. This current aids or opposes the current flowing in the ohm-meter, thus moving the needle as the cone assembly is moved. It naturally follows that this same idea has many other uses for testing. Magnetic pick-ups, dynamic microphones, headphones, even crystal pick-ups (if you use a high range ohms scale) may be tested without disconnecting. And, with a bit of experience, you will be able to judge the sensitivity of such apparatus by the amount of meter deflection you get from a bit of pressure in the proper place. But don't use too much pressure on crystals—they break easily.—Don Blair, Franklin, Pa.

* * *

Freshman 533 (Belmont BRC-533). Some of the early models used live-rubber insulation on the pilot light leads, and when servicing this model for HUM (similar to open filters), check for short to chassis, of the pilot leads. For a permanent repair, it is advisable to place a length of spaghetti over each lead, or to replace the leads with hook-up wire.—Joseph S. Napora, Dayton, Ohio.

Sylvania News

December, 1943 EMPORIUM, PENNA. Vol. 10, No. 10

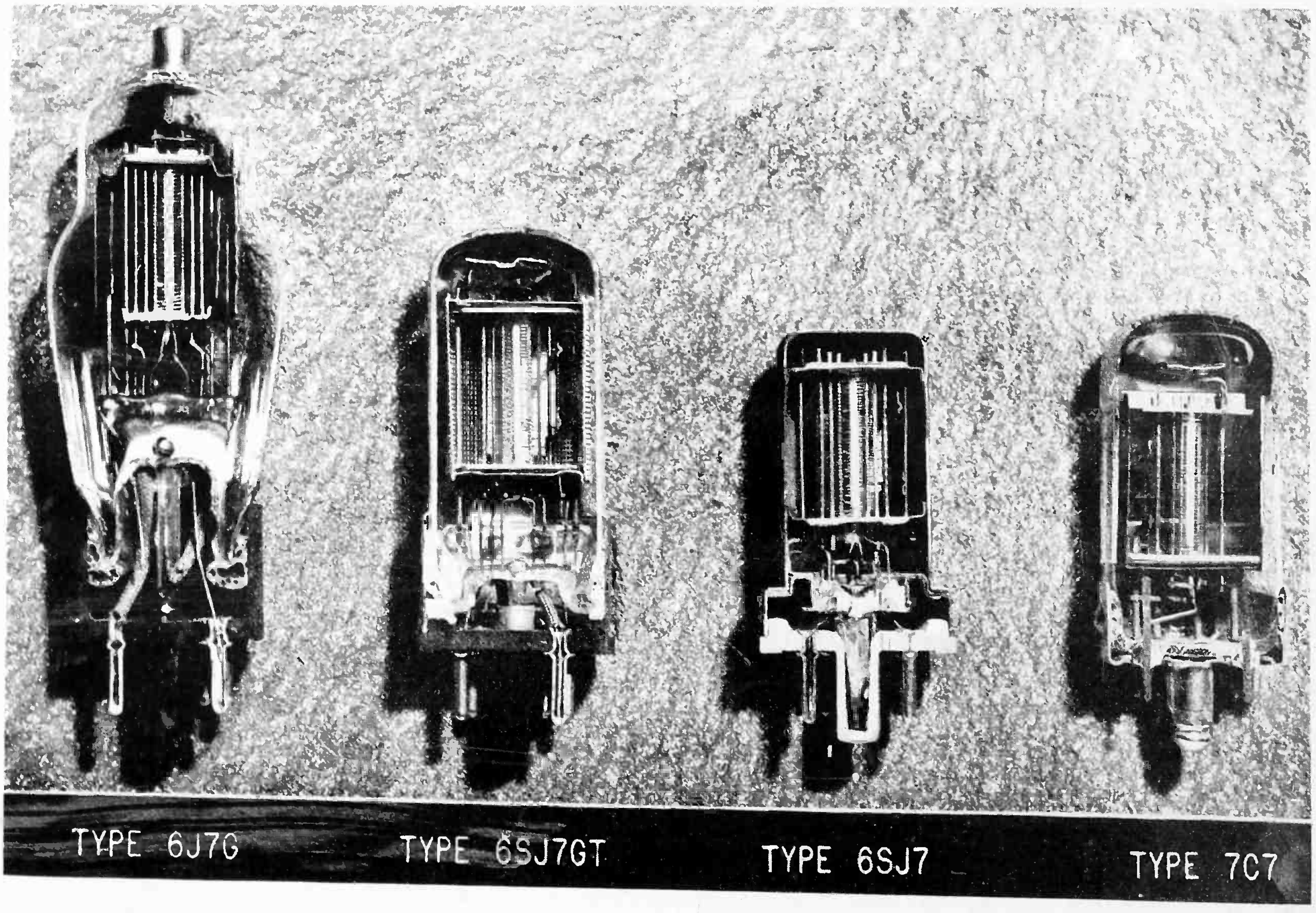
CONSTRUCTIONAL FEATURES OF VACUUM TUBES

There is an old expression, "Alike as two peas in a pod," which is often used to express a high degree of similarity, at least as to physical appearances. The tube manufacturer endeavors to make all tubes of any given type as nearly identical as possible since industry requirements necessitate standardization of physical and electrical characteristics. Tube shortages incurred by the heavy demands for war services have greatly amplified the use of substitute tube types in order to help maintain operation of civilian radios. Consequently, considerable interest exists in the various versions of essentially equivalent types. Electrical similarity does not necessarily imply physical likeness. Perhaps many readers have carefully inspected a worn-out tube by removing the glass envelope and then examined the structure so as to become more familiar with the actual component parts and construction. But how many of you have made a comparative study of equivalent types? Some points of interest are discussed in this article.

FOUR STYLES IN CROSS-SECTION

In order to provide concrete examples, special cross-sectional views of four tubes were prepared. These are shown in the photograph below and include the G, GT, metal and lock-in versions of the 6.3-volt sharp cut-off r-f amplifier pentode. Each tube is shown full size to permit direct comparison. The cut through each tube was made in essentially the same plane, that is, somewhat off center so that the control grid and screen grid structures would be preserved (front half of screen grid is not present in the G construction view). The front portion of the suppressor grid, plate and shield were cut away to show the internal construction and the relative spacings of the various elements. The G type employs a cylindrical plate whereas the other three styles have "open" plate structures. A portion of the plate is visible behind the grids while the side ribs appear adjacent to the suppressor grid support rod.

(Continued on page 2)



CONSTRUCTIONAL FEATURES OF VACUUM TUBES

(*Continued from page 1*)

FACTORS INFLUENCING SIZE

There are two major factors that contribute to the larger size of the G type of tube. These are the style of the envelope and the length of the press. The smaller size of the GT tube is the result of changing both of these. The T bulb or straight sided envelope is used and the press has been shortened. The bulb is also seated lower in the base. The still smaller size of the metal and lock-in tubes is a result of changing from a flat press to a header type of construction. Instead of the lead wires being sealed into the glass in a single plane, they are sealed in the glass header in a circular pattern. This eliminates the necessity of the large type of flare required in both the G and GT tubes below the press in order to seal the mount to the glass envelope. In a metal tube the glass header is sealed to a metal ring which in turn is welded to the metal shell or envelope. The metal shell is crimped on the tube base in the same manner as the base shell of the GT tube. The lead wires can be arranged in the header in practically any desired order so that cross-overs between the header and base are eliminated. This also contributed to a reduction in the required height of the tube. The construction of the lock-in header likewise lends itself to an arrangement of the leads in such a manner as to require no extra spacing. In this construction the sealed-in leads are also the contact pins for the tube and the space required between the metal base of the tube and the header are reduced to a minimum.

SPECIAL SHIELDING

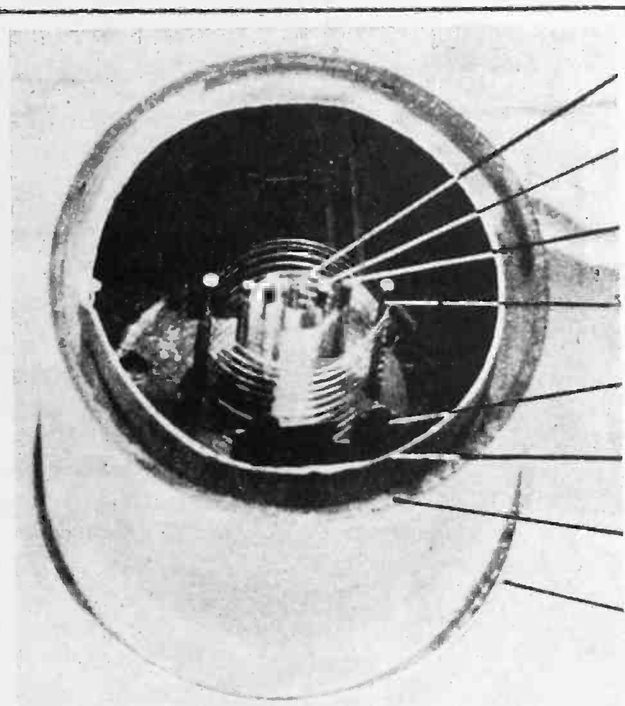
The exhaust tube, which can easily be seen in the cut-away of the G tube, is centered in the hole in the molded locating pins of the GT and metal tube base. In the lock-in construction the exhaust tube extends down into the base lock-in lug. A metal shield can be seen around the exhaust tube in the pictures of the GT and metal tubes. This shield which extends down into the locating lug is grounded to the number one pin of the base on those tubes in which it is used as an expedient in maintaining the capacitances of the pins and leads at a minimum. The metal tube shown has, in addition, a small conical shaped shield which fits into the top of the exhaust tube above the header which is also grounded to the No. 1 pin of the base. The metal base of the lock-in tube serves the same purpose as these various shields required in the other types of bases.

LEAD LENGTHS OFTEN IMPORTANT

The overall length of the leads from the socket contact points on the pins to the element within the tube to which it is connected has been materially reduced in all of the newer types of tubes, especially the lock-in construction. Before the introduction of multiple-band receivers this lead length was probably not of too great importance. As higher and higher frequencies were utilized it was essential to reduce the capacity between leads to as small a value as possible. This was accomplished by two methods; reducing the length of each lead to a minimum and separating the leads as far as possible. The GT type of structure has considerably shorter leads than the G type. However, the leads through the press still have approximately the same physical relation to each other. The chances for leakage across the top of the press due to getter deposit are about the same for both of these constructions. In the metal tube the length of the leads is considerably shorter than for the GT tube. Another advantage that has been gained is the arrangement of the pins through the header. The leads are sealed in the header at points which are more advantageous from the standpoint of the basing of that tube. Crossing over of the leads in the base of the tube is not required. The lock-in tube structure has the shortest length of lead from socket contact point to tube element of the four tubes shown in the picture. The length of lead for the other three types must be considered from the contact point on the pin which varies with the type of socket used to the end of the pin where the lead-in wire proper is soldered to the pin and from there back up through the header to the tube element. The length of lead for the lock-in structure extends from the socket contact point on the pin which is approximately half way up that part of the pin outside of the seal, directly to the tube elements. In some cases no connector is required from the pin to the element within the tube. The spacing between the pin seals is considerably greater than is possible in the other constructions shown as the seals are made near the outside of the header.

INSULATION PROBLEMS

The spaghetti which can be seen covering certain lead wires on the G and GT tubes is not required on all the leads and in some tubes none is required. This is only used to prevent short circuits between leads that must cross other leads in the space between the seal and the base or where a lead may come close to a grounded element such as the center shield in the GT tube. Spaghetti that is used on such leads must have low dielectric loss, especially under high humidity conditions. If poor grades of spaghetti are used the impedance of the input or output circuits or the conductance of the tube may be appreciably lowered depending on which leads have spaghetti and with what element they are in contact. Tubes that can be made without employing any spaghetti have this advantage in common.



Enlarged Top View of Lock-In R-F Amplifier Pentode

SOLDERED AND WELDED CONNECTIONS

Several of the base pins in the above picture are cut to show how the lead-in wire is soldered at the end of the pin. When the sealed-off tube is assembled to the base the lead wires are threaded through the body of the pins and extend out through small holes in the ends of the pins. These wires are then cut off even with the end of the pin and soldered. A small amount of solder enters inside the end of the pin to form the contact between the lead and the pin. Every effort is made

(*Continued on next page*)

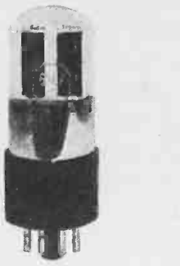
FOUR SYLVANIA TWIN-TRIODE AMPLIFIERS—CHARACTERISTICS AND USES

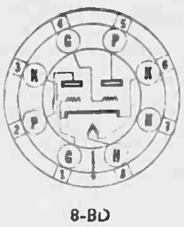
Sylvania Types 6SL7GT, 12SL7GT, 6SN7GT and 12SN7GT are voltage amplifier tubes consisting of two triode sections in one bulb.

Type 6SL7GT and 12SL7GT are the same except for heater rating and the characteristics are identical to Sylvania Lock-In Types 7F7 and 14F7 tubes except for interelectrode capacitances. The circuit applications for both of these types are the same as those given for Type 7F7 in the Sylvania tube manual.

Types 6SN7GT and 12SN7GT are the same except for heater rating and the characteristics are identical to Sylvania Lock-In Types 7N7 and 14N7 tubes. The circuit applications for these two types are the same as for Type 6F8G as given in the Sylvania tube manual.

Physical Characteristics





8-BD

Style	GT
Base	Intermediate Shell, Octal 8-Pin
Bulb	T-9
Diameter	1⁵⁄₁₆"
Overall Length	3⁵⁄₁₆"
Seated Height	2¾"
Mounting Position	Any
RMA Basing	8BD-0-0

Base Pin Connections

Pin 1	Grid Triode 2
Pin 2	Plate Triode 2
Pin 3	Cathode Triode 2
Pin 4	Grid Triode 1
Pin 5	Plate Triode 1
Pin 6	Cathode Triode 1
Pin 7	Heater
Pin 8	Heater

SYLVANIA TYPES 6SL7GT AND 12SL7GT
Twin Triode Amplifiers

RATINGS

	6SL7GT	12SL7GT
Heater Voltage (AC or DC)	6.3	12.6 Volts
Heater Current	0.3	0.6 Ampere
Maximum Plate Volts	250	250 Volts
Maximum Plate Dissipation (Per Plate)	1	1 Watt
Minimum Grid Volts	0	0 Volts

Interelectrode Capacitances:*

	Triode 1	Triode 2
Grid to Plate	2.8	2.8 μμf.
Grid to Cathode	3.0	3.4 μμf.
Plate to Cathode	3.8	3.2 μμf.
Plate to Plate	0.4	0.4 μμf.
Grid to Grid	0.65	0.65 μμf.
Grid T2 to Plate T1	0.13	0.13 μμf.

*With close fitting shield connected to cathode.

Operating Conditions & Characteristics Amplifier (Class A1) Each Triode

Plate Voltage	250 Volts
Grid Voltage	−2.0 Volts
Amplification Factor	70
Plate Resistance	44,000 Ohms
Mutual Conductance	1600 μmhos
Pla teCurrent	2.3 Ma.

SYLVANIA TYPES 6SN7GT AND 12SN7GT
Twin Triode Amplifiers

RATINGS

	6SN7GT	12SN7GT
Heater Voltage (AC or DC)	6.3	12.6 Volts
Heater Current	0.6	0.3 Ampere
Maximum Plate Voltage	300	300 Volts
Maximum Plate Dissipation	2.5	2.5 Watts
Minimum Grid Voltage	0	0 Volts

Interelectrode Capacitances:*

	Triode 1	Triode 2
Grid to Plate	4.0	4.0 μμf.
Grid to Cathode	3.2	3.8 μμf.
Plate to Cathode	3.4	2.6 μμf.
Plate to Plate	0.5	0.5 μμf.
Grid to Grid	0.034	0.034 μμf.
Grid T2 to Plate T1	0.12	0.12 μμf.

*With close fitting shield connected to cathode.

Operating Conditions & Characteristics Amplifier (Class A1) Each Triode

Plate Voltage	90	250 Volts
Grid Voltage	0	−8.0 Volts
Amplification Factor	20	20
Plate Resistance	6700	7700 Ohms
Mutual Conductance	3000	2600 μmhos
Plate Current	10	9 Ma.
Maximum Grid Circuit Resistance		1 Megohm

Resistance Coupled Amplifier—Each Triode

Plate Supply Voltage	90	180	300 Volts
Plate Resistor	0.1	0.1	0.1 Megohm
Grid Resistor (For Following Stage)	0.25	0.25	0.25 Megohm
Cathode Resistor	3940	2830	2400 Ohms
Voltage Output*	17	34	56 Peak Volts
Voltage Gain**	13	14	14

*Maximum voltage for start of grid current for following stage.

**For r-m-s output of 5 volts.

VACUUM TUBE FEATURES

(Continued)

to have a minimum of solder on the outside of the pin above the rounded end, as the presence of this soft metal on the straight side of the polished nickel pins may greatly increase the amount of pressure required to insert a tube in a socket. The majority of sockets have contacts which cut into any such soft metal extending beyond the normal diameter of the pin and scrape this metal off when the tube is inserted in the socket.

There are no soldered connections to the base pins used in the lock-in tube. The contacts of the lock-in socket bear directly upon the pins of this tube which are also the leads that are sealed into the header. These pins may be welded directly to the tube element inside of the tube or short jumpers are welded at the pin and tube element to provide the required connection.

Basing cement is employed to secure the evacuated envelope to the tube base of the structures shown in all styles except the metal tube. This cement requires baking before it makes a good adhesive bond to the base and glass envelope. The lower part of the GT envelope and the lock-in envelope are shaped in such a manner as to make a better bond than the G type of envelope since the bulbs fit the bases much tighter and less cement is required between the envelope and base. These bulbs are also seated much lower in the bases so the leverage between the glass envelope and base is reduced and the chance of the cement becoming loose when tubes are inserted or removed from sockets is likewise reduced.

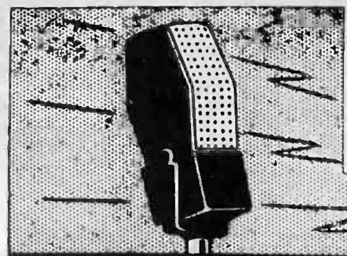
SINGLE ENDED CONSTRUCTION

The shortening of the leads in the base of the tubes, as described earlier, contributed largely to the possibility of making single ended tubes. With the coupling between plate and grid leads reduced to a minimum it was feasible to remove the top cap and connect the grid to a base pin. By eliminating the top cap requirement special sealing, cementing and soldering processes were done away with in the manufacture of such tubes.

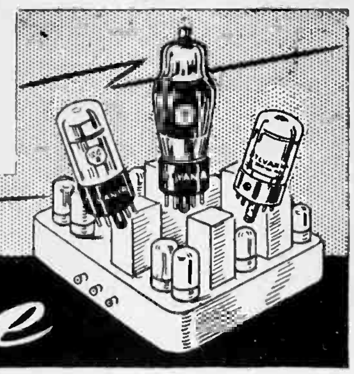
External shielding is seldom required on any of the later types of tubes made with the shorter mount structures. The metal tube requires no shielding. The GT tube requires external shielding on some occasions and for a very few applications the lock-in tube may require shielding. All of the tube types of GT or lock-in structure which are intended for use in critical circuits where external shielding would normally be required have internal shields within the tube surrounding the plate. The only other parts of the tube that might need shielding are the leads between the base pins and the tube elements. The metal shell of the base for GT tubes which might be used for r-f, i-f and converter applications is usually sufficient to shield these leads. Where bakelite bases have been employed an external shield may sometimes be required and if so a grounding clamp must be used. If shields are required with metal shell bases the shields are grounded through the base shell which is connected to the number one pin of the base. The lock-in tubes designed for these critical applications also employ a metal internal shield which is brought out to a separate pin or may be connected internally to another element which is effectively at ground potential under normal conditions. In addition, the metal base with its guide pin serves as an effective shield. Numerous types are especially suitable for use in UHF applications because of low lead inductances, low inter-electrode capacitances, and low dielectric losses.

As a further aid in visualizing the physical relation of tube parts a different view of the lock-in structure is shown on page 2. The glass dome has been cut off and the top mica removed to expose the various elements given in the tabulation. Comparison with the previous photograph will enable one to study the individual details of element arrangement.

Many of the factors mentioned in this discussion must be carefully considered by the tube designer and manufacturer in order to produce tubes that, at least electrically, will be interchangeable with similar types having different physical specifications. As an aid to servicemen, dealers, and users of tubes, Sylvania has provided numerous technical bulletins and articles relating to tube characteristics and suggestions regarding the use of substitute types.



THE information presented in the Sylvania Service Exchange is contributed by servicemen as the result of practical experience. It is very carefully considered before being accepted, and we believe it to be correct and authentic. However, we assume no responsibility for results. Please do not send routine or generally known information.



THE Service Exchange

Philco Model 37-675. To completely eliminate 120 cycle hum in these sets, replace the 8 mfd. filter, diagram 125, with a 16 mfd. suitable condenser 450 volts. In these same models to suppress a bad case of oscillation, replace bypass condenser #79 (0.05) with a 0.5 μf tubular condenser.—Fred Wolfenberger, Monroe, Michigan.

* * *

War-Time Volume Control Repair. Remove switch which is on the back of almost all controls. It is not always necessary to unsolder leads. Now go over the resistance strip with a common lead pencil from one end to the other full width using judgment as to the amount of marking you do as a high resistance control will require less than a low resistance one. Now put about a drop of oil on a tooth pick and shake off excess and wipe over the marking you did, with tooth pick. Now work the control several times and it is ready to reassemble. This has smoothed up all the controls the writer has tried it on except wire wound ones. I have worked hundreds this way and they seem as good as could be asked for.—Ralph O. Millican, Lewisville, Texas.

General Electric Model H-500. I have had the complaint of hum on several of these sets and have found that by soldering the metal can of filter condensers directly to the chassis that all hum disappears.—Emery Hazzard, Fort Edward, N. Y.

* * *

A Substitute for Adaptors. Here is a hint of a short cut in changing substitution tubes. In changing to a Lock-in type for an octal type, my suggestion is this: Cut the contact pins off of the old tube. Crimp each pin at the top, and slip onto the pins of the Lock-in tube. You will find that the tube will fit into the octal socket. Pins must be cut from old tube with hack saw. Then change your circuit to fit substitution tube used. Servicemen will find that this procedure will save fifty percent of time and also hard to get sockets. Try it.—J. D. Walker, Jr., Comanche, Texas.

Editor's Note: An appropriate mark on Lock-In tube base and socket should be made to insure correct insertion of tube since locating lug will not engage keyway. Customer should be advised not to remove tube without proper instruction.

Lock-In Adaptor Aids Substitution. Not being able to obtain any 12SK7 tubes I took the base of one and wired a lock-in socket on the top to use a 14A7/12B7. A little realignment was all that was needed to make the set operate perfectly, this being due to the increased capacity from the leads inside the adapter. I understand that 14A7 tubes are not on the WPB list, but my jobbers seem to have a fair stock yet, and doubtless others over the country also have some.

The above mentioned tube substitution could be made by changing sockets in the chassis, but I believe the adapter solves the problem with less work. I have found that usually changing a socket is a "major operation," mainly on account of sockets being buried under so many other parts.—John L. Cooper, Purvis, Miss.

* * *

Tube Substitution. Type 1N6G will replace the hard to find 1A5G. The characteristics are the same with the exception of a diode plate on the #6 pin of the 1N6G. This is a blank pin on the 1A5G. You can clip the #6 pin off the 1N6G and you have a 1A5G, no changes or adjustments to make.—Lyle C. Motley, Danville, Va.

* * *

Substitute Dial Belt. I have used the following idea for dial belts that were hard to get. Get some adhesive tape in the ½″ size, cut to the desired length, then lap it over in the middle so that the sticky sides are on the inside. Sew the two ends together and there you have a double-ply dial belt. Trim with a pair of scissors to suit the pulley width. I have used this a number of times with success. —George Motto, Wilkinsburg, Pa.

* * *

Crosley Model 52TE-U, Chassis #U-77. Complaint was hum which could not be traced to filter trouble. I found the dial plate, (upon which was mounted the pilot lamp), touching drive pulley on tuning condenser. The tuning condenser is above ground on this model, thus the dial plate which is at ground potential caused hum from pilot lamp when it touched the tuning condenser.—A. S. Wright, Tampa, Fla.

General Instrument 201, 202, 203. Rubber drive-wheel 65-70715 sometimes fails to run main-cam and gear 43-70517 far enough to complete the cycle. When put into playing position and the turntable rotated by hand, it was seen that the trip-lever pin (27) was actuated by the automatic trip-cam (12) without resulting in disengagement of the rubber drive-wheel train from the turntable. The rubber wheel was thus rotated against the teeth of the now stationary intermediate-drive gear, chewing off the rubber. The trouble was traced to the carrier-lever assembly (55-70722) bearings. The bearing hole is not round, but purposely machined oval, apparently in order to permit the drive-train pulley to maintain full contact with the inner surface of turntable even though the latter departs from true vertical plane. Some changers seem to have an over-generous amount of such ovalling, and the trip action is absorbed by the play at this bearing, leaving the pulley in contact with the turntable. There are no adjustments to correct this, so the bearing hub was removed and a new one turned up in the lathe. The bearing hole was made by a #18 drill while the hub was still in lathe. The new hub, when mounted in the carrier-lever, had enough play to assure full pulley contact, but gave positive and prompt disengagement from the turntable.

On this same changer, the record feed-spring 33-70754 seemed to have considerably more tension than required. This put a load on the small rubber drive-wheel. To overcome this, the end loops of the spring were partially opened up, giving a fish-hook shape to them and resulting in an overall increase in spring length of ¼″ or so. (Don't ever reduce spring tensions by stretching the spring out.) The turntable was then loaded to capacity with twelve-inch records to make sure the feed-spring could still push out the bottom record.—W. S. Arns, Kenmore, N. Y.

* * *

Material Conservation. To conserve solvent in removing speaker cones apply to cone, inside, and outside if possible, then place entire speaker in box or tin, with cover. This permits deeper penetration with less evaporation.—Frank Gause, Eustis, Florida.