

SECTION I. REFERENCE DATA

MAINTENANCE AND TROUBLE SHOOTING

REPAIR OF GROUND RADIO EQUIPMENT

1. **METHOD OF ATTACK.** Learn to attack a repair job with full knowledge of the job to be done and how to go about doing it. Experience has proved that a logical system should be followed in repairing even the simplest piece of equipment. Hit-or-miss methods waste time. The following information will help make repairs quickly and efficiently.

2. OPERATOR'S REPORT.

a. *General.* Always get the operator's report of the trouble he is having with the set. This will give a rough idea of what to look for and the possible location of the trouble. However, do not depend *entirely* upon the operator's opinion; operators are not repairmen. Make your own observations, and check them against the report received from the operator.

b. *Determine Need of Repair.* Quite often equipment is turned in for repair when actually there is nothing electrically wrong with the set. Perhaps the operator forgot to tighten the battery connections or turn up the volume control. Not long ago, dozens of sets were sent back to maintenance because the operators did not know how to turn them on. The maintenance man just snapped the switch. The only way that the repairman can tell if a set is inoperative is to turn the set on, after making a visual check as outlined in the following section.

3. USE OF SENSES.

a. *Sight.* In many cases, it is possible to find the trouble by *close observation* without even turning the set on. Look for broken leads, broken parts, blown fuses, and any lead or part that is shorting to the chassis or another part. There are a number of defects that may be found by moving or wiggling the various parts or leads in the circuit. Do not bend r-f leads out of line or damage the parts or their connections. After the other checks listed below have been made and the set has been turned on, look for smoking parts and sparking. Notice if any of the wax-impregnated paper capacitors are surrounded by a pool of melted paraffine, usually indicating a defective capacitor.

b. *Smell.* By using the sense of smell, first when the set is off, and then when it is turned on, it may be possible to note unusual odors, such as sealing compound, indicating an overloaded transformer; burning paint, usually indicating an overheated resistor; and burning rubber, probably

indicating defective insulation. If any unusual odor is detected coming from a part, the trouble may be in that part or it may be due to trouble in the associated circuit.

c. *Hearing.* Sense of hearing plays an important part in locating trouble. Hum, scratchy noises, and *plops* all have a special meaning to a radio repairman. In general, certain sounds indicate certain types of trouble. For example, hum can indicate a shorted or open filter capacitor. Usually the latter is a common fault where electrolytics are used, since with time the electrolyte, or paste, dries out and the capacity diminishes, reducing the filtering action. A shorted tube, cathode element to heater, will cause hum. For instructions on how to localize the stage, or tube, in which the hum initiates, see paragraph 9.

d. *Touch.* In most cases, touching the tubes after the set has been turned on for a few minutes will show whether or not the filaments are heated. If a tube remains cold after the set has been on for a few minutes, the filament of the tube is burned out or is not getting voltage. After the set has been turned on for a time, *turn it off* and cautiously touch the different parts, such as resistors, transformers, and capacitors. Notice if these parts are overheated. Capacitors in high-voltage circuits should be shorted after turning off the power. This will discharge the capacitor and prevent shock.

4. CHECKING ACCESSORIES.

a. *General.* A thorough check should be made of all the associated parts outside of the main component itself, since a break-down of even the smallest part will cause improper operation of the whole installation. Therefore, make a thorough check of one part at a time, making sure that this particular part operates properly before another part is tested.

b. *Checking Cording.* One of the greatest sources of trouble in military radio sets is the cording interconnecting the various components which make up the complete installation. To check cording, look for opens, shorts, and faulty contacts. An ohmmeter can be used to check cording continuity. A continuity check should be made of each conductor in the cord. Wiggling the cord at the socket or plug will often reveal intermittent shorts or loose connections which occur when the vehicle in which the set is mounted is in motion. See that all plugs fit snugly in the sockets.

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c. *Checking Batteries.* Reports from the field show that run-down storage batteries cause many communication failures. Always check the water level and the specific gravity of each cell in every storage battery. If dry batteries are used, check their voltage under operating load.

d. *Checking Power Unit.* Since no set will operate without power, the power unit is one of the first components to be checked. Check both the high and low-voltage outputs for correct value.

e. *Checking Other Accessories.* All other accessories, such as microphones, headsets, keys, antenna leads, insulators, and tubes should be checked for broken parts, shorts, opens, and correct operation. By checking all associated parts, these parts have been eliminated as sources of trouble. If any of the parts is defective, repair or replace it immediately. After this is done, test the set by placing it in operation.

5. RECEIVER TESTING METHODS.

a. *General.* The procedure for testing receivers is somewhat different from that for testing transmitters because of the different types of circuits employed.

b. *Operational Characteristics.* After all the accessories of the receiver, such as the headset, cords, battery, power unit, antenna, and tubes have been tested thoroughly, check the receiver to see whether it works on band A and not on band B, C, D, or E; whether it works only on MVC; or whether it is dead on all positions of the switch.

c. *Localization of Trouble.* If all of the above check OK, attempt to localize the trouble. There are several methods employed in isolating the trouble to a certain stage. The method used depends upon the conditions existing when the receiver is turned on. Signal substitution, circuit-disturbance testing, and the set-analyzer methods are used when the set is completely inoperative. The stage-muting method is used when there is hum or an indication of oscillation present in the output.

6. SIGNAL SUBSTITUTION.

a. *General.* This method can be used when the receiver is completely inoperative. A signal of the proper frequency is fed into a stage, and its ability to pass this signal is determined. This method may not locate the actual defect, but it will indicate the defective stage.

b. *Procedure.* (1) A-F STAGES. Feed an a-f signal into the grid of the output stage and note whether or not the stage will pass a signal, as indicated in the headset. If it does not, take voltage and resistance measurements of all the circuits in this stage. This check should reveal the trouble. Work back to the detector, determining if each stage will pass and amplify the signal. (2) I-F STAGES. If the a-f stages pass and amplify the signal, check the i-f stages. Feed a modulated i-f signal of the correct frequency into the grid or diode plate of the detector and then into the i-f stages, working back to the plate of the mixer

and listening for the modulating tone in the headset. Use a 0.001- μ f capacitor in series with the lead to the i-f signal source. If any one of these stages does not pass and amplify the signal, the trouble has been localized and a complete check should be made of the circuits in this stage. (3) MIXER, OSCILLATOR, AND R-F STAGES. If the i-f stages pass the signal, check the mixer and h-f oscillator. Do this by feeding a modulated r-f signal into the grid of the mixer and noting if the signal is heard in the headset when the set is tuned to this signal. If this stage is operating, work back through the r-f stages to the antenna terminal, checking to see if each stage passes the signal and amplifies it.

(4) INOPERATIVE STAGE. If any stage fails to pass a signal when using this method, make a complete check of the circuits in this stage.

c. *Source of Signal.* If a signal generator is not available, an identical set known to be working may be used to supply the test signal. However, make sure that the signal is of the right frequency. As an example to test the i-f stages, connect the grid or diode plate connection of the detector of the good set successively to the grids of the i-f stages in the set under test and see if the i-f stages pass the signal.

7. *CIRCUIT-DISTURBANCE TESTING.* This method is also used when the receiver is completely inoperative.

a. *General.* Turn the set on, and allow sufficient time for the tubes to warm up. Set all volume controls at maximum. Touch the control grid of the output tube with a coin, key, or other metallic object. A click or loud hum should be heard in the headset. If neither of these sounds is heard and the tube is OK, take voltage and resistance readings of all circuits in this stage.

b. *Procedure.* (1) A-F STAGES. If a click or hum was heard when the output stage was disturbed, follow back through the audio stages to the detector, listening for clicks or hum when the grids are touched. When a point of no clicks is reached from one of clicks, the defect is between these two points. Check the tube and the various circuits in this stage.

(2) I-F STAGES. In case the trouble is not found in the a-f stages, continue back through the i-f stages to the mixer, touching the grids in each case. Remember, when a point of no clicks is passed to one of clicks, the defective stage is isolated.

(3) OSCILLATOR AND R-F STAGES. Test the h-f oscillator stage by touching the grid. Two clicks should be heard: one when the grid is touched, and another when the contact is broken. The r-f stages are also tested by touching the grids. A click should be heard when the grids of these stages are touched.

(4) BEAT-FREQUENCY OSCILLATOR. If a beat-frequency oscillator is used in the set, turn it on. A rushing noise should be heard if the oscillator is functioning.

8. SET-ANALYZER METHOD.

a. *Test Set I-56-(*).* This method makes use of the selective analyzer which is part of Test Set

1-56-(*)¹. Voltages, currents, and resistances for each stage can be measured by this instrument. However, it is advisable to use this instrument only after the trouble has been isolated to a certain stage by some other method.

b. *Test Tubes.* Since there is a tube tester component in Test Set 1-56-(*), the initial step in its use is to test all tubes. Follow exactly all instructions and charts supplied for using this instrument.

c. *Voltage Measurements.* If one or more defective tubes are found in the set, replace them. Then test the set, since in most cases a defective tube may be the only trouble. However, if all tubes are good, the next step is to make voltage measurements at the tube-socket terminals. Failure to obtain a voltage reading at any socket terminal to which a tube element connects, is usually indicative of an open-circuited component which connects in that circuit. It is advisable to consult the wiring diagram of the unit and the chart or table of voltage measurements, since with some tubes there are only a limited number of internal elements.

d. *Short Circuits.* In a few cases of voltage failures at the tube-socket terminals, the fault can be attributed to a short circuit, usually a capacitor. For example, a shorted screen bypass capacitor will short the screen voltage to ground, and a shorted cathode bypass capacitor shorts out the cathode voltage. All components in the circuit of any particular element that does not show proper voltage under test must be suspected, and the defective part located by a series of tests in a process of elimination.

e. *Ohmmeter.* For testing individual components, use the ohmmeter section of Test Set 1-56-(*), as outlined in the instructions supplied. For high-resistance measurements, use the high-resistance scale of the ohmmeter; for low-resistance measurements, use the lowest resistance scale of the ohmmeter.

f. *Free-point Testing.* It may be advisable to use the free-point analyzer portion of Test Set 1-56-(*) with certain types of receiving or audio-amplifier equipment. Where it is difficult to obtain access to the socket terminals for making voltage tests, for example Receiver BC-312-(*) or Receiver BC-342-(*), the analyzer permits making this and other tests from the top of the chassis.

g. *Meter Sensitivity.* Since the meter sensitivity of the analyzer voltmeter varies from 1,000 to 10,000 ohms per volt, depending on the model, this variation must be considered when making certain voltage measurements, as in avc circuits or other circuits where the current flow is so low that operation is impaired when an ordinary voltmeter is connected to it. In instances of this sort, it is necessary to use an electronic or vacuum tube voltmeter for accurate voltage readings,

since an instrument of this type consumes negligible current. The small portable volt-ohmmeter, part of Test Set 1-56-(*), has a sensitivity of only 1,000 ohms per volt on voltage measurements, and should never be used in low current circuits (less than 10 mills) if precision measurements are desired.

9. STAGE-MUTING METHOD.

a. *General.* This method is used if there is hum or an indication of oscillation present in the output. Isolation of the stage or section where hum or oscillation originates requires a special method of troubleshooting known as stage muting. In using this method, the grid of a stage is shorted to the chassis. Signals or voltages originating further back in the set cannot affect or pass this stage.

b. *Procedure.* Starting at the output stage, short the grid to the chassis. If the hum or oscillation continues, the cause must be in the power supply or output stage. If the hum or oscillation stops, it is originating at some point preceding this stage. Work back through the set, shorting each grid to chassis in turn, until a grid is reached where the hum or oscillation does not stop. The point where the hum or oscillation originates will be between that grid and the preceding grid that was shorted to chassis.

10. RECEIVER TESTING ROUTINE.

a. Preliminary Checks.

- (1) Obtain report of complaint, if possible, and verify by actual operation.
- (2) Check all accessories, such as storage battery, power unit, cables, and headset.
- (3) Inspect for tubes in wrong sockets, grid leads connected to wrong tube caps, broken parts or wires, defective cables, loose connections, shorted or grounded resistors or capacitors, overheated parts, and other apparent defects.
- (4) Check the tubes.
- (5) Turn the set on, and note if the tubes light or get warm. Also note if there are any unusual noises or odors.
- (6) Try tuning the receiver, checking the mechanical operation of the controls. Check the receiver for operation over the entire frequency range and note if there is any output.

b. *Receiver Weak or Dead.* If the receiver is weak or dead, try signal substitution or circuit-disturbance testing to locate the defective stage or section. After the stage has been isolated, take voltage and resistance measurements to find the defective part.

c. *Distortion.* Poor audio output or distortion, in the majority of cases, will be caused by a defect in the detector or audio stages. By connecting a headset across the output of each of these stages, the defective stage can be isolated. Check the voltages; resistors, and capacitors in these

¹ The symbol (*) used in this manual in connection with Signal Corps nomenclature refers to all models of the particular equipment under discussion.

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stages. Open or shorted bypass capacitors, leaky coupling capacitors, or defective resistors may cause distortion. Check tubes, headsets, and speakers by substituting good ones.

d. Noise. If noisy, determine whether or not the noise originates outside the set by shorting the antenna to ground. If noise continues, it originates inside the set. If the noise originates within the set, check for loose parts, poor connections, and hum or oscillations. Use stage muting to locate the defective stage, and make voltage and resistance tests. Check for loose connections by wiggling wires and parts. If the noise originates outside the set and it is a vehicular set, check the vehicular suppression system as described in paragraph 11.

e. Broad Tuning. If the quality of the output is good but the receiver tunes broadly, check r-f and i-f alignment and r-f and i-f tube voltages. Also check the tubes, and check for high resistance in the r-f and i-f tuned circuits, including contacts on band-changing switches.

f. Intermittent Operation. In the case of intermittent operation, allow sufficient time for the set to warm up. It may take some time before the trouble will be evident. Sharply tap the tubes, resistors, capacitors, coils, and other parts in the unit. Wiggle the connections and the other parts in the circuit.

g. Final Check. After necessary repairs have been made, check the receiver performance over the entire frequency range, and when possible, compare its operation with that of a good receiver. Realign if necessary.

11. IGNITION INTERFERENCE.

a. Reasons for Suppression. Ignition systems of engines interfere with radio communication unless properly suppressed. This interference results from the action of the ignition system as a small transmitter of radio frequency energy. Equally important is the fact that these radiations can be detected as far as five miles from their source and can be picked up by enemy direction-finding stations, with subsequent danger to security.

b. Shielding. One of the most effective ways of suppressing any interference is to shield its source. Fortunately, since the source of practically all ignition interference is in the engine compartment; the hood, cowl, fire wall, fenders, and splashpan may serve as a shield. In order to act together as an effective shield these units must make good electrical contact with one another. Parts which are located entirely or partly under the hood, and are insulated from the chassis by rubber or asbestos, should be connected electrically to the chassis by means of bonding straps. If such parts are not grounded, they will act as radiators and will cause interference in the receiver of the vehicle as well as in those nearby.

c. Spark and Generator Suppression. The spark

plug is one of the chief causes of interference, since each time it fires it sends out an r-f wave. Sparking at the commutator of the generator also produces interference. The most commonly used method of suppressing possible interference from the ignition system is to use resistors in the ignition leads to reduce the intensity of interference set up by the firing of the plugs. Sparking at the generator commutator is suppressed by means of a capacitor connected from the generator output post to ground (chassis).

d. Checking Suppression. The efficiency of any suppression system can sometimes be determined quickly by actual test. Race the engine; then turn off the ignition key. If the interference continues, its source is probably in the generator. If the interference disappears as soon as the ignition key is turned off, the suppression of the ignition system is faulty.

e. Specific Units. Practically all field power units, such as Power Units PE-49(*), PE-75(*), and PE-95(*) are equipped with suppression devices. On these units, the head of the spark plug and its ignition lead are completely inclosed in a tubular, hose-like shield. This shield is connected to the frame of the engine. Grounding the frame to earth, where practicable, thus grounds the entire shield. Take care to see that all parts of the shield are tightly in place. Make certain that the ground connection from the engine frame to earth makes good contact both at the binding post on the frame and the terminal on the ground stake.

f. Marking Suppressed Units. Practically all army vehicles have their ignition systems noise-suppressed at the time of manufacture. Noise-suppressed army vehicles are marked with a stencilled letter S on the side of the engine hood. However, efficiency of the noise-suppression treatment deteriorates unless preventive maintenance is practiced frequently. Preventive maintenance in a suppression system is a simple matter. Keep all parts tight, dry, and clean; inspect all bonding points for badly frayed terminals and loose connections.

g. Troubleshooting in Suppressor Systems. Some troubles are easily detected: An open-circuited spark plug suppressor will cause balky engine performance. A shorted filter capacitor may show a discharge on the dash ammeter when the engine is stopped. An open distributor suppressor will prevent an engine from starting.

12. FIELD TESTING TRANSMITTER.

a. Operator's Report. To test the transmitter, follow essentially the same procedure that is used in testing a receiver. First obtain the operator's report, but do not rely on it entirely. Check for yourself.

b. Test Accessories. Test all accessories such as cording, power unit, key, microphone, and tubes. The cording, especially, is a source of trouble.

c. *Testing in Vehicle.* Checking the accessories is a simple matter if the set is brought in for repairs. Accessories that are known to be good should be used in testing the unit. It is then a simple matter to determine whether an accessory or the transmitter is faulty. However, in many instances the installation is in a vehicle. Dismantling the installation, checking each accessory and component, and then reinstalling it are time-consuming moves. Learn to isolate the trouble without disturbing the installation. A great deal can be learned merely by turning the set on.

d. *Cording.* Since most troubles in the field are found in the power input side of the transmitter, and especially in the cording, a logical checking procedure will determine whether or not the cording is defective. Such a procedure is outlined below. It is based on the fact that transmitter cording generally interconnects the following circuits: low-voltage, high-voltage, key, microphone, sidetone, relays, receiver, and control and terminal boxes.

13. *FIELD TESTING RADIO TRANSMITTER BC-191-(*).* This procedure can be applied, in general, to all transmitters. However, to illustrate this method more effectively, an actual installation, Radio Transmitter BC-191-(*) in Radio Set SCR-193-(*), is used as an example. Use the schematic diagram, (shown in the pages for Radio Transmitter BC-191-(*) in this technical manual), to analyze each step by tracing the circuit being covered. The following eight steps, taken in order, should establish the location of ordinary troubles. Make sure that correct operation exists at each step before proceeding to the next one.

a. Make a thorough visual inspection of the transmitter and its associated components. Look for broken parts. Observe the mechanical operation of the controls. Inspect the cordage. Check connections from the battery to the dynamotor.

b. Connect only the 8-conductor cord between the transmitter and the dynamotor. Place the TONE CW VOICE switch in the TONE position. Turn the OFF-ON switch to ON. The dynamotor should then be running, all filaments should light, and the FIL. VOLTAGE meter should indicate 10 to 10.5 volts. Press the TEST KEY and listen for a clicking sound from the keying relay. If these results are not obtained, any one or more of the following may be the cause: dead battery, defective cording, defective switches, defective relay, burned out fuses 1604 or 1605, incorrect filament voltage adjustment, open resistor 1138, open dynamotor. (Open field will cause the dynamotor to race.) Poor connections to the battery will cause the dynamotor relay to chatter. AC-DC or 12V-14.2V switch in the wrong position will cause improper filament voltage.

c. With the OFF-ON switch at the OFF position, connect the single-conductor cord. Remove the P.A. tube. Turn to C.W. only. Press the TEST KEY. TOTAL PL. CURRENT meter should indicate between 30 and 60 milliamperes.

CAUTION: Whenever the dynamotor is running, 1,000 volts is present in the transmitter. Turn the OFF-ON switch to OFF, and pull out the high-voltage single-conductor plug at the transmitter when making any adjustments or repairs.

If the meter reading indicated is not obtained, check for the following: open or shorted M.O. grid circuit, open or shorted high-voltage circuit, defective M.O. tube, defective keying relay.

d. With the OFF-ON switch at OFF, replace the P.A. tube. The antenna should not be connected, and switch N may be in any position but No. 1. With transmitter set for C.W., turn it on and key it. The TOTAL PL. CURRENT meter should read 80 to 120 milliamperes when the P.A. TUNING control C is adjusted to resonance. If this result is not obtained, check for the following: defective P.A. tube, short or open in the P.A. grid or plate circuits, no excitation from the oscillator.

e. With the OFF-ON switch at OFF, connect a headset to ground and to pin 33 of socket S0-44. With the transmitter set for C.W., turn it on and key it. Sidetone should be heard in the headset. If sidetone is not heard, check for the following: defective tube VT-25; transformers 1149 or 1157; resistors 1156; relay 1165 contacts; or capacitors 1150, 1180, or 1142.

f. With the OFF-ON switch at ON, connect a phantom antenna. Tune and load the transmitter for c-w operation. TOTAL PL. CURRENT meter should indicate between 180 and 220 milliamperes. The antenna current meter should give some indication of current. Failure to obtain these results may indicate: short or open in antenna tuning circuit, or wrong position of switch N for type of antenna being used.

g. With the transmitter properly loaded for c-w operation, operate it on VOICE. The TOTAL PL. CURRENT meter should, without speaking in the microphone, indicate 20 milliamperes more than on C.W. Speaking in the microphone should increase the plate current about 60 milliamperes. Failure to obtain these results may indicate: incorrect setting of S.A. BIAS, MOD. BIAS, or INPUT LEVEL controls; defective transformers 1149, 1157, or 1164; defective microphone or microphone cord; microphone voltage incorrect; defective tube VT-25; or defective modulator tubes.

h. With the transmitter operating properly on VOICE, switch to TONE. Turn the OFF-ON switch to ON, and close the key. The TOTAL PL. CURRENT meter should indicate 250 to 300 milliamperes. Failure to obtain this result may indicate: defective TONE C.W. VOICE switch, defective tube VT-25, open capacitor 1142.

14. *BENCH TESTING THE TRANSMITTER.* Where the transmitter component is brought in without its accessories, use tubes, dynamotor, cording, key, and microphone that are known to be good. Any

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trouble that exists is then localized to the transmitter.

a. *Localization of Trouble.* Many times a transmitter will operate correctly using cw, but not on voice. Always tune a transmitter for c-w operation first. If it operates correctly using this type of transmission, check its operation using voice and tone. If the transmitter operates on cw but not on voice, the trouble is now isolated to the audio or modulator section. Make a thorough check of the switch which selects the type of operation. If it is evident that the switch is not at fault a complete check must be made of the audio and modulator stages.

b. *Audio Section.* Low-power audio stages can be checked with an output meter or a headset in series with a capacitor. When using an output meter, the reading will fluctuate when you speak into the microphone. Sound should be heard when using the headset. Using either the meter or the headset, work toward the microphone or input stage until a stage is reached where the proper indication is observed. The defective stage will be the preceding stage which was tested. Do not use this method for testing high-power audio stages, such as are used in Radio Set SCR-299-(*).

c. *Radio-frequency Stages.* (1) D-C CIRCUIT. Most Signal Corps transmitters use a meter to measure the plate current. If the plate current is high for one stage, check tuning, alignment, neutralization, and grid bias of this stage. As an example, assume that the power-amplifier plate current is high. If the grid voltage of this stage is measured, the voltage will be extremely low. This indicates that the trouble is in the preceding stage, in the coupling or in the bias supply. In other words, by working toward the oscillator, the trouble can be isolated to one stage by measuring the grid voltage of each stage. A zero plate current reading might indicate the lack of plate voltage. Some transmitters have a grid-current meter which gives a further indication of trouble.

(2) R-F CIRCUIT. The presence of rf may be traced by the use of a neon bulb, attached to a stick for safety. Another method is to use a few turns of insulated wire in series with a flashlight bulb, also attached to a stick. In either case, the bulb will glow when placed near a circuit carrying radio-frequency energy. In an extreme emergency, the presence of rf in a transmitter's tank coil or capacitor, etc., may be checked by using an ordinary graphite lead pencil. Cover the end which is held with ordinary electrician's rubber tape to avoid shocks or burns. Rub the lead point lightly across the high r-f potential end or terminal of coil or capacitor. When the pencil point is raised to form a gap, small sparks or an arc should be obtained if rf is flowing. With experience, it is possible approximately to gauge the output of a transmitter stage by the size of the arc obtained.

(3) RESISTANCE MEASUREMENTS. After the trouble has been isolated to a certain stage, a complete check should be made of this particular stage. A resistance test of each circuit used in the defec-

tive stage is one of the surest and safest checks. Before measuring the resistance, remove the power connections. After repairing the defect, turn the transmitter on and check for correct operation over the whole range, using all modes of operation.

d. *Dirt and Moisture.* Dirt, moisture, and insects often cause trouble in the transmitter. Make certain the transmitter is clean, and dry all parts which have accumulated moisture. To dry, remove excessive moisture with a clean cloth; then place the stripped unit in the sun or expose it to the rays of an electric heater.

15. TESTING CIRCUIT COMPONENTS. After the trouble has been isolated to one section or stage, a complete check is made of all the parts in this stage. The following information deals with the troubles that are likely to occur in the various components.

a. *Tubes.* The tube is one of the first circuit components to be checked. Various conditions may cause a tube to be inoperative, namely, a burned out filament, shorted elements, or gas. Whenever there is evidence that excessive voltage or current has caused damage to the tube, check that part of the circuit carefully to determine the cause of this excessive voltage or current. Doing this will eliminate the chance of damaging a new tube when it is inserted in the circuit. Do not check the continuity of 1.5-volt filaments when using the low ranges of the ohmmeter, as the tubes are likely to burn out.

(1) SUBSTITUTE METHODS. Since the ordinary tube checker will not handle large transmitter tubes, use the substitution method. Try a known good tube in place of the one to be checked, and observe the performance of the transmitter; or place the tube to be checked in a transmitter that is known to be in normal operating condition, and observe its performance.

(2) SHORTS. Tube testers in common use will indicate shorted elements in a small number of receiver tubes when no short exists. The repairman should therefore omit the short test on such tubes unless the circuit of the tester has been modified for testing them. If the tube tests normal in all but the short test, and if the receiver still does not operate normally when using this tube, check it by substituting a good tube.

b. *Resistors.* Resistors are checked for opens and possible shorts to ground. To determine whether or not a resistor is open, use a continuity checker. An ohmmeter may be used to check for opens, shorts to ground, and changes in value.

c. *Capacitors.* The radio repairman is interested in three conditions in a capacitor under test: opens, shorts, and leakage. For mica, paper, or air capacitors, a continuity test is an easy method of checking the condition of a capacitor. When a good capacitor of sufficient size is connected to an ohmmeter, the needle will kick up scale and then show open circuit. If the needle does not kick, the capacitor is open. A shorted capacitor will give a meter reading somewhere between zero

and infinity. The ohmmeter method of testing capacitors for charge and discharge is generally used for all capacitances of $0.01 \mu\text{f}$ or larger.

(1) **SPARK TEST.** The spark test may be used for capacitances above $0.1 \mu\text{f}$. An initial charge of 90 volts or higher is applied. Allow the capacitor to set on the bench for a minute or so; then short the capacitor terminals with a screwdriver. If the capacitor is good, a spark will be seen. If the capacitor is open or partially shorted, no spark will be seen. For capacitances below $0.1 \mu\text{f}$, charge the capacitor with a battery and allow it to set for a shorter time. Then, connect the tips of a headset across the capacitor. If the capacitor is good, a click will be heard in the headset. Be careful that the fingers do not touch the headset tips or the capacitor while making this test.

(2) **ELECTROLYTIC CAPACITORS.** One method of checking an electrolytic capacitor is to measure the amount of current that flows through it when the d-c operating voltage is applied. Be sure to observe correct polarity. The current flow should not exceed $\frac{1}{2}$ milliamperes per μf .

Example: An $8 \mu\text{f}$ capacitor should not pass over 2 milliamperes at the rated voltage.

d. **Coils and Transformers.** An ohmmeter or some form of continuity test is used to check for opens, shorts, or grounds. Shorts result when the insulation of the wire breaks or wears off so that adjacent turns of a winding make contact; grounds result when turns of wire touch the core or frame.

(1) **CHOKES.** Filter chokes or speaker coils sometimes develop grounds, or burn out. Should a burn-out occur, check for a short to ground on the side away from the power supply to determine the cause.

(2) **TRANSFORMERS.** (a) A-f, i-f, and r-f transformers may develop burned-out primaries, open secondaries, or oxidized joints. Oxidized joints or opens usually occur where the fine wire of the coil is joined to the heavier lead wire. Corrosion may cause a high resistance joint, or entirely eat through the small wire. Always check for causes of excessive plate current whenever the primary of an r-f, i-f, or a-f transformer burns out. A shorted cathode capacitor or open grid circuit may cause this. In the tropics, keep the filaments burning or put a light bulb inside the cabinet to keep moisture out of the coils.

(b) Power transformers may develop opens, shorts, or grounds. The easiest method of checking a power transformer, if the d-c resistance of each winding is known, is to use an ohmmeter. If the resistances are not known, the suspected transformer may be compared with a good transformer.

16. MECHANICAL TROUBLES.

a. **Tools.** Many repairs in the field are mechanical in nature. Whenever a mechanical defect is encountered, exercise care in removing the part to be repaired. Always use tools provided with the set or wrenches and screwdrivers of the correct size, so as not to damage the head of a nut or screw. Never use force in trying to remove any part. Generally, a gentle but steady pressure will

remove the part, but if not, careful examination will locate the difficulty.

b. **Disassembly.** Locknuts and lockwashers prevent parts from shaking loose and thus are a means of preventive maintenance. Do not throw them away or forget to put them back when reassembling the equipment. When disassembling equipment, place all screws, bolts, nuts, and other parts in a small box. Do not scatter them over the bench.

c. **Assembly.** The manner in which wires are replaced in equipment is very important. Replace them in the same position as they were, or undesirable coupling may result. Be sure that all connections are soldered tightly. Never use acid-core solder as severe corrosion will result. Use rosin-core solder or plain solder with a nonacid paste.

d. **Final Check.** After all parts have been repaired and parts and connections have been replaced, a complete check of the set should be made to see that all shields, nuts, and screws have been replaced and are tight. Do not tighten screws or nuts too much, or the threads will be stripped. Finally, check the mechanical operation of all the controls to see that they operate, not only correctly, but smoothly.

17. **EMERGENCY TESTING METHODS.** Knowing how to use standard test equipment is important, but there are times when emergency test equipment has to be devised. The following are a few of the most commonly used emergency testing methods.

a. **Continuity Checkers.** A headset in series with a low-voltage battery is a good method of checking continuity. A neon bulb in series with a d-c source of 90 volts may also be used.

b. **Checking Voltage Without Meter.** If a meter is not available for checking the presence of voltages, a headset may be used (fig. 1). Connect

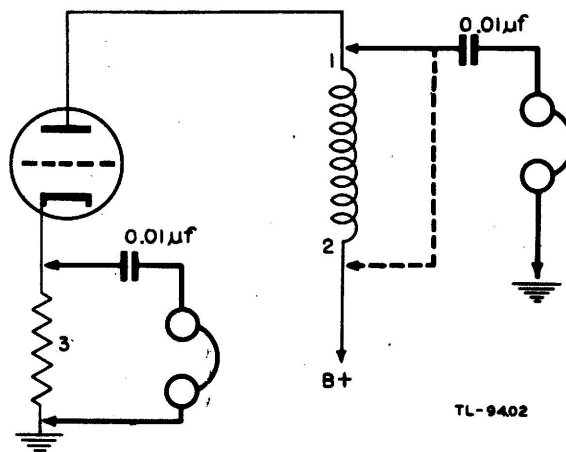


Fig 1. Use of a headset and capacitor for checking circuits

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a 0.01- μ f capacitor in series with the headset. The presence of voltage will be indicated by a click in the headset. It may be necessary to discharge the capacitor between tests.

(1) Connect the test end of the headset and capacitor from ground to point 2. The click that will be heard is caused by the source voltage. Then connect the test end to point 1. If a click is not heard, the element is open.

(2) To test for shorts, connect the headset and capacitor across the element 3 in figure 1. If no click is heard, the element is shorted.

18. EMERGENCY REPAIRS.

a. *General.* It is always best to replace defective parts in any radio set with identical parts; however, it is not always possible to do this. To handle such a situation, a good repairman makes emergency repairs or finds some way to make a substitution. The following ideas are just a few of the many that can be used. Whenever an emergency repair is made, be sure to attach a tag to the set stating the location and method of repair. This will indicate that there is an emergency repair in the set which should be corrected as soon as practicable.

b. *Resistors.* When a carbon resistor has become overheated, its resistance is decreased. The resistance may be raised to the correct value simply by scraping part of the carbon from the body until the correct value is obtained. A wire-wound resistor can sometimes be repaired by placing a clamp over the break or by shorting the break. This restores continuity with a slight decrease in resistance. Variable resistors and potentiometers as used in volume controls seldom burn out because of the small amount of current that passes through them. Faulty operation is generally due to poor contact, wear, and dirt at the rubbing contacts. Clean thoroughly with carbon tetrachloride. Polish with an ordinary eraser, one which is not too gritty, and adjust the tension of the arm so that it makes a firm contact. If the variable resistor is too worn to make temporary repair, replace it with a fixed resistor, the value of which must be found by experiment. If the variable resistor is wire-wound and there is a break in the winding, slipping a small metal tab underneath the broken section will restore continuity in most instances.

c. *Variable Capacitors.* The most common troubles that occur with variable capacitors are: bent plates, wobbling or scraping of the rotor plates due to loose or worn bearings, noise due to poor wiping contact to the rotor, and noise due to dirty plates. If the bearings are loose, they can be tightened. Take care not to tighten them excessively, or they will bind. If the bearings are too worn, it is best to replace the unit. If the wiping contact is poor, a good remedy is to install a stranded copper wire pigtail. Make several turns of the wire around the rotor shaft; then solder one end of the wire to the rotor shaft and the other to the chassis of the unit. If a high-pressure air hose is not available, a pipe cleaner makes a good plate cleaner for removing dust or grit from variable capacitors.

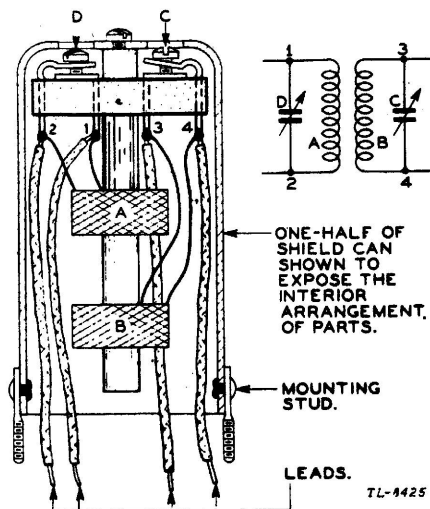


Fig 2. Internal structure of I-f transformer

d. *R-f and I-f Transformers.* Although r-f and i-f coils are designed carefully, they can be made to operate surprisingly well by emergency repair. With an i-f transformer having an open or intermittently open primary, (fig. 2, coil A), the procedure is as follows:

(1) Remove nuts from mounting studs after removing leads from various terminal points, and take entire transformer off chassis.

(2) Remove coil from shield can, and fold leads back, out of the way.

(3) Clip the two fine wires, which are the ends of coil A, from the terminal points 1 and 2. This should clear the way for unwinding the coil.

(4) Carefully unwind the turns onto a stick, cardboard, or other fairly smooth material so as not to cut the wire. Examine the wire carefully as it is unwound.

(5) The break or burnout usually is found by observing one of the following indications:

(a) A greenish spot, indicating a corrosion break.

(b) A burned spot, indicating arcing after a corrosion break.

(c) A sharp bend, indicating that the wire is broken inside the insulation.

(6) After enough wire has been removed to reveal the break, use an ohmmeter to check for continuity in the remaining wire and also in the wire that has been unwound.

(7) If the wire has no more breaks, the next step is splicing (fig. 3). The wire is very thin and may be solid or stranded, but in either case the splice is the same. First, with very fine sandpaper, remove about two inches of insulation from the two ends to be spliced. The insulation will usually be an enamel coating and a layer of cotton wrapping. Be careful. Do not break any of the fine strands. The transformer performs better with all strands intact and connected.

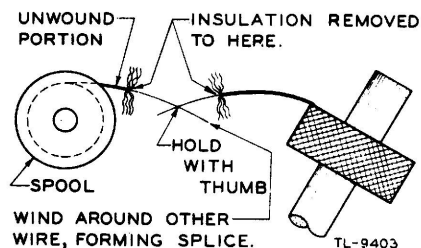


Fig 3 Method of splicing transformer winding

Form a pool of solder on the tip of the soldering iron, and solder the splice. Apply a little rosin to insure tinning. Remember that a clean iron gets the best results. Keep a rag handy to wipe it. Wipe joint thoroughly to prevent future corrosion. The coil is now ready for rewinding (fig. 4). Continue to rewind until the coil is completed (fig. 5). This method of repair can also be applied to choke coils, relay windings, and similar wire-wound components.

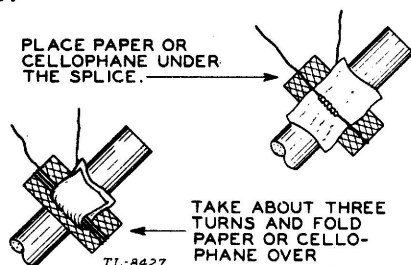


Fig 4 Method of rewinding after splicing

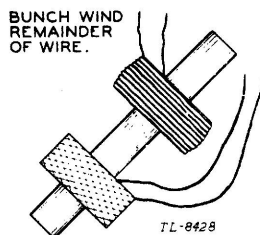


Fig 5 Rewound coil

e. **Substitution.** Burned-out primaries and open secondaries may be repaired by using an r-f choke or a resistor in place of the open winding and by connecting a coupling capacitor from primary to secondary (fig. 6). A resistor for the primary may be from 50,000 to 150,000 ohms; for the secondary, from 0.5 to 2 megohms. The capacitor may be from 0.000025 to 0.0005 μ f for rf, and from 0.01 to 0.1 μ f for af (fig. 6).

NOTE: In the following diagrams the dotted lines indicate connections to be removed, and the arrows and heavy lines indicate where new leads and parts are inserted.

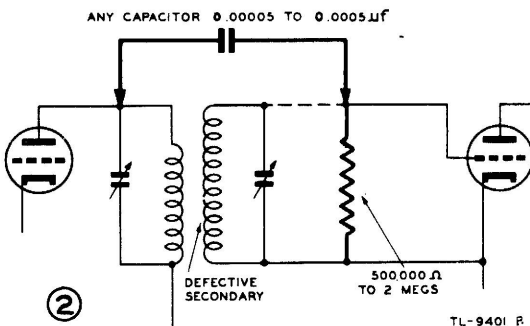
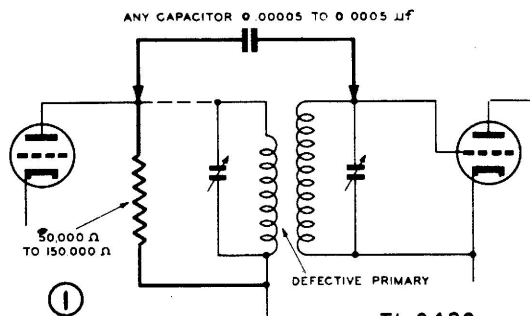


Fig 6 Method of substituting a resistor and capacitor for open winding

Where a capacitor is not available, a few turns of wire wound around the good winding or high r-f lead and then connected to grid or plate, depending on which winding is open, (figs. 7-1 and 7-2), may give the desired coupling.

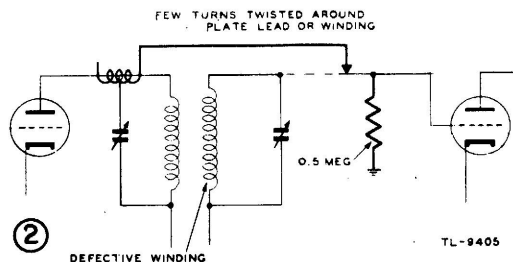
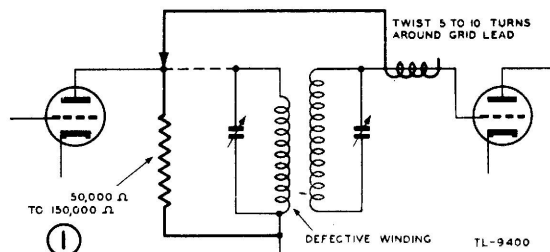


Fig 7 Method of substituting a resistor and few turns of wire for open winding

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When one half of a center-tapped secondary of an audio transformer burns out, substitution can be made as illustrated in figure 8.

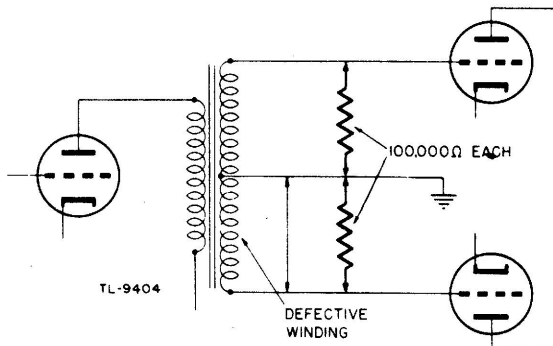


Fig 8 Substitution of resistors for transformer winding

f. Bridging Stages. When a defect has been isolated to a particular stage in the set and a repair or replacement is not possible, the stage may be bridged by connecting a capacitor from the plate of the stage preceding the defective stage to the

grid of the stage following the defective stage (fig. 9). This will not work for detector stages. Use a 0.0005 μf capacitor for r-f and i-f stages; use a 0.01 μf capacitor for a-f stages.

g. Cables. Whenever it is determined that one of two conductors in a cable is defective and a replacement cable is not available, a simple repair may be made as follows: Disconnect the defective conductor or conductors at both ends of the cable. Use outside conductors or jumpers and connect them to the terminals, plugs, or sockets of the cable.

h. Summary. These emergency repairs are not infallible. In circuits in which electrical characteristics are critical, these repairs may not work; but for the most part they will work under the conditions indicated.

19. CONCLUSION. Learning to use the various methods of trouble location and repair as outlined will save a lot of time in the field. With practice, these methods will become second nature and a routine will be developed that will become practically automatic. It is your job to repair a piece of radio equipment just as rapidly and efficiently as possible. Good radio repairs have saved many lives in this war.

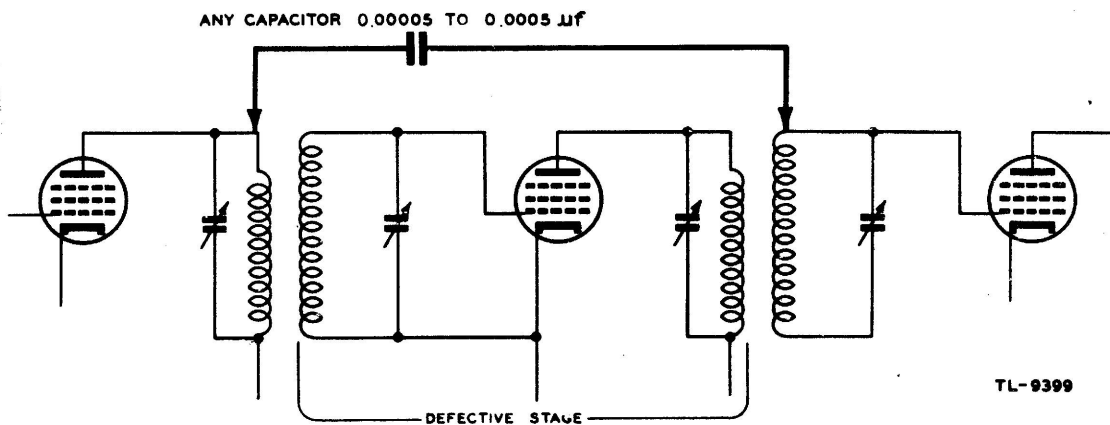


Fig 9 Method of bridging defective stage

STANDARD COLOR CODES

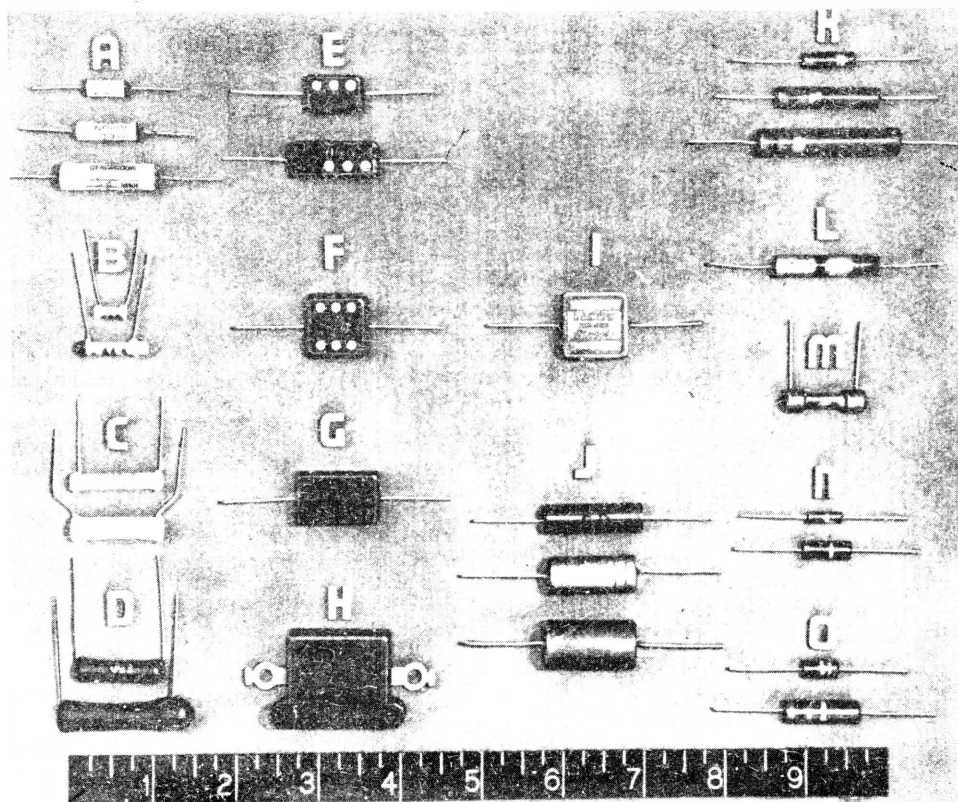


Fig 1. Types of capacitors and resistors

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1. TYPES OF CAPACITORS AND RESISTORS.

Pictures of the most common types of capacitors and resistors used are shown in figure 1. The first column (A-D) shows ceramic capacitors. The second (E-H) shows mica capacitors, and the third (I-J) shows oiled paper capacitors. In the fourth column (K-O), various resistors are shown. While figure 1 shows the range of types, it does not necessarily include all of the variations introduced by different manufacturers. Several systems are in use for marking the values of capacitance and resistance. Some capacitors and resistors have their values stamped on, but in many cases colored dots and bands are used instead.

2. THE THREE-DOT COLOR CODE FOR MICA CAPACITORS (fig. 1E).

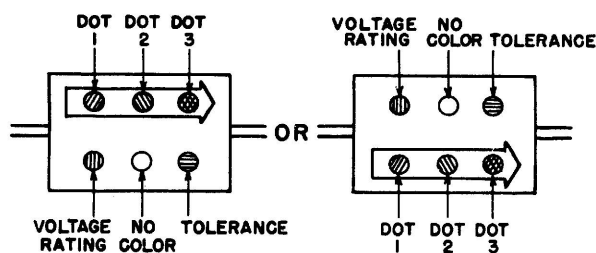
a. This code is gradually being replaced by other, more involved, codes. The basis of this code (fig. 2) is a series of three colored dots which indicate the capacitance in micromicrofarads. Two auxiliary colored dots indicating, the voltage rating and the capacitance tolerance are sometimes

added. Usually an arrow is molded or stamped on the case of the capacitor to indicate the sequence in which the dots are to be read. Dots one and two show the first two digits of the capacitance in micromicrofarads, while dot three indicates the decimal multiplier to be used. As an example, a 0.006-microfarad capacitor (6,000 micromicrofarads) is marked by the three dots in sequence, as follows: blue (6), black (0), red (100).

b. The dot indicating tolerance, when used, is usually located above or below the third (decimal multiplier) dot. The color of the tolerance dot corresponds to tolerance between plus or minus 1 percent and plus or minus 20 percent. For example: a green tolerance dot is used on capacitors having a tolerance of plus or minus 5 percent (fig. 2).

c. The voltage dot, when used, is located above or below the first (first digit) dot. The various colors denote, according to the code of figure 2, the d-c working voltage.

d. Omission of both of the auxiliary dots is made for capacitors having a tolerance of plus or minus 20 percent, and a d-c working voltage rating which is the lowest used for that type and size of capacitor.



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Fig 2 Molded mica capacitors: three dot color code

Color	First dot First digit	Second dot Second digit	Third dot Decimal multiplier	Percent of Tolerance	*Voltage Rating
Black	0	0	1	±20	
Brown	1	1	10	± 1	100
Red	2	2	100	± 2	200
Orange	3	3	1,000	± 3	300
Yellow	4	4	10,000	± 4	400
Green	5	5	100,000	± 5	500
Blue	6	6	1,000,000	± 6	600
Violet	7	7	10,000,000	± 7	700
Gray	8	8	100,000,000	± 8	800
White	9	9	1,000,000,000	± 9	900
Gold	-	-	0.1	± 5	1,000
Silver	-	-	0.01	±10	2,000
Body	-	-	-	±20	-

*When no color is indicated, the voltage rating may be as low as 300 volts.

3. THE RMA CODE FOR MICA CAPACITORS (fig. 1F). The RMA (Radio Manufacturers Association) code is illustrated in figure 3. This code uses six colored dots with an arrow to show the sequence. The first three dots give the first three digits of the capacitance in micromicrofarads, the fourth dot (directly below the third) gives the decimal multiplier, the fifth indicates the tolerance in capaci-

tance, and the sixth, the d-c working voltage. For example: a capacitor of 0.006 microfarads (6,000 micromicrofarads) plus or minus 10 percent, 800 volts d-c, working, would be marked: blue (6), black (0), black (0), brown (multiplier 10), silver (plus or minus 10 percent), gray (800 volts), in that order.

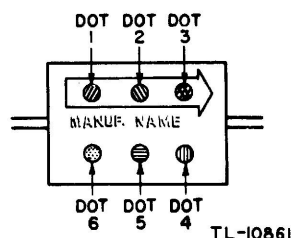


Fig 3 Molded mica capacitors: RMA six dot color code

Color	First dot First digit	Second dot Second digit	Third dot Third digit	Fourth dot Decimal multiplier	Fifth dot Percent of Tolerance	Sixth dot Voltage
Black	0	0	0	1	-	-
Brown	1	1	1	10	± 1	100
Red	2	2	2	100	± 2	200
Orange	3	3	3	1,000	± 3	300
Yellow	4	4	4	10,000	± 4	400
Green	5	5	5	100,000	± 5	500
Blue	6	6	6	1,000,000	± 6	600
Violet	7	7	7	10,000,000	± 7	700
Gray	8	8	8	100,000,000	± 8	800
White	9	9	9	1,000,000,000	± 9	900
Gold	-	-	-	0.1	± 5	1,000
Silver	-	-	-	0.01	± 10	2,000
Body	-	-	-	-	± 20	500

4. THE AWS CODE FOR MICA CAPACITORS.

a. The AWS (American War Standard) code for molded mica capacitors is shown in figure 4. Like the RMA code, it makes use of six colored dots, but with somewhat different significance. The first four dots give the capacitance in micro-microfarads, as follows: first significant figure, second significant figure, third significant figure, and the decimal multiplier. It will be noted that this scheme makes provision for marking units with three significant figures. However, none of the capacitors standardized under the AWS code requires more than two significant digits to specify its capacitance. *The first dot on all molded mica capacitors, marked with the AWS code, is black, and the two necessary significant figures are given by the second and third dots. As a result the black first dot becomes an important feature or identification symbol for a molded mica capacitor marked according to the AWS code. A few*

examples may serve to make this clear. A 120-micromicrofarad capacitor is marked as follows: black (0), brown (1), red (2), brown (10); indicating a molded mica capacitor of 120 micromicrofarads. A 9,100-micromicrofarad capacitor will be marked black, white, (9), brown (1), or red (100); indicating a molded mica capacitor of 9,100 micromicrofarads. It will be noted that in each instance the first dot is black.

b. The fifth dot in the AWS color code indicates the capacitance tolerance in percent of rated capacitance. The sixth dot denotes characteristics of design. For example, a 0.006-microfarad (6,000 micromicrofarads) plus or minus 10 percent mica bypass capacitor would be marked: black (0), blue (6), black (0), red (100), silver (plus or minus 10 percent), black; (mica bypass, with no temperature coefficient specified).

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c. It will be noted that this color code does not include the voltage rating. This is considered unnecessary since, with few exceptions, all capacitors marked with the AWS color code are rated at 500 d-c working volts. The exceptions, all of

which are rated at 300 volts, are: AWS type CM35 capacitors with capacitances of 6,800, 7,500, and 8,200 micromicrofarads; AWS type CM40 capacitors with capacitances of 9,100 and 10,000 micromicrofarads.

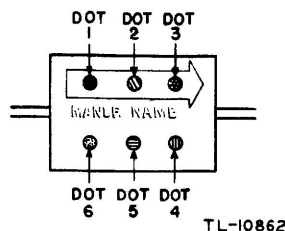


Fig 4. Molded mica capacitors: AWS six dot color code

Color	First dot First digit	Second dot Second digit	Third dot Third digit	Fourth dot Decimal multiplier	Fifth dot Percent of Tolerance	Sixth dot Charac- teristics
Black	0	0	0	1	± 20	A
Brown	1	1	1	10	-	B
Red	2	2	2	100	± 2	C
Orange	3	3	3	1,000	-	D
Yellow	4	4	4	-	-	E
Green	5	5	5	-	-	F
Blue	6	6	6	-	-	G
Violet	7	7	7	-	-	-
Gray	8	8	8	-	-	-
White	9	9	9	-	-	-
Gold	-	-	-	0.1	± 5	-
Silver	-	-	-	0.01	± 10	-

Legend: A. Ordinary mica bypass.

B. Same as A, low-loss case.

C. Bypass or silver-mica temperature co-efficient; capacitor (temperature co-efficient: ± 200 parts /million/ $^{\circ}\text{C}$).

D. Silver-mica capacitor (temperature co-efficient: ± 100 parts /million/ $^{\circ}\text{C}$).

E. Silver-mica capacitor (temperature co-efficient: 0 to +100 parts /million/ $^{\circ}\text{C}$).

F. Silver-mica capacitor (temperature co-efficient: 0 to +50 parts /million/ $^{\circ}\text{C}$).

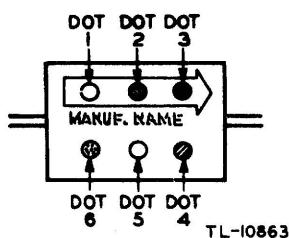
G. Silver-mica capacitor (temperature co-efficient: 0 to -50 parts /million/ $^{\circ}\text{C}$).

5. THE AWS CODE FOR MOLDED PAPER CAPACITORS.

a. The AWS color code for molded paper dielectric capacitors is shown in figure 5. Like the code for mica capacitors, referred to above, it uses six colored dots, together with an arrow to indicate the sequence. Units marked according to this system can readily be identified by the fact that both the first and fifth dots are always silver. The other dots are used as follows: The second dot gives the first digit of the capacitance in micromicrofarads; the third dot gives the second

significant figure; the fourth dot indicates the decimal multiplier; and the sixth shows whether the unit has a maximum operating temperature of 167° or 185° Fahrenheit.

b. No indication of the working voltage is given by this color code. However, all AWS molded paper capacitors have d-c working voltages between 300 and 800 volts. The lower voltage rating applies to units with high-capacitance ratings, the higher voltage rating applies to units with low-capacitance ratings.



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Fig 5. Molded paper capacitors: AWS six dot color code

Color	First dot First Digit	Second dot Second digit	Fourth dot Decimal multiplier	Sixth dot Characteristics
Black	0	0	1	A
Brown	1	1	10	B
Red	2	2	100	-
Orange	3	3	1,000	-
Yellow	4	4	-	-
Green	5	5	-	-
Blue	6	6	-	-
Violet	7	7	-	-
Gray	8	8	-	-
White	9	9	-	-
Gold	-	-	-	-
Silver	-	-	-	-

Legend: A. Operating temperature range: -67° to +185° F.

B. Operating temperature range: -67° to +167° F.

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6. TUBULAR CERAMIC DIELECTRIC CAPACITORS. Tubular ceramic dielectric capacitors are sometimes marked according to the RMA color code shown in figure 6. The negative temperature coefficient is indicated by the color of the band or tips at one end of the unit, the capacitance in micromicrofarads is shown by the first three dots; the capacitance tolerance, either in percent or tenths of a micromicrofarad,

depending upon the size of the unit, is indicated by the fourth and last dot. For example, a 30-micromicrofarad plus or minus 5 percent capacitor with a negative temperature coefficient of 80 parts per million per degree centigrade would be marked as follows: tip, red (-80); first dot, orange (3); second dot, black (0); third dot, black (1); fourth dot, green (plus or minus 5 percent).

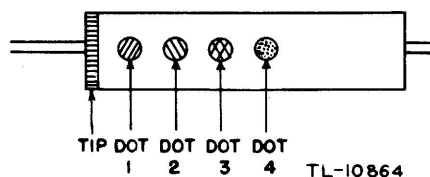


Fig 6. Tubular ceramic capacitors: RMA color code

Color	Tip *Temperature Coefficient	First dot First digit	Second dot Second digit	Third dot Decimal multiplier	Fourth dot †Tolerance
Black	0	0	0	1	±20
Brown	0.00003 neg.	1	1	10	± 1
Red	0.00008 neg.	2	2	100	± 2
Orange	0.00015 neg.	3	3	1,000	± 3
Yellow	0.00022 neg.	4	4	10,000	± 4
Green	0.00033 neg.	5	5	100,000	± 5
Blue	0.00047 neg.	6	6	1,000,000	± 6
Violet	0.00075 neg.	7	7	0.001	± 7
Gray	-	8	8	0.01	± 2.5
White	-	9	9	0.1	±10

*The abbreviation neg. (negative) indicates that the capacitance varies inversely with temperature. The temperature coefficient is expressed in micromicrofarads per micromicrofarad per degree centigrade. Some capacitors are marked with a numeral instead of a color code; for example, M-030 represents 0.00003 neg.

†Tolerances for capacitors of 10 micromicrofarads or less are expressed in tenths of a micromicrofarad instead of percentages.

7 FIXED RESISTORS.

a. Small fixed resistors, both composition type and wire-wound, are frequently marked with colored bands and dots to indicate the resistance and tolerance. Two color codes are widely used, the RMA and the AWS. The two codes are not identical in all particular, but they are similar in many respects. One chart, applicable to both, is shown in figure 7. It will be seen that in all cases

the various combinations of body color, bands and dots indicate the resistance to two significant figures (the first two digits), the decimal multiplier, and the percent tolerance in resistance.

b. As illustrated by figure 7, two methods are used for indicating the resistance and tolerance: Method A. This method makes use of four colored bands, starting at one end of the unit, to show resistance and tolerance. The

in use (B1, B2, B3, of fig. 7.). With all of these, however, the interpretation of the code is practically the same: in that the left end, gives tolerance; body, first significant figure; right end, second significant figure; and the central dot or band, decimal multiplier.

To illustrate the basic schemes, consider a 5,600-ohm ± 10 -percent fixed resistor. It would be marked:

Method A. First band, green (5); second band, blue (6); third band, red (100); fourth bands, reading from left to right, indicate: first significant figure, second significant figure, decimal multiplier, and percent tolerance. (The significance of the body color under this method will be explained later.)

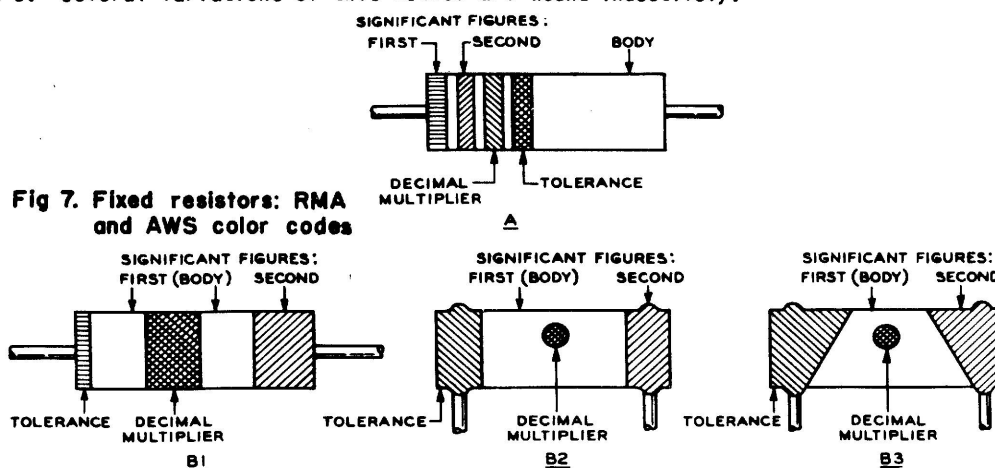
Method B. Several variations of this method are

band, silver (± 10 percent).

Method B. Left end, silver (± 10 percent); body, green (5); right end, blue (6); central band or dot, red (100).

In method A, where the body color plays no part in indicating resistance or tolerance, it may be used to indicate the type of resistor unit. Under the RMA code, a black body is frequently used to indicate an uninsulated composition unit a tan, olive, or white body, usually has an insulated wire-wound unit. The AWS code requires that an insulated unit using Method A have a black body; the body of an insulated unit may be any color, although a natural tan is preferred.

c. When there is doubt as to whether a particular resistor is composition or wire-wound, it is well to remember that any resistor of 100 ohms or less is most likely wire-wound, and is probably wound inductively.



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Color	First significant figure	Second significant figure	Decimal multiplier	Percent of Tolerance
Black	0	0	1	-
Brown	1	1	10	± 1
Red	2	2	100	± 2
Orange	3	3	1,000	± 3
Yellow	4	4	10,000	± 4
Green	5	5	100,000	± 5
Blue	6	6	1,000,000	± 6
Violet	7	7	10,000,000	± 7
Gray	8	8	100,000,000	± 8
White	9	9	1,000,000,000	± 9
Gold	-	-	0.1	± 5
Silver	-	-	0.01	± 10
No color	-	-		± 20

VACUUM-TUBE CROSS-REFERENCE GUIDE

ALL TUBES	VT NUMBER	JAN TYPE	RMA & OTHER	BASE VIEW	DESCRIPTION
0A3	VT-260	0A3/VR-75	VR-75-30	4SB	Voltage regulator
0A4G	-----	0A4G	0A4G	4V	Cold-cathode gas triode
0B3	VT-184	0B3/VR-90	VR-90-30	4SB	Voltage regulator
0C3	VT-200	0C3/VR-105	VR-105-30	4SB	Voltage regulator
0D3	VT-139	0D3/VR-150	VR-150-30	4SB	Voltage regulator
0Z4	-----	-----	0Z4	4R	Full-wave rect
0Z4G	-----	-----	0Z4G	4R	Full-wave rect
01A	VT-30	01A	01A	4D	Triode detectr amplr
XXD	-----	-----	14AF7	8AC	Twin triode
1A3	-----	1A3	1A3	5AP	H-f diode
1A4	-----	-----	1A4P	4M	R-f pentode
1A5GT	VT-124	1A5GT	1A5GT/G	6X	Pentode power amplr
1A6	-----	-----	1A6	6L	Pentagrid converter
1A7G	-----	-----	1A7G	7Z	Pentagrid converter
1A7GT	VT-147	1A7GT	1A7GT/G	7Z	Pentagrid converter
1B4	-----	1B4P	1B4P/951	4M	Pentode r-f amplr
1B5/25S	-----	-----	25S	6M	Duo-diode triode
1B22	-----	1B22	471A	None	Spark gap tube
1B23	-----	-----	729A	None	Double spark gap tube
EL-1C	-----	3B22	3B22	4C	Full-wave gas rect
1C5G	VT-125-A	-----	1C5G	6X	Pentode power amplr
1C5GT	VT-125	1C5GT	1C5GT/G	6X	Pentode power amplr
1C6	-----	1C6	1C6	6L	Pentagrid converter
1C21	-----	1C21	920	4V	Gas triode
1D5G	-----	1D5G	1D5GP	5Y	R-f pentode remote cut-off
1D8GT	VT-148	1D8GT	1D8GT	8AJ	Diode-triode pentode power amplr
1E1	-----	1E1	1E1	4A	Ballast tube
1E4G	-----	-----	1E4G	5S	Triode amplr
1E5GP	VT-170	-----	1E5GP	5Y	Tetrode r-f amplr
1E5GT	-----	-----	1E5GT	5R	Pentode r-f amplr
1E7G	-----	1E7G	1E7G	8C	Double pentode power amplr
1F5G	-----	-----	1F5G	6X	Pentode power amplr
1F6	-----	-----	1F6	6W	Duo-diode pentode
1F7G	-----	1F7G	1F7G	7AD	Duo-diode pentode
1G4GT	-----	1G4GT/G	1G4GT/G	5S	Triode amplr
1G5GT	-----	-----	1G5GT	6X	Pentode power amplr
1G6GT	-----	1G6GT	1G6GT	7AB	Twin triode
1H4G	-----	-----	1H4G	5S	Triode amplr
1H5G	-----	-----	1H5G	5Z	Diode-triode
1H5GT	VT-223	1H5GT/G	1H5GT/G	5Z	Diode-triode
1H6G	-----	1H6G	1H6G	7AA	Duo-diode triode
1J6GX	-----	1J6GX	1J6GX	7AB	Twin triode
1L4	-----	1L4	1L4	6AR	Pentode r-f amplr
1LA4	-----	1LA4	1LA4	5AD	Pentode power amplr
1LA6	-----	1LA6	1LA6	7AK	Pentagrid converter
1LB4	-----	1LB4	1LB4	5AD	Pentode power amplr
1LC5	-----	1LC5	1LC5	7A0	Triple-grid variable- μ
1LC6	VT-178	1LC6	1LC6	7AK	Pentagrid converter
1LD5	-----	1LD5	1LD5	6AX	Diode pentode
1LE3	VT-239	1LE3	1LE3	4AA	Triode amplr
1LN4	VT-177	1LN4	1LN4	5AG	Diode high- μ triode
1LN5	VT-179	1LN5	1LN5	7A0	Triple-grid amplr
1N5G	-----	-----	1N5G	5Y	Pentode r-f amplr
1N5GT	VT-146	1N5GT	1N5GT/G	5Y	Pentode r-f amplr
1N21	-----	-----	1N21	None	Xtal detectr
1N22	-----	-----	1N22	None	Xtal detectr
1P5G	-----	-----	1P5G	5Y	Triple-grid pentode
1P5GT	-----	-----	1P5GT	5Y	Triple-grid pentode

ALL TUBES	VT NUMBER	JAN TYPE	RMA & OTHER	BASE VIEW	DESCRIPTION
1P23	-----	1P23	1P23	41	Phototube, gas
1Q5GT	-----	-----	1Q5GT/G	6AF	Tetrode power amplr
1R4	VT-183	1R4/1294	1294	4AE	U-h-f diode
1R5	VT-171	1R5	1R5	7AT	Pentagrid converter
1R5 Loc.	VT-171-A	-----	1R5 Loc.	7AT	Loctal pentagrid converter
1S4	VT-210	1S4	1S4	7AV	Pentode power amplr
1S5	VT-172	1S5	1S5	6AU	Diode pentode
1T4	VT-173	1T4	1T4	6AR	Triode-grid remote cut-off
1V	-----	1V	1V, 6Z3	4G	Half-wave rect
2A3	VT-95	2A3	2A3	4D	Triode power amplr
2A4G	-----	-----	2A4G	5S	Gas triode
2A5	-----	2A5	2A5	6B	Pentode power amplr
2A6	-----	-----	2A6	6G	Duo-diode triode
2A7	-----	-----	2A7	7C	Pentagrid converter
2AP1	-----	2AP1	2AP1	7BN	Electrostatic cathode-ray
2AP5	-----	-----	2AP5	7BN	Electrostatic cathode-ray
2B7	-----	2B7	2B7	7D	Duo-diode pentode
2B26	-----	-----	866 jr	4B	Half-wave rect
2C21	-----	2C21	1642, RK-33	T-7DA	Xmtg triode
2C22	-----	2C22	7193	4AM	U-h-f triode
2C34	VT-224	2C34	RK-34	T-7DC	Twin triode
2D21	-----	-----	R-6200	70	Thyratron, gas tetrode
2E22	-----	2E22	TS-70, DT-70	5J	Pentode power amplr-osc-mod
2V3	-----	2V3G	2V3G	4Y	Half-wave rect
2X2	VT-119	2X2	879	4B	Half-wave rect
3AP1	-----	3AP1	2X2/879	7BN	Electrostatic cathode-ray
3AP4	-----	-----	906P1	7BN	Electrostatic cathode-ray
3A4	-----	3A4	3AP1/906-P1	7BN	Electrostatic cathode-ray
3A5	-----	3A5	906-P4	7BN	Electrostatic cathode-ray
3A8GT	VT-149	3A8GT	3AP4/906-P4	7BB	Pentode power amplr
3BP1	-----	3BP1	3A4	7BC	H-f twin triode
3B7	VT-182	3B7/1291	3A8GT	8AS	Diode triode pentode
3B21	-----	3B21	3BP1	7BN	Electrostatic cathode-ray
3B22	-----	3B22	1291	7A1	U-h-f twin triode
3B23	-----	3B23	EL-302.5	4C	Full-wave rect
3B24	-----	3B24	EL-1C	T-4AG	Full-wave rect
EL-3C	-----	-----	RK-22	T-4AG	Full-wave rect
3C21	-----	-----	RK-22	T-2Q	Half-wave rect
3C24	VT-204	3C24	732A	T-3BR	Full-wave gas rect
3C31/C1B	-----	3C31/C1B	4B24	T-3AA	Xmtg triode
3DP1	-----	-----	ZB-120	T-4BC	Xmtg triode
3DP1-S1	-----	-----	HK-24-G	T-3AD	Thyratron gas
3D6	VT-185	3D6/1299	3C31/C1B	14-AA	Electrostatic cathode-ray
3EP1	VT-226	3EP1	3DP1	14-AA	Electrostatic cathode
3E29	-----	3E29	3DP1-S1	6BB	U-h-f tetrode
3FP7	-----	-----	1299	11A	Electrostatic cathode-ray
3GP1	-----	3GP1	1806-P1	T-9B	Push-pull beam-power tetrode
3GP4	-----	-----	829A	14-AA	Electrostatic cathode-ray
3GP5	-----	-----	3FP7	11A	Electrostatic cathode-ray
3HP7	-----	-----	2537A3	11A	Electrostatic cathode-ray
3LF4	VT-180	-----	3GP4	11A	Electrostatic cathode-ray
3Q4	VT-264	3Q4	3GP5	11A	Electrostatic cathode-ray
3Q5GT	VT-221	3Q5GT	C7501	5BJ	Electromagnetic cathode-ray
3S4	VT-174	3S4	3LF4	6BB	Beam tetrode power amplr
4A1	-----	4A1	3Q4	7BA	Pentode Power amplr
4B22	-----	4B22	3Q5GT	7AP	Beam power amplr
4B23	-----	4B23	3S4	7BA	Pentode power amplr
4B24	-----	4B24	4A1	4A	Ballast tube
4B25	-----	4B25	EL-5B2-5	Mogul	Full-wave gas rect
4B26	-----	4B26	EL-5B-HD	Mogul	Full-wave gas rect
4B27	-----	4B27	EL-3C	T-3BR	Full-wave gas rect
			EL-6C	T-3BR	Full-wave gas rect
			4B26	Mogul	Half-wave gas rect
			4B27	T-3BR	Full-wave mercury-vapor rect

REFERENCE DATA

ALL TUBES	VT NUMBER	JAN TYPE	RMA & OTHER	BASE VIEW	DESCRIPTION
4C22	-----	-----	HF-100	T-48C	Xmtg triode
4E27	-----	4E27	HK-257-B 8001	T-7CB	Xmtg pentode
EL-5B2-5	-----	-----	4B22	Mogul	Full-wave gas rect
EL-5B-HD	-----	-----	4B23	Mogul	Full-wave gas rect
5AP1	-----	5AP1	1805-P1	10A	Electrostatic cathode-ray
5AP4	-----	5AP4	1805-P4	10A	Electrostatic cathode-ray
5BP1	-----	5BP1	1802-P1	10A	Electrostatic cathode-ray
5BP1-XXX	-----	-----	5GP1	11A	Electrostatic cathode-ray
5BP4	VT-111	5BP4	1802-P4	10A	Electrostatic cathode-ray
5B4G	-----	-----	5B4G		
5CP1	-----	5CP1	5CP1	14-AA	Electrostatic cathode-ray
5CP4	-----	-----	5CP4	14-AA	Electrostatic cathode-ray
5CP7	-----	5CP7	5CP7	14-AA	Electrostatic cathode-ray
5D21	-----	-----	5D21	5AY	U-h-f tetrode
5FP7	-----	-----	1812-P7	5BR	Electromagnetic cathode-ray
5GP1	-----	5GP1	5BP1-XXX	11A	Electrostatic cathode-ray
5HP1	-----	5HP1	5HP1	10A	Electrostatic cathode-ray
5HP4	-----	5HP4	5HP4	10A	Electrostatic cathode-ray
5JP1	-----	5JP1	5JP1	11E	Electrostatic cathode-ray
5JP4	-----	-----	5JP4	11E	Electrostatic cathode-ray
5LP1	-----	5LP1	2511A5	11F	Electrostatic cathode-ray
5LP2	-----	-----	2511B5	11F	Electrostatic cathode-ray
5LP4	-----	-----	5LP4	11F	Electrostatic cathode-ray
5LP5	-----	-----	5LP5	11F	Electrostatic cathode-ray
5MP1	-----	5MP1	2505A5	7AN	Electrostatic cathode-ray
5NP1	-----	5NP1	5NP1	11A	Electrostatic cathode-ray
5R4GY	-----	5R4GY	R6175B	5T	Full-wave rect
5T4	VT-114	5T4	5T4	5T	Full-wave rect
5U4G	VT-244	5U4G	5U4G	5T	Full-wave rect
5V4G	VT-206-A	5V4G	5V4G	5L	Full-wave rect
5W4	VT-97	5W4	5W4	5T	Full-wave rect
5W4G	-----	-----	5W4G	5T	Full-wave rect
5W4GT	-----	5W4GT/G	5W4GT/G	5T	Full-wave rect
5X3	-----	-----	5X3	4C	Full-wave rect
5X4G	-----	5X4G	5X4G	5Q	Full-wave rect
5Y3G	-----	5Y3G	5Y3G	5T	Full-wave rect
5Y3GT	VT-197-A	5Y3GT	5Y3GT/G	5T	Full-wave rect
5Y4G	-----	-----	5Y4G	5Q	Full-wave rect
5Z3	VT-145	5Z3	5Z3	4C	Full-wave rect
5Z4	VT-74	5Z4	5Z4	5L	Full-wave rect
5Z4GT	-----	-----	5Z4GT/G	5L	Full-wave rect
EL-6C	-----	-----	4B25	T-38R	Full-wave gas rect
6A3	-----	6A3	6A3	4D	Triode power amplr
6A4/LA	-----	-----	6A4/LA	5B	Pentode power amplr
6A5G	-----	-----	6A5G	6T	Triode power amplr
6A6	-----	6A6	6A6	7B	Twin triode amplr
6A7	-----	6A7	6A7	7C	Pentagrid converter
6A8	-----	-----	6A8	8A	Pentagrid converter
6A8G	VT-151	6A8G	6A8G	8A	Pentagrid converter
6A8GT	VT-151-B	6A8GT	6A8GT/G	8A	Pentagrid converter
6AB5	-----	-----	6N5	6R	Electron-ray tube
6AB7	VT-176	6AB7	1853	8N	H-f pentode
			1853/6AB7		
6AC5G	-----	-----	6AC5G	6Q	High- μ triode amplr
6AC5GT	-----	-----	6AC5GT	6Q	High- μ triode amplr
6AC7	VT-112	6AC7	6AC7/1852	8N	H-f pentode
			1852		
6AD6G	-----	-----	6AD6G	7AG	Electron-ray tube
6AE5GT	-----	-----	6AE5GT/G	6Q	Triode amplr
6AE6G	-----	-----	6AE6G	7AH	Twin-plate triode
6AF6G	-----	-----	6AF6G	7AG	Electron-ray tube
6AG5	-----	6AG5	6AG5	7BD	Pentode r-f amplr
6AG7	VT-247	6AG7	6AG7	8Y	Pentode amplr

ALL TUBES	VT NUMBER	JAN TYPE	RMA & OTHER	RASE VIEW	DESCRIPTION
6AK5	-----	6AK5	731	7B0	Pentode variable- μ
6AK6	-----	-----	6AK6	7BK	Pentode r-f amplr
6B4G	-----	6B4G	6B4G	5S	Triode power amplr
6B5	-----	-----	6B5	6AS	Direct-coupled power amplr
6B7	VT-68	6B7	6B7	7D	Duo-diode pentode
6B8	VT-93	6B8	6B8	8E	Duo-diode pentode
6B8G	VT-93-A	6B8G	6B8G	8E	Duo-diode pentode
6C4	-----	6C4	6C4	6BG	Triode amplr
6C5	VT-65	6C5	6C5	6Q	Triode detecr-amplr
6C5G	VT-65-A	-----	6C5G	6Q	Triode detecr-amplr
6C5GT	-----	6C5GT/G	6C5GT/G	6Q	Triode detecr-amplr
6C6	-----	6C6	6C6	6F	Triple-grid amplr
6C8G	VT-163	6C8G	6C8G	8G	Twin-triode
6D6	VT-69	6D6	6D6	6F	R-f pentode remote cut-off
6D8G	-----	-----	6D8G	8A	Pentagrid converter
6E5	VT-215	6E5	6E5	6R	Electron-ray tube
6E6	-----	-----	6E6	7B	Twin triode amplr
6E7	-----	-----	6E7	7H	Triple-grid remote cut-off
6F5	-----	6F5	6F5	5M	High- μ triode
6F5G	-----	-----	6F5G	5M	High- μ triode
6F5GT	-----	6F5GT	6F5GT/G	5M	High- μ triode
6F6	VT-66	6F6	6F6	7S	Pentode power amplr
6F6G	VT-66-A	6F6G	6F6G	7S	Pentode power amplr
6F6GT	-----	-----	6F6GT/G	7S	Pentode power amplr
6F7	VT-70	6F7	6F7	7E	Triode pentode
6F8G	VT-99	6F8G	6F8G	8G	Twin triode
6G5	VT-98	6U5/6G5	6U5/6G5	5R	Electron-ray tube
			6U5		
6G6G	VT-98-A	6G6G	6G6G	7S	Pentode power amplr
6G7G	-----	-----	6G7G	7N	Duo-diode pentode
6H6	VT-90	6H6	6H6	7Q	Duo-diode
6H6GT	VT-90-A	6H6GT/G	6H6GT/G	7Q	Duo-diode
6J5	VT-94	6J5	6J5	6Q	Triode detecr-amplr
6J5G	VT-94-A	-----	6J5G	6Q	Triode detecr-amplr
6J5GT	VT-94-D	6J5GT/G	6J5GT/G	6Q	Triode detecr-amplr
6J6	-----	6J6	6J6	7BF	Twin triode
6J7	VT-91	6J7	6J7	7R	Pentode detecr-amplr
6J7G	-----	6J7G	6J7G	7R	Pentode detecr-amplr
6J7GT	VT-91-A	6J7GT	6J7GT/G	7R	Pentode detecr-amplr
6J8G	-----	-----	6J8G	8H	Triode-heptode
6K5G	-----	-----	6K5G	5U	High- μ triode
6K5GT	-----	-----	6K5GT/G	5U	High- μ triode
6K6G	VT-152-A	-----	6K6G	7S	Pentode power amplr
6K6GT	VT-152	6K6GT/G	6K6GT/G	7S	Pentode power amplr
6K7	VT-86	6K7	6K7	7R	R-f pentode remote cut-off
6K7G	VT-86-A	6K7G	6K7G	7R	R-f pentode remote cut-off
6K7GT	VT-86-B	6K7GT	6K7GT/G	7R	R-f pentode remote cut-off
6K8	VT-167	6K8	6K8	8K	Triode-hexode converter
6K8G	VT-167-A	6K8G	6K8G	8K	Triode-hexode converter
6K8GT	-----	6K8GT	6K8GT/G	8K	Triode-hexode converter
6L5G	VT-213-A	6L5G	6L5G	6Q	Triode detecr-amplr
6L6	VT-115	6L6	6L6	7AC	Beam-power amplr
6L6G	VT-115-A	6L6G	6L6G	7AC	Beam-power amplr
6L6GA	-----	6L6GA	-----	7AC	Beam-power amplr
6L6GX	-----	-----	6L6GX	7AC	Beam-power amplr
6L7	VT-87	-----	6L7	7T	Pentagrid mixer
6L7G	VT-87-A	-----	6L7G	7T	Pentagrid mixer
6N5	-----	-----	6A85/6N5	6R	Electron-ray tube
6N6G	-----	-----	6N6G	7AU	Direct-coupled amplr
6N7	VT-96	6N7	6N7	8B	Class B twin triode
6N7G	-----	-----	6N7G	8B	Class B twin triode
6N7GT	-----	6N7GT/G	6N7GT/G	8B	Class B twin triode
6P5GT	-----	-----	6P5GT/G	6Q	Triode amplr
6P7G	-----	-----	6P7G	7U	Triode-pentode
6Q6GT	-----	-----	6Q6GT	6Y	Diode-triode

REFERENCE DATA

ALL TUBES	VT NUMBER	JAN TYPE	RMA & OTHER	BASE VIEW	DESCRIPTION
6Q7	VT-92	6Q7	6Q7	7V	Duo-diode triode
6Q7G	VT-92-A	6Q7G	6Q7G	7V	Duo-diode triode
6Q7GT	-----	6Q7GT	6Q7GT/G	7V	Duo-diode triode
6R7	VT-88	6R7	6R7	7V	Duo-diode triode
6R7G	VT-88-A	6R7G	6R7G	7V	Duo-diode triode
6R7GT	VT-88-B	6R7GT	6R7GT/G	7V	Duo-diode triode
6S7	-----	-----	6S7	7R	Triple-grid remote cut-off
6S7G	-----	-----	6S7G	7R	Triple-grid remote cut-off
6SA7 Spec.	VT-150	6SA7	6SA7 Spec.	8R	Pentagrid converter
6SA7GT	VT-150-A	6SA7GT/G	6SA7GT	8CB	Pentagrid converter
6SC7	VT-105	6SC7	6SC7	8S	Twin triode
6SC7GT	-----	6SC7GT	6SC7GT	8S	Twin triode
6SD7GT	-----	6SD7GT	7SD7GT	8N	Triple-grid semi-remote cut-off
6SF5	-----	6SF5	6SF5	6AB	High- μ triode
6SF5GT	-----	6SF5GT	6SF5GT	6AB	High- μ triode
6SF7	-----	-----	6SF7	7AZ	Diode variable- μ pentode
6SG7	VT-211	6SG7	6SG7	8BK	Pentode semi-variable- μ
6SG7GT	-----	6SG7GT	6SG7GT	8BK	Pentode semi-variable- μ
6SH7	-----	6SH7	6SH7	8BK	H-f pentode amplr
6SH7GT	-----	6SH7GT	6SH7GT	8BK	H-f pentode amplr
6SH7L	-----	6SH7L	6SH7L	8BK	H-f pentode amplr
6SJ7	VT-116	6SJ7	6SJ7	8N	Pentode detectr-amplr
6SJ7 spc	VT-116-B	6SJ7Y	6SJ7 spc	8N	Pentode detectr-amplr
6SJ7GT	VT-116-A	6SJ7GT	6SJ7GT/G	8N	Pentode detectr-amplr
6SJ7Y	-----	-----	6SJ7 spc	8N	Pentode detectr-amplr
6SK7	VT-117	6SK7	6SK7	8N	R-f pentode remote cut-off
6SK7GT	VT-117-A	6SK7GT/G	6SK7GT	8N	R-f pentode remote cut-off
6SL7GT	VT-229	6SL7GT	6SL7GT	8BD	Twin triode
6SN7GT	VT-231	6SN7GT	6SN7GT	8BD	Twin triode
6SQ7	VT-103	6SQ7	6SQ7	8Q	Duo-diode triode
6SQ7GT	-----	6SQ7GT/G	6SQ7GT	8Q	Duo-diode triode
6SR7	VT-233	6SR7	6SR7	8Q	Duo-diode triode
6SR7GT	-----	6SR7GT	6SR7GT	8Q	Duo-diode triode
6SS7	VT-199	6SS7	6SS7	8N	R-f pentode remote cut-off
6ST7	VT-205	6ST7	6ST7	8Q	Duo-diode triode
6SU7GTY	-----	6SU7GTY	6SU7GTY	7CA	Twin triode amplr
6T7G	-----	-----	6T7G	7V	Duo-diode triode
6U5	VT-98	6U5/6G5	6G5	6R	Electron-ray tube
6U6GT	-----	-----	6U6GT	7AC	Beam-power amplr
6U7G	-----	-----	6U7G	7R	Triple-grid remote cut-off
6V6	VT-107	6V6	6V6	7AC	Beam-power amplr
6V6G	VT-107-B	6V6G	6V6G	7AC	Beam-power amplr
6V6GT	VT-107-A	6V6GT/G	6V6GT/G	7AC	Beam-power amplr
6V7G	-----	-----	6V7G	7V	Duo-diode triode
6W5G	VT-196	-----	6W5G	6S	Full-wave rect
6W7G	-----	-----	6W7G	7R	Triple-grid detectr-amplr
6X5	VT-126	6X5	6X5	6S	Full-wave rect
6X5G	VT-126-A	6X5G	6X5G	6S	Full-wave rect
6X5GT	VT-126-B	6X5GT/G	6X5GT/G	6S	Full-wave rect
6Y6G	VT-168-A	6Y6G	6Y6G	7AC	Beam-power amplr
6Z3	-----	1V	1V	4G	Half-wave rect
6Z4	VT-84	84/6Z4	84	5D	Full-wave rect
6Z5	-----	-----	6Z5	6K	Full-wave rect
6ZY5G	-----	6Z75G	6ZY5G	6S	Full-wave rect
6Z7G	-----	-----	6Z7G	8B	Twin triode amplr
7A4	VT-192	7A4	7A4	5AC	Triode detectr-amplr
7A5	-----	7A5	7A5	6AA	Beam-power amplr
7A6	-----	7A6	7A6	7AJ	Twin diode
7A7	-----	7A7	7A7	8V	Pentode remote cut-off
7A8	-----	7A8	7A8	8U	Multigrid converter
7B4	-----	7B4	7B4	5AC	High- μ triode
7B5	-----	7B5	7B5	6AE	Pentode power amplr
7B6	-----	-----	7B6	8W	Duo-diode triode
7B7	-----	7B7	7B7	8V	Pentode remote cut-off

REFERENCE DATA

ALL TUBES	VT NUMBER	JAN TYPE	RMA & OTHER	BASE VIEW	DESCRIPTION
788	VT-208	-----	788	8X	Pentagrid converter
7BP7	-----	-----	1813-P7	5BL	Electromagnetic cathode-ray
7CP1	-----	7CP1	1811-P1	6AZ	Electromagnetic cathode-ray
7C4	VT-243	7C4/1203-A	7C4	4AE	U-h-f diode
			1203-A		
7C5	-----	7C5	7C5	6AA	Beam tetrode power amplr
7C6	-----	7C6	7C6	8W	Duo-diode triode
7C7	VT-193	7C7	7C7	8V	Pentode detectr-amplr
7E5	VT-241	7E5/1201	1201	8BN	U-h-f triode
7E6	VT-188	7E6	7E6	8W	Duo-diode triode
7E7	-----	-----	7E7	8AE	Duo-diode triode
7F7	VT-189	7F7	7F7	8AC	Twin triode
7G7	-----	-----	7G7/1232	8V	Triple-grid amplr
			1232		
7H7	VT-190	7H7	7H7	8V	Triple-grid semi-variable- μ
7J7	VT-194	-----	7J7	8AR	Triode-hexode converter
7K7	-----	-----	7K7	8BF	Duo-diode high- μ triode
7L7	-----	7L7	7L7	8V	Triple grid amplr
7N7	-----	7N7	7N7	8AC	Twin triode
7Q7	-----	-----	7Q7	8AL	Pentagrid converter
7R7	-----	-----	7R7	8AE	Duo-diode pentode
7S7	-----	-----	7S7	8BL	Triode hexode converter
7V7	-----	7V7	7V7	8V	Triple-grid amplr
7W7	-----	7W7	1282	8BJ	Triple-grid variable- μ
7Y4	-----	7Y4	7Y4	5AB	Full-wave rect
7Z4	VT-181	7Z4	7Z4	5AB	Full-wave rect
9AP4	-----	-----	1804-P4	6AL	Electromagnetic cathode-ray
9CP4	-----	-----	9CP4	4AF	Electromagnetic cathode-ray
9GP1	-----	-----	-----	5BM	Electromagnetic cathode-ray
9GP7	-----	-----	9GP7	5BM	Electromagnetic cathode-ray
9HP1	-----	-----	9HP1	5BM	Electromagnetic cathode-ray
10	VT-25	10Y	210	4D	Triode power amplr
			RK-10		
10 spc	VT-25-A	VT-25-A	10 spc	4D	Triode power amplr
10Y	-----	-----	210	4D	Triode power amplr
RK-10	-----	801-A	10	4D	Triode power amplr
			801A/801		
RK-11	-----	-----	RK-11	T-4BB	Xmtg triode
WX-12	VT-7	-----	WX-12	4D	Triode detectr-amplr
12A	-----	112A	112A	4D	Triode detectr-amplr
12A5	-----	-----	12A5	7F	Pentode power amplr
12A6	VT-134	12A6	12A6	7AC	Beam power amplr
12A6GT	-----	12A6GT	12A6GT	7AC	Beam power amplr
12A7	-----	-----	12A7	7K	Diode pentode
12A8GT	-----	-----	12A8GT	8A	Pentagrid converter
12AH7GT	VT-207	12AH7GT	12AH7GT	8BE	Twin triode
12AP4	-----	-----	1803-P4	6AL	Electromagnetic cathode-ray
12B7	-----	-----	12B7/14A7	8V	Triple-grid variable- μ
			14A7		
12B8GT	-----	-----	12B8GT	8T	Triode-pentode
12CP4	-----	-----	12CP4	4AF	Electromagnetic cathode-ray
12C8	VT-169	12C8	12C8	8E	Duo-diode pentode
12C8 spc	VT-153	VT-153	12C8 spc	8E	Duo-diode pentode
12F5GT	-----	-----	12F5GT	5M	Triode amplr
12H6	VT-214	12H6	12H6	7Q	Duo-diode
12J5	VT-135-A	12J5	12J5	6Q	Triode detectr-amplr
12J5GT	VT-135	12J5GT	12J5GT	6Q	Triode detectr-amplr
12J7GT	-----	-----	12J7GT	7R	Pentode voltage amplr
12K7GT	-----	-----	12K7GT/G	7R	Pentode remote cut-off
12K8 spc	VT-132	12K8Y	12K8 spc	8K	Triode hexode converter
12K8GT	-----	-----	12K8GT	8K	Triode hexode converter
12L8GT	-----	12L8GT	12L8GT	8BU	Twin power amplr pentode
12Q7GT	-----	12Q7GT	12Q7GT	7V	Duo-diode triode

REFERENCE DATA

ALL TUBES	VT NUMBER	JAN TYPE	RMA & OTHER	BASE VIEW	DESCRIPTION
12SA7	VT-161	12SA7	12SA7	8R	Pentagrid converter
12SA7GT	-----	12SA7GT/G	12SA7GT	8R	Pentagrid converter
12SC7	VT-268	12SC7	12SC7	8S	Twin triode
12SF5	-----	-----	12SF5	8P	High- μ triode
12SF5GT	-----	-----	12SF5GT	8P	High- μ triode
12SF7	-----	12SF7	12SF7	7AZ	Diode variable- μ pentode
12SG7	VT-209	12SG7	12SG7	8BK	Triple-grid variable- μ
12SG7GT	-----	12SG7GT	12SG7GT	8BK	Triple-grid variable- μ
12SH7	VT-288	12SH7	12SH7	8BX	Pentode h-f amplr
12SH7GT	-----	12SH7GT	12SH7GT	8BK	Pentode h-f amplr
12SJ7	VT-162	12SJ7	12SJ7	8N	Pentode detectr-amplr
12SJ7GT	-----	12SJ7GT	12SJ7GT	8N	Pentode detectr-amplr
12SK7	VT-131	12SK7	12SK7	8N	Pentode variable- μ
12SK7GT	-----	12SK7GT/G	12SK7GT	8N	Pentode variable- μ
12SL7GT	VT-289	12SL7GT	12SL7GT	8BD	Twin triode
12SN7GT	-----	12SN7GT	12SN7GT	8BD	Twin triode
12SQ7	VT-104	12SQ7	12SQ7	8Q	Duo-diode triode
12SQ7GT	-----	12SQ7GT	12SQ7GT	8Q	Duo-diode triode
12SR7	VT-133	12SR7	12SR7	8Q	Duo-diode triode
12SR7GT	-----	12SR7GT	12SR7GT	8Q	Duo-diode triode
12Z3	-----	-----	HZ-50	46	Half-wave rect
14AF7	-----	-----	XXD	8AC	Twin triode
14A7	-----	-----	12B7	8V	Triple-grid variable- μ
14F7	-----	14F7	14F7	8AC	Twin triode
14N7	-----	14N7	14N7	8AC	Twin triode
15E	-----	15E	8023	None	U-h-f triode
15R	-----	15R	8022	T-3C	Half-wave rect
RK-18	-----	-----	RK-18	T-4BB	Xmtg triode
FG-17	-----	-----	967		
19	-----	19	19	6C	Twin triode amplr
RK-20A	-----	-----	RK-20A	T-5C	Xmtg pentode
T-20	-----	-----	T-20	30	Xmtg triode
TZ-20	-----	-----	TZ-20	30	Xmtg triode
KY-21	-----	-----	KY-21		Gas triode
RK-21	-----	-----	RK-21	4AB	Half-wave rect
T-21	-----	-----	RK-49	T-6B	Xmtg beam power amplr
22	VT-26	22	22	4K	Tetrode r-f amplr
RK-22	-----	3826	3823	T-4AG	Full-wave rect
RK-23	-----	-----	RK-23	T-7C	Xmtg pentode
HK-24	-----	-----	HK-24	T-4L	Xmtg triode
24-A	VT-28	24-A	24	5E	Tetrode r-f amplr
HK-24-G	VT-204	3C24	3C24	T-4BC	Xmtg triode
RK-24	-----	-----	RK-24	4D	Triode amplr
HY-24	-----	-----	HY-24	T-4L	Xmtg triode
HY-25	-----	-----	HY-25	T-4BB	Xmtg triode
RK-25	-----	-----	RK-25	T-7C	Xmtg pentode
RK-25-A	-----	-----	RK-25-A	T-7C	Xmtg pentode
RK-25-B	-----	-----	RK-25-B	T-7C	Xmtg pentode
VT-25-A	VT-25-A	VT-25-A	10 spc	T-4L	Xmtg triode
25A6	-----	-----	25A6	7S	Pentode power amplr
25A6GT	-----	-----	25A6GT/G	7S	Pentode power amplr
25A7GT	-----	-----	25A7GT/G	8F	Diode pentode
25C6G	-----	-----	25C6G	7AC	Beam-power amplr
25L6	VT-201	25L6	25L6	7AC	Beam-power amplr
25L6G	-----	-----	25L6G	7AC	Beam-power amplr
25L6GT	VT-201-C	25L6GT/G	25L6GT/G	7AC	Beam-power amplr
25S	-----	-----	185	6M	Duo-diode triode
25Z5	-----	25Z5	25Z5	6E	Rect doubler
25Z6	-----	-----	25Z6	7Q	Rect doubler
25Z6G	-----	-----	25Z6G	7Q	Rect doubler
25Z6GT	-----	-----	25Z6GT/G	7Q	Rect doubler
26	-----	-----	26	4D	Triode amplr
27	-----	-----	27	5A	Triode amplr
RK-28A	-----	28D7	28D7	T-5C	Xmtg pentode

REFERENCE DATA

ALL TUBES	VT NUMBER	JAN TYPE	RMA & OTHER	BASE VIEW	DESCRIPTION
30	VT-27	30	30	4D	Triode amplr
30 spc	VT-67	VT-67	30 spc	4D	Triode amplr
HY-30-Z	-----	-----	HY-30-Z	T-4BE	Xmtg triode
RK-30	-----	-----	RK-30	T-4BC	Xmtg triode
31	VT-31	31	31	4D	Triode power amplr
HY-31-Z	-----	-----	NU-31-Z	T-4D	Xmtg twin triode
RK-31	-----	-----	RK-31	30	Xmtg triode
32	VT-44	32	32	4K	Tetrode r-f amplr
33	VT-33	33	33	5K	Pentode power amplr
RK-33	-----	2C21	2C21	7BH	Twin triode
			1642		
34	VT-54	34	34	4M	Pentode variable- μ
RK-34	VT-224	-----	2C34	T-7DC	Xmtg twin triode
35	VT-35	35	35/51	5E	Tetrode variable- μ
35A5	-----	35A5	35A5	6AA	Beam power amplr
35L6GT	-----	35L6GT	35L6GT/G	7AC	Beam power amplr
35T	-----	35T	35T	30	Xmtg triode
35TG	-----	-----	35TG	T-4BC	Xmtg triode
RK-35	-----	-----	RK-35	T-4BC	Xmtg triode
UH-35	-----	-----	UH-35	30	Xmtg triode
35Z3	-----	-----	35Z3	4Z	Half-wave rect
35Z4GT	-----	-----	35Z4GT	5AA	Half-wave rect
35Z5GT	-----	35Z5GT/G	35Z5GT	6AD	Half-wave rect
35Z6GT	-----	-----	35Z6GT	7Q	Rect voltage doubler
36	VT-36	36	36	5E	Tetrode detectr-amplr
RK-36	-----	-----	RK-36	T-4BC	Xmtg triode
37	VT-37	37	37	5A	Triode detectr-amplr
RK-37	-----	-----	RK-37	T-4BC	Xmtg triode
38	VT-38	38	38	5F	Pentode power amplr
RK-38	-----	-----	RK-38	T-4BC	Xmtg triode
39	VT-49	39/44	39	5F	Pentode variable- μ
			39/44		
RK-39	VT-100	807	807	5AW	Xmtg beam-tetrode r-f amplr
WE-39-DY1	VT-142	-----	-----		
40	VT-40	40	40	4D	Triode voltage amplr
40Z5	-----	-----	45Z5GT	6AD	Half-wave rect
HY-40	-----	-----	HY-40	30	Xmtg triode
HY-40-Z	-----	-----	HY-40-Z	30	Xmtg triode
T-40	-----	-----	T-40	30	Xmtg triode
TZ-40	-----	-----	TZ-40	30	Xmtg triode
41	VT-48	41	41	6B	Pentode power amplr
RK-41	-----	-----	RK-41	T-5BB	Tetrode power amplr
42	-----	42	42	6B	Pentode power amplr
RK-42	-----	-----	RK-42	4D	Triode amplr
43	-----	43	43	6B	Pentode power amplr
RK-43	-----	-----	RK-43	6C	Twin triode amplr
44	VT-49	39/44	39/44	5F	Pentode variable- μ
			39		
45	VT-45	45	45	4D	Triode amplr
45 spc	VT-52	38142	45 spc	4D	Triode amplr
RK-45	-----	-----	RK-45	T-7C	Xmtg pentode
45Z5GT	-----	-----	45Z5GT	6AD	Half-wave rect
			40Z5		
46	VT-63	46	46	5C	Dual grid power amplr
47	VT-47	47	47	5B	Pentode amplr
RK-47	VT-154	814	814	T-5D	Xmtg beam tetrode
			RK-47		
RK-48-A	-----	-----	RK-48-A	T-5D	Xmtg beam tetrode
49	-----	-----	49	5C	Dual-grid power amplr
RK-49	-----	-----	RK-49	T-6B	Xmtg beam tetrode
			T-21		
50	VT-50	50	50	4D	Triode amplr
50L6GT	-----	50L6GT	50L6GT	7AC	Beam power amplr
50T	-----	-----	50T	T-4BC	Xmtg triode
HZ-50	-----	-----	1223	4G	Half-wave rect

REFERENCE DATA

ALL TUBES	VT NUMBER	JAN TYPE	RMA & OTHER	BASE VIEW	DESCRIPTION
UH-50	-----	UH-50	UH-50	T-48C	Xmtg triode
50Y6GT	-----	-----	50Y6GT	7Q	Full-wave rect
50Z7G	-----	-----	50Z7G	8AN	Voltage doubling rect
5I	-----	35	35	5E	Tetrode variable- μ
			35/51		
HY-51-Z	-----	-----	HY-51-Z	30	Xmtg triode
RK-51	-----	-----	RK-51	30	Xmtg triode
RK-52	-----	-----	RK-52	30	Xmtg triode
53	-----	53	53	7B	Twin triode amplr
54	-----	-----	54		
RK-54	-----	-----	RK-54		
55	-----	-----	55	6G	Duo-diode triode
T-55	-----	-----	T-55	30	Xmtg triode
56	VT-56	56	56	5A	Triode detectr-amplr
RK-56	-----	-----	RK-56	T-5BB	Xmtg tetrode
57	VT-57	57	57	6F	Pentode detectr-amplr
FG-57	-----	FG-57	FG-57	3Z	Thyratron-mercury
RK-57	-----	-----	RK-57	T-3AB	Xmtg triode
58	VT-58	58	58	6F	Pentode variable- μ
59	VT-59	59	59	7A	Pentode power amplr
RK-59	-----	-----	RK-59	T-4D	Xmtg triode
HY-60	-----	-----	HY-60	T-5BB	Xmtg tetrode
RK-60	-----	-----	RK-60	T-4AG	Full-wave rect
HY-61	VT-100	807	RK-39	T-5BB	Xmtg beam power amplr
RK-62	-----	-----	RK-62	4D	Gas triode
RK-63	-----	-----	RK-63	T-3AC	Xmtg triode
HY-64	-----	-----	RK-64	T-5BB	Xmtg tetrode
RK-65	-----	65	65	5E	Xmtg tetrode
RK-66	-----	-----	RK-66	T-5C	Xmtg pentode
HY-67	-----	-----	HY-67	T-5DB	Xmtg tetrode
30 spc	VT-67	VT-67	30 spc	4D	Triode amplr
HY-69	-----	-----	HY-69	T-5D	Xmtg tetrode
DT-70	-----	2E22	TS-70	T-5C	Pentode amplr osc
TS-70	-----	2E22	2E22	T-5C	Pentode amplr osc
V-70-D	-----	-----	V-70-D	T-4BB	Xmtg triode
70A7GT	-----	-----	70A7GT	8AB	Diode-beam tetrode
70L7GT	-----	-----	70L7GT	8AA	Diode-beam tetrode
71A	-----	71A	71A	4D	Triode amplr
72R	-----	72	CE-72	4P	Half-wave rect
CE-72	-----	-----	72R	4P	Half-wave rect
RKR-72	-----	-----	72-R	4P	Half-wave rect
75	VT-75	75	75	6G	Duo-diode triode
HY-75	-----	-----	HY-75	T-8AC	Xmtg triode
75T	-----	75TL	75T	T-48C	Xmtg triode
TW-75	-----	-----	TW-75	T-48C	Xmtg triode
VR-75-30	VT-260	0A3/VR-75	VR-75-30	4SB	Voltage regulator
76	VT-76	76	76	5A	Triode detectr amplr
77	VT-77	77	77	6F	Triple-grid detectr
78	VT-78	78	78	6F	Triple-grid variable- μ
79	-----	79	79	6H	Twin triode amplr
80	VT-80	80	80	4C	Full-wave rect
81	-----	81	81	4B	Half-wave rect
82	-----	82	82	4C	Full-wave rect
83	VT-83	83	83	4C	Full-wave rect
83V	-----	83V	83V	4L	Full-wave rect
84	VT-84	84/6Z4	6Z4	5D	Full-wave rect
85	-----	85	85	6G	Duo-diode triode
89	VT-89	89Y	89	6F	Pentode power amplr
VR-90-30	VT-184	0B3/VR-90	VR-90-30	4SB	Voltage regulator
100-R	-----	100-R	100-R	T-4AD	Half-wave rect
100TH	VT-218	100-TH	100-TH	T-48C	Xmtg triode
100-TS	VT-127	60TL	100-TS	T-48C	Xmtg triode
HF-100	-----	-----	4C22	T-48C	Xmtg triode
101-D	-----	-----	101-D	T-4L	Triode amplr
101-F	-----	-----	101-F	T-4L	Triode amplr

REFERENCE DATA

ALL TUBES	VT NUMBER	JAN TYPE	RMA & OTHER	BASE VIEW	DESCRIPTION
FG-105	-----	FG-105	FG-105	T-5A	Thyratron-mercury
VR-105-30	VT-200	OC3/VR-105	VR-105-30	4SB	Voltage regulator
112-A	-----	112-A	12-A	4D	Triode detectr-amplr
HY-114-B	VT-234	114-B	HY-114-B	T-8AC	Xmtg triode
HY-115	-----	-----	HY-115	5K	Pentode voltage amplr
117L7GT	-----	-----	117L/M7GT	8A0	Rect-amplr
117M7GT	-----	-----	117L7GT	8A0	Rect-amplr
117N7GT	-----	-----	117N7GT	8AV	Rect-amplr
117P7GT	-----	-----	117P7GT	8AV	Rect-amplr
117Z6GT	-----	-----	117Z6GT	7Q	Full-wave rect
C-120	-----	120	ZB-120	T-3AA	Xmtg triode
			3C21		
ZB-120	-----	-----	3C21	T-3AA	Xmtg triode
			C-120		
HY-125	-----	-----	HY-125	5K	Pentode power amplr
T-125	-----	-----	T-125	T-3AC	Xmtg triode
128-A	-----	128-A	128-A	None	R-f power amplr
			F-128-A		
HF-130	-----	-----	HF-130	None	Xmtg triode
HF-140	-----	-----	HG-140	None	Xmtg triode
AB-150	-----	-----	AB-150	None	Xmtg triode
HF-150	-----	-----	HF-150	None	Xmtg triode
TW-150	-----	-----	TW-150	T-3AC	Xmtg triode
VR-150-30	VT-139	OD3/VR-150	VR-150-30	4SB	Voltage regulator
150T	-----	-----	150T	T-3AC	Xmtg triode
GL-152	-----	-----	150T	T-4BG	Xmtg triode
152TH	-----	152TH	GL-152	T-4BG	Xmtg triode
152-TL	-----	152-TL	152-TL	T-4BF	Xmtg triode
VT-153	VT-153	VT-153	12C8 spc	8E	Duo-diode pentode
HK-154	-----	-----	HK-154	T-4BC	Xmtg triode
QGM-159	-----	-----	1005	5AQ	Full wave hot/cold cathode rect
GL-169	-----	-----	GL-169	T-4BG	Xmtg triode
HF-200	-----	-----	HF-200	T-3AC	Xmtg triode
T-200	-----	-----	T-200	T-3AC	Xmtg triode
203A	VT-1	203A	303A	T-3AA	Xmtg triode
HD-203-A	-----	-----	HD-203-A	T-3AB	Xmtg triode
203-B	-----	-----	203-B	T-3AB	Xmtg triode
203-H	-----	-----	203-H	T-3AB	Xmtg triode
203-Z	-----	-----	203-Z	T-3AB	Xmtg triode
204-A	VT-22	204-A	204-A	None	Xmtg triode
205-B	-----	-----	205-B	T-4L	Xmtg triode
205-D	-----	-----	205-D	T-4L	Xmtg triode
207	VT-34	207	F-307-A		Xmtg triode
210-T	-----	-----	210-T	4D	Xmtg triode
211	VT-4-B	-----	211	T-3AA	Xmtg triode
HD-211	-----	-----	211-H	T-3AA	Xmtg triode
211 spc	VT-4-C	211	211 spc	T-3AA	Xmtg triode
211-H	-----	-----	HD-211	T-3AA	Xmtg triode
212-E	-----	212-E	212-E	T-2A	Xmtg triode
			38112		
217-A	-----	217-A	217-A	T-3A	Half-wave rect
217-C	-----	217-C	217-C	T-3A	Half-wave rect
218	-----	218	218	T-2B	Half-wave rect
221-A	-----	371		T-2B	Half-wave rect
Z-225	-----	-----	Z-225	T-4AD	Half-wave rect
241-B	-----	-----	241-B	T-2A	Xmtg triode
242-A	-----	-----	242-A	T-3AA	Xmtg triode
242-C	-----	-----	242-C	T-3AA	Xmtg triode
250-TH	VT-220	250-TH	250-TH	T-3AC	Xmtg triode
250-TL	VT-130	250-TL	250-TL	T-3AC	Xmtg triode
252-A	-----	-----	252-A	4D	Xmtg triode
254	-----	-----	HK-254	T-3AC	Xmtg triode
254-A	-----	-----	254-A	T-4C	Xmtg tetrode
257	-----	4E27	HK-257	5B	Pentode power amplr
			4E27		

REFERENCE DATA

ALL TUBES	VT NUMBER	JAN TYPE	RMA & OTHER	BASE VIEW	DESCRIPTION
261A	-----	-----	261A	T-3AA	Xmtg triode
274B	-----	274B	274B	5T	Full-wave rect
276A	-----	-----	276B	6-AT	Full-wave rect
282A	-----	282A	282A	T-4C	Xmtg tetrode
282B	-----	282B	282B	4AR	Tetrode amplr
284D	-----	-----	284D	T-3AA	Xmtg triode
293A	-----	-----	293A	5G	Twin triode
HF-300	-----	-----	HF-300	T-3AC	Xmtg triode
			C-300		
C-300	-----	-----	HF-300	T-3AC	Xmtg triode
303A	VT-1	203A	203A	T-3AA	Xmtg triode
304B	-----	-----	304B	T-4BC	Xmtg triode
304TH	VT-254	304-TH	304-TH	T-3AE	Xmtg triode
304-TL	VT-129	304-TL	304-TL	T-4BF	Xmtg triode
305A	-----	-----	305A	T-4CE	Xmtg triode
306A	-----	-----	306A	T-5CB	Xmtg pentode
F-307	-----	-----	207	None	Xmtg triode
307A	VT-225	307A	307A	T-5C	Xmtg pentode
311	-----	-----	311	T-3AA	Xmtg triode
312A	-----	312A	312A	T-6C	Xmtg pentode
316A	VT-191	316A	316A	T-316	U-h-f triode
342B	-----	-----	342B	T-3AA	Xmtg triode
350A	VT-230	-----	-----	5AW	Beam power tetrode
F-353-A	VT-42-A	872A	872	T-2B	Half-wave rect
			353A		
354	-----	-----	HK-354	T-3AC	Xmtg triode
354A thru 354F	-----	-----	HK-354A thru 354F	T-3AC	Xmtg triode
371A	VT-166	371	WE-371A	T-2B	Half-wave rect
			221A		
371B	-----	371B	371B	T-2B	Half-wave rect
376A	-----	-----	376A	T-3AA	Xmtg triode
393A	-----	393A	393A	T-3AG	Thyratron gas and mercury
394A	-----	394A	394A	T-3AG	Thyratron gas and mercury
450-TH	VT-108	450-TH	450-TH	T-3AC	Xmtg triode
450-TL	-----	450-TL	450-TL	T-3AC	Xmtg triode
454-H	-----	-----	HK-454-H	T-3A	Xmtg triode
483	-----	-----	483	4D	Triode power amplr
530	VT-122	-----	WL-530		
532A	-----	1B32	1B32	None	Half-wave rect
			GA-5		
575A	VT-187	-----	575A		
578	VT-267	-----	578		
615	VT-235	615	HY-615	3P	U-h-f xmtg triode
705A	VT-255	705A	8021	T-2AC	Half-wave rect
713A	-----	713A	713A	6BH	U-h-f pentode sharp cut-off
717A	VT-269	717A	717A	6BJ	U-h-f pentode sharp cut-off
731	-----	-----	6AK5	6BD	Pentode amplr
750-TH	-----	750-TH	750-TH	T-4BC	Xmtg triode
750-TL	-----	750-TL	750-TL	T-4BC	Xmtg triode
756	-----	-----	756	T-4B	Xmtg triode
800	VT-64	800	800	T-4BC	Xmtg triode
801	VT-62	801A	801	T-4B	Xmtg triode
			801A		
801A	-----	801A	801A	T-4B	Xmtg triode
802	-----	-----	802	T-7C	Xmtg pentode
803	VT-106	803	803	T-5C	Xmtg pentode
804	-----	-----	804	T-5C	Xmtg pentode
805	VT-143	805	805	T-3AB	Xmtg triode
806	-----	-----	806	T-3AC	Xmtg triode
807	VT-100	807	RK-39	T-5BB	Xmtg beam-power tetrode
			HY-61		
807A	VT-100A	807	807A	T-5BB	Xmtg beam-power tetrode
808	-----	808	808	T-4BC	Xmtg triode
809	-----	809	809	T-4BB	Xmtg triode

REFERENCE DATA

ALL TUBES	VT NUMBER	JAN TYPE	RMA & OTHER	BASE VIEW	DESCRIPTION
810	-----	-----	810	T-3AC	Xmtg triode
811	VT-217	811	811	30	Xmtg triode
812	-----	812	812	30	Xmtg triode
813	VT-144	813	813	58A	Xmtg tetrode
814	VT-154	814	RK-47	T-5D	Xmtg tetrode
815	VT-287	815	815	T-8FA	Xmtg twin beam tetrode
816	VT-216	816	816	4D	Half-wave rect
825	-----	-----	825	T-48	Xmtg triode
826	-----	826	826	T-9A	Xmtg triode
828	-----	-----	828	T-5C	Xmtg pentode
829	VT-259	829B	829	T-9B	Xmtg twin tetrode
829-A	-----	-----	829A, 3E29	T-9B	Xmtg Push Pull Beam Power tetrode
830	-----	-----	830	T-4B	Xmtg triode
830-B	-----	-----	930-B	T-48B	Xmtg triode
832	VT-118	832	832	T-9B	Xmtg dual-tetrode
832-A	VT-286	-----	832-A	T-9B	Xmtg dual-tetrode
833-A	-----	833-A	833-A	None	Xmtg pentode
834	-----	-----	834	T-4BC	Xmtg triode
836	VT-236	836	836	T-4AD	Half-wave rect
837	VT-101	837	837	68M	Xmtg pentode
838	-----	838	838	T-3BZ	Triode amplr Class B
840	-----	-----	840	5J	Pentode r-f amplr
841	VT-51	841	841	4D	Xmtg triode
841-A	-----	-----	841-A	30	Xmtg triode
842	VT-72	842	842	4D	Triode class A amplr
843	VT-73	843	843	5A	Xmtg triode
845	VT-43	845	845	T-3BZ	Xmtg triode
846	-----	846	846	None	Xmtg triode
849	-----	849	849	T-3BC	Xmtg triode
850	VT-60	850	-----	T-3B	Xmtg tetrode
851	VT-41	851	851	T-48C	Xmtg triode
852	-----	852	852	T-48C	Xmtg triode
857-B	-----	857-B	857-B	None	Half-wave rect
858	-----	858	858	None	Xmtg triode
860	VT-17	860	860	T-4C8	Xmtg tetrode
861	VT-19	861	861	T-3Y	Xmtg triode
862	-----	862	862	None	Xmtg triode
864	VT-24	864	864	4D	Triode amplr
865	VT-55	865	865	4AR	Xmtg tetrode
866	VT-46	-----	966	4P	Half-wave rect
866-A	VT-46-A	866-A/866	966-A	4P	Half-wave rect
866 Jr.	-----	-----	2826	4P	Half-wave rect
868	-----	868	868	4AL	Gas phototube
869-B	-----	869-B	869-B	T-2B	Half-wave rect
870-A	-----	870-A	870-A	None	Half-wave rect
871	-----	871	871	T-4AD	Half-wave rect
872	VT-42	-----	872	T-3A	Half-wave rect
872-A	VT-42-A	872-A	872-A	T-3A	Half-wave rect
874	-----	874	874	4S	Voltage regulator
876	-----	876	876	Mogul	Current regulator
878	-----	878	878	T-4AD	Half-wave rect
879	VT-119	2X2	2X2	T-4AD	Half-wave rect
			2X2/879		
880	-----	-----	880	T-3AJ	Xmtg triode
884	VT-222	884	884	6Q	Gas triode
885	-----	885	885	5A	Gas triode
886	-----	886	886	Mogul	Current regulator
887	-----	-----	887	None	Xmtg triode r-f power amplr
888	-----	-----	888	None	Xmtg triode r-f power amplr
889	-----	-----	889	T-3BY	Xmtg triode
893	-----	893	893	None	Xmtg triode
893-R	-----	-----	893-R	None	Xmtg triode
898	-----	-----	898	T-5CD	Xmtg triode
902-P1	-----	902-P1	902-P1	Fig A	Electrostatic cathode ray

REFERENCE DATA

ALL TUBES	VT NUMBER	JAN TYPE	RMA & OTHER	BASE VIEW	DESCRIPTION
904	-----	-----	904	Fig C	Electrostatic cathode ray
905	-----	5AP4	1805-P4	10A	Electrostatic cathode ray
906-P1	-----	3AP1	3AP1	7BN	Electrostatic cathode ray
			3AP/906-P1		
906-P4	-----	-----	3AP4/906-P4	7BN	Electrostatic cathode ray
907	-----	-----	907	Fig D	Electrostatic cathode ray
908	-----	-----	908	7BN	Electrostatic cathode ray
913	-----	-----	913	Fig A	Electrostatic cathode ray
914	-----	914	914	Fig B	Electrostatic cathode ray
917	-----	-----	917	4BD	Photo tube
918	VT-246	918	918	4AL	Gas photo tube
919	-----	-----	919	4BE	Photo tube
920	-----	1C21	1C21	4V	Gas triode
921	-----	921	921	None	Gas photo tube
922	-----	-----	922	None	Photo tube
923	VT-252	923	923	4AL	Gas photo tube
924	-----	-----	924	Screw	Gas Photo tube
925	-----	-----	925	4BA	Phototube
926	-----	-----	926	None	Phototube
927	-----	927	927		Gas phototube
929	-----	-----	929	4BA	Phototube
930-B	-----	-----	830-B	T-4BB	Xmtg triode
931	-----	931-A	931	11-AA	Phototube, multiplier-9 stage
938	-----	-----	938	T-3AA	Xmtg triode
951	-----	-----	951	4M	Pentode r-f amplr
954	VT-120	954	954	6BB	U-h-f pentode detectr-amplr
955	VT-121	955	955	5BC	U-h-f triode detectr
956	VT-238	956	956	5BB	U-h-f pentode variable- μ
957	VT-237	957	957	5BD	U-h-f triode detectr-amplr
958	VT-212	-----	958	5BD	U-h-f triode a-f amplr osc
958-A	-----	958-A	958-A	5BD	Acorn triode
959	-----	959	959	Fig E	Pentode detectr-amplr
966	VT-46	-----	866	T-4AD	Half-wave rect
966-A	VT-46-A	-----	866-A	T-4AD	Half-wave rect
967	-----	-----	FG-17		Mercury-vapor triode
972-A	VT-42-A	872-A	872-A	T-3A	Half-wave rect
975-A	-----	-----	975-A	T-3A	Half-wave rect
991	-----	991	991	Bayonet	Voltage regulator
1005	VT-195	1005	QGM-159	5-AG	Full-wave, hot/cold cathode rect
1006	VT-249	1006	1006	4C	Full-wave, hot/cold cathode rect
E-1148	VT-232	-----	E-1148		
1201	VT-241	7E5/1201	7E5	8BN	U-h-f triode
1203-A	VT-243	7C4/1203-A	7C4	4AE	U-h-f diode
1221	-----	-----	1221	6F	Triple-grid amplr
HY-1231-Z	-----	-----	HY-1231-Z	T-4D	Xmtg triode
1223	-----	-----	1223	7R	Pentode amplr
1231	-----	-----	1231	8V	Pentode amplr
1232	-----	-----	7G7	8V	Triple-grid amplr
HY-1269	-----	-----	HY-1269	T-5DB	Xmtg tetrode
1282	-----	7W7	7W7	8BJ	Triple-grid variable- μ
1291	VT-182	387/1291	387	7A1	U-h-f twin triode
1294	VT-183	1R4/1294	1R4	4A1	U-h-f diode
1299	VT-185	3D6/1299	3D6	6BB	U-h-f tetrode
1500T	-----	1500T	1500T	T-4CA	Xmtg triode
1602	-----	-----	1602	T-4L	Xmtg triode
1603	-----	-----	1603	6F	Triple-grid amplr
1608	-----	-----	1608	T-4L	Xmtg triode
1609	-----	-----	1609	5B	Pentode amplr
1610	-----	-----	1610	T-5CA	Xmtg tetrode
1612	-----	-----	1612	7T	Pentagrid converter
1613	VT-175	1613	1613	T-8CB	Xmtg tetrode
1614	-----	-----	1614	7AC	Xmtg tetrode
1616	VT-266	1616	866-Jr.	4B	Half-wave rect
1619	VT-164	1619	1619	7AC	Xmtg tetrode

REFERENCE DATA

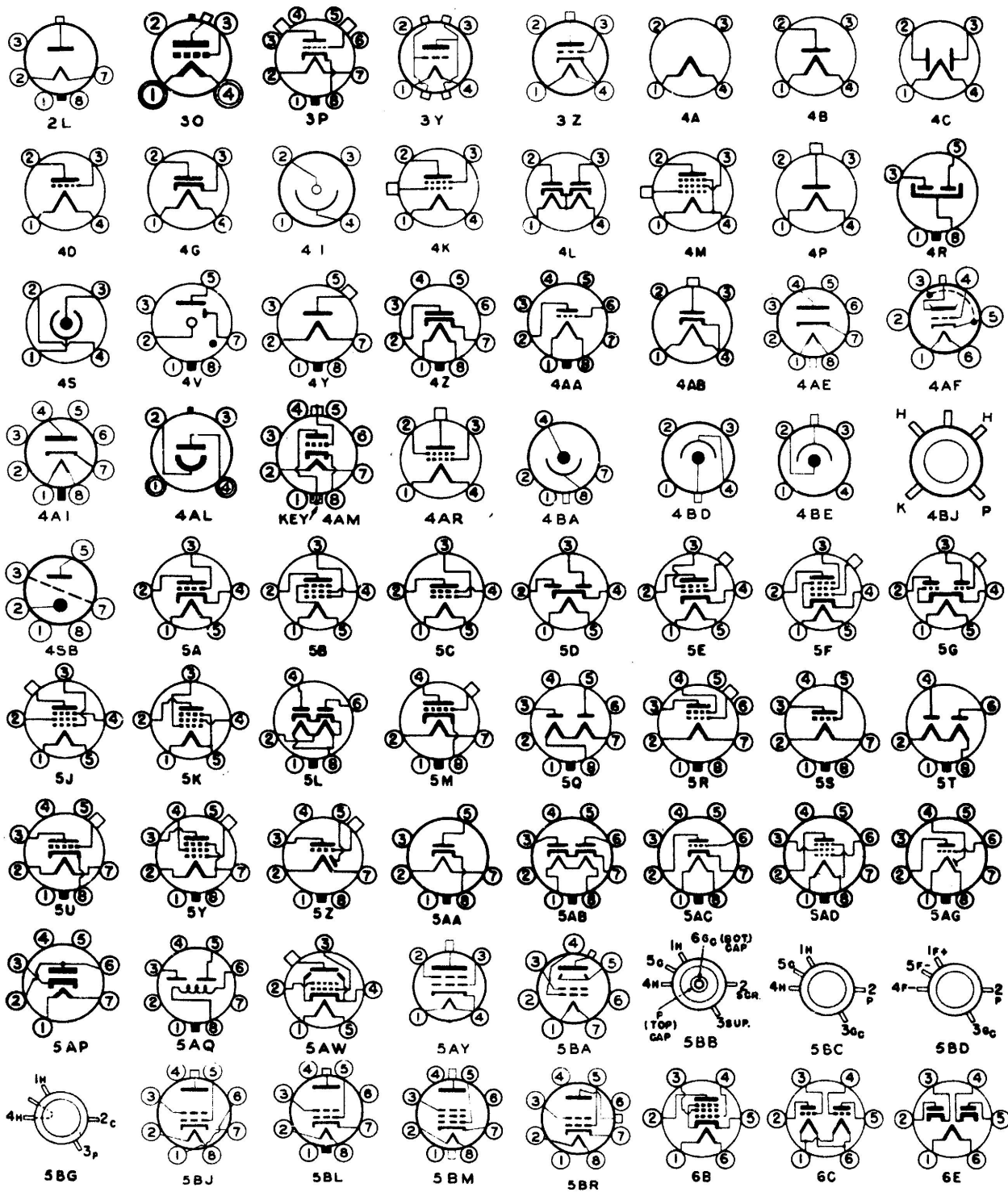
ALL TUBES	VT NUMBER	JAN TYPE	RMA & OTHER	BASE VIEW	DESCRIPTION
1620	-----	-----	1620	7R	Triple-grid detectr-amplr
1621	-----	-----	1621	7S	Pentode power amplr
1622	-----	-----	1622	7AC	Beam power amplr
1623	-----	-----	1623	30	Xmtg triode
1624	VT-165	1624	1624	T-5DC	Xmtg tetrode
1625	VT-136	1625	1625	T-5BB	Xmtg tetrode
1626	VT-137	1626	1626	T-8AD	Xmtg triode
1627	-----	-----	1627	T-3AC	Xmtg triode
1629	VT-138	1629	1629	6RA	Electron-ray
1630	VT-128	1630	A-5588	8BZ	Orbital-Beam secondary emission r-f amplr
1631	-----	-----	1631	7AC	Beam power amplr
1632	-----	-----	1632	7AC	Beam power amplr
1633	-----	-----	1633	8BD	Twin triode
1634	-----	-----	1634	8S	Twin triode
1635	-----	1635	1635	8B	Twin triode
1641	-----	1641	1641		Full-wave rect
1642	-----	2C21	2C21	7BH	Twin triode
1644	-----	-----	1644	8BQ	Twin pentode
1801	-----	-----	1801	Flg F	Electromagnetic cathode ray
1802-P1	-----	5BP1	5BP1	10A	Electrostatic cathode ray
1802-P4	VT-111	5BP4	5BP4	10A	Electrostatic cathode ray
1803-P4	-----	-----	12AP4	6AL	Electromagnetic cathode ray
1804-P4	-----	-----	9AP4	6AL	Electromagnetic cathode ray
1805-P1	-----	5AP1	1805-P1	10A	Electrostatic cathode ray
1805-P4	-----	5AP4	905	10A	Electrostatic cathode ray
1806-P1	VT-226	3EP1	3EP1	11A	Electrostatic cathode ray
1811-P1	-----	-----	7CP1	6AZ	Electromagnetic cathode ray
1812-P7	-----	-----	5FP7	5BR	Electromagnetic cathode ray
1813-P7	-----	-----	7BP7	5BL	Electromagnetic cathode ray
1851	-----	-----	1851	7R	Pentode vidio amplr
1852	VT-112	6AC7	6AC7/1852	8N	Pentode vidio amplr
1853	VT-176	6AB7	6AB7	8N	Pentode vidio amplr
2000-T	-----	2000-T	2000-T	None	Xmtg triode
2050	VT-245	2050	2050	88A	Gas tetrode
2051	VT-109	2051	2051	88A	Gas tetrode
2501-A3	-----	-----	3AF1	7BN	Electrostatic cathode-ray
A-5588	VT-128	-----	1630	8BZ	Orbital-beam secondary emission r-f amplr
6175-B	-----	-----	5R4GY	5T	Full-wave rect
R-6200	-----	-----	2D21	70	Thyratron, gas tetrode
7184	VT-227	-----	KR-7184	6B0	Tetrode amplr
7193	-----	7193	2C22	4AM	U-h-f triode
8000	-----	-----	8000	T-3AC	Xmtg triode
8001	-----	4E27	4E27	T-7CB	Xmtg pentode
8003	-----	-----	8003	T-3AB	Xmtg triode
8005	-----	8005	8005	30	Xmtg triode
8012	VT-228	8012	8012	None	Xmtg triode
8013A	-----	8013A	8013A	T-4AD	Half-wave rect
8014A	-----	-----	8014A		
8016	-----	8016	8016	2L	Half-wave rect
8020	-----	8020	8020		
8021	VT-255	705A	8021		Half-wave rect
8022	-----	15R	15R	T-3C	Half-wave rect
8025	-----	8025	8025	3Y	U-h-f triode
9001	-----	9001	9001	7BD	Triple-grid detectr-amplr
9002	VT-202	9002	9002	7AW	Triode-detectr-amplr-osc
9003	VT-203	9003	9003	7BD	Triple-grid variable-μ
9004	-----	-----	9004	4BJ	U-h-f diode
9005	-----	-----	9005	5BG	U-h-f diode
9006	-----	9006	9006	6BH	Diode rect
38111A	-----	38111A	-----	T-3AA	Xmtg triode
38112A	-----	-----	212E	T-2A	Special Xmtg triode
38142	VT-52	38142	45 spc	4D	Triode power amplr
38674	-----	38674	-----	T-3BR	Full-wave rect

REFERENCE DATA

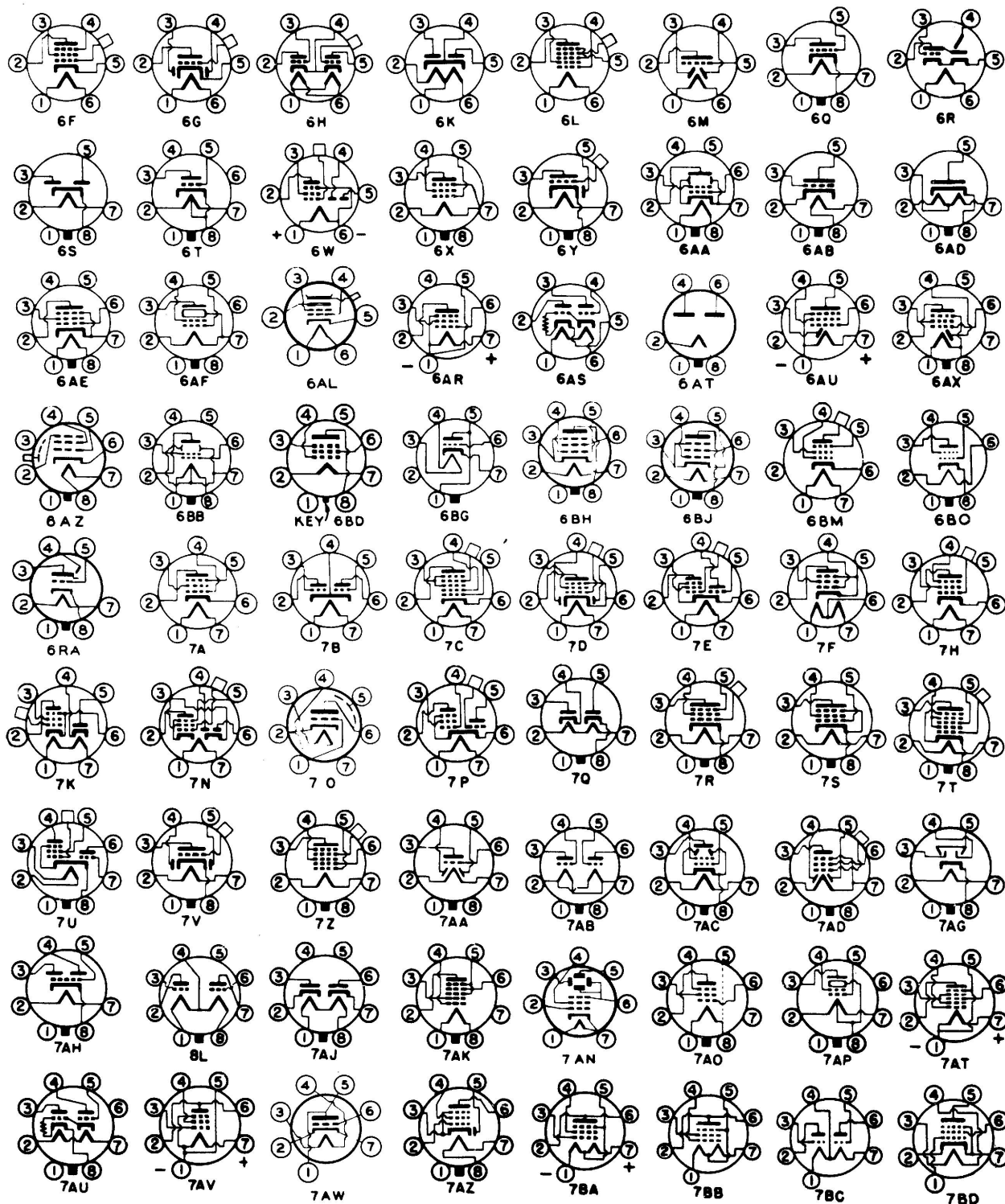
VACUUM-TUBE CROSS-REFERENCE GUIDE — SIGNAL CORPS TYPE TO COMMERCIAL TYPE

VT NO.	COMM'L NO.	VT NO.	COMM'L NO.	VT NO.	COMM'L NO.	VT NO.	COMM'L NO.
VT-1	203A	VT-78	78	VT-129	304-TL	VT-198-A	6G6G
VT-4-B	211	VT-80	80	VT-130	250-TL	VT-199	6SS7
VT-4-C	211 spc	VT-83	83	VT-131	12SK7	VT-200	VR-105-30
VT-5	WE-215-A	VT-84	84/624	VT-132*	12K8	VT-201	25L6
VT-6	212A	VT-86	6K7	VT-133	12SR7	VT-201-C	25L6GT
VT-7	WX-12	VT-86-A	6K7G	VT-134	12A6	VT-202	9002
VT-17	860	VT-86-B	6K7GT	VT-135	12J5GT	VT-203	9003
VT-19	861	VT-87	6L7	VT-135-A	12J5	VT-204	HK-24-G
VT-22	204A	VT-87-A	6L7G	VT-136	1625	VT-205	6ST7
VT-24	864	VT-88	6R7	VT-137	1626	VT-206-A	5V4G
VT-25	10	VT-88-A	6R7G	VT-138	1629	VT-207	12AH7GT
VT-25-A	10 spc	VT-88-B	6R7GT	VT-139	VR-150-30	VT-208	7B8
VT-26	22	VT-89	89	VT-142	WE-39-DY1	VT-209	12SG7
VT-27	30	VT-90	6H6	VT-143	805	VT-210	134
VT-28	24A	VT-90-A	6H6GT	VT-144	813	VT-211	6SG7
VT-29	27	VT-91	6J7	VT-145	523	VT-212	958
VT-30	01A	VT-91-A	6J7GT	VT-146	1N5GT	VT-213-A	6L5G
VT-31	31	VT-92	6Q7	VT-147	1A7GT	VT-214	12H6
VT-33	33	VT-92-A	6Q7G	VT-148	1D8GT	VT-215	6E5
VT-34	207	VT-93	6B8	VT-149	3A8GT	VT-216	816
VT-35	35/51	VT-93-A	6B8G	VT-150	6SA7	VT-217	811
VT-36	36	VT-94	6J5	VT-150-A	6SA7GT	VT-219	8007
VT-37	37	VT-94-A	6J5G	VT-151	6A8G	VT-218	100TH
VT-38	38	VT-94-B	6J5 spc sel.	VT-151-B	6A8GT	VT-220	250-TH
VT-39	UV-869	VT-94-C	6J5G spc sel.	VT-152	6K6GT	VT-221	3Q5GT
VT-39-A	869-A	VT-94-D	6J5GT	VT-152-A	6K6G	VT-222	884
VT-40	40	VT-95	2A3	VT-153	12C8 spc	VT-223	1H5GT
VT-41	851	VT-96	6N7	VT-154	814	VT-224	RK-34
VT-42	872	VT-97	5W4	VT-161	12SA7	VT-225	307A
VT-42-A	872A	VT-98	6U5/6G5	VT-162	12SJ7	VT-226	3EPI/1806-P1
VT-43	845	VT-98-A	6G5G	VT-163	6C8G	VR-227	KR-7184
VT-44	32	VT-99	6F8G	VT-164	1619	VT-228	8012
VT-45	45	VT-100	807	VT-165	1624	VT-229	6SL7GT
VT-46	866	VT-100-A	807 mod	VT-166	WE-371-A	VT-230	WE-350-A
VT-46-A	866-A/866	VT-101	837	VT-167	6K8	VT-231	6SN7GT
VT-47	47	VT-103	6SQ7	VT-167-A	6K8G	VT-232	E-1148
VT-48	41	VT-104	12SQ7	VT-168-A	6Y6G	VT-233	6SR7
VT-49	39/44	VT-105	6SC7	VT-170	1E5GP	VT-234	HY-114-B
VT-50	50, 585, 586	VT-106	803	VT-171	1R5	VT-235	HY-615
VT-51	841	VT-107	6Y6	VT-171-A	1R5 1ok	VT-236	836
VT-52	45 spc	VT-107-A	6V6GT	VT-172	1S5	VT-237	957
VT-53	use VT-42-A	VT-107-B	6V6G	VT-173	1T4	VT-238	956
VT-54	34	VT-108	540-TH	VT-174	3S4	VT-239	1LE3
VT-55	865	VT-109	2051	VT-175	1613	VT-240	WE-710-A
VT-56	56	VT-111	1802-P4	VT-176	6AB7/1853	VT-241	7E5/1201
VT-57	57	VT-112	6AC7/1852	VT-177	1LH4	VT-243	7C4/1203-A
VT-58	58	VT-114	5T4	VT-178	1LC6	VT-244	5U4G
VT-60	850	VT-115	6L6	VT-179	1LN5	VT-245	2050
VT-62	801A, 801	VT-115-A	6LG7	VT-180	3LF4	VT-246	918
VT-63	46	VT-116	6SJ7	VT-181	7Z4	VT-247	6AG7
VT-64	800	VT-116-A	6SJ7GT	VT-182	3B7/1291	VT-248	1808-P1
VT-65	6C5	VT-116-B	6SJ7 spc	VT-183	1R4/1294	VT-249	CK-1006
VT-65-A	6C5G	VT-117	6SK7	VT-184	VR-90-30	VT-252	923
VT-66	6F6	VT-117-A	6SK7GT	VT-185	3D1/1299	VT-254	304-TH
VT-66-A	6F6G	VT-118	832	VT-187	575-A	VT-255	705A
VT-67*	30 spc	VT-119	2X2/879	VT-188	7E6	VT-259	829
VT-68	687	VT-120	954	VT-189	7F7	VT-260	VR-75-30
VT-69	6D6	VT-121	955	VT-190	7H7	VT-264	3Q4
VT-70	6F7	VT-124	1A5GT	VT-191	316-A	VT-266	1816
VT-72	842	VT-125	1C5GT	VT-192	7A4	VT-267	578
VT-73	843	VT-126	6X5	VT-193	7C7	VT-268	12SC7
VT-74	524	VT-126-A	6X5G	VT-194	7J7	VT-269	WE-717-A
VT-75	75	VT-126-B	6X5GT	VT-195	CK-1005	VT-286	832A
VT-76	76	VT-127	100-TS	VT-196	6W5G	VT-287	815
VT-77	77	VT-128	1630 (A5588)	VT-197-A	5Y3GT/G	VT-288	12SH7
						VT-289	12SL7GT

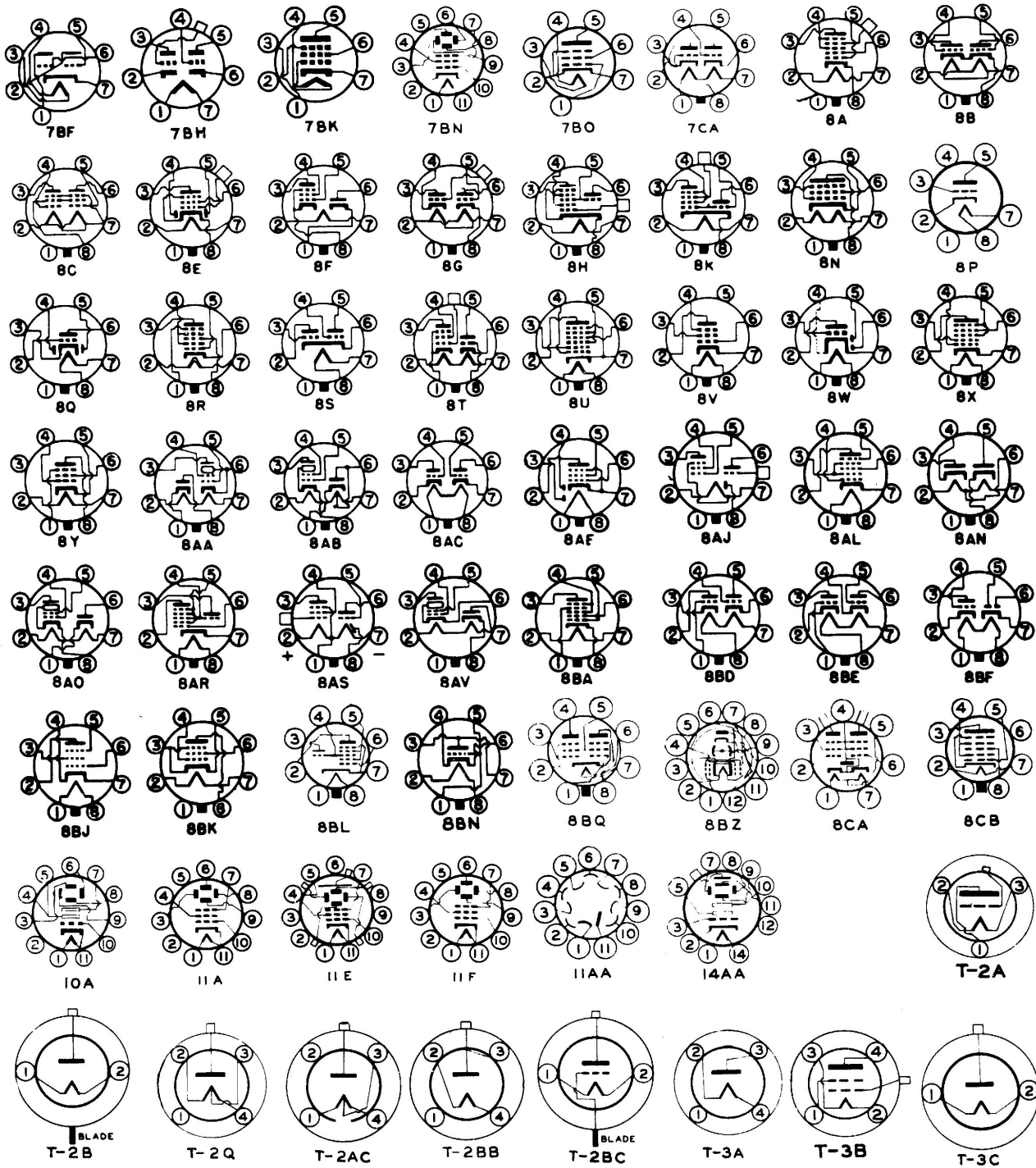
VACUUM TUBE BASE DIAGRAMS



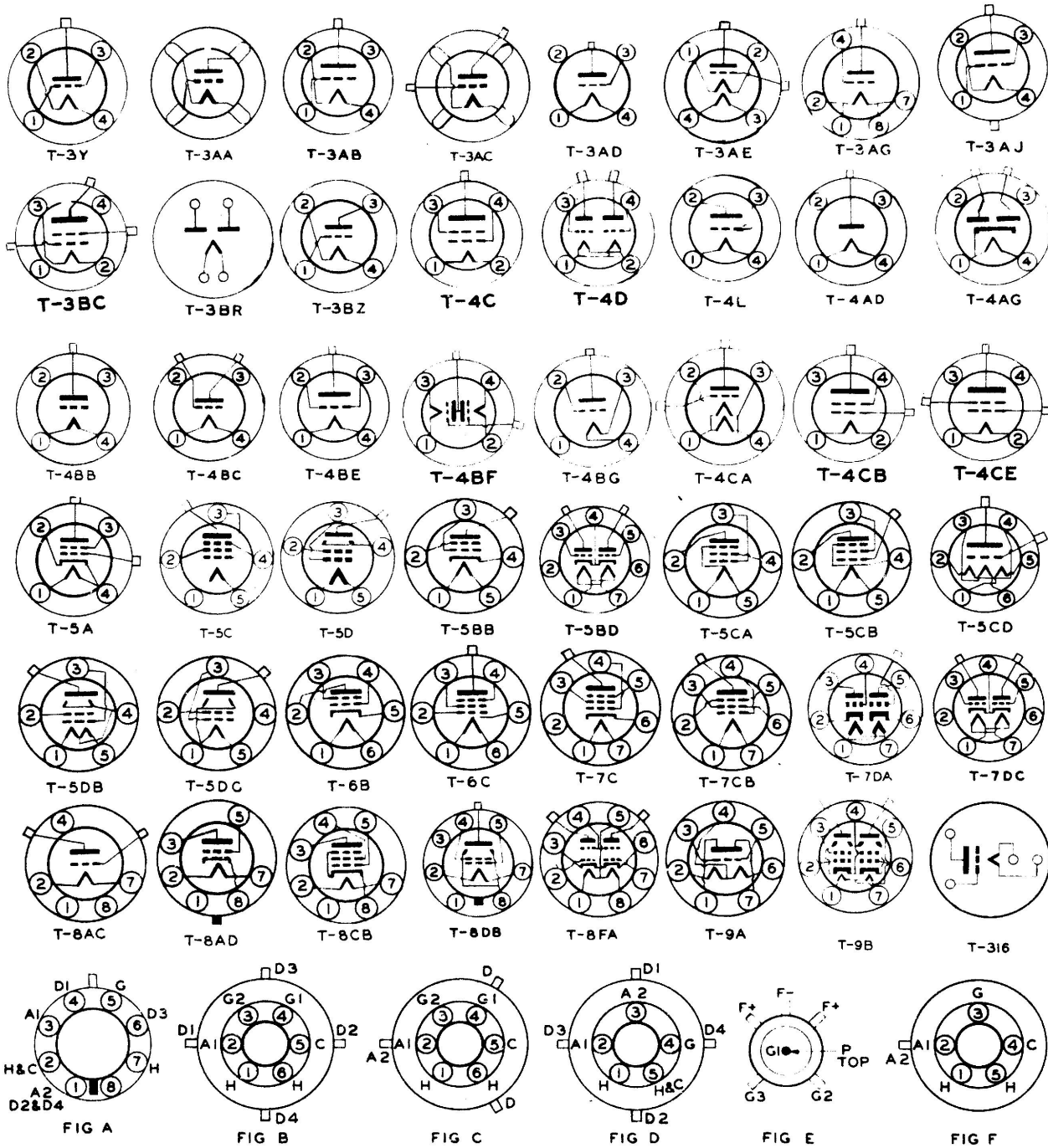
VACUUM-TUBE BASE DIAGRAMS (cont)



VACUUM-TUBE BASE DIAGRAMS (cont)



VACUUM TUBE BASE DIAGRAMS (cont)



Tabulation of Common Radio Symbols

Device	Symbol	Device	Symbol	Device	Symbol
Switch, Double Pole, Double Throw		Connector, Male (typical)		Envelope or Shell	
Selector Switch (typical)		Connector, Female (typical)		Envelope, Gas Filled	
Switch, Power		Dry Cell or Battery		Beam Tetrode Vacuum Tube	
Relay (typical contact arrangement)		Headset		Vacuum Tube, Voltage Regulator	
Jacks		Loud Speaker		Vacuum Tube, Triode, Octal Base	
Plug, Microphone, Headset or Speaker		Microphone		Vacuum Tube, Triode, Octal Base	
Plug for power outlet		Cathode, Thermionic		Vibrator	
Power Receptacle or Outlet		Cathode, Cold Discharge		Crystal	
Connector, Polarized, Male		Filament		Oxide Rectifier	
Connector, Polarized, Female		Grid		Fuse	
Connector, Twistlock, Female		Plate or Anode		Lamp or Pilot Light	
Connector, Polarized, 2-Wire, Male		Beam Forming Electrodes		Voltmeter	

Tabulation of Common Radio Symbols

Device	Symbol	Device	Symbol	Device	Symbol
Conductor or Wire		Cable, Shielded		Coil or Inductor, Tapped	
Crossed wires — top, connection; bottom, no connection		Resistor, Fixed		Coil or Inductor, Iron Core	
Ground		Resistor, Variable		Coil or Inductor, Powdered Iron Core	
Antenna		Capacitor, Fixed		Transformer, Powdered Iron Core	
Counterpoise		Capacitor, Fixed, Shielded		Transformer, Air Core	
Antenna, Loop		Capacitor, Variable		Transformer, Variable Coupling, moving coil shown	
Terminals		Capacitor, Variable, moving plates shown		Transformer, Iron Core	
Shielding		Capacitor, Variable, Shielded		Transformer, Air Core, Tuned	
Wire, Shielded		Capacitors, Variable, Ganged		Inductors, Link Coupled	
Wire, Twisted Pair		Capacitor, Dual Section		Key	
Cable, Coaxial		Coil or Inductor		Switch, Single Pole Double Throw	
Wire in cable		Coil or Inductor, Variable		Switch, Rotary	

Tabulation of Common Radio Symbols

Device	Symbol	Device	Symbol	Device	Symbol
Galvanometer		Milliammeter		Unit Section Detail	
Ammeter		Casing, Unshielded		Panel	

METRIC PREFIXES

μ	$\frac{1}{1,000,000}$	one-millionth	micro-
m	$\frac{1}{1,000}$	one-thousandth	milli-
c	$\frac{1}{100}$	one-hundredth	centi-
k	1,000	one thousand	kilo-
M	1,000,000	one million	mega-

MULTIPLES AND SUB-MULTIPLES

Ampere	 =	1,000,000 microamperes
Ampere	 =	1,000 milliamperes
Cycle	 =	0.000,001 megacycle
Cycle	 =	0.001 kilocycle
Farad	 =	1,000,000,000,000 micromicro-farads
Farad	 =	1,000,000 microfarads
Farad	 =	1,000 millifarads
Henry	 =	1,000,000 microhenrys
Henry	 =	1,000 millihenrys
Kilocycle	 =	1,000 cycles
Kilovolt	 =	1,000 volts
Kilowatt	 =	1,000 watts
Megacycle	 =	1,000,000 cycles
Megohm	 =	1,000,000 ohms
Mho	 =	1,000,000 micromhos
Mho	 =	1,000 millimhos
Microampere	 =	0.000,001 ampere
Microfarad	 =	0.000,001 farad
Microhenry	 =	0.000,001 henry
Micromho	 =	0.000,001 mho
Micro-ohm	 =	0.000,001 ohm
Microvolt	 =	0.000,001 volt
Microwatt	 =	0.000,001 watt
Micromicrofarad	 =	0.000,000,000,001 farad
Micromicro-ohm	 =	0.000,000,000,001 ohm
Milliampere	 =	0.001 ampere
Millihenry	 =	0.001 henry
Millimho	 =	0.001 mho
Milliohm	 =	0.001 ohm
Millivolt	 =	0.001 volt
Milliwatt	 =	0.001 watt
Volt	 =	1,000,000 microvolts
Volt	 =	1,000 millivolts
Watt	 =	1,000,000 microwatts
Watt	 =	1,000 milliwatts
Watt	 =	0.001 kilowatt

SPECIAL ABBREVIATIONS

Alternating current -----	A-C	Microampere ($\frac{\text{amp}}{1,000,000}$) -----	μA
Ampere -----	AMP	Microfarad ($\frac{\text{farad}}{1,000,000}$) -----	μf or MF
Amplifier -----	AMPLR	Micromicrofarad ($\frac{\text{farad}}{1,000,000,000,000}$) -----	$\mu\mu\text{f}$ or MMF
Antenna -----	ANT	Microphone -----	MIC
Audio frequency -----	A-F	Microvolt ($\frac{\text{volt}}{1,000,000}$) -----	μV
Automatic -----	AUTO	Milliampere ($\frac{\text{ampere}}{1,000}$) -----	ma
Automatic volume control -----	AVC	Millihenry ($\frac{\text{henry}}{1,000}$) -----	mh
Battery -----	BATT	Millivolt ($\frac{\text{volt}}{1,000}$) -----	mv
Black -----	BLK	Modulator -----	MOD
Blue -----	BLU	Ohm -----	Ω
Brown -----	BRN	Orange -----	ORG
Capacitor -----	C	Oscillator -----	OSC
Center tap -----	CT	Plug -----	PI
Choke coil (reactor) -----	CH	Power -----	PWR
Coil -----	L	Plate -----	PLT
Continuous wave -----	C-W	Radio frequency -----	R-F
Crystal -----	XTAL	Reactor (reactance) -----	REACT
Cycles (per second) -----		Receiver -----	RCVR
Detector -----	DETECR	Rectifier -----	RECT
Direct current -----	D-C	Relay -----	Ry
Electrical (electrolytic) -----	ELECT	Resistor -----	R
Filament -----	FIL	Socket -----	So
Frequency modulation -----	F-M	Speaker or loudspeaker -----	SPKR
Fuse -----	FU (F) (FS)	Starting turn -----	ST
Green -----	GRN	Switch -----	SW
Ground -----	GND	Terminal strip -----	TS
Gray -----	GRY	Tracer -----	TR
Henry (henries) -----	h	Transformer -----	T
High voltage -----	H-V	Transmitter -----	XMT
Inductance (coil) -----	L	Transmitting -----	XMTG
Intermediate frequency -----	I-F	Vacuum tube -----	vt, VT
Jack -----	J	Vibrator -----	VB
Kilocycles (1000 cycles) -----	kc	Volt -----	v
Kilovolt (1000 volts) -----	kv	Watt -----	w
Kilowatt (1000 watts) -----	kw	White -----	WHT
Lamp -----	Lm	Yellow -----	YEL
Loudspeaker -----	SPKR		
Low voltage -----	L-V		
Manual -----	MAN		
Master oscillator -----	MO		
Megacycles (1,000,000 cycles) -----	mc		
Megohm (1,000,000 ohms) -----	meg		
Meter -----	M (M_1 , M_2 , etc.)		