

GENERAL ELECTRIC

POWER TUBE DEPARTMENT

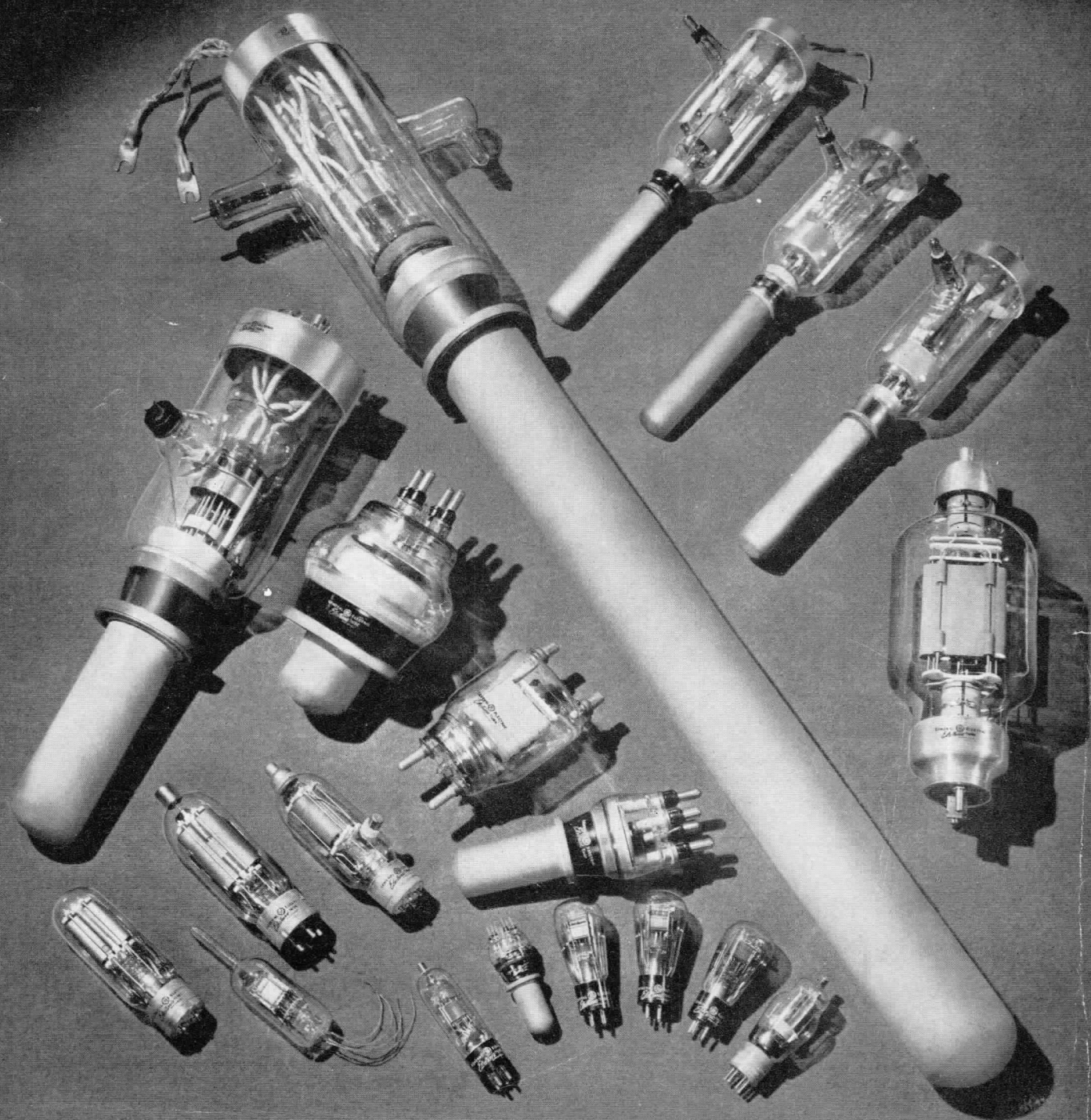
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GENERAL  ELECTRIC

Supersedes ETX-108

TRANSMITTING TUBES



DESCRIPTION

The term "transmitting tubes" is broad in implication. Power output ratings for example, range from a few watts to many kilowatts and tube lengths from three inches to more than five feet. No exact line of demarcation exists between transmitting and receiving tubes either in function or in name. The technical and application data contained in this manual deals primarily with tubes normally found in transmitters and associated equipment.

One of the most significant methods of classify-

ing transmitting tubes is by the system of cooling used. The three main classes are convection, forced-air, and water cooling, each roughly related to power output rating and physical size. Other systems of division are by the number and nature of the electrodes involved, by frequency range, or by common application. Since no single breakdown is all inclusive, technical information sheets are arranged by type number, and correlation charts and tables supplied in the "Quick Selection Chart"; ETX-104.

DEFINITIONS

The following definitions of terms which appear in this manual have been obtained from the IRE Standards for 1938. The key number refers to the identification number appearing in the Standards.

- 1E17. Cathode. A cathode is an electrode which is the primary source of an electron stream.
- 1E18. Filament. A filament is a cathode of a thermionic tube, usually in the form of a wire or ribbon, to which heat may be supplied by passing current through it.
- 1E19. Indirectly Heated Cathode. (Equipotential Cathode, Unipotential Cathode.) An indirectly heated cathode is a cathode of a thermionic tube to which heat is supplied by an independent heater element.
- 1E20. Heater. A heater is an electric heating element for supplying heat to an indirectly heated cathode.
- 1E21. Control Electrode. A control electrode is an electrode on which a voltage is impressed to vary the current flowing between two or more other electrodes.
- 1E22. Grid. A grid is an electrode having one or more openings for the passage of electrons or ions.
- 1E23. Space-Charge Grid. A space-charge grid is a grid which is placed adjacent to the cathode and positively biased so as to reduce the limiting effect of space charge on the current through the tube.
- 1E24. Control Grid. A control grid is a grid, ordinarily placed between the cathode and an anode, for use as a control electrode.
- 1E25. Screen Grid. A screen grid is a grid placed between a control grid and an anode, and usually maintained at a fixed positive potential, for the purpose of reducing the electrostatic influence of the anode in the space between the screen grid and the cathode.
- 1E26. Suppressor Grid. A suppressor grid is a grid which is interposed between two electrodes (usually the screen grid and

plate), both positive with respect to the cathode, in order to prevent the passing of secondary electrons from one to the other.

- 1E27. Anode. An anode is an electrode to which a principal electron stream flows.
- 1E28. Plate. Plate is a common name for the principal anode in a vacuum tube.
- 1E29. Electron Emission. Electron emission is the liberation of electrons from an electrode into the surrounding space. Quantitatively, it is the rate at which electrons are emitted from an electrode.
- 1E30. Thermionic Emission. Thermionic emission is electron or ion emission due directly to the temperature of the emitter.
- 1E31. Secondary Emission. Secondary emission is electron emission due directly to impact by electrons or ions.
- 1E32. Grid Emission. Grid emission is electron or ion emission from a grid.
- 1E33. Emission Characteristic. An emission characteristic is a relation, usually shown by a graph, between the emission and a factor controlling the emission (as temperature, voltage, or current of the filament or heater).
- 1E34. Cathode Current. Cathode current is the total current passing to or from the cathode through the vacuous space.
- 1E35. Filament Current. Filament current is the current supplied to a filament to heat it.
- 1E36. Filament Voltage. Filament voltage is the voltage between the terminals of a heater.
- 1E37. Heater Current. Heater current is the current flowing through a heater.
- 1E38. Heater Voltage. Heater voltage is the voltage between the terminals of a heater.
- 1E39. Electrode Current. Electrode current is the current passing to or from an electrode through the vacuous space. The terms grid current, anode current, plate current, etc., are used to designate currents passing to or from these specific electrodes.

- 1E40. **Electrode Voltage.** Electrode voltage is the voltage between an electrode and a specified point of the cathode. The terms grid voltage, anode voltage, plate voltage, etc., are used to designate the voltage between these specific electrodes and the cathode.
- 1E41. **Direct Grid Bias.** Direct grid bias is the direct component of grid voltage. This is commonly called grid bias.
- 1E42. **Grid Driving Power.** Grid driving power is the average product of the instantaneous value of the grid current and of the alternating component of the grid voltage over a complete cycle. This comprises the power supplied to the biasing device and to the grid.
- 1E43. **Peak Forward Anode Voltage.** Peak forward anode voltage is the maximum instantaneous anode voltage in the direction in which the tube is designed to pass current.
- 1E44. **Peak Inverse Anode Voltage.** Peak inverse anode voltage is the maximum instantaneous anode voltage in the direction opposite to that in which the tube is designed to pass current.
- 1E45. **Tube Voltage Drop.** Tube voltage drop in a gas or vapor-filled tube is the anode voltage during the conducting period.
- 1E46. **Electrode Dissipation.** Electrode dissipation is the power dissipated in the form of heat by an electrode as a result of electron and/or ion bombardment.
- 1E47. **Ionization Current.** Ionization current is the electric current resulting from the movement of electric charges in an ionizing medium under the influence of an applied electric field.
- 1E48. **Gas Current.** Gas current is a current flowing to an electrode and composed of positive ions which have been produced as a result of gas ionization by an electron current flowing between other electrodes.
- 1E49. **Leakage Current.** Leakage current is a conductive current which flows between two or more electrodes by any path other than across the vacuous space.
- 1E50. **Electrode Admittance.** Electrode admittance is the quotient of the alternating component of the electrode current by the alternating component of the electrode voltage, all other electrode voltages being maintained constant. As most precisely used, the term refers to infinitesimal amplitudes.
- 1E52. **Electrode Conductance.** Electrode conductance is the quotient of the in-phase component of the electrode alternating current by the electrode alternating voltage, all other electrode voltages being maintained constant. This is a variational and not a total conductance. As most precisely used, the term refers to infinitesimal amplitudes.
- 1E53. **Electrode Resistance.** Electrode resistance is the reciprocal of the electrode conductance. This is the effective parallel resistance and is not the real component of the electrode impedance.
- 1E54. **Transadmittance.** Transadmittance from one electrode to another is the quotient of the alternating component of the current of the second electrode by the alternating component of the voltage of the first electrode, all other electrode voltages being maintained constant. As most precisely used, the term refers to infinitesimal amplitudes.
- 1E55. **Transconductance.** Transconductance from one electrode to another is the quotient of the in-phase component of the alternating current of the second electrode by the alternating voltage of the first electrode, all other electrode voltages being maintained constant. As most precisely used, the term refers to infinitesimal amplitudes.
- 1E56. **Control-Grid-Plate Transconductance.** Control-grid-plate transconductance is the name for the plate-current-to-grid-voltage transconductance. This is ordinarily the most important transconductance and is commonly understood when the term "transconductance" is used.
- 1E60. **Conversion Transconductance.** Conversion transconductance is the quotient of the magnitude of a single beat-frequency component ($f_1 + f_2$) or ($f_1 - f_2$) of the output-electrode current by the magnitude of the control-electrode voltage of frequency f_1 , under the conditions that all direct electrode voltages and the magnitude of the electrode alternating voltage f_2 remain constant and that no impedances at the frequencies f_1 or f_2 are present in the output circuit. As most precisely used, the term refers to an infinitesimal magnitude of the voltage of frequency f_1 .
- 1E61. **μ Factor.** μ factor is the ratio of the change in one electrode voltage to the change in another electrode voltage, under the conditions that a specified current remains unchanged and that all other electrode voltages are maintained constant. It is a measure of the relative effect of the voltages on two electrodes upon the current in the circuit of any specified electrode. As most precisely used, the term refers to infinitesimal changes.