NOT FOR PUBLICATION

Institute of Radio Engineers
330 West 42nd Street
New York City

Report on: Electronics Definitions
Report to: Standards Committee
Report from: Technical Committee on Electronics
Date: March 30, 1936

Section 1 - General

1.1 Vacuum Tube. (Electron Tube). A vacuum tube is a device consisting of an evacuated enclosure containing a number of electrodes between two or more of which conduction of electricity through the vacuum or contained gas may take place.

Note:- The term is used in a more restricted sense to mean a device of this nature designed for such use as amplifier, rectifier, modulator, or oscillator.

1.2 Gas Tube. A gas tube is a vacuum tube in which the pressure of the contained gas or vapor is such as to affect substantially the electrical characteristics of the tube.

1.3 Mercury Vapor Tube. A mercury vapor tube is a gas tube in which the active contained gas is mercury vapor.

1.4 High Vacuum Tube. A high vacuum tube is a vacuum tube evacuated to such a degree that its electrical characteristics are essentially unaffected by gaseous ionization.

1.5 Thermionic Tube. A thermionic tube is a vacuum tube in which one of the electrodes is heated for the purpose of causing electron or ion emission.

1.6 Phototube. (Photoelectric Tube). A phototube is a vacuum tube in which one of the electrodes is irradiated for the purpose of causing electron emission.

1.7 Cathode-Ray Tube. A cathode-ray tube is a vacuum tube in which the electron stream is directed along a confined path to produce nonelectrical effects on the object upon which the electrons impinge.

Note:- This classification includes cathode-ray oscillograph tubes, similar devices for television reception, electron microscopes, etc.

1.8 Cathode-Ray Oscillograph Tube. A cathode-ray oscillograph tube is a cathode-ray tube in which the movement of an electron beam, deflected by means of applied electric and/or magnetic fields, indicates the instantaneous values of the actuating voltages and/or currents.

1.9 Electron Beam Tube. An electron beam tube is a vacuum tube used for producing electrical effects and in which the useful characteristics of the tube are due substantially to confining the electron stream to a restricted path.

1.10 Diode. A diode is a two-electrode vacuum tube containing an anode and a cathode.

1.11 Triode. A triode is a three-electrode vacuum tube containing an anode, a cathode, and a control electrode.

1.12 Tetrode. A tetrode is a four-electrode vacuum tube containing an anode, a cathode, a control electrode, and one additional electrode ordinarily in the nature of a grid.

1.13 Pentode. A pentode is a five-electrode vacuum tube containing an anode, a cathode, a control electrode, and two additional electrodes ordinarily in the nature of grids.

1.14 Hexode. A hexode is a six-electrode vacuum tube containing an anode, a cathode, a control electrode, and three additional electrodes ordinarily in the nature of grids.

1.15 Heptode. A heptode is a seven-electrode vacuum tube containing an anode, a cathode, a control electrode, and four additional electrodes ordinarily in the nature of grids.

1.16 Octode. An octode is an eight-electrode vacuum tube containing an anode, a cathode, a control electrode, and five additional electrodes ordinarily in the nature of grids.

1.17 Multielectrode Tube. A multielectrode tube is a vacuum tube containing more than three electrodes associated with a single electron stream.

1.18 Multiple-Unit Tube. A multiple-unit tube is a vacuum tube containing within one envelope two or more groups of electrodes associated with independent electron streams.

Note:- A multiple-unit tube may be so indicated, as for example; duodiode, duotriode, diode-pentode, duodiode-triode, duodiode-pentode, and triode-pentode.

1.19 Cathode. A cathode is an electrode which is the primary source of an electron stream.

1.20 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.

1.21 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.

1.22 Heater. A heater is an electric heating element for supplying heat to an indirectly heated cathode.

1.23 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.

1.24 Grid. A grid is an electrode having one or more openings through which electrons or ions may pass.

1.25 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.

1.26 Control Grid. A control grid is a grid, ordinarily placed between the cathode and the anode, for use as a control electrode.

1.27 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.

1.28 Suppressor Grid. A suppressor grid is a grid which is interposed between two electrodes, both positive with respect to the cathode (usually the screen grid and plate), in order to prevent secondary electrons passing from one to the other.

1.29 Anode. An anode is an electrode to which a principal electron stream flows.

1.30 Plate. Plate is a common name for the principal anode in a vacuum tube.

1.31 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.

1.32 Thermionic Emission. Thermionic emission is electron or ion emission under the influence of heat.

1.33 Secondary Emission. Secondary emission is electron emission due directly to impact by electrons or ions.

1.34 Grid Emission. Grid emission is electron emission from a grid.

1.35 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).

1.36 Cathode Current. Cathode current is the total current passing to or from the cathode through the vacuous space.

Note:- This term should be carefully distinguished from heater current and filament current.

1.37 Filament Current. Filament current is the current supplied to a filament to heat it.

1.38 Filament voltage. Filament voltage is the voltage between the terminals of a filament.

1.39 Heater Current. Heater current is the current flowing through a heater.

1.40 Heater Voltage. Heater voltage is the voltage between the terminals of a heater.

1.41 Grid Current. Grid current is the current passing from or to a grid through the vacuous space.

1.42 Grid Voltage. Grid voltage is the voltage between a grid and a specified point of the cathode.

1.43 Grid Bias. Grid bias is the externally applied direct component of grid voltage.

1.44 Alternating Grid Voltage. Alternating grid voltage is the alternating component of the grid voltage.

1.45 Grid Driving Power. Grid driving power is the integral of the product of the instantaneous values of the alternating components of the grid current and voltage over a complete cycle.

1.46 Anode Current. (Plate Current). Anode current is the current passing to or from the anode through the vacuous space.

1.47 Anode Voltage (Plate Voltage). Anode voltage is the voltage between the anode and a specified point of the cathode.

1.48 Peak (or Crest) Forward Anode Voltage. Peak (or crest) forward anode voltage is the maximum instantaneous anode voltage in the direction in which the tube is designed to pass current.

1.49 Peak (or Crest) Inverse Anode Voltage. The peak (or crest) inverse anode voltage is the maximum instantaneous anode voltage in the direction opposite to that in which the tube is designed to pass current.

1.50 Tube Voltage Drop. Tube voltage drop in a gas or vapor-filled tube is the anode voltage during the conducting period.

1.51 Anode Dissipation. Anode dissipation is the power dissipated in the form of heat by an anode as a result of electron and/or ion bombardment.

1.52 Ionization Current. (Gas Current). An ionization 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.

1.53 Leakage Current. A leakage current is a current which flows between two or more electrodes by any other path than across the evacuated space.

1.54 Electrode Conductance. (Variational). Electrode conductance is the ratio of the in-phase component of the electrode alternating current to the electrode alternating voltage, all other electrode voltages being maintained constant.

Note:- As most precisely used, the term refers to infinitesimal amplitudes.

1.55 Electrode Resistance. (Variational). Electrode resistance is the reciprocal of the electrode conductance.

1.56 Electrode Admittance. Electrode admittance is the ratio of the alternating component of the electrode current to the alternating component of the electrode voltage, all other electrode voltages being maintained constant.

Note:- As most precisely used, the term refers to infinitesimal amplitudes.

1.57 Electrode Impedance. Electrode impedance is the reciprocal of the electrode admittance.

1.58 Transadmittance. Transadmittance between two electrodes is the ratio of the alternating component of the current of one electrode to the alternating component of the voltage of the other electrode, all other electrode voltages being maintained constant.

Note:- As most precisely used, the term refers to infinitesimal amplitudes.

1.59 Transconductance. Transconductance between two electrodes is the ratio of the in-phase component of the alternating current of one electrode to the alternating voltage of the other electrode, all other electrode voltages being maintained constant.

Note:- As most precisely used, the term refers to infinitesimal amplitudes.

1.60 Control Grid - Plate Transconductance. (Transconductance, Mutual Conductance) Control grid - plate transconductance is the name for the plate current to control grid voltage transconductance.

1.61 Rectification Factor. The rectification factor is the ratio of the change in average current of an electrode to the change in effective value of the alternating sinusoidal voltage applied to the same electrode, the direct voltages of this and other electrodes being maintained constant.

Note:- As most precisely used, the term refers to infinitesimal

changes.

1.62 Transrectification Factor. The transrectification factor is the ratio of the change in average current of an electrode to the change in the effective value of the alternating sinusoidal voltage applied to another electrode, the direct voltages of this and other electrodes being maintained constant.

Note:- As most precisely used, the term refers to infinitesimal changes.

1.63 Conversion Transconductance. Conversion transconductance is the ratio of the magnitude of a single beat-frequency component ($f_1 - f_2$) or ($f_1 - f_2$), of the output electrode current to 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.

Note:- As most precisely used, the term refers to an infinitesimal magnitude of the voltage of frequency f_1.

1.64 Mu-Factor. The mu-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 on the current in the circuit of any specified electrode.

Note:- As most precisely used, the term refers to infinitesimal changes.

1.65 Amplification Factor. The amplification factor is the ratio of the change in plate voltage to the change in control electrode voltage under the conditions that the plate current remains unchanged and that all other electrode voltages are maintained constant. It is a measure of the effectiveness of the control electrode voltage relative to that of the plate voltage on the plate current. The sense is usually taken as positive when the voltages are changed in opposite directions.

Note:- As most precisely used, the term refers to infinitesimal changes. See also "mu-factor."

1.66 Electrode Characteristic. An electrode characteristic is a relation, usually shown by a graph, between an electrode voltage and current, other electrode voltages being maintained constant.

1.67 Transfer Characteristic. A transfer characteristic is a relation, usually shown by a graph, between one electrode voltage and another electrode current.

1.68 Interelectrode Capacitance. Interelectrode capacitance is the direct capacitance between two electrodes.

1.69 Electrode Capacitance. Electrode capacitance is the capacitance of one

electrode to all other electrodes connected together.

1.70 Input Capacitance. The input capacitance of a vacuum tube is the sum of the direct capacitances between the control grid and cathode and such other electrodes as are operated at the alternating potential of the cathode.

1.71 Output Capacitance. The output capacitance of a vacuum tube is the sum of the direct capacitances between the output electrode (usually the plate) and the cathode and such other electrodes as are operated at the alternating potential of the cathode.

1.72 Class A Amplifier. A class A amplifier is an amplifier in which the grid bias and alternating grid voltages are such that plate current in a specific tube flows at all times.

1.73 Class AB Amplifier. A class AB amplifier is an amplifier in which the grid bias and alternating grid voltages are such that plate current in a specific tube flows for appreciably more than half but less than the entire electrical cycle.

1.74 Class B Amplifier. A class B amplifier is an amplifier in which the grid bias is approximately equal to the cut-off value so that the plate current is approximately zero when no exciting grid voltage is applied, and so that plate current in a specific tube flows for approximately one-half of each cycle when an alternating grid voltage is applied.

1.75 Class C Amplifier. A class C amplifier is an amplifier in which the grid bias is appreciably greater than the cut-off value so that the plate current in each tube is zero when no alternating grid voltage is applied, and so that plate current flows in a specific tube for appreciably less than one-half of each cycle when an alternating grid voltage is applied.

Note: To denote that grid current does not flow during any part of the input cycle, the suffix 1 may be added to the letter or letters of the class identification. The suffix 2 may be used to denote that grid current flows during some part of the cycle.

Section 2 - Gas-Filled Tubes

(1.2) Gas Tube. A gas tube is a vacuum tube in which the pressure of the contained gas or vapor is such as to affect substantially the electrical characteristics of the tube.

2.1 Critical Grid Current. The critical grid current in a gas or vapor-filled tube is the instantaneous value of grid current when the anode current starts to flow.

2.2 Critical Grid Voltage. Critical grid voltage in a gas or vapor-filled tube is the instantaneous value of grid voltage when the anode current

starts to flow.

2.3 Control Characteristic. The control characteristic of a gas or vapor-filled tube is a relation, usually shown by a graph, between the instantaneous grid voltage and the instantaneous anode voltage when the anode current starts to flow.

2.4 Deionization Time. Deionization time of a gas or vapor-filled tube is the time required after anode current interruption for the grid to regain control.

Note: To be exact the ionization time of a tube should be presented as a family of curves relating such factors as condensed mercury temperature, anode and grid currents, anode and grid voltages and regulation of the grid current.

2.5 Cathode Heating Time. Cathode heating time is the time required for the cathode to attain operating temperature with normal voltage applied to the heating element.

2.6 Tube Heating Time. Tube heating time in a mercury vapor tube is the time required for the coolest portion of the tube to attain operating temperature.

Section 3 - Cathode-Ray and Electron Beam Tubes

(1.7) Cathode-Ray Tube. A cathode-ray tube is a vacuum tube in which the electron stream is directed along a confined path to produce non-electrical effects on the object upon which the electrons impinge.

Note: This classification includes cathode-ray oscillograph tubes, similar devices for television reception, electron microscopes, etc.

(1.8) Cathode-Ray Oscillograph Tube. A cathode-ray oscillograph tube is a cathode ray tube in which the movement of an electron beam, deflected by means of applied electric and/or magnetic fields, indicates the instantaneous values of the actuating voltages and/or currents.

(1.9) Electron Beam Tube. An electron beam tube is a vacuum tube used for producing electrical effects and in which the useful characteristics of the tube are due substantially to confining the electron stream to a restricted path.

3.1 Modulating Electrode. A modulating electrode is an electrode to which a potential is applied to control the magnitude of the beam current.

3.2 Accelerating Electrode. An accelerating electrode is an electrode to which a potential is applied to increase the velocity of the electrons in the beam.

3.3 Focusing Electrode. A focusing electrode is an electrode to which a

potential is applied to control the cross-sectional area of the electron beam.

3.4 Deflecting Electrode. A deflecting electrode is an electrode to which a potential is applied to produce an angular displacement of the beam.

3.5 Viewing Screen. The viewing screen of a cathode-ray oscilloscope is the medium which converts the useful energy of the electrons of the beam into visible radiation.

3.6 Spot. The spot is the luminous area of the viewing screen produced by the electron beam.

3.7 Gas Focusing. Gas focusing is a method of focusing an electron stream in which focus is produced mainly with the action of ionized gas.

3.8 Electrostatic Focusing. Electrostatic focusing is a method of focusing an electron beam in which focus is produced through the action of an electric field.

3.9 Magnetic Focusing. Magnetic focusing is a method of focusing an electron stream in which focus is produced through the action of a magnetic field.

3.10 Deflection Factor (Units of a Cathode-Ray Oscilloscope Tube). The deflection sensitivity of a cathode-ray oscilloscope is the ratio of the displacement of the electron beam at the plane of impact to the change in deflecting field.

Note: It is usually expressed in millimeters per volt applied between the deflecting electrodes or in millimeters per gauss of the deflecting magnetic field.

3.11 Deflection Factor (Units of a Cathode-Ray Oscilloscope Tube). The reciprocal of the deflection sensitivity of a cathode-ray oscilloscope tube is the reciprocal of the deflection sensitivity.

3.12 Screen Luminous Persistence (Fluorescence). The screen luminous persistence (fluorescence) is a property, usually shown by a graph, between the luminance of the spot and the time elapsed after cessation of excitation.

3.13 Screen Spectral Characteristic. The screen spectral characteristic is a property, usually shown by a graph, between radiant power emitted from the screen and the wavelength of the radiation.

(Part 4.) Transmitting Devices

(4.1) Electrode. (Of vacuum-tube). A conductor in a vacuum tube which is one of the elements introduced for the purpose of causing electrons to travel...

4.1 Static Sensitivity. Static sensitivity is the ratio of the direct anode current to the incident radiant flux of constant value.

4.2 Dynamic Sensitivity. (Vertebinal Sensitivity). Dynamic sensitivity is the ratio of the alternating component of anode current to the alternating component of incident radiant flux.

Note: As most precisely used, the term refers to infinitesimal amplitudes.

4.3 Gas Amplification Factor. Gas amplification factor is the ratio of increase in the sensitivity of a gas phototube due solely to the ionization of the contained gas.

Note: For a gas phototube having a structure such as to permit saturation to occur at a voltage less than that causing appreciable ionization, the gas amplification factor at a specified operating voltage is the ratio of the sensitivity measured at that voltage to the sensitivity measured at the saturation voltage.

4.4 Luminous Sensitivity. Luminous sensitivity is the ratio of the anode current to the incident flux.

4.5 2870 Tungsten Sensitivity. 2870 tungsten sensitivity is the ratio of the anode current to the total incident luminous flux in lumens from a tungsten filament lamp at a color temperature of 2870 degrees Kelvin.

4.6 Current-Wavelength Characteristic. Current-wavelength characteristic is a relation usually shown by a graph between the direct anode current per unit energy of the incident radiant flux and the wavelength of the flux.

-oOOo-

GRAPHICAL SYMBOLS

High vacuum tube envelope

Gas tube envelope

Filament or heater

Cold cathode

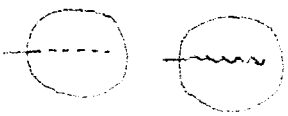
Indirectly heated cathode

Photoelectric cathode

Mercury pool cathode

Mercury pool cathode with immersion igniter

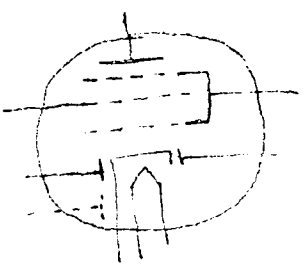
Grid (Either symbol may be used as is most convenient)



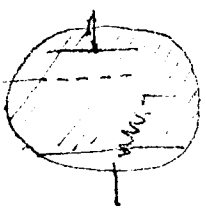
Plate

Sample Combinations of Elements

Indirectly heated cathode duodiode-pentode with internal connection between grids 1 and 3. The diode plates may be placed on one or both sides of the indirectly heated cathode



Grid-controlled mercury-pool cathode gas tube with immersion igniter



Gas phototube