

## ELECTRICAL DEFINITIONS

- 1. Volt.\*** The unit of electromotive force, electrical pressure, or difference of potential. Represented by E or V.
- 2. Ampere.\*** The unit of current flow. Represented by I.
- 3. Ohm.\*** The unit of electrical resistance. Represented by R.
- 4. Energy.** The capacity for doing work.
- 5. Power.** Rate of work, equals work divided by time.
- 6. Watt.** The unit of electrical power. Represented by P or W.
- 7. Joule.** The unit of work.
- 8. Kilowatt.** One thousand watts. Expressed by kW.
- 9. Current.** The motion of a charge in a conductor.
- 10. Direct Current.** A unidirectional current. Abbreviated DC.
- 11. Pulsating Current.** Direct current which changes regularly in magnitude.
- 12. Continuous Current.** Steady-state current, AC or DC.
- 13. Alternating Current.** A current which reverses regularly in direction. The term "alternating current," or AC, refers to a current with successive waves of the same shape, area and period.
- 14. Cycle.** One complete wave of positive and negative values of an alternating current.
- 15. Electrical Degree.** One 360th part of a cycle.
- 16. Period.** The time required for the current to pass through one cycle.
- 17. Frequency.** The number of cycles per second. One cycle per second equals one **Hertz (Hz)**.

\*One volt will cause one ampere of current to flow through a resistance of one ohm.

**18. Root-Mean Square or Effective Value.** The square root of the mean of the squares of the instantaneous values for one complete cycle. It is usually abbreviated r.m.s. Unless otherwise specified, the numerical value of an alternating current refers to its r.m.s. value. The r.m.s. value of a sinusoidal wave is equal to its maximum, or peak value, divided by  $\sqrt{2}$ .

**19. Wave-Form or Wave-Shape.** The shape of the curve obtained when the instantaneous values of an alternating current are plotted against time in rectangular coordinates. The distance along the time axis corresponding to one complete cycle of values is usually taken as  $2\pi$  radians, or 360 electrical degrees.

**20. Simple Alternating or Sinusoidal Current.** Current whose waveshape is sinusoidal. Alternating current calculations are commonly based upon the assumption of sinusoidal currents and voltages.

**21. Phase.** The fractional part of the period of a sinusoidal wave, usually expressed in electrical degrees and referenced to the origin.

**22. Crest Factor.** The ratio of the peak or maximum value of a wave, to the r.m.s. value. The crest factor of a sine wave is  $\sqrt{2}$ .

**23. Form Factor.** The ratio of the r.m.s. to the average value of a periodic wave.

**\*24. Phase Difference: Lead and Lag.** The difference in phase between two sinusoidal waves having the same period, usually expressed in electrical degrees. The voltage wave is generally taken as the reference, so in an inductive circuit the current lags the voltage, and in a capacitive circuit the current leads the voltage. Sometimes called the phase angle.

**\*25. Counter-Clockwise Convention.** It is a convention that in any vector diagram, the leading vector be drawn counter-clockwise with respect to the lagging vector, as in the accompanying diagram, where OI represent the vector of a current in a simple alternating current circuit, lagging behind the vector OE or impressed voltage.



\* Refers only to cases where the current and voltage are both sinusoidal.

**\*26. The Active or In-Phase Component** of the current in a circuit is that component which is in phase with the voltage across the circuit.

**\*27. Reactive or Quadrature Component.** That component of the current which is quadrature, or 90 degrees out of phase, with the voltage across the circuit.

**\*28. Reactive Factor.** The ratio of the reactive volt-amperes to the apparent power.

**\*29. Reactive Volt Amperes.** The product of the voltage, current and the sine of the phase difference between them. Expressed in vars.

**\*30. Non-Inductive Load and Inductive Load.** A non-inductive load is a load in which the current is in phase with the voltage across the load. An inductive load is a load in which the current lags behind the voltage across the load.

**31. Power in an Alternating-Current Circuit.** The product of the voltage, current and the cosine of the phase difference between them. Expressed in watts.

**32. Volt Amperes or Apparent Power.** The product of the voltage across a circuit and the current in the circuit. Expressed in VA.

**33. Power Factor.** The ratio of the power as defined in (31) to the volt amperes (32). In the case of sinusoidal current and voltage, the power factor is equal to the cosine of their phase angle.

**34. Single-Phase.** A term characterizing a circuit energized by a single alternating voltage source.

**35. Three Phase.** A term characterizing a combination of three circuits energized by alternating voltage sources which differ in phase by one-third of a cycle, 120 degrees.

**36. Quarter-Phase or Two-Phase.** A term characterizing a combination of two circuits energized by alternating voltage sources which differ in phase by a quarter of a cycle, 90 degrees.

\* Refers only to cases in where the current and voltage are both sinusoidal.

**37. Six-Phase.** A term characterizing the combination of six circuits energized by alternating e.m.f.'s which differ in phase by one-sixth of a cycle; i.e., 60 degrees.

**38. Polyphase.** A general term applied to any system of more than a single phase. This term is ordinarily applied to symmetrical systems.

**39. The Load Factor of a Machine, Plant or System.** The ratio of the average power to the peak power during a specified period of time. In each case, the interval of maximum load and the period over which the average is taken should be definitely specified. The proper interval and period are usually dependent upon local conditions and upon the purpose for which the load factor is to be used.

**40. Plant Factor or Plant Capacity.** The ratio of the average load to the rated capacity of the power plant.

**41. Demand Factor.** The ratio of the maximum demand of any system to the total connected load of the system, or of the part of the system under consideration.

**42. Diversity Factor.** The ratio of the sum of the maximum power demands of the subdivisions, or parts of a system, to the maximum demand of the whole system or of part of the system under consideration.

**43. Connected Load.** The combined continuous rating of all the equipment connected to the system or part of the system under consideration.

**44. Efficiency.** The efficiency of an electrical machine or apparatus is the ratio of its useful power output to its total power input.

**45. Rating.** The rating of an electrical device includes (1) the normal r.m.s. current which it is designed to carry, (2) the normal r.m.s. voltage of the circuit in which it is intended to operate, (3) the normal frequency of the current and the interruption (or withstand) rating of the device (see 52).

**46. Continuous Rating.** The maximum constant load that can be carried continuously without exceeding established temperature rise limitations under prescribed conditions.

- 47. Short-Time Rating.** The maximum constant load that can be carried for a specified time without exceeding established temperature rise limitations under prescribed conditions.
- 48. Ampacity.** The current a conductor can carry continuously without exceeding its temperature rating. Ampacity is a function of cable size, insulation type and the conditions of use.
- 49. Overcurrent.** Any current in excess of conductor ampacity or in excess of equipment continuous current rating.
- 50. Overload.** The operation of conductors or equipment a current that will cause damage if allowed to persist.
- 51. Short Circuit.** Excessive current flow caused by insulation breakdown or wiring error.
- 52. Interrupting Rating or Capacity.** Interrupting (breaking or rupturing) capacity is the highest r.m.s. current at normal voltage which a device can interrupt under prescribed conditions.
- 53 Ambient Temperature.** The temperature surrounding an object under consideration.

### ROTATING MACHINES

- 54. Generator.** A machine which converts mechanical power into electrical power.
- 55. Motor.** A machine which converts electrical power into mechanical power.
- 56. Booster.** A generator inserted in series in a circuit to add or subtract from the circuit voltage.
- 57. Motor-Generator Set.** A conversion device consisting of one or more motors mechanically coupled to one or more generators.
- 58. Dynamotor.** A converter with both motor and generator in one magnetic field, either with two armatures, or with one armature having two separate windings.

- 59. Direct-Current Compensator or Balancer.** Comprises two or more similar direct-current machines (usually with shunt or compound excitation) directly coupled to each other and connected in series across the outer conductors a multiple-wire system of distribution, for the purpose of maintaining the potentials of the intermediate wires of the system, which are connected to the junction points between the machines.
- 60. Double-Current Generator.** Supplies both direct and alternating currents from the same winding.
- 61. Converter.** A device which changes electrical energy from one form to another. There are several types of converters:
- 62. Direct-Current Converter.** A device which converts direct current to direct current, usually with a change of voltage.
- 63. Synchronous Converter or Rotary Converter.** Converts an alternating current to a direct current.
- 64. Frequency Converter.** Converts the power of an alternating current system from one frequency to one or more other frequencies.
- 65. Rotary Phase Converter.** Converts an alternating current system of one or more phases to alternating current system of a different number of phases, but of the same frequency.
- 66. Phase Modifier or Phase Advancer.** A machine which supplies leading or lagging reactive volt amperes to the system to which it is connected. Phase modifiers may be either synchronous or asynchronous.
- 67. Synchronous Phase Modifier or Synchronous Condenser.** A synchronous motor, running without mechanical load, the field excitation of which may be varied so as to modify the power factor of the system.
- 68. Alternator.** An alternating current generator, either single phase or polyphase.
- 69. Inductor Alternator.** An alternator in which both field and armature windings are stationary and in which the voltage is produced by varying the flux linking the armature winding.
- 70. Synchronous Motor.** An alternating current motor which operates at the speed of rotation of the magnetic flux.

**71. Induction Motor.** An alternating current motor, either single phase or polyphase, comprising independent primary and secondary windings, in which the secondary receives power from the primary by electromagnetic induction.

**72. Induction Generator.** An induction machine, driven above synchronous speed, used to convert mechanical power to electrical power.

**73. Unipolar or Acyclic Machine.** A direct current machine in which the voltage generated in the active conductors maintains the same direction with respect to those conductors.

**74. Constant-Speed Motor.** A motor whose speed is either constant or varies little, such as synchronous motors, induction motors with low slip and ordinary direct-current shunt motors.

**75. Multispeed Motor.** A motor which can be operated at any of several distinct speeds, usually by changing the number of poles or number of windings.

**76. Adjustable-Speed Motor.** A motor whose speed may be varied gradually over a considerable range, but remains practically unaffected by the load.

**77. Varying-Speed Motor.** A motor whose speed varies with the load, ordinarily decreasing when the load increases.

**78. Base Speed of an Adjustable-Speed Motor.** That speed of a motor obtained with full field under full load with no resistor in the armature circuit.

**79. Variable Speed Motor.** A motor with a positively damped speed-torque characteristic which lends itself to controlled speed applications.

## TRANSFORMERS

**80. Transformer.** A device for transferring energy in an alternating current system from one circuit to another, consisting of two independent electric circuits linked by a common magnetic circuit.

**81. Potential Transformer.** A transformer designed for shunt or parallel connection in its primary circuit, with the ratio of transformation appearing as a ratio of potential differences.

- 82. Current Transformer.** A transformer designed for series connection in its primary circuit with the ratio of transformation appearing as a ratio of currents.
- 83. Instrument Transformer.** A transformer (current or potential) suitable for use with measuring instruments; i.e., one in which the conditions of the current, voltage and phase angle in the primary circuit are represented with acceptable accuracy in the secondary circuit.
- 84. Auto-Transformer.** A transformer having some of its turns common to both primary and secondary circuits.
- 85. Primary.** The windings of a transformer which receive energy from the supply circuit.
- 86. Secondary.** The windings which receive the energy by induction from the primary.
- 87. Voltage Ratio.** The voltage ratio of a transformer is the ratio of the r.m.s. primary terminal voltage to the r.m.s. secondary current, under specified conditions of load.
- 88. Current Ratio.** The current ratio of a current transformer is the ratio of r.m.s. primary current to r.m.s. secondary current, under specified conditions of load.
- 89. Marked Ratio.** The marked ratio of an instrument transformer is the ratio of the rated primary value to the rated secondary value as stated on the nameplate.

## FUSES

- 90. Fuse.** An overcurrent protective device containing a calibrated current-carrying member which melts and opens under specified overcurrent conditions.
- 91. General Purpose Fuse.** A fuse which meets industry standards for overload and short circuit protection as well as physical dimensions. This fuse type is tested and certified by nationally recognized testing laboratories and may be applied in accordance with the National Electrical Code and the Canadian Electrical Code to provide main, feeder and branch circuit protection.

- 92. Enclosed Cartridge Fuse.** A fuse with a tubular body having a terminal on each end and a current-responsive element (link) inside.
- 93. Non-Renewable Fuse.** An enclosed fuse with a link which cannot be replaced after operation. This fuse contains an arc quenching filler.
- 94. Renewable Fuse.** An enclosed fuse, the body of which can be opened and the fusible link replaced for re-use. This fuse usually does not have a filler.
- 95. Time Delay Fuse.** A fuse which will carry an overcurrent of a specified magnitude for a minimum specified time without opening, as defined in the tri-national Fuse Standard 248.
- 96. Current-Limiting Fuse.** A fuse which will limit both the magnitude and duration of current flow under short circuit conditions.
- 97. UL/CSA Class Fuses.** General purpose fuses meeting one of the industry standards called "classes." Fuse classifications H, J, K, L, R, CC, G and T. Qualifying fuses are typically tested and certified by UL or CSA to tri-national Fuse Standard 248.
- 98. Rejection Fuse.** A current-limiting fuse with high interrupting rating and with unique dimensions or mounting provisions.
- 99. Bolt-In Fuse.** A fuse which is intended to be bolted directly to bus bars, contact pads or fuse blocks.
- 100. Semiconductor Fuse.** An extremely fast-acting fuse intended for the protection of power semiconductors. Sometimes referred to as a rectifier fuse.
- 101. Midget Fuse.** A term describing a group of fuses used for supplementary circuit or component protection, all having dimensions of 1-1/2" long and 13/32" diameter.
- 102. Glass Fuses.** A loose term describing a group of low voltage fuses, with glass or ceramic bodies, having dimensions smaller than midget fuses. Also called "miniature" fuses, they are typically 1/4" x 1-1/4," 1/4" x 1," or 5mm x 20mm. These fuses are used to protect electronic circuits or components.

**103. Micro Fuses.** Term describing the smallest sizes of fuses, usually mounted on, or used to protect, printed circuit boards or small electronic components.

**104. Special Purpose Fuses.** Fuses with special performance characteristics or ratings intended to protect equipment or components under specified conditions.

**105. Limiter.** A special purpose fuse which is intended to provide short circuit protection only.

**106. Welder Protector.** A fuse with special characteristics to meet heavy inrush current demands of an electric welder and protect the welder on short circuits.

**107. Cable Protector.** A fuse with characteristics designed to protect cables against fault damage. Cable protectors have unique mounting and crimping terminals.

**108. Low Voltage Fuses.** Fuses rated 600 volts and below.

**109. Medium voltage Fuses.** Fuses rated from 601 volts to 34,500 volts.

**110. High Voltage Fuses.** Fuses rated 34,500 volts and above.

**111. Plug Fuse.** A “household” type fuse with a threaded base such as an Edison-base or Type S tamperproof base. Rated 0-30 amperes, 125 volts.

**112. Class CC Fuse.** A small current-limiting rejection type fuse for control circuits. Rated 0-30 amperes, 600 volts and 200,000 amperes interrupting rating.

**113. Class G Fuse.** A small current-limiting fuse which comes in four sizes 0-15A, 20A, 25-30A and 35-60A which are non-interchangeable. Rated 480 volts with a 100,000 ampere interrupting rating.

**114. Class H Fuse.** Any 250 or 600 volt “standard” dimension fuse, either renewable or non-renewable which has a 10,000 ampere interrupting rating.

**115. Class J Fuse.** A 600 volt non-interchangeable current-limiting fuse of small, unique dimensions. Available in ratings 0-600 amperes with a 200,000 ampere interrupting rating.

**116. Class K Fuse.** A 250 or 600 volt standard dimension fuse (no rejection feature) with an interrupting rating of 50,000 or 100,000 amperes, meeting specific  $I_p$  and  $I_{2t}$  limits. Available in ratings 0-600 amperes.

**117. Class L Fuse.** A 600 volt bolt-in, current-limiting fuse of unique dimensions. Class L fuses are rated 601-6000 amperes with a 200,000 ampere interrupting rating.

**118. Class R Fuse.** A 250 or 600 volt standard dimensions fuse with a 200,000 ampere interrupting rating and a rejection feature on one terminal. They are current-limiting fuses rated 0-600 amperes.

**119. Class T Fuse.** A small, unique dimension current limiting fuse, non-interchangeable with any other fuse. Available in 300 volt and 600 volt sizes, rated 0-1200 amperes, with a 200,000 ampere interrupting rating.

**120. Ampere Rating.** The continuous current carrying capability of a fuse under defined laboratory conditions. The ampere rating is marked on each fuse. Class L fuses and E-rated fuses may be loaded to 100% of their ampere rating. For all other fuses, continuous load current should not exceed 80% of fuse rating.

**121. Filler.** A non-conductive medium filling the inside of a fuse for quenching electric arcs and absorbing energy produced by element or link melting during interruption.

**122. Fuse Block or Fuse Holder.** A device, designed and intended to hold a fuse and provide the means to connect it to the electrical circuit. Fuse blocks consist of fuse clips, insulator and terminals.

**123. Rejection Fuse Block.** A fuse block designed to accept fuses of a specific class.

**124. Fuse Clip.** A conductive mechanical device for accepting and securing the conductive part of a fuse to an electrical terminal or connection point.

### **SWITCHES, CIRCUIT BREAKERS AND AUXILIARY APPARATUS**

**125. Circuit Breaker.** A device designed to open and close a circuit by non-automatic means and to open the circuit automatically on a predetermined overcurrent without injury to itself when properly applied within its rating.

**126. Air Switch.** A switch arranged to interrupt circuits in air.

**127. Air Circuit Breaker.** A circuit breaker arranged to interrupt one or more electric circuits in air.

**128. Molded-Case Circuit Breaker.** A circuit breaker which is assembled as an integral unit in a supporting and enclosing housing of molded insulating material.

**129. Thermal-Magnetic Circuit Breaker.** A circuit breaker which has the overcurrent and tripping means of the thermal type, the magnetic type or a combination of both.

**130. Fused Circuit Breaker.** An integrally fused circuit breaker which combines the design and operating features of a circuit breaker and current-limiting fuse in one package.

**131. Oil Switch.** A switch arranged to interrupt one or more electric circuits in oil.

**132. Oil Circuit Breaker.** A circuit breaker arranged to interrupt one or more electric circuits in oil.

**133. Conducting Parts.** Those parts designed to carry current or which are conductively connected therewith.

**134. Contact.** The surface common to two conducting parts, united by pressure, for the purpose of carrying current.

**135. Grounded Parts.** Parts that are intentionally connected to ground.

**136. Dust-Proof.** Apparatus is designated as dust-proof when so constructed or protected that the accumulation of dust with or without the device will not interfere with its successful operation.

**137. Dust-Tight.** Apparatus is designated as dust-tight when so constructed that the dust will not enter the enclosing case under specified test conditions.

**138. Gas-Proof.** Apparatus is designated as gas-proof when so constructed or protected that the specified gas will not interfere with successful operation.

**139. Gas-Tight.** Apparatus is designated as gas-tight when so constructed that the specified gas will not enter the enclosing case under specified test conditions.

**140. Totally Enclosed.** Apparatus with an integral enclosure so constructed that, while not airtight, the enclosed air has no deliberate connection with external air except for draining and breathing.

**141. Moisture-Resisting.** Apparatus is designated as moisture-resisting when so constructed or treated that it will not be readily injured by moisture.

**142. Drip-Proof.** Apparatus is designated as drip-proof when it is constructed so that successful operation is not interfered with when falling drops of liquid or solid particles strike or enter the enclosure at an angle of 0 to 15 degrees from vertical.

**143. Splash-Proof.** An open apparatus in which the ventilation openings are so constructed that drops of liquid or solid particles coming toward it at any angle up to 100° downward from vertical cannot enter directly or by running along a surface.

**144. Submersible.** Apparatus is designated as submersible when so constructed that it operates successfully in water under specified pressure and time conditions.

**145. Sleet-Proof.** Apparatus is designated as sleet-proof when so constructed or protected that the accumulation of sleet will not interfere with its successful operation.

**146. Contactor.** A device for repeatedly establishing or interrupting an electrical circuit under normal conditions. It is usually magnetically operated.

**147. Electric Controller.** A device, or group of devices, which serves to control, in some manner, the electric power delivered to the apparatus to which it is connected.

**148. Switch.** A device for making, breaking, or changing connections in an electric circuit, the operation of which is independent of the circuit to which it is connected.

**149. Master Switch.** A switch which serves to dominate the operation of contactors, relays and auxiliary devices of an electric controller.

**150. Control Switch.** A manually operated switch for controlling power operated switches and circuit breakers.

**151. Auxiliary Switch.** A switch actuated by the main device for signaling, interlocking, etc.

**152. Disconnecting Switch.** A switch which is intended to open a circuit only after the load has been removed by some other means.

**153. Load-Break Switch.** A switch which is designed for, and intended to open a circuit which may be under load.

**154. Relay.** A device which is operative by variation in the conditions of one electric circuit to effect the operation of other devices in the same or another electric circuit.

**155. Rheostat.** An adjustable resistor constructed so that its resistance may be changed without opening the circuit.