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PART XVII SWITCHGEAR AND CONTROLGEAR

(*First Revision*)

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Indian Standard

ELECTROTECHNICAL VOCABULARY

PART XVII SWITCHGEAR AND CONTROLGEAR

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part XVII) (First Revision) was adopted by the Indian Standards Institution on 29 June 1979, after the draft finalized by the Electrotechnical Standards Sectional Committee in consultation with the Switchgear and Controlgear Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 The definitions contained in this standard have been drawn up with the object of striking a correct balance between absolute precision and simplicity. The principal object of this standard (Part XVII) is to provide definitions which are sufficiently clear so that each term is understood with the same meaning by all electrical engineers and it does not, therefore, constitute a treatise on electrical engineering. It may sometimes be felt that the definitions are not sufficiently precise, do not include all cases, do not take account of certain exceptions or are not identical with those which may be found in other publications designed with other objects and for other readers. Such differences are inevitable and should be accepted in the interest of uniformity and clarity.

0.3 This revision is being brought out with a view to aligning the definitions with those accepted as standard internationally. Considerable assistance has been derived, hence, from IEC Pub 50 (441) (1974) 'International Electrotechnical Vocabulary, Chaper 441 : Switchgear and Controlgear' issued by the International Electrotechnical Commission.

0.4 Definitions of terms earlier in vogue have also been retained, in the form of an appendix, as it is felt that they would serve a useful purpose in conjunction with the other terms defined. This is in view of the fact that they find extensive application in the various Indian Standards in the field of electrotechnology. It is intended, at a later stage, to consider exclusion of the terms contained in Appendix A or to modify its contents as may be found appropriate.

However, if any contradiction is observed between the definitions in the main text and Appendix A, those contained in the former shall prevail.

1. SCOPE

1.1 This standard (Part XVII) covers definitions of terms applicable to switchgear and controlgear.

2. GENERAL TERMS

2.1 Switchgear — A general term covering switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures, intended in principle for use in connection with generation, transmission, distribution and conversion of electric energy.

2.2 Controlgear — A general term covering switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures, intended in principle for the control of electric energy consuming equipment.

2.3 Operation (of a Mechanical Switching Device) — The transfer of the moving contact(s) from one position to an adjacent position.

NOTE 1 — For a circuit-breaker, this may be a closing operation or an opening operation.

NOTE 2 — If distinction is necessary, an operation in the electrical sense, for example, make or break, is referred to as a switching operation, and an operation in the mechanical sense, for example, close or open, is referred to as a mechanical operation.

2.4 Operating Cycle (of a Mechanical Switching Device) — A succession of operation from one position to another and back to the first position through all other positions, if any.

NOTE — A succession of operations not forming an operating cycle is referred to as an operating series.

2.5 Operating Sequence (of a Mechanical Switching Device) — A succession of specified operations with specified time intervals.

2.6 Main Circuit (of a Switching Device) — All the conductive parts of a switching device included in the circuit which it is designed to close or open.

2.7 Control Circuit (of a Switching Device) — All the conductive parts (other than the main circuit) of a switching device which are included in a circuit used for the closing operation or opening operation, or both, of the device.

2.8 Auxiliary Circuit (of a Mechanical Switching Device) — All the conductive parts of a mechanical switching device which are intended to be included in a circuit other than the main circuit and the control circuits of the device.

NOTE — Some auxiliary circuits serve supplementary requirements such as signalling, interlocking, etc, and, as such, they may be part of the control circuit of another switching device.

2.9 Pole of a Switching Device — The portion of a switching device associated exclusively with one electrically separated conducting path of its main circuit and excluding those portions which provide a means for mounting and operating all poles together.

NOTE — A switching device is called single-pole if it has only one pole. If it has more than one pole, it may be called multipole (two-pole, three-pole, etc) provided the poles are or can be coupled in such a manner as to operate together.

2.10 Closed Position (of a Mechanical Switching Device) — The position in which the predetermined continuity of the main circuit of the device is secured.

2.11 Open Position (of a Mechanical Switching Device) — The position in which the predetermined clearance between open contacts in the main circuit of the device is secured.

2.12 Position of Rest (of a Contactor) — The position which the moving elements of the contactor take up when its electromagnet or its compressed-air device in not energized.

2.13 Short Circuit — The connection of two or more points of a circuit through a negligible impedance.

NOTE 1 — A short circuit may be intentional or accidental.

NOTE 2 — The term 'short circuit' is frequently applied to the whole group of phenomena which accompany a short circuit between points of different potential, for example, the short circuit current is the current which is the result of such a short circuit.

2.14 Short-Circuit Current — An overcurrent resulting from a short circuit due to a fault or an incorrect connection in an electric circuit.

2.15 Overcurrent — Any current exceeding the rated current.

2.16 Overload — Operating conditions in an electrically undamaged circuit, which cause an overcurrent.

3. TYPES OF CONSTRUCTION AND PHYSICAL PROTECTION

3.1 Oil-Immersed Apparatus — Apparatus in which the main parts, or some of these parts, are immersed in oil.

3.2 Indoor Switchgear and Controlgear — Switchgear and controlgear designed solely for installation within a building or other housing, where the switchgear and controlgear is protected against wind, rain, snow, abnormal dirt deposits, abnormal condensation, ice and hoarfrost.

3.3 Outdoor Switchgear and Controlgear — Switchgear and controlgear suitable for installation in the open air, that is capable of withstanding wind, rain snow, dirt deposits, condensation, ice and hoarfrost.

3.4 Metal-Enclosed Switchgear and Controlgear — Switchgear and controlgear assemblies with an external metal enclosure intended to be earthed, and complete except for external connections.

3.5 Metalclad Switchgear and Controlgear — Metal-enclosed switchgear and controlgear in which certain components (for example, each circuit-breaker) are arranged in separate compartments with metal partitions intended to be earthed.

3.6 Ambient Air Temperature — The temperature, determined under prescribed conditions, of the air surrounding the complete switching device (for example, for enclosed switching devices, it is the air outside the enclosure).

4. CONSTRUCTIONAL ELEMENTS

4.1 Terminal — A conductive part of a device, provided for electrical connection to external circuits.

4.2 Earth Terminal — A terminal intended to ensure, by means of a specified connection, the earthing of a part of an apparatus.

4.3 Contact (of a Mechanical Switching Device) — Two or more conductors designed to establish circuit continuity when they touch, and which, due to their relative movement during operation, open or close a circuit.

4.4 Contact Piece — One of the conductor forming a contact.

NOTE — If no confusion can arise, the term "contact" may be used instead of "contact piece".

4.5 Main Contact (of a Mechanical Switching Device) — A contact included in the main circuit of a mechanical switching device, intended to carry, in the closed position, the current of the main circuit.

4.6 Arcing Contact (of a Mechanical Switching Device) — A contact on which the arc is intended to be established.

NOTE — An arcing contact may serve as a main contact; it may be a separate contact so designed that it opens after and closes before another contact which it is intended to protect from injury.

4.7 Control Contact (of a Mechanical Switching Device) — A contact included in a control circuit of a mechanical switching device and mechanically operated by this device.

4.8 Auxiliary Contact (of a Mechanical Switching Device) — A contact included in an auxiliary circuit and mechanically operated by the switching device.

4.9 A-Contact (Make Contact) — A control or auxiliary contact which is closed when the main contacts of the mechanical switching device are closed and open when they are open.

4.10 B-Contact (Break Contact) — A control or auxiliary contact which is open when the main contacts of the mechanical switching device are closed and closed when they are open.

4.11 Butt Contact — A contact in which the relative movement of the contact pieces is substantially in a direction perpendicular to the contact surface.

4.12 Sliding Contact — A contact in which relative movement of the contact pieces is substantially in a direction parallel to the contact surface.

4.13 Rolling Contact — A contact in which one contact piece rolls on the other.

4.14 Release (of a Mechanical Switching Device) — A device, mechanically connected to a mechanical switching device, which releases the holding means and permits the opening or the closing of the switching device.

4.15 Arc-Control Device — A device, surrounding the arcing contacts of a mechanical switching device, designed to confine the arc and to assist in its extinction.

4.16 Arc-Chute — A chamber into which the arc is transferred to assist in its extinction.

4.17 Blow-Out Coil — A coil designed to produce a magnetic field arranged to deflect an arc, for example, into an arc-chute.

4.18 Bushing — An insulating structure carrying a conductor through a partition or cover.

4.19 Conductive Part — A part which is capable of conducting current although it may not necessarily be used for carrying service current.

4.20 Exposed Conductive Part — A conductive part which can readily be touched and which is not normally alive, but which may become alive under fault conditions.

NOTE — Typical exposed conductive parts are walls of enclosures, operating handles, etc.

5. OPERATION OF SWITCHING DEVICES

5.1 Manual Control — Control of an operation by human intervention.

5.2 Automatic Control — Control of an operation without human intervention, in response to the occurrence of predetermined conditions.

5.3 Local Control — Control of an operation at a point on or adjacent to the controlled switching device.

5.4 Remote Control — Control of an operation at a point distant from the controlled switching device.

5.5 Closing Operation (of a Mechanical Switching Device) — An operation by which the device is brought from the open position to the closed position.

5.6 Opening Operation (of a Mechanical Switching Device) — An operation by which the device is brought from the closed position to the open position.

5.7 Auto-reclosing (of a Mechanical Switching Device) — The operating sequence of a mechanical switching device, whereby, following its opening, it closes automatically after a predetermined time.

5.8 Dependent Manual Operation (of a Mechanical Switching Device) — An operation solely by means of directly applied manual energy, such that the speed and force of the operation are dependent upon the action of the operator.

5.9 Dependent Power Operation (of a Mechanical Switching Device) — An operation by means of energy other than manual, where the completion of the operation is dependent upon the continuity of the power supply (to solenoids, electric or pneumatic motors, etc).

5.10 Stored Energy Operation (of a Mechanical Switching Device) — An operation by means of energy stored in the mechanism itself prior to the completion of the operation and sufficient to complete it under predetermined conditions.

NOTE — This kind of operation may be subdivided according to:

a) the manner of storing the energy (spring, weight, etc);

b) the origin of the energy (manual, electric, etc); and

c) the manner of releasing the energy (manual, electric, etc).

5.11 Independent Manual Operation (of a Mechanical Switching Device) — A stored energy operation where the energy originates from manual power, stored and released in one continuous operation, such that the speed and force of the operation are independent of the action of the operator.

5.12 Fixed Trip Mechanical Switching Device — A mechanical switching device which cannot be released except when it is in the closed position.

5.13 Trip-Free Mechanical Switching Device — A mechanical switching device, the moving contacts of which return to and remain in the open position when the opening operation is initiated after the initiation of the closing operation, even if its closing command is maintained.

NOTE — To ensure proper breaking of the current which may have been established, it may be necessary that the contacts momentarily reach the closed position.

5.14 Instantaneous Release — A release which operates without any intentional time-delay.

5.15 Overcurrent Release — A release which permits a mechanical switching device to open with or without time-delay when the current in the release exceeds a predetermined value.

NOTE — This value can in some cases depend upon the rate-of-rise of current.

5.16 Definite Time-Delay Overcurrent Release — An overcurrent release which operates with a definite time-delay, which may be adjustable, but is independent of the value of the overcurrent.

5.17 Inverse Time-Delay Overcurrent Release — An overcurrent release which operates after a time-delay inversely dependent upon the value of the overcurrent.

NOTE — Such a release may be designed so that the time-delay approaches a definite minimum value for high values of overcurrent.

5.18 Direct Overcurrent Release — An overcurrent release directly energized by the current in the main circuit of a mechanical switching device.

5.19 Indirect Overcurrent Release — An overcurrent release energized by the current in the main circuit of a mechanical switching device through a current transformer or a shunt.

5.20 Shunt Release — A release energized by a source of voltage.

NOTE — The source of voltage may be independent of the voltage of the main circuit.

5.21 Undervoltage Release — A shunt release which permits a mechanical switching device to open or close, with or without time-delay, when the voltage across the terminals of the release falls below a predetermined value.

5.22 Reverse Current Release (DC only) — A release which permits a mechanical switching device to open, with or without time-delay, when the current flows in reverse direction and exceeds a predetermined value.

5.23 Inching (Jogging) — Energizing a motor or solenoid repeatedly for short periods to obtain small movements of the driven mechanism.

5.24 Operating Current (of an Overcurrent Release) — The current value at and above which the release can operate.

5.25 Current Setting (of an Overcurrent Release) — The value of the operating current for which the release is adjusted and in accordance with which its operating conditions are defined.

5.26 Current Setting Release (of an Overcurrent Release) — The range between the minimum and maximum values over which the current setting of the release can be adjusted.

5.27 Antipumping Device — A device which prevents reclosing after a close-open operation as long as the device initiating closing is maintained in the position for closing.

5.28 Interlocking Device — A device which makes the operation of a switching device dependent upon the position or operation of one or more other pieces of equipment.

6. CHARACTERISTIC QUANTITIES

6.1 Prospective Current (of a Circuit and with Respect to a Switching Device) — The current that would flow in the circuit if each pole of the switching device were replaced by a conductor of negligible impedance.

NOTE — The method to be used to evaluate and to express the prospective current is to be specified in the individual specifications.

6.2 Prospective Peak Current — The peak value of a prospective current during the transient period following initiation.

NOTE — The definition assumes that the current is made by an ideal switching device, that is with instantaneous transition from infinite to zero impedance. For circuits where the current can follow several different paths, for example, polyphase circuits, it further assumes that the current is made simultaneously in all poles, even if only the current in one pole is considered.

6.3 Prospective Symmetrical Current (of an AC Circuit) — The prospective current when it is initiated at such an instant that no transient phenomenon follows the initiation.

NOTE 1 — For polyphase circuits, the condition of nontransient period can only be satisfied for the current in one pole at a time.

NOTE 2 — The prospective symmetrical current is expressed by its rms value.

6.4 Maximum Prospective Peak Current (of an AC Circuit) — The prospective peak current when initiation of the current takes place at the instant which leads to the highest possible value.

NOTE — For a multipole device in a polyphase circuit, the maximum prospective peak current refers to a single-pole only.

6.5 Prospective Making Current (for a Pole of a Switching Device) — The prospective current when initiated under specified conditions.

NOTE — The specified conditions may relate to the method of initiation, for example, by an ideal switching device, or to the instant of initiation, for example, leading to the maximum prospective peak current in an ac circuit, or to the highest rate of rise. The specification of these conditions is found in the individual standards.

6.6 Prospective Breaking Current (for a Pole of a Switching Device) — The prospective current evaluated at a time corresponding to the instant of the initiation of the breaking process.

NOTE — Specifications concerning the instant of the initiation of the breaking process are to be found in the individual standards. For mechanical switching devices, it is usually defined as the moment of initiation of the arc during the opening operation.

6.7 Breaking Current — The current in a pole of a switching device at the instant of initiation of the arc during a breaking operation.

6.8 Breaking Capacity (of a Switching Device) — A value of prospective breaking current that a switching device is capable of breaking at a stated voltage under prescribed conditions of use and behaviour.

NOTE — The voltage to be stated and the conditions to be prescribed are dealt with in the individual specifications.

6.9 Making Capacity (of a Switching Device) — A value of prospective making current that a switching device is capable of making at a stated voltage under prescribed conditions of use and behaviour.

NOTE — The voltage to be stated and the conditions to be prescribed are dealt with in the individual specifications.

6.10 Short-Circuit Making Capacity — A making capacity for which the prescribed conditions include a short circuit at the terminals of the switching device.

6.11 Short-Circuit Breaking Capacity — A breaking capacity for which the prescribed conditions include a short circuit at the terminals of the switching device.

6.12 Cut-Off Current (of a Switching Device) — The maximum instantaneous value of current attained during the breaking operation of a switching device.

NOTE — This concept is of particular importance when the switching device operates in such a manner that the prospective peak current of the circuit is not reached.

6.13 Time-Current Characteristic (of a Switching Device on AC) — A curve giving, under stated conditions of operation, the value of operating time expressed as virtual time as a function of the prospective symmetrical current, expressed as the rms value.

6.14 Cut-Off Current Characteristic (of a Switching Device on AC) — A curve giving, under stated conditions of operation, the cut-off current as a function of the prospective symmetrical current, expressed as the rms value.

6.15 Overcurrent Discrimination — Co-ordination of the operating characteristics of two or more overcurrent protective devices such that, on the incidence of overcurrents within stated limits, the device intended to operate within these limits does so, while the others do not operate.

6.16 Take-Over Current — The current co-ordinate of the intersection between the time-current characteristics of two overcurrent protective devices.

6.17 Short-Time Withstand Current — The current that a switching device can carry in the closed position during a specified short time under prescribed conditions of use and behaviour.

6.18 Peak Withstand Current — The value of peak current that a switching device can withstand in the closed position under prescribed conditions of use and behaviour.

6.19 Applied Voltage — The voltage which exists across the terminals of a pole of a switching device just before the making of the current.

6.20 Recovery Voltage — The voltage which appears across the terminals of a pole of a switching device after the breaking of the current.

NOTE — This voltage may be considered in two successive intervals of time, one during which a transient voltage exists, followed by a second one during which power-frequency voltage alone exists.

6.21 Transient Recovery Voltage (TRV) — The recovery voltage during the time in which it has a significant transient character.

NOTE 1 — The transient voltage may be oscillatory or nonoscillatory or a combination of these depending on the characteristics of the circuit and the switching device. It includes the voltage shift of the neutral of a polyphase circuit.

NOTE 2 — The transient recovery voltage in three-phase circuits is, unless otherwise stated, that across the first pole to clear, because this voltage is generally higher than that which appears across each of the other two poles.

6.22 Power-Frequency Recovery Voltage — The recovery voltage after the transient voltage phenomena have subsided.

NOTE — This definition applies also to the case of dc, the frequency being then considered as zero.

6.23 Prospective Transient Recovery Voltage (of a Circuit) — The transient recovery voltage following the breaking of the prospective symmetrical current by an ideal switching device.

NOTE — The definition assumes that the switching device, for which the prospective transient recovery voltage is sought, is replaced by an ideal switching device, that is having

instantaneous transition from zero to infinite impedance at the very instant of zero current (that is at the 'natural' current zero). For circuits where the current can follow several different paths, for example polyphase circuits, the definition further assumes that the breaking of the current by the ideal switching device takes place only in the pole considered.

6.24 Peak Arc Voltage — The maximum instantaneous value of voltage which under prescribed conditions appears across the terminals of a pole of a switching device during the arcing time.

6.25 Clearance — The distance between two conductive parts along a string stretched the shortest way between these conductive parts.

6.26 Clearance Between Poles — The clearance between any conductive parts of adjacent poles.

6.27 Clearance to Earth (of a Pole) — The clearance between any conductive parts and any parts which are earthed or intended to be earthed.

6.28 Clearance Between Open Contacts (Gap) — The total clearance between the contacts, or any conductive parts connected thereto, of a pole of a mechanical switching device in the open position.

6.29 Creepage Distance — The shortest distance along the surface of an insulating material between two conductive parts.

NOTE — A joint between two pieces of insulating material is considered part of the surface.

6.30 Isolating Distance (of a Pole of a Mechanical Switching Device) — The clearance between open contacts meeting the safety requirements specified for disconnectors.

6.31 Opening Time (of a Mechanical Switching Device) — The interval of time between the specified instant of initiation of the opening operation and the instant when the arcing contacts have separated in all poles.

NOTE — The instant of initiation of the opening operation, that is the application of the opening command (for example, energizing the release, etc) is given in the relevant specifications.

6.32 Arcing Time of a Pole — The interval of time between the instant of the initiation of the arc in a pole and the instant of final arc extinction in that pole.

6.33 Arcing Time of Multipole Switching Device — The interval of time between the instant of the first initiation of an arc and the instant of final arc extinction in all poles.

6.34 Break-Time — The interval of time between the beginning of the opening time of a mechanical switching device (or the pre-arcing time of a fuse) and the end of the arcing time.

6.35 Make-Time — The interval of time between the initiation of the closing operation and the instant when the current begins to flow in the main circuit.

6.36 Closing Time — The interval of time between the initiation of the closing operation and the instant when the contacts touch in all poles.

6.37 Make-Break Time — The interval of time between the instant when the current begins to flow in a pole and the instant of final arc extinction in all poles, with the opening release energized at the instant when current begins to flow in the main circuit.

6.38 Dead Time (During Autoreclosing) — The interval of time between final arc extinction in all poles on the opening operation and the first re-establishment of current in any pole on the subsequent closing operation.

6.39 Reignition (of an AC Mechanical Switching Device) — A resumption of current between the contacts of a mechanical switching device during a breaking operation with an interval of zero current of less than a quarter cycle of power frequency.

6.40 Restrike (of an AC Mechanical Switching Device) — A resumption of current between the contacts of a mechanical switching device during a breaking operation with an interval of zero current of a quarter cycle of power frequency or longer.

7. SWITCHING DEVICES

7.1 Switching Device — A device designed to make or break the current in one or more electric circuits.

7.2 Mechanical Switching Device — A switching device designed to close and open one or more electric circuits by means of separable contacts.

7.3 Semiconductor Switching Device — A switching device designed to make the current in an electric circuit by means of the controlled conductivity of a semiconductor.

7.4 Switch (Mechanical) — A mechanical switching device capable of making, carrying and breaking currents under normal circuit conditions which may include specified operating overload conditions and also carrying for a specified time currents under specified abnormal circuit conditions such as those of short circuit.

7.5 Switch-Fuse — A switch in which one or more poles have a fuse in series in a composite unit.

7.6 Fuse-Switch — A switch in which a fuse-link or a fuse carrier with fuse-link forms the moving contact of the switch.

7.7 Earthing Switch — A mechanical switching device for earthing parts of a circuit, capable of withstanding for a specified time currents under abnormal conditions such as those of short circuit, but not required to carry current under normal conditions of the circuit.

7.8 Circuit Breaker (Mechanical) — A mechanical switching device, capable of making, carrying and breaking currents under normal circuit conditions and also making, carrying for a specified time and breaking currents under specified abnormal circuit conditions such as those of short circuit.

7.9 Current-Limiting Circuit-Breaker — A circuit-breaker with a break-time short enough to prevent the short-circuit current reaching its otherwise attainable peak value.

7.10 Contactor (Mechanical) — A mechanical switching device having only one position of rest, operated otherwise than by hand, capable of making, carrying and breaking currents under normal circuit conditions including operating overload conditions.

7.11 Control Switch — A mechanical switching device which serves the purpose of controlling the operation of switchgear or controlgear, including signalling, electrical interlocking, etc.

NOTE — A control switch consists of one or more contact elements with a common actuating system.

7.12 Pilot Switch — A nonmanual control switch actuated in response to specified conditions of an actuating quantity.

NOTE — The actuating quantity may be pressure, temperature, velocity, liquid level, elapsed time, etc.

7.13 Push-Button — A control switch having an actuator intended to be operated by force exerted by a part of the human body, usually the finger or palm of the hand, and having stored energy (spring) return.

7.14 Disconnector (Isolator) — A mechanical switching device which provides, in the open position, an isolating distance in accordance with specified requirements.

NOTE — A disconnector is capable of opening and closing a circuit when either negligible current is broken or made, or when no significant change in the voltage across the terminals of each of the poles of the disconnector occurs. It is also capable of carrying currents under normal circuit conditions and carrying for a specified time currents under abnormal conditions such as those of short circuit.

7.15 Switch-Disconnector (Switch-Isolator) — A switch which, in the open position, satisfies the isolating requirements specified for a disconnector.

7.16 Fuse-Disconnector (Fuse-Isolator) — A disconnector in which a fuse-link or a fuse carrier with fuse-link forms the moving contact of the disconnector.

8. FUSES

8.1 Fuse — A switching device that, by the melting of one or more of its specially designed and proportioned components, opens the circuit in which it is inserted and breaks the current when this exceeds a given value for a sufficient time.

NOTE — The fuse comprises all the parts that form the complete switching device.

8.2 Fuse-Element — The part of a fuse designed to melt when the fuse operates.

8.3 Fuse-Link (Fuse-Unit) — The part of a fuse intended to be replaced after the fuse has operated.

8.4 Fuse Carrier — The movable parts of a fuse designed to carry the fuse-link.

NOTE — The fuse-carrier does not include the fuse-link.

8.5 Fuse-Base — The fixed part of a fuse provided with terminals for connection to a circuit.

8.6 Enclosed Fuse-Link — A fuse-link in which the fuse-element is totally enclosed and which has been designed to eliminate any harmful external effects during operation within its rating.

NOTE — External arcing, the release of gas or the ejection of flame or metallic particles are considered harmful effects.

8.7 Indicating Device (Indicator) — A part of a fuse provided to indicate at the fuse whether the fuse has operated.

8.8 Expulsion Fuse — A fuse in which operation is accomplished by expulsion of gases produced by the arc.

8.9 Striker — A mechanical device forming part of a fuse which, when the fuse operates, releases the energy required to cause operation of other apparatus or to provide interlocking.

8.10 Fuse-Holder — The combination of a fuse-base with its fuse-carrier.

8.11 Pre-arcing Time (Melting Time) — The interval of time between the beginning of a current large enough to cause a break in the fuse element(s) and the instant when an arc is initiated.

8.12 Arcing Time — The interval of time between the instant of the initiation of the arc and the instant of final arc extinction.

8.13 Operating Time (Break Time) — The sum of the pre-arcing time and the arcing time.

8.14 Joule-Integral (I^2t) — The integral of the square of the current over a given time interval:

$$I^2t = \int_{t_o}^{t_1} i^2 \, dt$$

NOTE 1 — When considered from the point of view of the circuit protected by a fuse, the value of the Joule-integral over the operating time of the fuse is referred to a specific energy, that is the energy released as heat in 1 Ω of circuit resistance.

NOTE 2 — The values of the Joule-integral usually stated for fuse-links are pre-arcing Joule-integral and operating Joule-integral extended over the pre-arcing time and the operating time, respectively.

8.15 Virtual Time — The value of Joule-integral divided by the square of the value of the prospective current.

NOTE — The values of virtual times usually stated for a fuse-link are the values of pre-arcing time and of operating time.

8.16 Conventional Non-fusing Current — A value of current specified as that which the fuse-link is capable of carrying for a specified time (conventional time) without melting.

8.17 Conventional Fusing Current — A value of current specified as that which causes operation of the fuse-link within a specified time (conventional time).

APPENDIX A

(*Clause* 0.4)

ADDITIONAL TERMS AND DEFINITIONS

A-1. GENERAL TERMS

A-1.1 Co-ordination of Insulation — The process of correlating the insulating strength of electrical equipment with anticipated overvoltages and with the characteristics of protective devices (*see* IS : 2165-1977*). It consists of the steps taken to prevent damage to electrical equipment due to overvoltages and to localize flashover (when they cannot economically be prevented) to points where they will not cause damage.

A-1.2 Earthing Position — A position in which the closing of a mechanical switching device causes a main circuit to be short-circuited and earthed.

*Guide for insulation co-ordination (*second revision*).

A-1.3 Electrically Exposed Installation — An installation in which the apparatus is not subjected to overvoltages of atmospheric origin.

A-1.4 Electrically Nonexposed Installation — An installation in which the apparatus is subjected to overvoltages of atmospheric origin.

A-1.5 Interlocking Device — A device which makes the operation of a switching device dependent upon the position of one or more other pieces of equipment.

A-1.6 Isolated Position (Disconnected Position) — The position of a withdrawable part in which the isolating distance is established whilst the withdrawable part remains mechanically attached to the enclosure.

A-1.7 Maintenance Position (Test Position) — An isolated position in which the control circuits are connected, allowing tests of the mechanical operation of the withdrawable part.

A-1.8 Mechanical Switching Device — A switching device designed to close and open one or more electric circuits by means of separable contacts.

A-1.9 Operating Duty (of a Circuit-Breaker) — A defined sequence of making and breaking operations without any deliberate alterations of the main circuit in which circuit-breaker is placed.

A-1.10 Removed Position — The position of a removable part when outside of and mechanically separated from the enclosure.

A-2. TYPE OF CONSTRUCTION AND PHYSICAL PROTECTION

A-2.1 Compartment — A part of a metal-enclosed switchgear and controlgear, itself totally enclosed except for opening necessary for interconnection, control or ventilation.

NOTE — A compartment may be qualified by the main component contained therein, for example, circuit-breaker compartment, busbar compartment.

A-2.2 Cover — A part of the external enclosure of metal-enclosed switchgear and controlgear.

A-2.3 Cubicle Switchgear and Controlgear — Metal-enclosed switchgear and controlgear other than metal-clad switchgear and controlgear.

NOTE — This term applies to switchgear and controlgear having an external metal enclosure and having either:

a) no partition,

b) non-metallic partitions, or

c) metallic partitions having a degree of protection lower than those included in the relevant standard.

A-2.4 Door — A hinged cover.

A-2.5 Enclosure — Surrounding part of metal-enclosed switchgear and controlgear used to prevent personnel from accidentally approaching live or moving parts contained therein and to protect internal equipment against external effects.

A-2.6 Factory Assembled Switchgear and Controlgear — Switchgear and controlgear built in the factory as transportable assemblies constructed and tested under the responsibility of the manufacturer.

A-2.7 Flameproof Enclosure — An enclosure for mechanical switching device that will withstand, when the covers or other access doors are properly secured, an internal explosion of the flammable gas or vapour which may enter or which may originate inside the enclosure without suffering damage and without communicating the internal inflammation (or explosion) to the external flammable gas or vapour, for which it is designed; through any joints or other structural openings in the enclosure.

NOTE — The term 'flameproof' as used here is synonymous with the term 'explosion-proof' as used in the USA or 'pressure-proof type of protection' used in Germany for the class of apparatus covered.

A-2.8 Gate-End Box — A flameproof enclosure containing electrical apparatus such as controlgear, switchgear, and/or protective gear, designed primarily for use in proximity to the coal face.

A-2.9 Open Type Apparatus — Apparatus in which live parts can be touched.

A-2.10 Partition — A part of the enclosure of a compartment separating it from another compartment.

NOTE — A partition becomes a cover when it is accessible from the outside in one of the positions defined in **2.10** of IS : 3427-1969*.

A-2.11 Proof — Apparatus is defined as proof when so designed that its successful operation is not interfered with when the apparatus is subjected to the specified external agent under given conditions.

A-2.12 Removable Part — A part which may be removed entirely from the metal-enclosed switchgear and controlgear even though the main circuit is live.

A-2.13 Resistant — Apparatus is defined as resistant when so designed that it will not deteriorate when subjected to the specified external agent under given conditions.

A-2.14 Screened Apparatus (Partially Enclosed Apparatus) — Apparatus in which live parts are protected from accidental contact by any person.

*Specification for metal-enclosed switchgear and controlgear for voltages above 1 000 V but not exceeding 11 000 V.

A-2.15 Segregation — A general term describing an arrangement of conductors with earthed metal interposed between them in such a manner that dielectric breakdown can only occur to earth.

A-2.16 Shutter — A part which can be moved between a position in which it permits contacts of removable parts to engage fixed contacts, and a position in which it becomes a part of a cover or a partition shielding the fixed contacts.

A-2.17 Single-Tank Switch (Single-Tank Circuit-Breaker) — A multipole switch or circuit-breaker with a single-oil filled tank containing the breaking element of all the poles.

A-2.18 Tight — Apparatus is defined as tight when so constructed that the enclosing case will prevent entry of the specified external agent under given conditions.

A-2.19 Totally Enclosed Apparatus — Apparatus completely enclosed in such a way as to make it impossible for foreign bodies to make accidental or intentional contact with a live part so long as the enclosure is in position.

A-2.20 Transportable Assembly — An assembly or sub-assembly of metal-enclosed switchgear and controlgear, suitable for shipping without being dismantled.

A-2.21 Withdrawable Part — A removable part capable of being displaced to a position in which it provides an isolating distance or segregation whilst remaining mechanically attached to the enclosure.

A-3. CONSTRUCTIONAL ELEMENTS

A-3.1 Accidentally Dangerous Part — A conducting part which can be touched readily by an operator and which is normally not alive, but which may become alive as a result of an insulation failure if it is not earthed.

A-3.2 Break (Applicable to a Circuit-Breaker) — A sum of gaps introduced in one pole between main contacts or arcing contacts (if any) when the circuit-breaker is fully open.

A-3.3 Closing Release — A release which mechanically releases the energy stored in a spring, a counterweight or the like, used for closing the circuit-breaker.

A-3.4 Conducting Part — A part which is capable of conducting current although it may not necessarily be used for carrying service current.

A-3.5 Making Current Release (of a Circuit-Breaker) — A release which permits a circuit-breaker to open, without any intentional time-delay only during a closing operation if the making current exceeds a predetermined value, and which is rendered inoperative when the circuit-breaker is in the closed position.

A-3.6 Overcurrent Device — A device designed to cause interruption of the circuit with both operational excess current and short-circuit current.

A-3.7 Overload Device — A device, the operation of which causes the mechanical switching device to interrupt current at a predetermined excess value but not necessarily under short-circuit conditions. Such a device normally includes some form of time delay.

A-3.7.1 *Overload Release* — A release which permits a mechanical switching device to open automatically when current in at least one of the poles of its main circuit exceeds a predetermined value.

A-3.7.2 *Overload Relay* — A relay which permits a mechanical switching device to open automatically through an auxiliary contact or a device when current in at least one of the poles of its circuit exceeds a predetermined value.

A-3.8 Relay — An auxiliary device which may or may not be part of the mechanical switching device intended to cause the automatic opening or closing of the main circuit current when predetermined conditions are realized.

A-3.9 Undervoltage Protection (of a Starter) — A protection in which the starter opens the circuit if the voltage fails or falls to an abnormally low value but cannot be closed on restoration of adequate voltage until subsequent manual operation or its equivalent.

A-4. OPERATION

A-4.1 Mechanical Switching Device with Lock-Out Preventing Closing — A mechanical switching device in which none of the moving contacts can make current if the closing command is initiated while the conditions necessary for the opening operation remain established.

A-5. CHARACTERISTIC QUANTITIES

A-5.1 Amplitude Factor — Ratio between the highest peak value of the transient recovery voltage and the amplitude of the recovery voltage at supply frequency.

A-5.2 Arc Voltage (of a Fuse-Link) — The voltage that exists across a fuse-link during the arcing time.

A-5.3 Symmetrical Breaking Capacity — The rms value of the ac component of the current that the switching device shall be able to break at a stated voltage simultaneously in all the poles of a switching device.

A-5.4 Asymmetrical Breaking Capacity — The rms value of the combined ac and dc components of the currents that the switching device shall be able to break at a stated voltage by any one pole of a switching device.

A-5.5 Mainly Active Load Breaking Capacity — The breaking capacity when breaking a load at an inductive power factor of 0·7.

A-5.6 Closed Loop Breaking Capacity (of a Switch or Switch Isolator) — The breaking capacity at an inductive power factor of 0·3 in a closed loop circuit, that is, a circuit in which both sides of the switch remain live after breaking and in which the voltage appearing across the terminals is substantially less than the system voltage.

A-5.7 Critical Current — The value of the breaking current, less than the rated breaking capacity, at which the arc duration is at maximum and shows a marked increase compared with that corresponding to the rated breaking capacity.

A-5.8 Discrimination — Discrimination between two or more fuse-links or any other protective device in series is said to occur when on the incidence of a short circuit or an overcurrent only the desired fuse-link or other protective device operates.

A-5.9 Duration of Short Circuit — The period of time for which the switch or switch-isolator can carry a short circuit current of specified value.

A-5.10 Duty (of a Fuse-Link) — The satisfactory opening, at declared voltages not higher than its rated voltage, of the circuit or circuits protected by a fuse-link under conditions that produce for the requisite length of time any prospective current greater than its minimum fusing current up to its rupturing capacity rating.

A-5.11 Fusing Factor — The ratio, greater than unity, of the minimum fusing current to the rated current, namely:

$$\text{Fusing factor} = \frac{\text{Minimum fusing current}}{\text{Rated current}}$$

A-5.12 Insulation Level (Rated) — The voltage values (both power frequency and impulse) which characterise insulation of the equipment with regard to its capability to withstand the dielectric stresses.

A-5.12.1 *Impulse Withstand Voltage* — The value of the amplitude of the standard impulse voltage wave which the insulation of the mechanical switching device shall withstand under specified test conditions.

A-5.13 Pre-arcing I^2t (of a Fuse-Link) — The measure of the heating effect of the current during the pre-arcing time derived from the time integral of the square of the current actually passed by the fuse-link during the pre-arcing time as recorded by the oscillogram during the test laid down in the relevant specification and where I is rms current.

A-5.14 Arcing I^2t (of a Fuse-Link) — The measure of the heating effect of the current during the arcing time derived from the time integral

of the square of the current actually passed by the fuse-link during the arcing time as recorded by the oscillogram during the test laid down in the relevant specification and where I is the rms current.

A-5.15 Total I^2t (of a Fuse-Link) — The sum of the pre-arcing I^2t and arcing I^2t.

A-5.16 Loop — That part of an alternating wave which extends from one zero to next.

NOTE 1 — Successive loops may have different durations or amplitudes in the region of initiation of current. The larger loops are called major loops and the smaller ones are called minor loops.

NOTE 2 — For the purpose of indicating the number of current-zeros during arcing-time, arcing-time may be referred to as including a stated number of loops.

A-5.17 Mechanical Loading of Terminal (of an Isolator) — The mechanical load at each terminal equivalent to the combined mechanical forces to which the isolator may be subjected.

A-5.18 Minimum Fusing Current — The minimum current at which a fuse-element shall melt, that is, the asymptotic value of current shown by the curve of total operating time.

A-5.18.1 In practice, this is deemed to be the value of the current corresponding (on the curve) to an arbitrary time sufficiently long for the asymptotic value to be nearly reached.

A-5.19 Minimum Nonfusing Current — The asymptotic value of current shown by the curve of pre-arcing time.

A-5.19.1 In practice, this is deemed to be the value of current corresponding on the curve to an arbitrary time sufficiently long for the asymptotic value to be nearly reached.

A-5.20 Natural Frequency — The frequency at which the circuit shall oscillate if it is free to do so. Circuit may have more than one natural frequency. These are the frequencies which occur in the transient component of the recovery voltage.

A-5.21 Opening Time (Until Separation of the Arcing Contacts) — The opening time until separation of the arcing contacts of a mechanical switching device is defined according to the type of its opening release as stated below, and with any time delay device forming an integral part of the mechanical switching device adjusted to its minimum setting or, if possible, cut out entirely:

a) For a mechanical switching device tripped by any form of auxiliary power, the opening time is measured from the instant of application of the auxiliary power to the opening release of the mechanical switching device, when in the closed position, to the instant when the closed position, to the instant when the arcing contacts have separated in all poles.

b) For a mechanical switching device tripped by a current in the main circuit without the aid of any form of auxiliary power, the opening time is measured from the instant at which, the mechanical switching device being in the closed position, the current in the main circuit reaches the operating value of the overcurrent release to the instant when the arcing contacts have separated in all poles.

NOTE — For switching devices which embody switching resistors, it may be necessary to make a distinction between the opening time up to the instant of the separation of the arcing contacts and the opening time up to the instant of the separation of the contacts in series with the switching resistors.

A-5.22 Operating Time — The sum of the pre-arcing time and the arcing time.

A-5.23 Operation (of a Fuse-Link) — The process between the beginning of the pre-arcing time and the end of the arcing time. Operation is sometimes called 'blowing'.

A-5.24 Overvoltage to Earth — A voltage to earth, expressed as a peak voltage, which is greater than the normal peak voltage to earth corresponding to the highest system voltage.

A-5.24.1 *Assigned Maximum Overvoltages* — The maximum permissible overvoltages which may occur under prescribed test conditions when breaking current lower than or equal to the rated breaking capacity. They shall include the overvoltage values for the load side and for the supply side of the switch or switch-isolator measured at its terminals.

A-5.25 Peak Current (of a Starter) — The highest peak value of the rms current which is attained during the short-circuit conditions between the steps.

A-5.26 Peak Making Current — The highest peak value of current in a pole of a switching device when the current is established by the closing of the device.

A-5.26.1 *Peak Making Current of Circuit, Prospective (with Respect to a Switching Device Situated Therein)* — The highest peak value of prospective current of a circuit.

NOTE 1 — The prospective peak making current is used instead of the peak making current, in expressing the making capacity of switching device which inherently and materially influence the current in the circuit.

NOTE 2 — The prospective peak making current of a polyphase circuit refers to the conditions when the circuit is made simultaneously in all phases.

A-5.27 Peak Short-Circuit Current — The peak value (including the dc component) of the first major half-cycle of the short-circuit current.

A-5.28 Peak Withstand Current — The value of peak current that a switching device withstand in the closed position under prescribed conditions of use and behaviour.

A-5.29 Power Frequency Withstand Voltage — The rms value of the sinusoidal alternating voltage at power frequency which the insulation of a mechanical switching device shall withstand under specified test conditions.

A-5.30 Pre-arcing Time (Melting Time) of a Fuse — The time between the commencement of a current large enough to cause the fuse element(s) to melt and the instant where the arc is initiated.

A-5.31 Rated Air Supply Pressure — The rated supply pressure of pneumatic or electro-pneumatic switching device is the air pressure upon which the operating characteristics of the pneumatic control system are based.

A-5.32 Rated Breaking Capacity (of a Fuse) — The value of breaking capacity assigned to a fuse.

A-5.33 Rated Current — The rms value of the current which the mechanical switching device shall be able to carry continuously at its rated frequency, under prescribed test conditions.

A-5.34 Rated Frequency — The service frequency for which the mechanical switching device is designed and to which characteristic values correspond.

A-5.35 Rated Insulation Voltage (of a Starter) — The value of voltage which designates the starter and to which dielectric tests clearance and creepage distances in air are referred. For polyphase circuits it is the voltage between phases.

A-5.36 Rated Mechanical Load (of an Isolator) — The highest static force that an isolator is capable of withstanding, this force being applied at each terminal in any direction, in a plane at right angles to the axis of the insulator.

A-5.37 Rated Operational Current (of a Contactor) — It is the value of current which determines the conditions of use of the contactor. It is stated by the manufacturer and takes into account the rated operational voltage, frequency, rated duty, the utilization category and the type of protective enclosures specified by the user.

The rated making and breaking capacities of a contactor are generally expressed in relation to the rated operational current. In the case of contractors of motors, the indication of operational current may be replaced by a statement of the power rating of the motor corresponding to the rated operational voltage considered. The manufacturer shall be prepared to indicate the assured relation between the current and the power.

A-5.38 Rated Operational Currents (of a Starter) — It is stated by the manufacturer and takes into account the rated current of the overload relay installed in the starter, the rated operational voltage, the rated frequency, the rated duty, the utilization category and the type of protective enclosure.

A-5.38.1 The indication of a rated operational current may be replaced by the indication of the maximum rated power output at the rated operational voltage considered, of the motor for which the starter is intended. The manufacturer shall be prepared to state the relationship assumed between the current and the power.

A-5.39 Rated Operational Voltage (of a Starter or Contactor) — The value of voltage which combined with a rated operational current determines the application of the starter or contactor and to which are referred to the making and breaking capacities, the types of duty and the utilization category. For polyphase circuits, it is stated as a voltage between phase.

A-5.40 Rated Peak Short-Circuit Current — That value of the peak short-circuit current which a mechanical switching device can carry in the closed position without damage.

A-5.41 Rated Short Time Current (of an Isolator or Earthing Switch) — That short time current which an isolator or an earthing switch can carry for a period of 1 second.

A-5.42 Rated Supply Voltage and Frequency of Control Circuit — The values of supply voltage and frequency upon which the operation, temperature-rise and insulation characteristics of the operating coils are based.

A-5.43 Rated Thermal Current — It is the value of current which determines the temperature-rise conditions of the main circuit in the absence of any starting or stopping operation of the starter or closing or opening operation of a contactor. The starter or contactor is capable of carrying this current for 8 hours. The contacts being closed throughout this period without the temperature-rise of its several parts exceeding the limits specified in the relevant specification. The rated thermal current may differ according to the type of enclosure.

A-5.44 Rated Voltage — The rms value of the voltage used to designate the mechanical switching device and to which are related the operating conditions.

A-5.45 Rating — General terms employed to designate the characteristic values that together define the working conditions upon which the tests are based and for which the equipment is designed.

NOTE — Examples of rated values usually stated are: voltage, current, breaking capacity, insulation level, etc.

A-5.46 Rupturing Capacity (of a Fuse-Link) — A value of the prospective current (stated by the manufacturer) a fuse-link is capable of breaking at a stated voltage under prescribed conditions of use and behaviour.

A-5.47 Short-Circuit Breaking Power Factor — Under consideration.

A-5.48 Short-Time Current — The rms value of the current that a switching device can carry in the closed position during a specified short time under prescribed conditions of use and behaviour.

A-5.49 Size (of a Fuse) — The maximum rated current (expressed in amperes) that fuse of a given dimension may be allocated.

A-5.50 Take-Over Current — The current co-ordinate of the intersection between the time-current characteristics of two over-current protective devices.

A-6. SWITCHES AND DISCONNECTOR

A-6.1 Auxiliary Switch — A switch working in conjunction with and actuated by the mechanical switching device and serving to control auxiliary devices, such as trip coils, indicating lamps and alarm-bells or for providing electrical interlocking.

A-6.2 Air-Break Isolator — A manually-operated device capable of isolating in air the circuit under no-load conditions only.

A-6.3 Air-Break Switch — A non-automatic device capable of making, carrying and breaking its normal rated current and limited overcurrent in air in addition to being capable of making circuits under abnormal conditions, for instance, short circuit when associated with a fuse.

A-6.4 Cam-Operated Switch — A switch consisting of fixed contact elements and movable contact elements operated in sequence by a camshaft.

A-6.5 Composite Unit of Switches and Fuse — A combination of a switch in series with a fuse (or fuses) within an enclosure (or enclosures) so as to form a composite whole.

A-6.6 Drum Controller — A selector switch in which the moving contact members are arranged on a cylindrical surface.

A-6.7 Indicating Device (of a Switch or Switch Isolator) — A device which indicates, at the location of the switch or switch-isolator, whether the separable contacts of the switch or switch-isolator are in the open or closed position.

A-6.8 Isolating Switch — A switch which isolates a circuit and is capable of breaking not less than its rated current at rated voltage.

A-6.9 Limit Switch — A position switch in which the contacts are actuated when a moving part reaches the end of its normal travel.

A-6.10 Master Controller (Auxiliary Controller) — A controller the contacts of which are included in the auxiliary circuit of an apparatus.

A-6.11 Over Travel Switch — A position switch in which the contacts are actuated when a moving part passes beyond its normal travel.

A-6.12 Position Switch — A device in which the contacts are actuated in accordance with a predetermined position of a moving part.

A-6.13 Push Button Switch — A switching device wherein a push button acts as operating element.

A-6.14 Quick Make-and-Break Switch — A switch in which quick make-and-break of the circuit is ensured through the medium of a spring or by other means independent of the speed of operation of the operator.

A-6.15 Reversing Switch — A selector switch for reversing the connections of a part of a circuit.

A-6.16 Rotary Switch — A switch or selector switch in which the movable contact members move in an accurate path.

A-6.17 Selector Switch — A device used to select any one of two or more circuits.

A-6.18 Splitter Unit — A composite unit comprising a switch of not more than 2 poles and a bank of not more than 8 fused ways connected in any one pole to a common busbar.

NOTE — In some forms of splitter unit a fuse of the same rated current as that of the switch is in series with the bank of fused ways.

A-6.19 Star-Delta Switch — A selector switch intended to connect the three circuits of a three-phase device either in star or delta.

A-6.20 Travel Reversing Switch — A device in which the contacts are actuated to reverse the direction of movement of a reciprocating part at a predetermined position.

A-7. CIRCUIT-BREAKERS

A-7.1 Air Blast Circuit-Breaker — A circuit-breaker in which circuit breaking occurs in a blast of air under pressure.

A-7.2 Air Break Circuit-Breaker — A circuit-breaker in which circuit breaking occurs in air at atmospheric pressure.

A-7.3 Automatic Circuit-Breaker — A circuit-breaker in which the breaking occurs automatically under predetermined conditions.

A-7.4 Automatic Reclosing Circuit-Breaker (Automatic Circuit Recloser) — A circuit-breaker designed to reclose automatically a circuit according to a predetermined duty cycle after an automatic opening.

A-7.5 Circuit-Breaker (Mechanical) — A mechanical switching device, capable of making, carrying and breaking currents under normal circuit conditions and also making, carrying for a specified time and breaking currents under specified abnormal circuit conditions, such as those of short circuit.

NOTE — A circuit-breaker is usually intended to operate in frequently although some types are suitable for frequent operation.

A-7.6 Dead Tank Oil Circuit-Breaker (Bulk Oil Circuit-Breaker) — An oil circuit-breaker in which the oil content is used for arc-extinction and also for insulating live parts from the tank which is dead and generally earthed (grounded).

A-7.7 Hard Gas Circuit-Breaker — A circuit-breaker in which the arc acts upon gas-producing solid material and so produces a quantity of gas sufficient to create an arc quenching blast.

A-7.8 High Speed Circuit-Breaker (DC) — A circuit-breaker with very short breaking time which is intended to prevent the short-circuit current from attaining its prospective value.

A-7.9 Live Tank Oil Circuit-Breaker (Small Oil Volume Circuit-Breaker) — An oil circuit-breaker in which the oil is primarily used for ac extinction and not necessarily for insulating live parts from earth (ground). The tanks of such circuit-breakers are insulated from earth (ground). These circuit-breakers are always phase separated.

A-7.10 Magnetic Blow Out Circuit-Breaker — A circuit-breaker in which the interaction between a magnetic field and the arc current is used to extinguish the arc.

A-7.11 Oil Circuit-Breaker — A circuit-breaker in which circuit breaking occurs in oil.

A-7.12 Remote Controlled Circuit-Breaker — A circuit-breaker that may be opened and closed from a distance.

A-8. APPARATUS FOR STARTING AND CONTROL

A-8.1 Composite Resistor — A resistor in which the element having resistance is composed of mixtures of conducting and insulating materials in the form of compressed powders.

A-8.2 Constant Voltage Regulator (Voltage Stabilizer) — A device intended to maintain a constant voltage across a circuit connected to a variable voltage bus.

A-8.3 Contactor — A mechanical switching device having only one position of rest (corresponding to the position of the main contacts either open or closed) operated otherwise than by hand, capable of making, carrying and breaking currents under normal circuit conditions including operating overload conditions, the speed of make and break being independent of the operator.

A-8.3.1 *Air-Break Contactor* — A contactor in which the main circuit is made and broken in the air.

A-8.3.2 *Electro-pneumatic Contactor* — A contactor the moving elements of which leave the position of rest when compressed air is fed by means of electrically controlled valves, to a device which acts on the mechanism of the contactor.

A-8.3.3 *Electromagnetic Contactor* — A contactor the moving elements of which leave the position of rest when an electromagnet is energized and acts directly on the mechanism of the contactor.

A-8.3.4 *Latched Contactor* — A contactor the moving elements of which leave the position of rest when the operating means are energized, but which are prevented by means of a latching arrangement from returning to the position of rest when the operating means are de-energized. The latching and the release of the latching may be mechanical, magnetic, electrical or pneumatic.

NOTE — Because of the latching, the latched contactor actually acquires a second position of rest and, according to the definition in **A-8.3**, it is not a contactor. However, since the latched contactor in both its utilization and its design is more closely related to contactors in general than to any other classification of switching devices, it is considered proper that it should comply with the specifications of contactors wherever they are applicable.

A-8.3.5 *Oil-Immersed Contactor* — A contactor in which main circuit is made and broken ino il.

A-8.3.6 *Pneumatic Contactor* — A contactor the moving elements of which leave the position of rest when compressed air is fed without the use of electrical means, to a device which acts on the mechanism of the contactor.

A-8.4 Controller — A device, or group of devices, which serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected.

A-8.5 Field Rheostat — A rheostat designed to regulate the excitation current of a machine.

A-8.6 Film Resistor — A resistor in which the element having resistance comprises a thin film of conducting material on an insulating support.

A-8.7 Inductor with Adjustable Air Gap — An inductor which can be regulated by varying the reluctance of its magnetic circuit by means of an adjustable air gap.

A-8.8 Liquid Resistor — A resistor comprising electrodes immersed in a liquid.

A-8.9 Load Rheostat (Loading Resistor) — A rheostat intended to constitute a load, for example, for load tests of generators.

A-8.10 Metallic Resistor — A resistor in which the conductor is metallic.

A-8.11 Potentiometer Type Resistor — A resistor with intermediate tappings allowing fractions of the voltage across the resistor to be obtained between the tappings.

A-8.12 Potentiometer Type Rheostat — A potentiometer type resistor from which varying voltage values can be tapped off (by a switch or sliding contact) without disconnecting the connections.

A-8.13 Regulating Inductor — A device designed to regulate within certain limits either the current or the voltage drop in the circuit where it is connected.

A-8.14 Regulator — A device capable of maintaining practically constant, or varying in a prescribed manner, one operational quantity, namely, current, voltage, speed or power.

A-8.15 Resistance Step — The value of the resistance between two adjacent steps of the starters.

A-8.16 Resistor — An arrangement of conductors mainly used for its resistance.

A-8.17 Rheostat — A variable resistor which can be regulated without disconnecting any connection.

A-8.18 Rotor Rheostat — A rheostat connected to the rotor windings of a motor.

A-8.19 Slip Regulator — A speed adjusting rheostat for an induction motor.

A-8.20 Speed Regulating Rheostat — A rheostat for the regulation of the speed of a motor.

A-8.21 Starter — A device (or assembly of devices) designed for starting a motor or controlling an apparatus.

A-8.21.1 *Air-Break Starter* — A starter in which the main circuit is made and broken in air.

A-8.21.2 *Automatic Starter* — A device so designed that, after an initiating impulse given by another device or an operator, the complete cycle of operations necessary for starting is carried out automatically.

A-8.21.3 *Cam Starter* — A starter in which the moving contacts are operated by a cam shaft.

A-8.21.4 *Direct-On-Line Starter* — A switching starter which connects a line voltage across the motor terminals in one step.

A-8.21.5 *Drum Starter* — A starter in which the moving contact parts are arranged upon a cylindrical surface.

A-8.21.6 *Face Plate Starter* — A starter in which switch contact parts are arranged upon a plane surface.

A-8.21.7 *Motor Starter* — A combination of all the switching and regulating means to start and stop a motor.

NOTE — For normal applications, the starter is provided with protective device, such as for overload and undervoltage.

A-8.21.7.1 *Motor switch* — Switch capable of performing the functions of a motor starter but without any protective devices.

A-8.21.8 *Oil-Immersed Starter* — A starter in which main circuit is made and broken in oil.

A-8.21.9 *Pole Changing Starter* — A starter for an induction motor having several starter windings which may be combined differently depending on the desired number of poles; the starter is designed to feed the different windings according to a sequence suitable for starting the motor.

A-8.21.10 n-*Step Starter* — A starter in which there are ($n - 1$) accelerating positions between the 'off' and the 'full-on' positions.

Example:

A 5-step resistance starter has four resistance sections and a star-delta starter is a 2-step starter.

A-8.21.11 *Reduced Voltage Starter* — A starter so arranged that with the switching device in intermediate or starting position, reduced voltage is applied to the motor terminals.

A-8.21.12 *Resistance Starter* — A starter comprising a resistor and means for readily reducing the amount of resistance in the circuit.

A-8.21.13 *Reversing Starter* — A switching starter meant for changing over the connections to the stator windings of the motor with the object of changing its direction of rotation.

A-8.21.14 *Semi-automatic Starter* — A starter, the automatic operation of which can be limited to a greater or smaller part of the starting operations, at the will of the operator.

A-8.21.15 *Series-Parallel Starter* — A switching starter for induction motors arranged in such a way that in the starting position all the windings of each phase are in series and in the running position the windings of each phase are in parallel circuit.

A-8.21.16 *Single-Phase Split Phase Starter* — A starter for a single-phase induction motor which has in the starting position on the stator side a phase splitter consisting of a resistor or reactor or both for starting purposes.

A-8.21.17 *Single-Step Starter* — A starter in which there is no accelerating position between the 'off' and the 'full-on' positions.

A-8.21.18 *Stator/Rotor Starter* — A resistance starter which comprises a switching device for connecting the primary winding of an ac motor to the supply and means for varying the amount of resistance in the secondary circuit. The switching device for the primary winding may be supplied separately.

A-8.21.19 *Star-Delta Starter* — A switching starter for a three-phase induction motor arranged in such a way that in the starting position the stator windings are connected in star and in the running position they are connected in delta.

A-8.21.20 *Stator Resistance (or Inductance) Starter* — A starter for an ac motor which inserts momentarily one or more resistances (or inductances) in series with the stator winding and cuts them out in succession.

A-8.21.21 *Switching Starter* — A starter which is arranged to start a motor without any current limiting devices, such as auto-transformers and resistors.

A-8.21.22 *Transformer Starter (or Auto-transformer Starter)* — A reduced-voltage starter for an ac motor which uses for starting one or several reduced voltages derived from a transformer (or an auto-transformer).

A-8.21.23 *Two-Step Starter* — A starter in which there is one accelerating position between the 'off' and the 'full-on' positions.

A-8.21.24 *Starter with Automatic Cutout (Starter with Automatic Trip Device)* — A starter which automatically stops the motor under predetermined conditions.

A-8.21.25 *Rotor Resistance Starter* — A starter for an ac motor which inserts momentarily one or more resistances in series with the rotor winding and cuts them out in succession.

A-8.22 Starter Rheostat — A rheostat designed to limit the current taken by a starting motor or device and the resistors of which are cut out when the motor of device is in normal operation.

A-8.23 Starting Capacitor — A capacitor connected in series with the auxiliary winding of a single-phase motor in order to obtain the phase-displacement necessary to start the rotor.

A-8.24 Tap Changer (for Off-Voltage and On-Load Operation) — A device designed to change the connections to transformer tappings so as to modify the voltage ratio of the transformer.

A-8.25 Tapped Variable Inductor — An inductor which can be varied by means of taps in the winding.

A-8.26 Variable Voltage Regulator — A device connected between a constant voltage circuit and a receptor circuit designed for gradually varying the voltage across the receptor.

A-9. SWITCHBOARD CUBICLE, BOXES

A-9.1 Box — An enclosure in the form of a box containing an assembly of switchgear.

A-9.2 Bus Bars — Conductors to which several sources of supply, or several distribution circuits, are connected.

A-9.3 Cell — Compartment of a sub-station or of a switchboard separated by partitions from adjoining compartments.

A-9.4 Corridor Switchboard (Duplex Switchboard) — A switchboard on which apparatus is mounted on two opposite sides separated by an accessible corridor.

A-9.5 Cubicle — A container in the form of a cabinet enclosing an assembly of switchgear.

A-9.6 Cubicle Switchboard — A switchboard the different elements or groups of elements of which are enclosed in separate compartments.

A-9.7 Cutout — An appliance for automatically interrupting the transmission of energy through any conductor when the current rises above a predetermined value, and shall also include fusible cutout.

A-9.8 Desk — A switchboard in the form of a desk.

A-9.9 Distribution Pillar — A totally enclosed structure or cubicle containing bus bars connected to incoming and outgoing distribution feeders controlled through links or fuses.

A-9.10 Draw-Out Switchboard — A switchboard composed of draw-out elements for easy change and inspection.

A-9.11 Dual Switchboard — A switchboard closed at the sides on which apparatus is mounted on two opposite faces.

A-9.12 Enclosed Distribution Fuseboard — An enclosure containing bus bars with fuses for the purpose of protecting, controlling or connecting more than one outgoing circuit fed from one or more incoming circuits.

A-9.13 Mimic Diagram Board — A switchboard on which is reproduced the diagram of the main circuits and which sometimes includes the controlling device of the main switchgear.

A-9.14 Neutral of a Distribution Fuseboard — A bus bar intended to be connected to the neutral conductor of a distribution system, provided with terminals and links (if required) for outgoing circuits.

A-9.15 Neutral of a Distribution Pillar — A bus bar provided with terminals (and if required, links) for connection to the neutral conductor of outgoing and incoming circuits of a distribution system.

A-9.16 Number of Ways of a Distribution Pillar — The maximum number of circuits for which the distribution pillar is designed.

A-9.17 Pillar — A pillar which supports or contains electrical control device.

A-9.18 Pole of a Distribution Fuseboard — When a bus bar of a distribution fuseboard has associated with its fuses for outgoing circuits; bus bar, with its associated fuses, is called a pole of the distribution circuits.

A-9.19 Pole of a Distribution Pillar — When a bus bar of a distribution pillar is associated with its fuses and/or links for outgoing or incoming circuits, a bus bar along with its associated fuses and/or links is called a pole of the distribution circuit.

A-9.20 Switchboard — An assembly including the switchgear for the control of electrical circuits, the electrical connections and the supporting frame.

A-9.21 Wiring — The whole group of conductors of small cross section in an electrical apparatus.

A-10. FUSES

A-10.1 Arc Extinguishing Medium — Material surrounding the fuse element provided to facilitate breaking of the current.

A-10.2 Cartridge Fuse-Link — A fuse-link having an insulating enclosure, usually cylindrical, provided at its two ends with metal contacts.

A-10.3 Current Limiting Fuse-Link — A fuse-link that, during and by its operation in a specified current range limits the current to a substantially lower value than the peak value of the prospective current.

A-10.4 Drop-Out Fuse — A fuse in which the fuse-carrier drops into a position to provide an isolating distance after the fuse has operated.

A-10.5 Expandable Cap — Replacement part or assembly for closing one end of the fuse-carrier. It includes a pressure-responsive section that opens to relieve the pressure within the fuse-carrier when a predetermined value is exceeded during circuit interruption.

A-10.6 Fuse-Base Contact (Fuse-Mount Contact) — A conducting part of a fuse-base connected to a terminal designed to engage with a fuse-carrier contact or with a fuse-link contact.

A-10.7 Fuse-Carrier Contact — A conducting part of a fuse-carrier connected to a fuse-link contact and designed to engage with a fuse-base contact.

A-10.8 Fuse-Link Contact — A conducting part of a fuse-link designed to engage with a fuse-base contact or with a fuse-carrier contact.

A-10.9 Fuse with Enclosed Fuse Element A fuse in which the fuse element is totally enclosed in such a way that at the time of operation it cannot produce any external effect harmful to persons or objects in the immediate vicinity.

A-10.10 HRC (High Rupturing Capacity, that is, Breaking Capacity) Cartridge Fuse-Link — A cartridge fuse-link having a rupturing capacity not less than that specified in the relevant specification.

A-10.11 Indicating Fuse — A fuse incorporating a device to indicate that the fuse has opened the circuit.

A-10.12 Noninterchangeable Fuse — A fuse so designed and proportioned as to accept only a fuse-link of a predetermined type and of a rated current equal to or less than a predetermined value.

A-10.13 Open Wire Fuse — A fuse that does not include arrangements limiting the development of an arc, the release of gas, and the ejection of flame or metal particles caused by its operation.

A-10.14 Renewable Fuse-Link — A fuse-link that, after operation may be restored for service by a refill unit.

A-10.15 Refill Unit — A set of parts required to be replaced after each operation to restore a fuse-link to its original condition.

A-10.16 Rewirable Fuse — A fuse in which the fuse-element consists of a wire which may be replaced when necessary.

A-10.17 Semi-enclosed Fuse — A fuse in which the development of an arc, the release of gas and the ejection of flame or metal particles caused by its operation are controlled so as to limit danger to persons.

A-10.18 Striker Fuse — A fuse which contains a striker.

(*Continued from page* 2)

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