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(Revision of IEEE C37.100-1981)

IEEE Standard Definitions for Power Switchgear

Sponsor
Switchgear Committee
of the
IEEE Power Engineering Society

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Abstract: Terms that encompass the products with the scope of the C37 project are defined. These include power switchgear for switching, interrupting, metering, protection, and regulating purposes as used primarily in connection with generation, transmission, distribution, and conversion of electric power. The definitions do not purport to embrace other meanings that the terms may properly have when used in connection with other subjects.
Keywords: power switchgear, definitions; power switchgear, terminology

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Foreword

(This foreword is not a part of IEEE Std C37.100-1992, IEEE Standard Definitions for Power Switchgear.)

This standard continues the compilation of terms and definitions relating to power switchgear and should be considered to reflect common and current usage of that industry. It is an update of the 1981 revision with additions and changes.

The 1981 revision of this standard incorporated the definitions formerly contained in IEEE C37.90-1978, IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus (ANSI). The agreement to move these definitions from IEEE C37.90-1978 to IEEE C37.100-1981 was based on identifying the definitions for prime responsibility. Accordingly, the code shown was adopted and is used in the current edition as well. Each of the eight participating entities of the Power System Relaying, Substations, and Switchgear Committees of the Technical Operations Department of the IEEE Power Engineering Society identified definitions in which they had basic responsibility. This is shown immediately following the definition. The code indicates interest and consent required for any changes.

The size of this standard has been kept to a minimum by omitting all terms satisfactorily covered in readily available dictionaries. In many instances, terms and definitions of related products exhibiting minor variations have been combined for greater clarity.

International Electrotechnical Commission (IEC) definitions have been adopted wherever possible, without change, or with minor modifications.

Specifications and ratings have been excluded from definitions where possible. This information is included in standards covering the specific products.

The C37 Subcommittee on Definitions and Terms that prepared this revision of the standard was as follows:

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Listed below are the codes for the committees responsible for each of the definitions in this standard. The first designation after a definition indicates the prime responsibility; subsequent designation(s) indicate interest and consent required for changes:

PSRC	Power System Relaying Committee, Relay Standards Subcommittee
SUB	Substation Committee
HVF, Swg	Switchgear Committee, High-Voltage Fuses Subcommittee
HVS, Swg	Switchgear Committee, High-Voltage Switches Subcommittee
LVSwgD	Switchgear Committee, Low-Voltage Switchgear Devices Subcommittee
HVCB,Swg	Switchgear Committee, High-Voltage Circuit Breaker Subcommittee
R and S, Swg	Switchgear Committee, Reclosers and Sectionalizers Subcommittee
SwgA	Switchgear Committee, Switchgear Assemblies Subcommittee

CLAUSE PAGE

IEEE Standard Definitions for Power Switchgear

1. Scope

The terms and definitions in the standard are intended to encompass the products within the scope of the C37 project that include power switchgear for switching, interrupting, metering, protection, and regulating purposes as used primarily in connection with generation, transmission, distribution, and conversion of electric power.

The definitions of terms and explanatory notes relating thereto contained in this standard are not intended to embrace all possible meanings of the terms. They are intended for the sole purpose of establishing only those meanings of terms used in switchgear standards. They do not purport to embrace other meanings that the terms may properly have when used in connection with other subjects.

In some instances, terms and definitions that are not identical to those in this standard have been developed by other branches of industry. Where this situation exists, the definitions in this standard shall be used for power switchgear within the C37 product scope.

2. General

In this standard, preferred terms are in some instances followed by less favored or alternate terms in parentheses. Also, since the terms are arranged alphabetically, application phrases have been parenthetically appended to many terms.

For definitions of terms of related component parts, accessories, etc., not covered in this standard, reference should be made to standards covering those products; for example, IEEE C57.13-1978, and IEEE Std 21-1976.

3. References

When the standards referred to in this standard are superseded by an approved revision, the latest revision shall be used.

[1] ANSI C84.1-1989, American National Standard for Electric Power Systems and Equipment—Voltage Ratings (60 Hz).[1]

[1] ANSI publications are available from the Sales Department, American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036, USA.

[2] ANSI S1.13-1971 (Reaff 1986), American National Standard Methods for the Measurement of Sound Pressure Levels.

[3] ASTM D 2472-92, Specification for Sulfur Hexafluoride.[2]

[4] IEEE C37.09-1979 (Reaff 1988), IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis (ANSI).[3]

4 Definitions

***a* auxiliary switch:** *See:* **auxiliary switch** and ***a* contact (front contact).**
LVSwgD; HVCB, Swg

***a* contact (front contact):** A contact that is open when the main device is in the standard reference position and that is closed when the device is in the opposite position.
LVSwgD; PSRC; HVCB, Swg

NOTES:

1 — *a* contact has general application. However, this meaning for front contact is restricted to relay parlance.

2 — For indication of the specific point of travel at which the contact changes position, an additional letter or percentage figure may be added to *a*.

3 — See standard reference position.

***aa* auxiliary switch:** *See:* **auxiliary switch** and ***aa* contact.**
LVSwgD; HVCB, Swg

***aa* contact:** A contact that is open when the operating mechanism of the main device is in the standard reference position and that is closed when the operating mechanism is in the opposite position.
LVSwgD; HVCB, Swg

NOTE — *See:* **standard reference position (of a contact)**

accelerating relay: A programming relay whose function is to control the acceleration of rotating electrical equipment.
PSRC

acceptance tests: *See:* **conformance tests**

NOTE — American National Standards should use the term *conformance test*, as directed by the Standards Council of ANSI, rather than the term *acceptance test*. Use of the term *conformance test* avoids the implication of contractual relations between buyer and seller.

accessories: Devices that perform a secondary or minor duty as an adjunct or refinement to the primary or major duty of a unit of equipment.
HVS, Swg; LVSwgD

acting stress (working stress): The maximum applied or expected stress in a material during operation of the apparatus of which it is a part and including the stresses caused by gas pressure, wind, ice, or seismic loading.
SUB

active power relay: A power relay that responds to active power.
PSRC

NOTE — *See:* **power relay** and **reactive power relay**

[2] ASTM publications are available from the Customer Service Department, American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103, USA.
[3] IEEE publications are available from the Institute of Electrical and Electronics Engineers, Service Center, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855–1331, USA.

actual transient recovery voltage (TRV): That which actually occurs across the terminals of a pole of a switching device following current interruption.
HVCB, Swg

NOTE — The actual TRV may differ from the inherent TRV due to the modifying effects of device impedance and arc-circuit interaction.

actuating current (of an automatic line sectionalizer): The rms current that actuates a counting operating or an automatic operation.
R and S, Swg

aging: The effects of operational, environmental, and system conditions on equipment during a period of time up to, but not including, design basis events, or the process of simulating these effects.
PSRC

air-blast circuit breaker: See NOTE (2) under **circuit breaker.**

air circuit breaker: See NOTE (2) under **circuit breaker.**

air switch: A switching device designed to close and open one or more electric circuits by means of guided separable contacts that separate in air.
HVS, Swg

alarm condition: A predefined change in the condition of equipment or the failure of equipment to respond correctly. Indication may be audible, visual, or both.
SUB

alarm (signal) relay: A monitoring relay whose function is to operate an audible or visual signal to announce the occurrence of an operation or a condition needing personnel attention, and which is usually provided with a signaling cancellation device.
PSRC

alarm switch (of a switching device): An auxiliary switch that actuates a signaling device upon the automatic opening of the switching device with which it is associated.
LVSwgD

alternating-current component (of a total current): *See:* **symmetrical component (ac component) (of a total current)**

ambient air temperature: The temperature of the surrounding air that comes in contact with equipment.
SwgA

NOTE — Ambient air temperature, as applied to enclosed switchgear assemblies, is the average temperature of the surrounding air that comes in contact with the enclosure.

ambient temperature: The temperature of the surrounding medium that comes in contact with the device or equipment.
LVSwgD; HVF, Swg; HVS, Swg

amplitude factor (of transient recovery voltage): The ratio of the highest peak of the transient recovery voltage to the peak value of the normal-frequency recovery voltage.
HVCB, Swg

NOTE — In tests made under one condition to simulate duty under another, as in single-phase tests made to simulate duty on three-phase ungrounded faults, the amplitude factor is expressed in terms of the duty being simulated.

analog device: A device that operates with variables represented by continuously measured quantities such as voltages, resistances, rotations, and pressures.
SUB

analog quantity: A continuous variable that is typically digitized and represented as a scalar value.
SUB

analog telemetering: Telemetering in which some characteristic of the transmitter signal is proportional to the quantity being measured.
SUB

analog-to-digital (a/d) conversion: Production of a digital output corresponding to the value of an analog input quantity.
SUB

analog-to-digital converter (digitizer): A device or a group of devices that converts an analog quantity or analog position input signal into some type of numerical output signal or code. The input signal is either the measurand or a signal derived from it.
SUB

anode circuit breaker: A low-voltage power circuit breaker (1) that is designed for connection in an anode of a mercury-arc power rectifier unit, (2) that trips automatically only on reverse current and starts reduction of a current in a specified time when the arc-back occurs at the end of the forward current conduction, and (3) that substantially interrupts the arc-back current within one cycle of the fundamental frequency after the beginning of the arc-back.
LVSwgD

NOTE — The specified time in present practice is 0.008 s or less (at an ac frequency of 60 Hz).

antipump (pump-free) device: A device that prevents reclosing after an opening operation as long as the device initiating closing is maintained in the position for closing.
HVCB, Swg; LVSwgD

anti-single-phase tripping device: A device that operates to open all phases of a circuit by means of a polyphase switching device, in response to the interruption of the current in one phase.
LVSwgD

NOTES:

1 — This device prevents single phasing of connected equipment resulting from the interruption of any one phase of the circuit.

2 — This device may sense operation of a specific single-phase interrupting device or may sense loss of single-phase potential.

applied-fault protection: A protective method in which, as a result of relay action, a fault is intentionally applied at one point in an electrical system in order to cause fuse blowing or further relay action at another point in the system.
PSRC

arc chute (of a switching device): A structure affording a confined space or passageway, usually lined with arc-resisting material, into or through which an arc is directed to extinction.
LVSwgD; HVCB, Swg

arc-extinguishing medium (fuse filler) (of a fuse): Material included in the fuse to facilitate current interruption.
HVF, Swg

arc reach: The distance from a point midway between the arc extremities to the most remote point of the arc at the time of its maximum length.
HVS, Swg

arc-shunting-resistor-current arcing time: The interval between the parting of the secondary arcing contacts and the extinction of the arc-shunting-resistor current.
HVCB, Swg

arcing contacts: The contacts of a switching device on which the arc is drawn after the main (and intermediate, where used) contacts have parted.
HVS, Swg; LVSwgD; HVCB, Swg

arcing horn: One of a pair of diverging electrodes on which an arc is extended to the point of extinction after the main contacts of the switching device have parted.
HVS, Swg

NOTE — Arcing horns are sometimes referred to as arcing runners.

arcing time (of a fuse): The time elapsing from the severance of the current-responsive element to the final interruption of the circuit.
HVF, Swg

arcing time (of a mechanical switching device): The interval of time between the instant of the first initiation of the arc and the instant of final arc extinction in all poles.
LVSwgD; HVCB, Swg

NOTE — For switching devices that embody switching resistors, a distinction should be made between the arcing time up to the instant of the extinction of the main arc, and the arcing time up to the instant of the breaking of the resistance current.

armature (of a relay): The moving element of an electromechanical relay that contributes to the designed response of the relay and that usually has associated with it a part of the relay contact assembly.
PSRC

articulated unit substation: A unit substation in which the incoming, transforming, and outgoing sections are manufactured as one or more subassemblies intended for connection in the field.
SwgA

assembly(GIS): Gas-insulated substation fully erected.
SUB

asymmetrical current: *See*: **total (asymmetrical) current**

attachments: Accessories to be attached to switchgear apparatus, as distinguished from auxiliaries.
HVS, Swg; LVSwgD

automatic: Pertaining to a process or device that, under specified conditions, functions without intervention by a human operator.
SUB

automatic capacitor control equipment: A piece of equipment that provides automatic control for functions related to capacitors, such as their connection to and disconnection from a circuit in response to predetermined conditions such as voltage, load, or time.
SUB; R and S, Swg

automatic circuit recloser: A self-controlled device for automatically interrupting and reclosing an alternating-current circuit, with a predetermined sequence of opening and reclosing followed by resetting, hold-closed, or lock-out operation.
R and S, Swg

NOTE — When applicable, it includes an assembly of control elements required to detect overcurrents and control the recloser operation.

automatic control: An arrangement of electrical controls that provides for switching or otherwise controlling or both in an automatic sequence and under predetermined conditions the necessary devices comprising a piece of equipment. These devices thereupon maintain the required character of service and provide adequate protection against all unusual operating emergencies.
SUB

automatic control equipment: Equipment that provides automatic control for a specified type of power circuit or apparatus.
SUB

automatic line sectionalizer: A self-contained circuit-opening device that automatically opens the main electrical circuit through it after sensing and responding to a predetermined number of successive main current impulses equal to or greater than a predetermined magnitude. It opens while the main electrical circuit is de-energized. It may also have provision to be manually operated to interrupt loads.
R and S, Swg

NOTE — When applicable, it includes an assembly of control elements required to detect overcurrents and control the sectionalizer operation.

automatic load throw-over equipment (transfer or switchover): Equipment that automatically transfers a load to another source of power when the original source to which it has been connected fails, and that automatically restores the load to the original source under desired conditions.
SUB

NOTE — The restoration of the load to the preferred source from the emergency source upon reenergization of the preferred source after an outage may be of the continuous circuit restoration type or interrupted circuit restoration type.

1) **equipment of the nonpreferential type:** Equipment that automatically restores the load to the original source only when the other source, to which it has been connected, fails.
2) **fixed preferential type:** Equipment in which the original source always serves as the preferred source and the other source as the emergency source. The automatic transfer equipment will restore the load to the preferred source upon its reenergization.
3) **selective preferential type:** Equipment in which either source may serve as the preferred or the emergency source of pre-selection as desired, and that will restore the load to the preferred source upon its re-energization.
4) **semiautomatic load throw-over equipment:** Equipment that automatically transfers a load to another (emergency) source of power when the original (preferred) source to which it has been connected fails, but that requires manual restoration of the load to the original source.

automatic machine control equipment: Equipment that provides automatic control for functions related to rotating machines or power rectifiers.
SUB

automatic opening (tripping): The opening of a switching device under predetermined conditions without the intervention of an attendant.
LVSwgD; HVCB, Swg; R and S, Swg

automatic operation (of a switching device): The ability to complete an assigned sequence of operations by automatic control without the assistance of an attendant.
R and S, Swg

automatic reclosing equipment: Automatic equipment that provides for reclosing a switching device as desired after it has opened automatically under abnormal conditions.
SUB; R and S, Swg

NOTE — Automatic reclosing equipment may be actuated by conditions sensed on either or both sides of the switching device as designed.

automatic station: A station (usually unattended) that under predetermined conditions goes into operation by an automatic sequence; that thereupon by automatic means maintains the required character of service within its capability; that goes out of operation by automatic sequence under other predetermined conditions; and includes protection against the usual operating emergencies.
SUB

NOTE — An automatic station may go in and out of operation in response to predetermined voltage, load, time, or other conditions, or in response to supervisory control or to a remote or local manually operated control device.

automatic transfer (or throw-over) equipment: Equipment that automatically transfers a load to another source of power when the original source to which it has been connected fails, and that will automatically retransfer the load to the original source under desired conditions.
SUB

NOTES:

1 — It may be of the nonpreferential, fixed-preferential, or selective-preferential type.

2 — Compare with transfer switch where transfer is accomplished without current interruption.

automatic transfer (or throw-over) equipment of the fixed-preferential type: Automatic transfer equipment in which the original source always serves as the preferred source and the other source as the emergency source. The automatic transfer equipment will retransfer the load to the preferred source upon its reenergization.
SUB

NOTE — The restoration of the load to the preferred source from the emergency source upon the reenergization of the preferred source after an outage may be of the continuous-circuit restoration type or the interrupted-circuit restoration type.

automatic transfer (or throw-over) equipment of the nonpreferential type: Automatic transfer equipment that automatically retransfers the load to the original source only when the other source, to which it has been connected, fails.
SUB

automatic transfer (or throw-over) equipment of the selective-preferential type: Automatic transfer equipment in which either source may serve as the preferred or the emergency source of preselection as desired, and which will retransfer the load to the preferred source upon its reenergization.
SUB

NOTE — The restoration of the load to the preferred source from the emergency source upon the reenergization of the preferred source after an outage may be of the continuous-circuit restoration type or the interrupted-circuit restoration type.

automatic transformer control equipment: Equipment that provides automatic control for functions relating to transformers, such as their connection, disconnection or regulation in response to predetermined conditions such as system load, voltage or phase angle.
SUB

automatic tripping: *See:* **automatic opening (tripping)**

automatically reset relay: *See:* **self-reset relay**

auxiliaries: Accessories to be used with switchgear apparatus but not attached to it, as distinguished from attachments.
HVS, Swg; LVSwgD; R and S, Swg

auxiliary circuit breaker: The circuit breaker used to disconnect the current circuit from direct connection with the test circuit breaker.
HVCB, Swg

auxiliary circuits: All control, indicating and measuring circuits.
SUB

auxiliary relay: A relay whose function is to assist another relay or control device in performing a general function by supplying supplementary actions.
PSRC; HVCB, Swg

NOTES:

1 — Some of the specific functions of an auxiliary relay are as follows:
a)Reinforcing contact current-carrying capacity of another relay or device.
b)Providing circuit seal-in functions.
c)Increasing available number of independent contacts.
d)Providing circuit-opening instead of circuit-closing contacts or vice-versa.
e)Providing time delay in the completion of a function.
f)Providing simple functions for interlocking or programming.

2 — The operating coil of the contacts of an auxiliary relay may be used in the control circuit of another relay or other control device. *Example:* An auxiliary relay may be applied to the auxiliary contact circuits of a circuit breaker in order to coordinate closing and tripping control sequences.

3 — A relay that is auxiliary in its functions even though it may derive its driving energy from the power system current or voltage is a form of auxiliary relay. *Example:* A timing relay operating from current or potential transformers.

4 — Relays that, by direct response to power system input quantities, assist other relays to respond to such quantities with greater discrimination are NOT auxiliary relays. *Example:* Fault detector relay.

5 — Relays that are limited in function by a control circuit, but are actuated primarily by system input quantities, are NOT auxiliary relays. *Example:* Torque-controlled relays.

auxiliary relay driver: A circuit that supplies an input to an auxiliary relay.
PSRC

auxiliary switch: A switch mechanically operated by the main device for signaling, interlocking, or other purposes.
LVSwgD; HVCB, Swg

NOTE — Auxiliary switch contacts are classed as follows: *a, b, aa, bb*, LC, etc., for the purpose of specifying definite contact positions with respect to the main device.

availability: The ratio of uptime and uptime plus downtime.
SUB

available (prospective) current (of a circuit with respect to a switching device situated therein): The current that would flow in that circuit if each pole of the switching device were to be replaced by a link of negligible impedance without any other change in the circuit or the supply.
LVSwgD

available (prospective) short-circuit current (at a given point in a circuit): The maximum current that the power system can deliver through a given circuit point to any negligible impedance short circuit applied at the given point, or at any other point that will cause the highest current to flow through the given point.
HVF, Swg; LVSwgD

NOTES:

1 — This value can be in terms of either symmetrical or asymmetrical; peak or rms current, as specified.

2 — In some resonant circuits the maximum available short-circuit current may occur when the short circuit is placed at some other point than the given one where the available current is measured.

available (prospective) short-circuit test current (at the point of test): The maximum short-circuit current for any given setting of a test circuit that the test power source can deliver at the point of test, with the test circuit short-circuited by a link of negligible impedance at the line terminals of the device to be tested.
HVF, Swg; LVSwgD

NOTE — This value can be in terms of either symmetrical or asymmetrical; peak or rms current, as specified.

average inside air temperature (of enclosed switchgear): The average temperature of the surrounding cooling air that comes in contact with the heated parts of the apparatus within the enclosure.
SwgA

b* auxiliary switch:** *See:* auxiliary switch and ***bcontact (back contact).

***b* contact (back contact):** A contact that is closed when the main device is in the standard reference position and that is open when the device is in the opposite position.
LVSwgD; PSRC; HVCB, Swg

NOTES:

1 — *b* contact has general application. However, this meaning for back contact is restricted to relay parlance.

2 — For indication of the specific point of travel at which the contact changes position, an additional letter or percentage figure may be added to *b*.

See: **standard reference position**

back-connected device: A device in which the current-carrying conductors are fastened to the studs in the rear of the mounting base.
HVF, Swg; HVS, Swg

backfeed: To energize a section of a power network that is supplied from a source other than its normal source.
PSRC

backup: Provision for an alternate means of operation if the primary system is not available.
SUB

backup current-limiting fuse: A fuse capable of interrupting all currents from the ratedmaximum interrupting current down to the rated minimum interrupting current.
HVF, Swg

backup, degraded: A backup capability that does not perform all the functions of the primary system.

SUB

backup protection (as applied to a relay system): A form of protection that operates independently of specified components in the primary protective system. It may duplicate the primary protection or may be intended to operate only if the primary protection fails or is temporarily out of service.
PSRC

balance beam (of a relay): A lever form of relay armature, one end of which is acted upon by one input and the other end restrained by a second input.
PSRC

balance relay: A relay that operates by comparing the magnitudes of two similar input quantities.
PSRC

NOTE — The balance may be effected by counteracting electromagnetic forces on a common armature, or by counter-acting magnetomotive forces in a common magnetic circuit, or by similar means, such as springs, levers, etc.

barrier: A partition for the insulation or isolation of electric circuits or electric arcs.
HVE, Swg; HVS, Swg; HVCB, Swg

base (high-voltage fuse): The supporting member to which the insulator unit or units are attached.
HVE, Swg

baseline data: Initial data needed to show acceptable functioning of the equipment during qualification testing.
PSRC

basic device (of a supervisory system): *See:* **common (basic) device (of a supervisory system)**

basic impulse insulation level (bil): A reference impulse insulation strength expressed in terms of the crest value of the withstand voltage of a standard full impulse voltage wave.
HW, SWg

baud: Defines the signaling speed, that is, keying rate of the modem.

The signaling speed in baud is equal to the reciprocal of the shortest element duration in seconds to be transmitted.

For example, in the following table, the signaling speed is calculated from the signaling element duration. In addition, the distinction between bit rate and baud for two different types of modem is illustrated.

Signaling Technique		
	Modem One	**Modem Two**
Signaling element duration	0.833 ms	
Signaling speed	1200 Bd	
Information transmitted per element duration	1b	2b
Bit rate	1200 b/s	2400 b/s

The bit rate and baud are not synonymous and shall not be interchanged in usage. Preferred usage is bit rate, with baud used only when the details of a communication modem or channel are specified.
SUB

***bb* auxiliary switch:** *See:* **auxiliary switch**and ***bb* contact.**

LVSwgD; HVCB, Swg

***bb* contact:** A contact that is closed when the operating mechanism of the main device is in the standard reference position and that is open when the operating mechanism is in the opposite position.
LVSwgD; HVCB, Swg

NOTE — *See:* **standard reference position**

bell crank: A lever with two arms placed at an angle diverging from a given point, thus changing the direction of motion of a mechanism.
HVS, Swg

bell crank hanger: A support for a bell crank.
HVS, SWg

benchboard: A combination of a control desk and a vertical switchboard in a common assembly.
SwgA:

biaxial test: The specimen under test is subject to acceleration in one principal horizontal axis and the vertical axis simultaneously.
PSRC; SwgA

bifurcated feeder: A stub feeder that connects two loads in parallel to their only power source.
SUB

bit:

1) **least significant.** In an *n* bit binary word its contribution is (0 or 1) toward the maximum word value of (2^{n-1}).
2) **most significant.** In an *n*bit binary word its contribution is (0 or 1 times 2^{n-1}) toward the maximum word value of (2^{n-1}).

SUB

bit rate: The number of bits transferred in a given time interval. Bits per second is a measure of the rate at which bits are transmitted.
SUB

blade (disconnecting blade) (of a switching device): The moving contact member that enters or embraces the contact clips.
HVS, Swg; HVF, Swg

NOTE — In cutouts, the blade may be a fuse carrier or fuse holder on which a nonfusible member has been mounted in place of a fuse link. When so used, the non fusible member alone is also called a blade in fuse parlance.

blade guide (switch): An attachment to ensure proper alignment of the blade and contact clip when closing the switch.
HVS, SWg

blade latch: A latch used on a stick-operated switch to hold the switch blade in the closed position.
HVS, Swg

blinder: A relay having a characteristic on an *R-X* diagram of one or more essentially straight lines, usually positioned at 75° to 90° from the *R*-axis and displaced from the origin.
PSRC

block (as applied to static relay design): An output signal of constant amplitude and specified polarity derived from an alternating input and with the duration controlled by the polarity of the input quantity.
PSRC

block-block element: A signal element in which two blocks are compared as to coincidence or sequence.
PSRC

blocking: A relay function which prevents action that would otherwise be initiated by the relay system.
PSRC

blocking relay: A relay whose function is to render another relay or device ineffective under specified conditions.

PSRC

block-spike element: A signal element in which a block and a spike are compared as to coincidence.
PSRC

bolted fault: A short-circuit condition that assumes zero impedance exists at the point of the fault.
PSRC

break distance (of a switching device): The minimum open-gap distance between the main-circuit contacts, or live parts connected there-to, when the contacts are in the open position.
HVF, Swg; HVS, Swg; LVSwgD; HVCB, Swg

NOTE — In a multiple-break device, it is the sum of the breaks in series.

buffer (buffer storage):

1) A device in which data are stored temporarily, in the course of transmission from one point to another; used to compensate for a difference in the flow of data, or time of occurrence of events, when transmitting data from one device to another.
2) An isolating circuit used to prevent a driven circuit from influencing a driving circuit.

SUB

burden (of a relay): Load impedance imposed by a relay on an input circuit expressed in ohms and phase angle at specified conditions.
PSRC

NOTE — If burden is expressed in other terms such as volt-amperes, additional parameters such as voltage, current, and phase angle must be specified.

bus: A conductor, or group of conductors, that serves as a common connection for two or more circuits.
SwgA

bus structure: An assembly of bus conductors, with associated connection joints and insulating supports.
SwgA

bus support: An insulating support for a bus. It includes one or more insulator units with fittings for fastening to the mounting structure and for receiving the bus.
HVSSWg

bushing: An insulating structure including a through conductor, or providing a passageway for such a conductor, with provision for mounting on a barrier, conducting or otherwise, for the purpose of insulating the conductor from the barrier and conducting current from one side of the barrier to the other.
HVCB, Swg

cable charging current: Current supplied to an unloaded cable.
HVCB, Swg

NOTE — Current is expressed in rms amperes.

calibration: The adjustment of a device to have the designed operating characteristics, and the subsequent marking of the positions of the adjusting means, or the making of adjustments necessary to bring operating characteristics into substantial agreement with standardized scales or marking.
PSRC; LVSwgD

calibration error: In the operation of a device, the departure, under specified conditions, of actual performance from performance indicated by scales, dials, or other markings on the device.
PSRC; LVSwgD

NOTE — The indicated performance may be by calibration markings in terms of input or performance quantities (amperes, ohms, seconds, etc.) or by reference to a specific performance data recorded elsewhere. *See also*:

setting error

calibration scale: A set of graduations marked to indicate values of quantities, such as current, voltage, or time at which an automatic device can be set to operate.

PSRC

capacitance-switching transient overvoltage ratio: The ratio of the peak value of voltage above ground, during the transient conditions resulting from the operation of the switch, to the peak value of the steady-state line-to-neutral voltage.
HVS, Swg; HVCB, Swg

NOTE — It is measured at either terminal of the switch, whichever is higher, and is expressed in multiples of the peak values of the operating line-to-ground voltages at the switch with the capacitance connected.

capacitive load: A lumped capacitance that is switched as a unit.
R and S, Swg

capacitor switch: A switch capable of making and breaking capacitive currents of capacitor banks.
R and S, Swg; HVS, Swg; HVCB, Swg

card extender: A device that provides access to components on a circuit card for testing purposes while maintaining all the electrical connections to the card.
PSRC

carrier, fuse: *See*: **fuse carrier (of an oil cutout)**

carrier-pilot protection: A form of pilot protection in which the communication means between relays is a carrier current channel.
PSRC

cartridge fuse: A low-voltage fuse consisting of a current-responsive element inside a fuse tube with terminals on both ends.
LVSwgD

cartridge size (of a cartridge fuse): The range of voltage and ampere ratings assigned to a fuse cartridge with specific dimensions and shape.
LVSwgD

cascading (of switching devices): The application of switching devices in which the devices nearest the source of power have interrupting ratings equal to, or in excess of, the available short-circuit current, while devices in succeeding steps further from the source, have successively lower interrupting ratings.
LVSwgD; HVCB, Swg

case (frame) ground protection: Over current relay protection used to detect current flow in the ground or earth connection of the equipment or machine.
PSRC

cathode ray tube (crt): A display device in which controlled electron beams are used to present alphanumeric or graphical data on an electroluminescent screen.
SUB

center-break switching device: A mechanical switching device in which both contacts are movable and engage at a point substantially midway between their supports.
LVSwgD

channel load factor: The percent of channel capacity in bits per second required to support the effective data rate for information exchange.
SUB

channel, scada: The communication path between master and remote stations.
SUB

checkback: The retransmission from the receiving end to the initiating end of a coded signal or message to verify, at the initiating end, the initial message before proceeding with the transmitting of data or a command.
SUB

checkback message: The response from the receiving end to the initiating end of a coded signal or message.

1) **partial checkback message.** Message from the initiating end is mirrored by the receiving end back to the initiating end to verify error-free transmission of the message.
2) **complete checkback message.** Message from the initiating end is interpreted by the receiving end. A new message is sent to the initiating end to verify error-free transmission and proper interpretation of the message.

SUB

circuit breaker: A mechanical switching device, capable of making, carrying, and breaking currents under normal circuit conditions and also, making and carrying for a specified time and breaking currents under specified abnormal circuit conditions such as those of short circuit.

HVCB, Swg; LVSwgD

NOTES:

1 — A circuit breaker is usually intended to operate infrequently, although some types are suitable for frequent operation.

2 — The medium in which circuit interruption is performed may be designated by suitable prefix, that is, air-blast circuit breaker, air circuit breaker, compressed-air circuit breaker, gas circuit breaker, oil circuit breaker, vacuum circuit breaker, oilless circuit breaker, etc.

3 — Circuit breakers are classified according to their application or characteristics and these classifications are designated by the following modifying words or clauses delineating the several fields of application, or pertinent characteristics:
High-voltage power — Rated above 1000 V ac.
Molded-case — See separate definition.
Low-voltage power — Rated 1000 V ac or below, or 300 V dc and below, but not including molded-case circuit breakers.
Direct-current low-voltage power circuit breakers are subdivided according to their specified ability to limit fault-current magnitude by being called general purpose, high-speed, semi-high-speed, rectifier or anode. For specifications of these restrictions see latest revision of the applicable standard.

circuit breaker, field discharge: A circuit breaker having main contacts for energizing and deenergizing the field of a generator, motor, synchronous condenser, or rotating exciter, and having discharge contacts for short-circuiting the field through the discharge resistor at the instant preceding the opening of the circuit-breaker main contacts. The discharge contacts also disconnect the field from the discharge resistor at the instant following the closing of the main contacts. For direct-current generator operation, the discharge contacts may open before the main contacts close.

LVSwgD

NOTE — When used in the main field circuit of an alternating- or direct-current generator, motor, or synchronous condenser, the circuit breaker is designated as a main field discharge circuit breaker. When used in the field circuit of the rotating exciter of the main machine, the circuit breaker is designated as an exciter field discharge circuit breaker.

circuit breaker, general purpose low-voltage dc power: A circuit breaker that, during interruption, does not limit the current peak of the available (prospective) fault current and may not prevent the fault current from rising to its sustained value.

LVSwgD

circuit-breaker grouping: The three poles of a circuit breaker grouped in adjacent configuration along the line of the same row.

SUB

circuit breaker, high-speed low-voltage dc power: A circuit breaker that, during interruption, limits the current peak to a value less than the available (prospective) fault current.

LVSwgD

circuit breaker, rectifier low-voltage dc power: A circuit breaker that carries the normal current output of one rectifier and that, during fault conditions, functions to withstand and/or interrupt abnormal current as required.

LVSwgD

circuit breaker, semi-high-speed low-voltage dc power: A circuit breaker that, during interruption, does not limit the current peak of the available (prospective) fault current on circuits with minimal inductance but that does limit current to a value less than the sustained current available on higher-inductance circuits.

LVSwgD

circuit switcher: A mechanical switching device with an integral interrupter, suitable for making, carrying, and interrupting currents under normal circuit conditions. It is also suitable for interrupting specified short-circuit current that may be less than its close and latch, momentary, and short-time current ratings.
HVS, Swg

NOTE — This device may be suitable for transformer protection where the majority of faults are limited by the transformer and system impedance.

circuit transient recovery voltage: *See*: **inherent transient recovery voltage.**
HVCB, Swg

Class A seismic component: That component or system whose failure, malfunction, or need for repair prevents the proper operation of the gas-insulated substation during or after the design earthquake.
SUB

Class B seismic component: That component or system whose failure, malfunction, or need for repair would not prevent the proper operation of the gas-insulated substation during or after the design earthquake. Class B components would be designed to either meet normal building codes and national standards in force at the site or another lower-level design earthquake. Application of further design requirements is left to the discretion of the user.
SUB

Class 1E: The safety classification of the electric equipment and systems that are essential to reactor emergency shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or otherwise are essential in preventing significant release of radioactive material to the environment.
PSRC, SwgA

clearance: *See*: **minimum clearance between poles (phases)**and **minimum clearance to ground.**

clearing time:

1) **of a mechanical switching device.** The interval between the time the actuating quantity in the main circuit reaches the value causing actuation of the release and the instant of final arc extinction on all poles of the primary arcing contacts.
   R and S, Swg; LVSwgD; HVCB, Swg
   NOTE — Clearing time is numerically equal to the sum of contact parting time and arcing time.
2) **total clearing time of a fuse.** The time elapsing from the beginning of a specified overcurrent to the final circuit interruption, at rated maximum voltage.
   HVF, Swg
   NOTE — The clearing time is equal to the sum of melting time and the arcing time.

clips: *See*: **contact clips (of a mechanical switching device)**and **fuse clips (contact clips or fuse contacts).**

close and latch: The capability of a switching device to close (allow current flow) and immediately thereafter latch (remain closed) and conduct a specified current through the device under specified conditions.
HVCB, Swg; R and S, Swg

close-open operation (of a switching device): A close operation followed immediately by an open operation without purposely delayed action.
LVSwgD; HVS, Swg; HVCB, Swg

NOTE — The letters CO signify this operation: Close-Open.

close operation (of a switching device): The movement of the contacts from the normally open to the normally closed position.
LVSwgD; HVCB, Swg

NOTE — The letter C signifies this operation: Close.

close-time delay-open operation (of a switching device): A close operation followed by an open operation after a purposely delayed action.
LVSwgD; HVCB, Swg

NOTE — The letters CTO signify this operation: Close-Time Delay-Open.

closing coil (of a switching device): A coil used in the electromagnet that supplies power for closing the device.
LVSwgD; HVCB, Swg

NOTE — In an air-operated, or other stored-energy-operated device, the closing coil may be the coil used to release the air or other stored energy that in turn closes the device.

closing operating time: The interval during which the contacts move from the fully open position to the fully closed position.
HVS, Swg

closing relay: A form of auxiliary relay used with an electrically operated device to control the closing and opening of the closing circuit of the device so that the main closing current does not pass through the control switch or other initiating device.
LVSwgD; PSRC; HVCB, Swg

closing time (of a mechanical switching device): The interval of time between the initiation of the closing operation and the instant when metallic continuity is established in all poles.
HVS, Swg; LVSwgD; HVCB, Swg

NOTES:

1 — It includes the operating time of any auxiliary equipment that is necessary to close the switching device, and that forms an integral part of the switching device.

2 — For switching devices that embody switching resistors, a distinction should be made between the closing time up to the instant of establishing a circuit at the secondary arcing contacts, and the closing time up to the establishment of a circuit at the main or primary arcing contacts, or both.

common (basic) device (of a supervisory system): A device in either the master or remote station that is required for the basic operation of the supervisory system and is not part of the equipment for the individual points.
SUB

common equipment: That complement of either the master or remote station supervisory equipment that interfaces with the interconnecting channel and is otherwise basic to the operation of the supervisory system, but is exclusive of those elements that are peculiar to and required for the particular applications and uses of the equipment.
SUB

common-mode failure: A multiple failure attributable to a common cause.
PSRC

common-mode voltage: The voltage common to all conductors of a group as measured between that group at a given location and an arbitrary reference (usually earth).
PSRC

communications interface equipment: A portion of a relay system that transmits information from the relay logic to a communications link, or conversely to logic, for example, audio tone equipment, a carrier transmitter-receiver when an integral part of the relay system.
PSRC

comparer: A signal element that performs an AND logic function.
PSRC

compartment (GIS): Any gas section of the gas-insulated substation assembly that can be isolated from the system by internal or external means.
SUB

compensator (as applied to relaying): A transducer with an air-gapped core that produces an output voltage proportional to input current. The voltage modifies (or *compensates*) the voltage applied to the relay.
PSRC

components: Items from which the switchgear assemblies are made (for example, power circuit breakers, instrument transformers, protective relays, control switches, primary insulation, etc.).
SwgA

computer interface equipment: A device that interconnects a protective relay system to an independent computer, for example, a scanner or a buffer amplifier.
PSRC

condenser (of a fuse): *See*: **fuse condenser.**

conductance relay: A mho relay for which the center of the operating characteristic on the *R-X* diagram is on the *R*-axis.
PSRC

NOTE — The equation that describes such a characteristic is $Z\text{-}K\cos\theta$, where K is a constant and θ is the phase angle by which the input voltage leads the input current.

conducting element (fuse link) (of a fuse): The conducting means, including the current-responsive element, for completing the electric circuit between the terminals of a fuse-holder or fuse unit.
HVF, Swg

conducting mechanical joint: The juncture of two or more conducting surfaces held together by mechanical means.
HVS, Swg; LVSwgD; HVCB, Swg; SwgA

NOTE — Parts jointed by fusion processes, such as welding, brazing, or soldering, are excluded from this definition.

conformance tests: Those tests made to demonstrate compliance with the applicable standards. The test specimen is normally subjected to all planned production tests prior to initiation of the conformance test program.
SUB; R and S, Swg; SwgA

NOTE — The conformance tests may, or may not, be similar to certain design tests. Demonstration of margin (capabilities) beyond the standards is not required.

connected position (of a switchgear-assembly removable element): That position of the removable element in which both primary and secondary disconnecting devices are in full contact.
SwgA

connecting rod or shaft: A component of a switch operating mechanism designed to transmit motion from an offset bearing or bell crank to a switch pole unit.
HVS, SWg

connection diagram: A diagram showing the relation and connections of devices and apparatus of a circuit or a group of circuits.
LVSwgD

console: That component of the system that provides facilities for control and observation of the system. Examples include operator's console and maintenance console.
SUB, SwgA

contact: A conducting part that coacts with another conducting part to make or break a circuit.
HVS, Swg; LVSwgD; HVCB, Swg

contact clip (of a mechanical switching device): The clip that the blade enters or embraces.
HVS, Swg

contact converter (as applied to relaying): A buffer element used to produce a prescribed output as the result of the opening or closing of a contact.
PSRC

contact current-carrying rating of a relay: The current that can be carried continuously or for stated periodic intervals without impairment of the contact structure or interrupting capability.
PSRC

contact current-closing rating of a relay: The current that the device can close successfully with prescribed operating duty and circuit conditions without significant impairment of the contact structure.
PSRC

contact interrupting rating of a relay: The current that the device can interrupt successfully with prescribed operating duty and circuit conditions without significant impairment of the contact structure.
PSRC

contact (of a relay): A conducting part that acts with another conducting part to make or break a circuit.
PSRC

contact opening time (of a relay): The time a contact remains closed while in process of opening following a specified change of input.
PSRC

contact parting time (of a mechanical switching device): The interval between the time when the actuating quantity in the release circuit reaches the value causing actuation of the release and the instant when the primary arcing contacts have parted in all poles.
R and S, Swg; HVCB, Swg

NOTE — Contact parting time is the numerical sum of release delay and opening time.

contact position indicator: A device that is located at or near the operating mechanism to indicate whether the main contacts are in the closed or open position. Typically colors are used to indicate a closed or open position; red shall signify closed and green shall signify open.
HVS, Swg; LVSwgD; HVCB, Swg

contact surface: That surface of a contact through which current is transferred to the coacting contact.
HVS, Swg; LVSwgD; HVCB, Swg

contact-wear allowance: The total thickness of material that may be worn away before the coacting contacts cease to perform adequately.
HVS, Swg; R and S, Swg

contention: An operational condition on a data communication channel in which no station is designated a master station. In contention, each station on the channel shall monitor the signals on the channel and wait for a quiescent condition before initiating a bid for circuit control.
SUB

continuous-current tests: Tests made at rated current, until temperature rise ceases, to determine that the device or equipment can carry its rated continuous current without exceeding its allowable temperature rise.
HVCB, Swg

continuous enclosure: A bus enclosure in which the consecutive sections of the enclosure for the same phase conductor are electrically bonded together to provide a continuous current path throughout the entire enclosure length.
SUB

NOTE — Cross-connections to the other phase enclosures are made only at the extremities of the installation and at selected intermediate points.

continuous monitoring: The process of sampling the state of some phenomenon either continuously or at a sample interval of one second or less.
SUB

control: The execution of a system change by manual means, remote means, automatic means, or partially automatic means.

1) **automatic.** An arrangement of electrical controls that proves for switching or controlling, or both, of equipment in an automatic sequence and under predetermined conditions.
2) **closed loop.** A type of automatic control in which control actions are based on signals fed back from the controlled equipment or system. For example, remote stations can manage local voltage conditions by control of load tap changers and volt-amperes reactive (VAR) control compensation equipment.
3) **open loop.** A form of control without feedback.
4) **manual.** Control in which the system or main device, whether direct or power-aid-ed in operation, is directly controlled by an attendant.

5) **partial automatic.** Control that is a combination of manual and automatic control. For example, to cause a voltage reduction, the local automatic load tap changing closed-loop control may be biased by way of a supervisory control command.
6) **remote.** Control of a device from a distant point.

SUB

control bus: A bus used to distribute power for operating electrically controlled devices.
HVCB, Swg

control desk: A control switchboard consisting of one or more relatively short horizontal or inclined panels mounted on an assembly of such a height that the panel-mounted devices are within convenient reach of an attendant.
SwgA

control relay: An auxiliary relay whose function is to initiate or permit the next desired operation in a control sequence.
PSRC, HVCB, Swg

control switch: A manually operated switching device for controlling power-operated devices.
HVCB, Swg

NOTE — It may include signaling, interlocking, etc., as dependent functions.

control switchboard: A type of switchboard including control, instrumentation, metering, protective (relays) or regulating equipment for remotely controlling other equipment. Control switchboards do not include the primary power circuit-switching devices or their connections.
SwgA

control voltage: The voltage applied to the operating mechanism of a device to actuate it, usually measured at the control power terminals of the mechanism.
LVSwgD; HVCB, Swg

conversion (switchgear): A general term covering the process of altering existing power switchgear equipment.
HVCB, Swg; SwgA; LVSwgD

correct relay operation: An output response by the relay that agrees with the operating characteristic for the input quantities applied to the relay.
PSRC

NOTE — *See also:* **correct relaying-system performance.**

correct relaying-system performance: The satisfactory operation of all equipment associated with the protective-relaying function in a protective-relaying system. It includes the satisfactory presentation of system input quantities to the relaying equipment, the correct operation of the relays in response to these input quantities, and the successful operation of the assigned switching device or devices.
PSRC

counting mechanism (of an automatic line sectionalizer or automatic circuit recloser): A device that counts the number of electrical impulses and, following a predetermined number of successive electrical impulses, actuates a releasing mechanism. It resets if the total predetermined number of successive impulses do not occur in a predetermined time.
R and S, Swg

counting operation (of an automatic line sectionalizer or automatic circuit recloser): Each advance of the counting mechanism towards an opening operation.
R and S, Swg

counting operation time (of an automatic line sectionalizer): The time between the cessation of a current above the minimum actuating current value and the completion of a counting operation.
R and S, Swg

creepage distance: The shortest distance between two conducting parts measured along the surface or joints of the insulating material between them.

LVSwgD

critical impulse (of a relay): The maximum impulse in terms of duration and input magnitude that can be applied suddenly to a relay without causing pickup.
PSRC

critical impulse time (of a relay): The duration of a critical impulse under specified conditions.
PSRC

critical overtravel time (of a relay): The time following a critical impulse until movement of the responsive element ceases just short of pickup.
PSRC

critical travel (of a relay): The amount of movement of the responsive element of a relay during a critical impulse, but not subsequent to the impulse.
PSRC

current-balance relay: A balance relay that operates by comparing the magnitudes of two current inputs.
PSRC

current-carrying part: A conducting part intended to be connected in an electric circuit to a source of voltage.
HVF, Swg; HVS, Swg; LVSwgD; HVCB, Swg

NOTE — Non-current-carrying parts are those not intended to be so connected.

current injection method: A synthetic test method in which the voltage circuit is applied to the test circuit breaker before power frequency current zero.
HVCB, Swg

current-limiting fuse unit: A fuse unit that, when it is melted by a current within its specified current-limiting range, abruptly introduces a high resistance to reduce the current magnitude and duration.
HVF, Swg

NOTES:

1 — There are two classes of current-limiting fuse units—power and distribution. They are differentiated one from the other by current ratings and minimum melting time current characteristics.

2 — The values specified in standards for the threshold ratio, peak let-through current, and 1^2t characteristics are used as the measures of current-limiting ability.

current-limiting (peak let-through or cutoff) characteristic curve: A curve showing the relationship between the maximum peak current passed by a device and the correlated rms available current magnitude under specified voltage and circuit impedance conditions.
HVF, Swg

current-limiting range (of a current-limiting fuse): That specified range of currents between the threshold current and the rated interrupting current within which current limitation occurs.
HVF, Swg

current, peak: The instantaneous value of current at the time of its maximum value.
LVSwgD

current phase-balance protection: A method of protection in which an abnormal condition within the protected equipment is detected by the current unbalance between the phases of a normally balanced polyphase system.
PSRC

current rating of a relay: The limiting current at specified frequency that may be sustained by the relay for an unlimited period without causing any of the prescribed limitations to be exceeded.
PSRC

current relay: A relay that responds to current.
PSRC

current-responsive element (of a fuse): That part with predetermined characteristics, the melting and severance or severances of which initiate the interrupting function of the fuse.
HVF, Swg

NOTE — The current-response element may consist of one or more fusible elements combined with a strain element or other component(s), or both, that affect(s) the current-responsive characteristic.

current-type telemeter: A telemeter that employs the magnitude of a single current as the translating means.
SUB

cutoff characteristic (of a current-limiting fuse): *See:* **current-limiting (peak let-through or cutoff) characteristic curve.**

cutout: An assembly of a fuse support with either a fuseholder, fuse carrier, or disconnecting blade. The fuseholder or fuse carrier may include a conducting element (fuse link), or may act as a disconnecting blade by the inclusion of a nonfusible member.
HVF, Swg

NOTE — The term *cutout*, as defined here, is restricted in practice to equipment used on distribution systems. *See:* **distribution** and **distribution cutout.** For fuses having similar components used on power systems, *see:* **power** and **power fuse.**

damping: A dynamic property of a vibrating structure that indicates its ability to dissipate mechanical energy. The phenomenon of damping is represented by a quantity called the damping factor, which is expressed as a percentage of critical damping. After being forced to deflect and allowed to freely vibrate, structures with zero damping will vibrate with a harmonic motion indefinitely. Structures with critical damping will creep back to their static or neutral position with no velocity reversal.
SUB, SwgA

data: Any representation of a digital or analog quantity to which meaning has been assigned.
SUB

data acquisition: The collection of data.
SUB

data acquisition system: A centralized system that receives data from one or more remote points—a telemetering system. Data may be transported by either analog or digital telemetering.
SUB

data logging: An arrangement for the alpha-numerical representation of selected quantities on log sheets; papers, magnetic tape, or the like, by means of an electric typewriter or other suitable devices.
SUB

data rate: The rate at which a data path (for example, channel) carries data, measured in bits per second (b/s).
SUB

dead band: The range through which an input can be varied without initiating response.
SUB

dead-front mounting (of a switching device): A method of mounting in which a protective barrier is interposed between all live parts and the operator, and all exposed operating parts are insulated or grounded.
SwgA

NOTE — The barrier is usually grounded metal.

dead-front pad-mounted switchgear (PMSG): A switchgear assembly in which all energized parts are insulated and completely enclosed within a grounded shield system when separable connectors are in place. The overall enclosure is of suitable environmental and tamper-resistant construction for outdoor above-ground installation. The term *front* refers specifically to any side of the enclosure that provides access to enclosed accessories external to the ground shield system.
R and S, Swg

dead-front switchboard: A switchboard that has no exposed live parts on the front.
SwgA

NOTE — The switchboard panel is normally grounded metal and provides a barrier between the operator and all live parts.

dead-tank switching device: A switching device in which a vessel(s) at ground potential surrounds and contains the interrupter(s) and the insulating medium.
HVCB, Swg

dead time (of a circuit breaker on a reclosing operation): The interval between interruption in all poles on the opening stroke and reestablishment of the circuit on the reclosing stroke.
PCB, Swg

NOTES:

1 — In breakers using arc-shunting resistors, the following intervals are recognized and the one referred to should be stated:
a)Dead time from interruption on the primary arcing contacts to reestablishment through the primary arcing contacts.
b)Dead time from interruption on the primary arcing contacts to reestablishment through the secondary arcing contacts.
c)Dead time from interruption on the secondary arcing contacts to reestablishment on the primary arcing contacts.
d)Dead time from interruption on the secondary arcing contacts to reestablishment on the secondary arcing contacts.

2 — The dead time of an arcing fault on a reclosing operation is not necessarily the same as the dead time of the circuit breakers involved, since the dead time of the fault is the interval during which the faulted conductor is deenergized from all terminals.

definite-minimum-time relay: An inverse-time relay in which the operating time becomes substantially constant at high values of input. See Fig 1.
PSRC

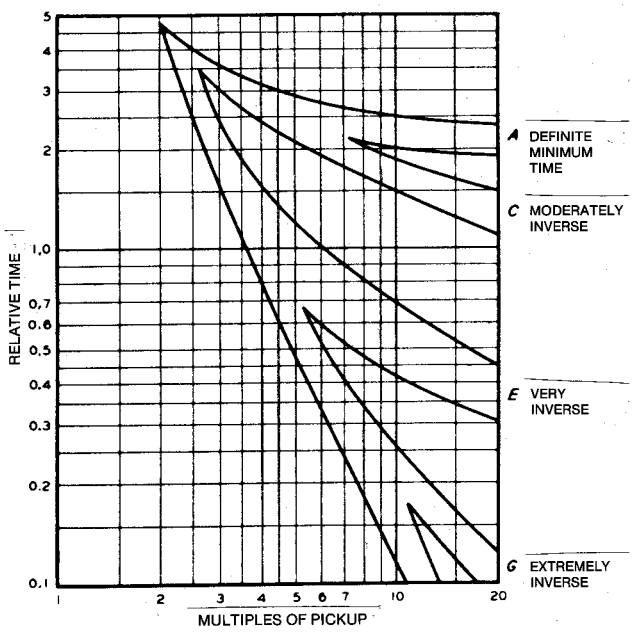

Figure 1— Typical Operating Characteristic Curve Shapes of Various Inverse-Time Relays (PSRC)

definite-purpose circuit breaker: A circuit breaker that has been designed, tested, and rated in accordance with general-purpose circuit breaker requirements of applicable standards and that has been designed, tested, and rated in accordance with the requirements of one or more specific performance requirements for a definite-purpose circuit breaker.
HVCB, Swg

definite-time delay: A qualifying term indicating that there is purposely introduced a delay in action, which delay remains substantially constant regardless of the magnitude of the quantity that causes the action.
LVSwgD; HVCB, Swg

definite-time relay: A relay in which the operating is substantially constant regardless of the magnitude of the input quantity.
PSRC

degree of asymmetry (of a current at any time): The ratio of the direct-current component to the peak value of the symmetrical component determined from the envelope of the current wave at that time.
LVSwgD; HVCB, Swg

NOTE — This value is 100% when the direct-current component equals the peak value of the symmetrical component.

delayed overcurrent trip: *See:* **delayed release (trip)** and **overcurrent release (trip).**

delayed release (trip): A release with intentional delay introduced between the instant when the activating quantity reaches the release setting and the instant when the release operates.
LVSwgD

dependability(of a relay or relay system): The facet of reliability that relates to the degree of certainty that a relay or relay system will operate correctly.
PSRC

dependent biaxial test: A test in which the horizontal and the vertical acceleration components are derived from a single-input signal.
PSRC

dependent manual operation: 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 attendant.
LVSgD

dependent power operation: 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.).
LVSwgD; HVF, Swg; HVCB, Swg

design basis events (DBEs): Postulated events, specified by the safety analysis of the station, used in the design to establish the acceptable performance requirements of the structures and systems.
PSRC

design earthquake: The greatest earthquake postulated during the life of the gas-insulated substation that the user wishes the gas-insulated substation to survive.
SUB

design life: The time during which satisfactory performance can be expected for a specific set of service conditions.
PSRC

design pressure (working pressure): The maximum gas pressure to which a gas-insulated substation enclosure will be subjected under normal operating conditions.
SUB

design tests: Those tests made to determine the adequacy of a particular type, style, or model of equipment with its component parts to meet its assigned ratings and to operate satisfactorily under normal service conditions or under special conditions if specified.
LVSwgD; HVCB, Swg; HVF, Swg

NOTE — Design tests are made only on representative apparatus to substantiate the ratings assigned to all other apparatus of basically the same design. These tests are not intended to be used as a part of normal production. The applicable portion of these design tests may also be used to evaluate modifications of a previous design and to assure that performance has not been adversely affected. Test data from previous similar designs may be used for current designs, where appropriate.

design verification (switchgear): A general term covering the overall qualification of any conversion to standards by means of design testing supported by justified technical evaluation.
HVCB, Swg; SwgA; LVSwgD

device (electrical equipment): An operating element such as a relay, contactor, circuit breaker, switch, valve, or governor used to perform a given function in the operation of electrical equipment.

SUB

dew withstand voltage test: A test to determine the ability of the insulating system to withstand specified overvoltages for a specified time without flashover or puncture while completely covered with dew.
SwgA

dielectric withstand-voltage tests: Tests made to determine the ability of insulating materials and spacings to withstand specified overvoltages for a specified time without flash-over or puncture.
HW, Swg; LVSwgD; HVCB, Swg; SwgA

differential capacitance voltage: The difference in magnitudes of the rms system normal frequency line-to-neutral voltage multiplied by the square root of two, with and without the capacitance connected.
HVS, Swg; HVCB, Swg

NOTE — This can be calculated from the equations:

$$\Delta V = \sqrt{2} E_S \frac{X_L}{X_C - X_L} \text{ or}$$

$$\Delta V = \sqrt{2} E_S \frac{\text{kvar}}{\text{kVA}_{SC} - \text{kvar}}$$

where

ΔV = Differential capacitance voltage in volts
E_S = System phase-to-neutral voltage in volts rms
X_L = Source inductive reactance to point of application, in ohms per phase
X_C = Capacitive reactance of bank being switched in ohms per phase
kvar = Size of bank being switched (three phase)
kVA_{SC} = System short-circuit kVA at point of capacitor application (symmetrical three phase)

differential protection: A method of apparatus protection in which an internal fault is identified by comparing electrical conditions at all terminals of the apparatus.
PSRC

differential relay: A relay that by its design or application is intended to respond to the difference between incoming and outgoing electrical quantities associated with the protected apparatus.
PSRC

differentiator(relaying): A transducer whose output wave form is substantially the time derivative of its input wave form.
PSRC

digital converter (code translator): A device, or group of devices, that converts an input numerical signal or code of one type into an output numerical signal or code of another type.
SUB

digital quantity: A variable represented by a number of discrete units.
SUB

digital readout clock: A clock that gives (usually with visual indication) a voltage or contact closure pattern of electrical circuitry for a read-out of time. A digital readout calendar clock also includes a readout of day, month, and year, usually, also with indication.
SUB

digital telemeter indicating receiver: A device that receives the numerical signal transmitted from a digital telemeter transmitter and gives a visual numerical display of the quantity measured.
SUB

digital telemeter receiver: A device that receives the numerical signal transmitted by a digital telemeter transmitter and stores it or converts it to a usable form, or both, for such purposes as recording, indication, or control.
SUB

digital telemeter transmitter: A device that converts its input signal to a numerical form for transmission to a digital telemeter receiver over an interconnecting channel.
SUB

digital telemetering: Telemetering in which a numerical representation, as for example some form of pulse code, is generated and transmitted; the number being representative of the quantity being measured.
SUB

digital-to-analog converter: A device, or group of devices, that converts a numerical input signal or code into an output signal some characteristic of which is proportional to the input.
SUB

digital-to-analog (d/a) conversion: Production of an analog signal whose magnitude is proportional to the value of a digital input.
SUB

direct-acting machine-voltage regulator: A machine-voltage regulator having a voltage-sensitive element that acts directly without interposing power-operated means to control the excitation of an electric machine.
LVSwgD

direct-acting overcurrent trip device: A release or tripping system that is completely self-contained on a circuit breaker and requires no external power or control circuits to cause it to function.
LVSwgD

direct-acting overcurrent trip device current rating: The value of current designated by the manufacturer on which trip element calibration marks are based.
LVSwgD

direct-current component (of a total current): That portion of the total current which constitutes the asymmetry.
LVSwgD; HVCB, Swg

direct operation: Operation by means of a mechanism connected directly to the main operating shaft or an extension of the same.
HVS, SWg

direct release (series trip): A release directly energized by the current in the main circuit of a switching device.
LVSwgD; HVCB, Swg

direct test: A test in which the applied voltage, current, and recovery voltage is obtained from a single power source, which may be comprised of generators, transformers, networks, or combinations of these.
HVCB, Swg

directional-comparison protection: A form of pilot protection in which the relative operating conditions of the directional units at the line terminals are compared to determine whether a fault is in the protected line section.
PSRC

directional control (as applied to a protective relay or relay scheme): A qualifying term that indicates a means of controlling the operating force in a nondirectional relay so that it will not operate until the two or more phasor quantities used to actuate the controlling means (directional relay) are in a predetermined band of phase relations with a reference input.
PSRC

directional-current tripping: *See:* **directional-overcurrent protection** and **directional-overcurrent relay.**

directional-ground relay: A directional relay used primarily to detect single-phase-to-ground faults, but also sensitive to double-phase-to-ground faults.
PSRC

NOTE — This type of relay is usually operated from the zero-sequence components of voltage and current, but is sometimes operated from negative-sequence quantities.

directional-overcurrent protection: A method of protection in which an abnormal condition within the protected equipment is detected by the current being in excess of a predetermined amount and in a predetermined band of phase relations with a reference input.
PSRC

directional-overcurrent relay: A relay consisting of an overcurrent unit and a directional unit combined to operate jointly.
PSRC

directional-power relay: A relay that operates in conformance with the direction of power.
PSRC

directional-power tripping: *See:* **directional-power relay.**

directional relay: A relay that responds to the relative phase position of a current with respect to another current or voltage reference.
PSRC

NOTE — The above definition, which applies basically to a single-phase directional relay, may be extended to cover a polyphase directional relay

disable: A command or condition that prohibits some specific event from proceeding.
SUB

discharge resistor: A resistor that, upon interruption of excitation source current, is connected across the field windings of a generator, motor, synchronous condenser, or an exciter to limit the transient voltage in the field circuit and to hasten the decay of field current of these machines.
LVSwgD

disconnected position (of a switchgear-assembly removable element): That position in which the primary and secondary disconnecting devices of the removable element are separated by a safe distance from the stationary element contacts.
SwgA

NOTE — Safe distance, as used here, is a distance at which the equipment will meet its withstand ratings, both power frequency and impulse, between line and load stationary terminals and phase-to-phase and phase-to-ground on both line and load stationary terminals with the switching device in the closed position.

disconnecting blade: *See:* **blade (disconnecting blade) (of a switching device).**

disconnecting cutout: A distribution cutout, having a disconnecting blade, that is used for closing, opening, or changing the connections in a circuit or system, or for isolating purposes.
HVF, Swg

NOTE — Some load-break ability is inherent in the device, but it has no load-break rating. This ability can best be evaluated by the user, based on experience under operating conditions.

disconnecting fuse: *See:* **fuse-disconnecting switch (disconnecting fuse).**

disconnecting or isolating switch (disconnector, isolator): A mechanical switching device used for changing the connections in a circuit, or for isolating a circuit or equipment from the source of power.
HVF; Swg; HVS, Swg

NOTE — It is required to carry normal load current continuously, and also abnormal or short-circuit currents for short intervals as specified. It is also required to open or close circuits either when negligible current is broken or made, or when no significant change in the voltage across the terminals of each of the switch poles occurs.

display graphic: A hardware device (crt, plasma panel, arrays of lamps, or light-emitting diodes) used to present pictorial information.
SUB

disruptive discharge: A term that relates to phenomena associated with the breakdown of insulation under electrical stress, in which the discharge completely bridges the insulation under test, reducing the voltage between the electrodes

to zero or nearly to zero. It applies to electrical breakdown in solid, liquid, and gaseous dielectrics and combinations of these.
HVCB, Swg

distance protection: A method of line protection in which an abnormal condition within a predetermined electrical distance of a line terminal on the protected circuit is detected by measurement of system conditions at that terminal.
PSRC

distance relay: A generic term covering those forms of measuring relays in which the response to the input quantities is a function of the electric circuit distance (impedance) between the point of measurement and the point of fault.
PSRC

NOTE — A distance relay response characteristic, when presented on an *R-X* impedance diagram, will have an operating area dependent on the manner in which the input quantities are processed and compared.

distance relay characteristic: The defined threshold between the operate and nonoperate response of a distance relay, generally referred to as reach and presented on an *R-X* impedance diagram (see Fig 2). The most commonly used characteristics are as follows:

1) **impedance characteristic.** A nondirectional relay characteristic in which the threshold of operation for the basic form plots as a circle on an *R-X* diagram, with the reach a constant impedance in all four quadrants [see Fig 2(a)].
2) **reactance characteristic.** A nondirectional distance relay characteristic in which the threshold of operation for the basic form plots as a straight line on an *R-X* diagram, with the reach a constant reactance for all values of resistance [see Fig 2(b)].
   NOTE — A small variation in the reactance reach for different values of resistance, as required in some applications, may also be referred to as a reactance characteristic.
3) **mho characteristic.** An inherently directional distance relay characteristic in which the threshold of operation for the basic form plots as a circle on an *R-X* diagram, with the circle passing through the origin [see Fig 2(c)].
   NOTE — For a self-polarized relay, the plot of the characteristic passes through the intersection of the *R-X* axes; for a cross-polarized relay it includes this intersection, but the relay retains its full directional characteristic.
4) **forward offset mho characteristic.** A variant of a mho characteristic in which the reach does not encompass the intersection of the *R-X* axes [see Fig 2(d)].
5) **reverse offset mho characteristic.** A modification of a mho characteristic to make it nondirectional so as to encompass the intersection of the *R-X* axes [see Fig 2(e)].
6) **composite (lens) characteristic**A modification of an impedance or mho characteristic in which the operating area on an *R-X* diagram is inherently restricted in the plus and minus *R* directions. The common area between two overlapping circles produces such a characteristic [see Fig 2(f)].
7) **composite (tomato) characteristic.** A modification of an impedance or mho characteristic in which the operating area on an *R-X* diagram is inherently expanded in the plus and minus direction. The total area of two overlapping circles produces such a characteristic [see Fig 2(g)].
8) **blinder characteristic.** A nondirectional distance relay characteristic in which the threshold of operation substantially plots as a straight line on an *R-X* diagram with the reach essentially resistive and largely independent of the reactance value. Generally this threshold of operation is positioned at an angle of 75° to 90°from the *R* axis [see Fig 2(h)].

PSRC

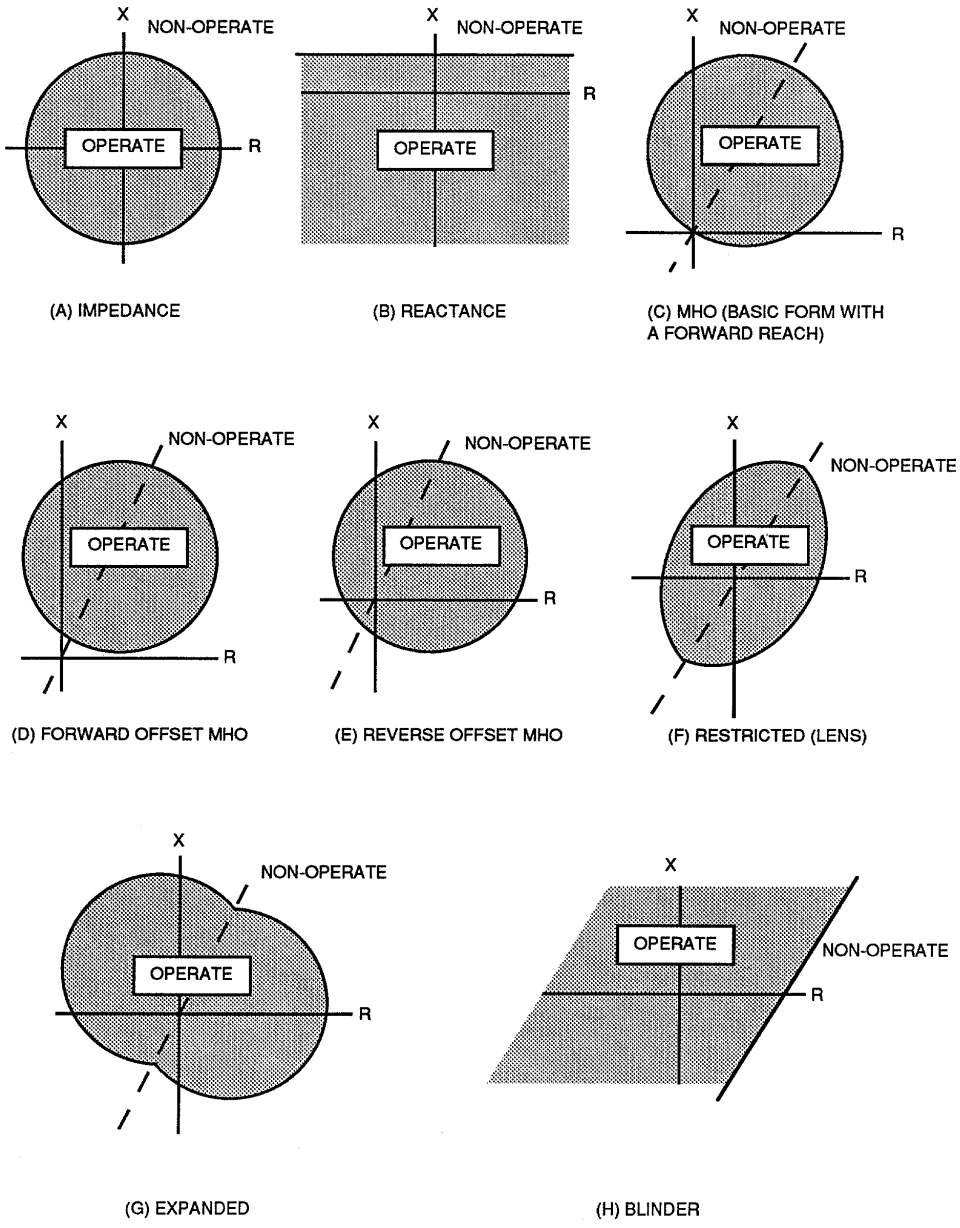

Figure 2— Diagrams of Distance Relay Characteristics

distorted current: The current through the test circuit breaker that is influenced by the arc voltage of both the test and auxiliary circuit breakers during the high current interval.
HVCB, Swg

distributed processing: A design in which all data is not processed in one processor. Multiple processors in the master station or in the remote stations, or both, share the functions.
SUB

distribution (used as an adjective): A general term used, by reason of specific physical or electrical characteristics, to denote application or restriction of the modified term, or both, to that part of an electric system used for conveying energy to the point of utilization from a source or from one or more main receiving stations.
HVF, Swg

NOTES:

1 — From the standpoint of a utility system, the area described is between the generating source, or intervening substations, and the customer's entrance equipment.

2 — From the standpoint of a customer's internal system, the area described is between a source or receiving station within the customer's plant and the points of utilization.

distribution current-limiting fuse: A fuse consisting of a fuse support and a current-limiting fuse unit.
HVP, Swg

NOTE — In addition, the distribution current-limiting fuse is identified by the following characteristics:
a) Dielectric withstand basic impulse insulation level (bil) strengths at distribution levels.
b) Application primarily on distribution feeders and circuits.
c) Operating voltage limits correspond to distribution system voltage.

distribution cutout: A fuse or disconnecting device consisting of any one of the following assemblies:
1) A fuse support and fuse holder that may or may not include the conducting element (or fuse link).
2) A fuse support and disconnecting blade.
3) A fuse support and fuse carrier that may or may not include the conducting element (fuse link) or disconnecting blade.

HVF, Swg

NOTE — In addition, the distribution cutout is identified by the following characteristics:
1) Dielectric withstand basic impulse insulation level (bil) strengths at distribution levels.
2) Application primarily on distribution feeders and circuits.
3) Mechanical construction basically adapted to pole or crossarm mounting except for the distribution oil cutout.
4) Operating voltage limits corresponding to distribution systems voltage.

distribution disconnecting cutout: *See*: **distribution cutout**and **disconnecting cutout.**

distribution enclosed single-pole air switch (distribution enclosed air switches): A single-pole disconnecting switch in which the contacts and blade are mounted completely within an insulated enclosure. (Cannot be converted into a distribution cutout or disconnecting fuse.)
HW, SWg

NOTE — The distribution enclosed air switch is identified by the following characteristics:
1) Dielectric withstand basic impulse insulation level (bil) strengths at distribution level.
2) Application primarily on distribution feeders and circuits.
3) Mechanical construction basically adapted to cross-arm mounting.
4) Operating voltage limits correspond to distribution voltage.
5) Unless incorporating load-break means, it has no interrupting (load-break current) rating. (Some load-break ability is inherent in the device. This ability can be best evaluated only by the user, based on experience under operating conditions.)

distribution fuse cutout: *See:* **distribution cutout**and **fuse cutout.**

distribution oil cutout: *See:* **distribution cutout**and **oil cutout (oil-filled cutout).**

distribution open cutout: *See:* **distribution cutout**and **open cutout.**

distribution open-link cutout: *See:* **distribution cutout**and **open-link cutout.**

distribution switchboard: A power switchboard used for the distribution of electric energy at the voltages common for such distribution within a building.
SwgA

NOTE — Knife switches, air circuit breakers, and fuses are generally used for circuit interruption on distribution switchboards, and voltages seldom exceed 600. However, such switchboards often include switchboard equipment for a high-tension incoming supply circuit and a step-down transformer.

double-break switch: One that opens a conductor of a circuit at two points.
HVS, Swg

double-throw (as applied to a mechanical switching device): A qualifying term indicating that the device can change the circuit connections by utilizing one or the other of its two operating positions.

LVSwgD

NOTE — A double-throw air switch changes circuit connections by moving the switchblade from one of two sets of contact clips into the other.

downtime: The time during which a device or system is not capable of meeting performance requirements.
SUB

drawout-mounted device: One having disconnecting devices and in which the removable portion may be removed from the stationary portion without the necessity of unbolting connections or mounting supports.
LVSwgD, SwgA

NOTE — Compare with stationary-mounted device.

dropout fuse: A fuse in which the fuseholder or fuse unit automatically drops into an open position after the fuse has interrupted the circuit.
HVF, Swg

dropout (of a relay): A term for contact operation (opening or closing) as a relay just departs from pickup. Also identifies the maximum value of an input quantity that will allow the relay to depart from pickup.
PSRC

dropout ratio (of a relay): The ratio of drop-out to pickup of an input quantity.
PSRC

NOTE — This term has been used mostly with relays for which reset is not differentiated from dropout. Hence a similar term, reset ratio, the ratio of reset to pickup, is not generally used, though technically correct.

dropout time (of a relay): The time interval to dropout following a specified change of input conditions.
PSRC

NOTE — When the change of input conditions is not specified it is intended to be a sudden change from pickup value of input to zero input.

dry vault: A ventilated, enclosed area not subject to flooding.
R and S, Swg

dual benchboard: A combination assembly of a benchboard and a vertical hinged panel switchboard placed back to back (no aisle) and enclosed with a top and ends.
SwgA

dual-element fuse: A fuse having current-responsive elements of two different fusing characteristics in series in a single fuse.
HW, Swg

dual overcurrent trip: *See:* **dual release (trip)**and **overcurrent release (trip).**

dual release (trip): A release that combines the function of a delayed and an instantaneous release.
R and S, Swg

dual switchboard: A control switchboard with front and rear panels separated by a comparatively short distance and enclosed at both ends and top. The panels on at least one side are hinged for access to the panel wiring.
SwgA

duplex benchboard: A combination assembly of a benchboard and a vertical control switchboard placed back to back and enclosed with a top and ends (not grille). Access space with entry doors is provided between the benchboard and vertical control switchboard.
SwgA

duplex switchboard: A control switchboard consisting of panels placed back to back and enclosed with a top and ends (not grille). Access space with entry doors is provided between the rows of panels.
SwgA

duty cycle: A prescribed sequence of operations for a specific time with specified time intervals between sequences.

HVCB, Swg;R and S, Swg

earth-fault protection: *See:* **ground protection.**

echo: A communication technique assuring that a word received at the termination point in a system is the same as the word originally transmitted. The received word is retransmitted to the sending device and matched to ensure that the original message was received properly.
SUB

electric: Containing, producing, arising from, actuated by, or carrying electricity, or designed to carry electricity and capable of so doing. *Examples:* Electric eel, energy, motor, vehicle, wave.
SwgA

electric center (of a power system out of synchronism): A point at which the voltage is zero when a machine is 180 degrees out of phase with the rest of the system.
PSRC

NOTE — There may be one or more electrical centers depending on the number of machines and the interconnections among them.

electric telemeter: The measuring, transmitting, and receiving apparatus, including the primary detector, intermediate means (excluding the channel) and end devices for electric telemetering.
SUB

NOTE — A telemeter that measures current is called a teleammeter; voltage, a televoltmeter; power, a telewattmeter; one that measures angular or linear position, a position telemeter. The names of the various component parts making up the telemeter are, in general, self-defining; for example, the transmitter, receiver, indicator, etc.

electric telemetering (electric telemetry): Telemetering performed by an electrical translating means separate from the measured.
SUB

electrical: Related to, pertaining to, or associated with electricity but not having its properties or characteristics. *Examples:* Electrical engineer, handbook, insulator, rating, school, unit.
SwgA

electrical interchangeability (of fuse links or fuse units): The characteristic that permits the designs of various manufacturers to be used interchangeably so as to provide a uniform degree of overcurrent protection and fuse coordination.
HVF, Swg

electrical operation: Power operation by electric energy.
LVSwgD; HVCB, Swg

electrically release-free (trip-free) (as applied to an electrically operated switching device): A term indicating that the release can open the device even though the closing control circuit is energized.
HVCB, Swg; LVSwgD; R and S, Swg

NOTE — Electrically release-free switching devices are usually arranged so that they are also anti-pump. With such an arrangement, the closing mechanism will not reclose the switching device after opening until the closing control circuit is opened and again closed.

electrically reset relay: A relay that is so constructed that it remains in the picked-up condition even after the input quantity is removed; an independent electrical input is required to reset the relay.
PSRC

electrically trip-free: *See:* **electrically release-free (trip free).**

electromagnetic compatibility (emc): A measure of equipment tolerance to external electromagnetic fields.
SUB

electromagnetic interference (emi): A measure of electromagnetic radiation from equipment.
SUB

electromagnetic relay: An electromechanical relay that operates principally by action of an electromagnetic element that is energized by the input quantity.
PSRC

electromechanical relay: A relay that operates by physical movement of parts resulting from electromagnetic, electrostatic, or electrothermic forces created by the input quantities.
PSRC

enable: A command or condition that permits some specific event to proceed.
SUB

enclosed cutout: A cutout in which the fuse clips and fuseholder or disconnecting blade are mounted completely within an insulating enclosure.
HW, Swg

enclosed switchboard: A dead-front switchboard that has an overall sheet-metal enclosure (not grille) covering back and ends of the entire assembly.
SwgA

NOTE — Access to the interior of the enclosure is usually provided by doors or removable covers. The top may or may not be covered.

enclosed switches, indoor or outdoor: Switches designed for service within a housing restricting heat transfer to the external medium.
HVS, Swg

enclosed switchgear assembly: An assembly that is enclosed on all sides and top.
SwgA

enclosure: A surrounding case or housing used to protect the contained equipment and to prevent personnel from accidentally contacting live parts.
SwgA

enclosure currents: Currents that result from the voltages induced in the metallic enclosure by effects of currents flowing in the enclosed conductors.
SUB

end device (of a telemeter): The final system element that responds quantitatively to the measurand through the translating means and performs the final measurement operation.
SUB

NOTE — An end device performs the final conversion of measurement energy to an indication, record, or the initiation of control.

engineering units (O/M): A unit of measure for use by operating/maintenance personnel usually provided by scaling the input quantity for display (meter, stripchart, or crt).
SUB

entrance terminal (distribution oil cutouts): A terminal with an electrical connection to the fuse contact and suitable insulation where the connection passes through the housing.
HVF, Swg

equipment qualification: The generation and maintenance of evidence to assure that the equipment will operate on demand, to meet the system performance requirements.
PSRC

event: A discrete change of state (status) of a system or device.
SUB

evolving fault: A change in the current during interruption whereby the magnitude of current increases to a fault current or to a higher value of fault current in one or more phases.
HVCB, Swg

excitation current: The current supplied to unloaded transformers or similar equipment.

HVCB, Swg

exciter ceiling voltage: The maximum voltage that may be attained by an exciter under specified conditions.
LVSwgD

expendability: The capability of a system to be increased in capacity or provided with additional functions.
SUB

expansion chamber (for an oil cutout): A sealed chamber separately attachable to the vent opening to provide additional air space into which the gases developed during circuit interruption can expand and cool.
HVF, Swg

expendable-cap cutout: An open cutout having a fuse support designed for and equipped with a fuseholder having an expendable cap.
HVF, Swg

expendable cap (of an expendable-cap cutout): A replacement part or assembly for clamping the button head of a fuse link and closing one end of the fuseholder. It includes a pressure-responsive section that opens to relieve the pressure within the fuseholder, when a predetermined value is exceeded during circuit interruption.
HVF, Swg

explosionproof apparatus: Apparatus enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor that may occur within it, and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within. The apparatus operates at such an external temperature that a surrounding flammable atmosphere will not be ignited.
HVS, Swg

explosionproof fuse: A fuse, so constructed or protected, that for all current interruptions within its rating, it will not be damaged nor transmit flame to the outside of the fuse.
HVF, Swg

exponential-cosine (exponential minus cosine) (ex-cos) envelope (of a transient recovery voltage): A voltage-versus-time curve that represents the maximum at any time of the 1-cosine (1 minus cosine) envelope and the exponential envelope.
HVCB, Swg

exponential (ex) envelope (of a transient recovery voltage): A voltage-versus-time curve of the general exponential form $e_1\ E_1\ [1 - \text{ex}\ (t/T)]$ in which e_1 represents the transient voltage across a switching device pole unit, reaching its crest E_1 at infinite time.
HVCB, Swg

NOTE — In practice, this envelope curve is derived from a circuit in which a voltage E_1 charges, by means of a switch, a circuit with inductance L in series with impedance Z and capacitance C in parallel. The voltage of e_1 is measured across Z.

E_1 represents the ac driving or ceiling voltage that is considered at its peak at the time of a current zero and remains practically constant during that portion of the transient defined by the first curve. Hence, it can be considered as dc source during this time. The voltage application is simulated by the closing of the switch.

e_1 represents the transient voltage across the circuit-breaker pole unit.

L represents the equivalent effective inductance on the source side of the circuit breaker.

Z represents the equivalent surge impedance of associated transmission lines.

C represents the equivalent lumped capacitance on the source side of the breaker and modifies the exponential envelope by what may be considered as a slight initial time delay, T_1.

R is the transient recovery voltage rate, corresponding to the initial slope of the exponential envelope.

expulsion fuse or fuse unit: A vented fuse or fuse unit in which the expulsion effect of gases produced by the arc and lining of the fuseholder, either alone or aided by a spring, extinguishes the arc.
HVF, Swg

external insulation: Insulation that is designed for use outside of buildings and for exposure to the weather.
SwgA

factory-renewable fuse unit: A fuse unit that after circuit interruption must be returned to the manufacturer to be restored for service.
HVF, Swg

failure (supervisory): An event that may limit the capability of a piece of equipment or system to perform its function(s).

1) **critical.** Causes a false or undesired operation of apparatus under control.
2) **major.** Loss of control or apparatus that does not involve a false operation.
3) **minor.** Loss of data relative to power flow or equipment status.

failure distribution: The manner in which failures occur as a function of time; generally expressed in the form of a curve with the abscissa being time.
SUB

failure mode: A process of failure of equipment that causes a loss of its proper function.
SUB

failure to trip: In the performance of a relay or relay system, the lack of tripping that should have occurred considering the objectives of the relay system design.
PSRC

failure:

1) **infant mortality.** A characteristic pattern of failure, sometimes experienced with new equipment that may contain marginal components, wherein the number of failures per unit of time decrease rapidly as the number of operating hours increase. A burn-in period may be utilized to age (or mature) a piece of equipment to reduce the number of marginal components.
2) **random.** The pattern of failures for equipment that has passed out of its infant mortality period and has not reached the wear-out phase of its operating life-time. The reliability of equipment in this period may be computed by the equation
   $R = e^{-t}$
   where
   $R =$ failure rate
   $t =$ time period of interest
3) **wear out.** The pattern of failures experienced when equipment reaches its period of deterioration. Wear-out failure profiles may be approximated by a Gaussian (bell-curve) distribution centered on the nominal life of the equipment.

SUB

false tripping: In the performance of a relay or relay system, the tripping that should not have occurred considering the objectives of the relay system design.
PSRC

fault: *See:* **short circuit.**

fault bus (fault ground bus): A bus connected to normally grounded parts of electric equipment, so insulated that all of the ground current passes to ground through fault-detecting means.
SwgA, PSRC

fault bus protection (relaying): A method of ground fault protection that makes use of a fault bus.
SwgA; PSRC

fault-detector relay: A monitoring relay whose function is to limit the operation of associated protective relays to specific system conditions.
PSRC

fault-incidence angle: The phase angle as measured between the instant of fault inception and a selected reference, such as the zero point on a current or voltage wave.
PSRC

fault-initiating switch: A mechanical switching device used in applied-fault protection to place a short circuit on an energized circuit and to carry the resulting current until the circuit has been de-energized by protective operation.
HVS, Swg

NOTES:

1 — This switch is operated by a stored-energy mechanism capable of closing the switch within a specified rated closing time at its rated making current. The switch may be opened either manually or by a power-operated mechanism.

2 — The applied short circuit may be intentionally limited to avoid excessive system disturbance.

fault interrupter: A self-controlled mechanical switching device capable of making, carrying, and automatically interrupting an alternating current. It includes an assembly of control elements to detect overcurrents and control the fault interrupter.
R and S, Swg

ferroresonance: An electrical resonant condition associated with the saturation of a ferromagnetic device, such as a transformer, through capacitance. Ferroresonance can arise when (1) due to dissimilar phase switching, the capacitance normally in shunt with the ferromagnetic device becomes energized in series with the device, (2) a weak source is isolated with a lightly loaded feeder containing power factor correction capacitors. For example, if the resulting voltage buildup produces saturation of the feeder transformers, there will be an interchange of energy between the system capacitance and the nonlinear magnetizing reactance of the transformers.
PSRC

ferrule (of a cartridge fuse): A fuse terminal of cylindrical shape at the end of a cartridge fuse.
HVF, Swg, LVSwgD

field application relay: A relay that initiates the application of field excitation to a synchronous machine under specified conditions.
PSRC

NOTE — It is usually a polarized relay sensitive to the slip frequency of the induced field current. It may also remove excitation during an out-of-step condition.

field discharge (as applied to a switching device): A qualifying term indicating that the switching device has main contacts for energizing and de-energizing the field of a generator, motor, synchronous condenser or exciter; and has auxiliary contacts for short-circuiting the field through a discharge resistor at the instant preceding the opening of the main contacts. The auxiliary contacts also disconnect the field from the discharge resistor at the instant following the closing of the main contacts.
LVSwgD

NOTE — For dc generator operation, the auxiliary contacts may open before the main contacts close.

field discharge circuit breaker: *See:* **field discharge** and **circuit breaker.**

field-renewable fuse or fuse unit: *See:* **renewable (field-renewable) fuse or fuse unit.**

field tests: Tests made on operating systems usually for the purpose of investigating the performance of switchgear or its component parts under conditions that cannot be duplicated in the factory.
HVCB, Swg

NOTE — Field tests are usually supplementary to factory tests and therefore may not provide a complete investigation of capabilities.

field tests (switchgear): Tests made after the assembly has een installed at its place of utilization.
SwgA

firmware: Hardware used for the nonvolatile storage of instructions or data that can be read only by the computer. Stored information is not alterable by any computer program.
SUB

fixed rack: An assembly enclosed at top and sides, either open or with door(s) for access, with a top-to-bottom front panel opening for equipment mounting (for example, nominal 19-in wide chassis and subpanel assemblies).
PSRC

flame retardant: So constructed or treated that it will not support flame.
SwgA

flow relay: A relay that responds to a rate of fluid flow.
PSRC

fluidly delayed overcurrent trip: *See:* **fluidly delayed release (trip)** and **overcurrent release (trip).**

fluidly delayed release (trip): A release delayed by fluid displacement or adhesion.
LVSwgD

flush-mounted device: A device in which the body projects only a small specified distance in front of the mounting surface.
SwgA

fragility: Susceptibility of equipment to malfunction as the result of structural or operational limitations, or both.
PSRC; SwgA

fragility level: The highest level of input excitation, expressed as a function of input frequency, that a piece of equipment can withstand and still perform the required Class 1E functions.
PSRC; SwgA

fragility response spectrum (FRS): A test response spectrum obtained from tests to determine the fragility level of equipment.
PSRC; SwgA

frame size (as applied to a low-voltage circuit breaker): The maximum continuous current rating in amperes for all parts except the coils of the direct-acting trip device.
LVSwgD

frequency relay: A relay that responds to the frequency of an alternating electrical input quantity.
PSRC

frequency-type telemeter: A telemeter that employs the frequency of a periodically recurring electric signal as the translating means.
SUB

front- and back-connected device: A device in which one or more current-carrying conductors are connected directly to the fixed terminals located at the front of the mounting base, with the remaining conductors connected to the studs on the back of the mounting base.
HVF, Swg; HVS, Swg

front-connected device: A device in which the current-carrying conductors are connected to the fixed terminals in front of the mounting base.
HVS, Swg; HVF, Swg

front contact: *See:* ***a*** **contact (front contact).**

function check: A check of master and remote station equipment by exercising a predefined component or capability.

1) **analog.** Monitor a reference quantity.
2) **control.** Control and indication from a control-check relay.
3) **scan.** Accomplished when control function check has been performed with all remotes.
4) **poll.** Accomplished when analog function is performed with all remotes.
5) **logging.** Accomplished when results of the control function check are logged.

SUB

functional component: A device that performs a necessary function for the proper operation and application of a unit of equipment.
LVSwgD

fuse: An overcurrent protective device with a circuit-opening fusible part that is heated and severed by the passage of overcurrent through it.

HVF, Swg; HVCB, Swg

NOTE — A fuse comprises all the parts that form a unit capable of performing the prescribed functions. It may or may not be the complete device necessary to connect it into an electric circuit.

fuse-arcing time: *See:* **arcing time (of a fuse).**

fuse blade (of a cartridge fuse): A cartridge-fuse terminal having a substantially rectangular cross section.
HVF, Swg

fuse carrier (of an oil cutout): An assembly of a cap that closes the top opening of an oil-cutout housing, an insulating member, and fuse contacts with means for making contact with the conducting element and for insertion into the fixed contacts of the fuse support.
HVF, Swg

NOTE — The fuse carrier does not include the conducting element (fuse link).

fuse clearing time: *See:* **clearing time (2).**

fuse clips (contact clips or fuse contacts): The current-carrying parts of a fuse support that engage the fuse carrier, fuse holder, fuse unit, or blade.
HVF, Swg

fuse condenser: A device that, added to a vented fuse, converts it to a nonvented fuse by providing a sealed chamber for condensation of the gases developed during circuit interruption.
HVF, Swg

fuse contact: *See:* **fuse terminal.**

fuse cutout: A cutout having a fuse link or fuse unit.
HVF, Swg

NOTE — A fuse cutout is a fuse-disconnecting switch.

fuse-disconnecting switch (disconnecting fuse): A disconnecting switch in which a fuse unit or fuseholder and fuse link forms all or a part of the blade.
HVF, Swg

fuse-enclosure package (FEP): An enclosure supplied with one or more fuses as a package for which application data covering the specific fuse(s) and enclosure are supplied.
HVF, Swg

fuse filler: *See:* **arc-extinguishing medium (fuse filler) (of a fuse).**

fuseholder (of a high-voltage fuse): An assembly of a fuse tube or tubes together with parts necessary to enclose the conducting element and provide means of making contact with the conducting element and the fuse clips. The fuseholder does not include the conducting element (fuse link or refill unit).
HVF, Swg

fuseholder (of a low-voltage fuse): An assembly of base, fuse clips, and necessary insulation for mounting and connecting into the circuit the current-responsive element, with its holding means if used for making a complete device.
LVSwgD

NOTES:

1 — For low-voltage fuses, the current-responsive element and holding means are called a fuse.

2 — For high-voltage fuses, the general type of assembly defined above is called a fuse support or fuse mounting. The holding means (fuseholder) and the current-responsive or conducting element are called a fuse unit.

fuse hook: A hook provided with an insulating handle for opening and closing fuses or switches and for inserting the fuseholder, fuse unit, or disconnecting blade into and removing it from the fuse support.
HVF, Swg

fuse link: A replaceable part or assembly, comprised entirely or principally of the conducting element, required to be replaced after each circuit interruption to restore the fuse to operating conditions.
HVF, Swg

fuse melting time: *See:* **melting time (of a fuse).**

fuse mounting: *See:* **fuse support (fuse mounting) (of a high-voltage fuse).**

fuse muffler: *See:* **muffler (of a fuse).**

fuse support (fuse mounting) (of a high-voltage fuse): An assembly of base, mounting support or oil-cutout housing, fuse clips, and necessary insulation for mounting and connecting into the circuit the current-responsive element with its holding means if such means are used for making a complete device.
HVF, Swg

NOTES:

1 — For high-voltage fuses, the holding means is called a fuse carrier or fuseholder, and in combination with the current-responsive or conducting element is called a fuse unit.

2 — For low-voltage fuses, the general type of assembly defined above is called a fuseholder.

fuse terminal (fuse contact): The means for connecting the current-responsive element or its holding means, if such means is used for making a complete device, to the fuse clips.
HVF, Swg

fuse time-current characteristic: The correlated values of time and current that designate the performance of all or a stated portion of the functions of the fuse.
HVF, Swg

NOTE — The time-current characteristics of a fuse are usually shown as a curve.

fuse time-current tests: Tests that consist of the application of current to determine the relation between the rms alternating current or direct current and the time for the fuse to perform the whole or some specified part of its interrupting function.
HVF, Swg

fuse tongs: Tongs provided with an insulating handle and jaws. Fuse tongs are used to insert the fuseholder or fuse unit into the fuse support or to remove it from the support.
HVF, Swg

fuse tube: A tube of insulating material that surrounds the current-responsive element, the conducting element, or the fuse link.
HVF, Swg

fuse unit: An assembly comprising a conducting element mounted in a fuseholder with parts and materials in the fuseholder essential to the operation of the fuse.
HVF, Swg

fusible element (of a fuse): That part, having predetermined current-responsive melting characteristics, which may be all or part of the current-responsive element.
HVF, Swg

future point (for supervisory control or indication or telemeter selection): Provision for the future installation of equipment required for a point.
SUB

NOTE — A future point may be provided with (1) space only; (2) drilling, or other mounting provisions only; or (3) drilling, or other mounting provisions, and wiring only.

gas-accumulator relay: A relay so constructed that it accumulates all or a fixed proportion of gas released by the protected equipment and operates by measuring the volume of gas so accumulated.
PSRC

gas-barrier insulator: A spacer insulator specifically designed to prevent passage of gas from one side to the other.
SUB

gas density, minimum: The minimum operating gas density at which the gas-insulated substation and its components will meet their assigned electrical ratings.
SUB

gas density, nominal: The manufacturer's recommended operating gas density (usually expressed as pressure at 20 °C).
SUB

gas-insulated substation (GIS): A compact, multicomponent assembly, enclosed in a grounded metallic housing in which the primary insulating medium is a compressed gas and that normally consists of buses, switchgear, and associated equipment (subassemblies).
SUB

gas-insulated substation (GIS) surge arrester: A surge arrester specifically designed for use in a gas-insulated substation.
SUB

gas leakage: Loss of insulating gas from the pressurized system.
SUB

gas-pressure relay: A relay so constructed that it operates by the gas pressure in the protected equipment.
PSRC

general purpose circuit breaker: A circuit breaker that has been designed, tested, and rated in accordance with general purpose circuit breaker requirements of applicable standards.
HVCB, Swg

general purpose current-limiting fuse: A fuse capable of interrupting all currents from the rated maximum prospective current down to the current that causes melting of the fusible element in no less than one hour.
HVF, Swg

general-purpose enclosure: An enclosure used for usual service applications where special types of enclosures are not required.
SwgA

general-purpose low-voltage dc power circuit breaker: *See:* **circuit breaker, general purpose low-voltage dc power.**

generic environment: A set of environmental conditions intended to envelop the range of expected environments.
PSRC

generic equipment: A family of equipment units having similar materials, manufacturing processes, limiting stresses, and design and operating principles that can be represented for qualification purposes by a representative unit(s).
PSRC

generic response spectra (GRS): The response spectra that define the seismic ratings of metal-enclosed power switchgear.
SwgA

granular-filled fuse unit: A fuse unit in which the arc is drawn through powdered, granular, or fibrous material.
HVF, Swg

ground acceleration: The acceleration of the ground resulting from a given earthquake's motion. The maximum ground acceleration can be obtained from the ground response spectrum as the acceleration at high frequencies (in excess of 33 Hz).
SwgA

ground and test device: A term applied to a switchgear assembly accessory device that can be inserted in place of a drawout circuit breaker for the purpose of (1) grounding the main bus and/or external circuits connected to the switchgear assembly, and/or (2) primary circuit testing.

SwgA

ground bus: A bus to which the grounds from individual pieces of equipment are connected, and that, in turn, is connected to ground at one or more points.
SwgA

ground contact (of a switchgear assembly): A self-coupling separable contact provided to connect and disconnect the ground connection between the removable element and the ground bus of the housing and so constructed that it remains in contact at all times except when the primary disconnecting devices are separated by a safe distance.
SwgA

NOTE — Safe distance, as used here, is a distance at which the equipment will meet its withstand-voltage ratings, both low-frequency and impulse, between line and load terminals with the switching device in the closed position.

ground overcurrent: The net (phasor sum) current flowing in the phase and neutral conductors or the total current flowing in the normal neutral-to-ground connection that exceeds a predetermined value.
LVSwgD

ground potential rise (GPR): The difference in ground potential between a location in proximity to a point of large current injection into the ground and any remote ground point. GPR is usually caused by a short circuit of an energized power conductor to ground and is the result of the injected current flowing through the impedance of the ground circuit.
PSRC

ground protection: A method of protection in which faults to ground within the protected equipment are detected.
PSRC,LVSwgD

ground relay: A relay that by its design or application is intended to respond primarily to system ground faults.
PSRC

groundable parts: Those parts that may be connected to ground without affecting operation of the device.
HVF, Swg; LVSwgD

grounded parts: Parts that are intentionally connected to ground.
HVF, Swg; HVS, Swg; LVSwgD; HVCB, Swg

grounding switch: A mechanical switching device by means of which a circuit or piece of apparatus may be electrically connected to ground.
HVS, Swg

group operation: The operation of all poles of a multipole switch device by one operating mechanism.
HVS, Swg; HVCB, Swg

guard signal: A signal sent over a communication channel to make the system secure against false information by preventing or guarding against the relay operation of a circuit breaker or other relay action until the signal is removed and replaced by a tripping or permissive signal.
PSRC

hand-reset relay (mechanically reset relay): A relay so constructed that it remains in the picked-up condition even after the input quantity is removed; specific manual action is required to reset the relay.
PSRC

handling device (of metal-clad switchgear): That accessory used for the removal, replacement, or transportation of the removable element.
SwgA

hard copy: A permanent record of information in readable form for human use, for example, reports, listings, displays, logs, and charts.
SUB

hardwired: The implementation of processing steps within a device by way of the placement of conductors between components within the device. The processing steps are not alterable except by modifying the conducting paths between components.
SUB

harmonic-restraint relay: A restraint relay so constructed that its operation is restrained by harmonic components of one or more separate input quantities.
PSRC

high-pressure contact (as applied to high-voltage disconnecting switches): One in which the pressure is such that the stress in the material of either of the contact surfaces is near the elastic limit of the material so that conduction is a function of pressure.
HVF, Swg

high-speed grounding switch: *See:* **fault-initiating switch.**

high-speed low-voltage dc power circuit breaker: *See:* **circuit breaker, high-speed low-voltage dc power.**

high-speed relay: A relay that operates in less than a specified time.
PSRC

NOTE — The specified time in present practice is 50 ms (three cycles on a 60 Hz basis).

high-speed short-circuiting switch: *See:* **fault-initiating switch.**

hinge clip (of a switching device): The clip to which the blade is movably attached.
HVS, Swg

homogeneous series (of current-limiting fuse units): A series of fuse units, deviating from each other only in such characteristics that, for a given test, the testing of one or a reduced number of particular fuse units of the series may be taken as representative of all the fuse units of the series.
HVF, Swg

hook operation: *See:* **stick (hook) operation.**

hook ring (air switch): A ring provided on the switch blade for operation of the switch with a switch stick.
HVS, Swg

hook stick: *See:* **switch stick (switch hook).**

horn-gap switch: A switch provided with arcing horns.
HVS, Swg

housing (body) (of an oil cutout): A part of the fuse support that contains the oil and provides means for mounting the fuse carrier, entrance terminals, and fixed contacts. The housing includes the means for mounting the cutout on a supporting structure and openings for attaching accessories such as a vent or an expansion chamber.
HVF, Swg

hydraulic operation: Power operation by movement of a liquid under pressure.
HVCB, Swg

hydraulically-release-free (trip-free) (as applied to a hydraulically operated switching device): A term indicating that by hydraulic control the switching device is free to open at any position in the closing stroke if the release is energized.
HVCB, Swg

NOTE — This release-free feature is operative even though the closing control switch is held closed.

***I^2t* characteristic (of a fuse).:** The amount of ampere-squared seconds passed by the fuse during a specified period and under specified conditions.
HVF, Swg

NOTES:

1 — The specified period may be the melting arcing, or total clearing time. The sum of melting and arcing I^2t is the clearing I^2t.

2 — The melting characteristic is related to a specified current wave shape, and the arcing I^2t to specified voltage and circuit-impedance conditions.

ice proof: So constructed or protected that ice of a specified composition and thickness will not interfere with successful operation.
HVS, Swg

ice tests: Design tests made to determine the rated ice-breaking ability of the switching equipment.
HVS, Swg

impedance relay: A distance relay in which the threshold value of operation depends only on the magnitude of the ratio of voltage to current applied to the relay, and is substantially independent of the phase angle of the impedance. See Fig 2(a).
PSRC

impulse rms sound level: The maximum rms value reached by a sound wave, with the mean (or average) taken over a short, specified time interval. Unit: decibel (dB A, B, or C). For the purposes of this standard, the averaging time shall be that given by a resistance-capacitance charging circuit with a 35 ms time constant.
HVCB, Swg

impulse (time) margin: In the operation of a relay, the difference between characteristic operating times and critical impulse times. See Fig 3.
PSRC

impulse withstand voltage: The crest voltage of an impulse that, under specified conditions, can be applied without causing flashover or puncture.
HVF, Swg

impulsive noise: A noise characteristic by brief excursions of sound pressure (acoustic impulses) that significantly exceed the ambient noise. The duration of a single impulse is usually less than one second (see ANSI S1.13-1971 [2]. For the purpose of this standard, the noise produced by the closing or opening of a circuit breaker, or their combination, shall be classified as impulsive noise. Other components, such as compressor unloader exhausts, may be sources of impulsive noise.
HVCB, Swg

incorrect relay operation: Any output response or lack of output response by the relay that, for the applied input quantities, is not correct.
PSRC

incorrect relaying-system performance: Any operation or lack of operation of the relays or associated equipment that, under existing conditions, does not conform to correct relaying-systems performance.
PSRC

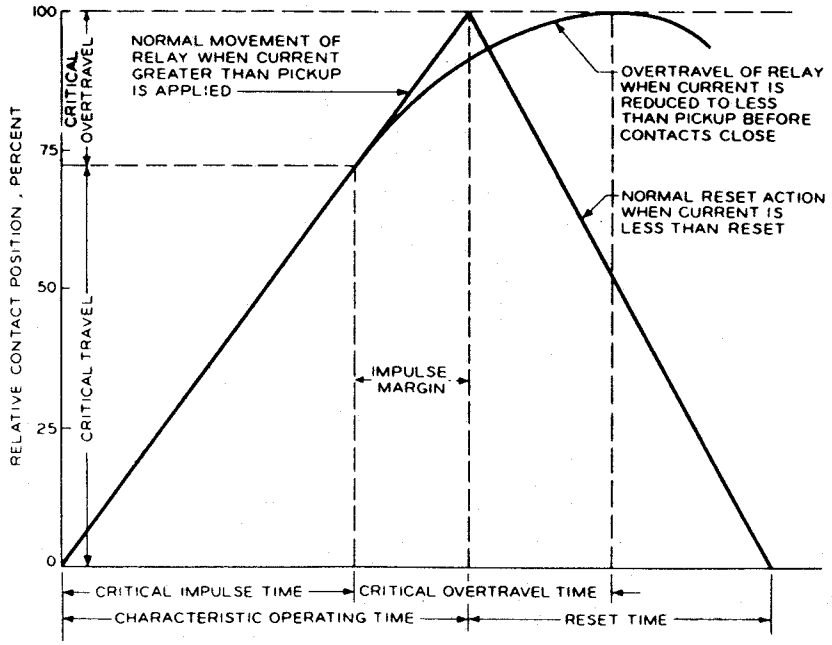

Figure 3— Relationship of Relay Operating Time for Electromechanical Relays (PSRC)

independent biaxial test: The horizontal and the vertical acceleration components are derived from two different input signals, which are phase incoherent.
PSRC

independent manual operation (of a switching device): A stored-energy operation where manual energy is stored and released, such that the speed and force of this operation are independent of the action of the attendant.
LVSwgD

independent pole tripping: The application of multipole circuit breakers in such a manner that a malfunction of one or more poles or associated control circuits will not prevent successful tripping of the remaining pole(s).
HVCB, Swg

NOTES:

1 — Circuit breakers used for independent pole tripping must inherently be capable of individual pole opening.

2 — Independent pole tripping is applied on ac power systems to enhance system stability by maximizing the probability of clearing at least some phases of a multiphase fault.

independent power operation: An operation by means of energy other than manual where the completion of the operation is independent of the continuity of the power supply.
LVSwgD

indicating control switch: A switch that indicates its last control operation.
SwgA

indicating fuse: A fuse that automatically indicates that the fuse has interrupted the circuit.
HVF, SWg

indication: A light or other signal (audio or visual) provided by the man/machine interface that signifies a particular condition.
SUB

indirect-acting machine voltage regulator: A machine voltage regulator having a voltage-sensitive element that acts indirectly, through the medium of an interposing device such as contactors or a motor, to control the excitation of an electric machine.
LVSwgD

NOTE — A regulator is called a generator voltage regulator when it acts in the field circuit of a generator and is called an exciter voltage regulator when it acts in the field circuit of the main exciter.

indirect manual operation (of a switching device): Operation by hand through an operating handle mounted at a distance from, and connected to the switching device by, mechanical linkage.
LVSwgD

indirect operation (of a switching device): Operating by means of an operating mechanism connected to the main operating shaft or an extension of it, through offset linkages and bearings.
HVS, Swg

indirect release (trip) (of a switching device): A release energized by the current in the main circuit through a current transformer, shunt, or other transducing device.
LVSwgD

individual pole operation (of a multipole circuit breaker or switching device): A descriptive term indicating that any pole(s) of the device can be caused to change state (open or close) without changing the state of the remaining pole(s). Devices may have capability for individual pole opening, individual pole closing, or both.
HVCB, Swg

indoor: Designed for use only inside buildings, or weather-resistant enclosures.
HVF, Swg; HVS, Swg; HVCB, Swg

induction cup (of a relay): A form of relay armature in the shape of a cylinder with a closed end that develops operating torque by its location within the fields of electromagnets that are excited by the input quantities.
PSRC

induction cylinder (of a relay): A form of relay armature in the shape of an open-ended cylinder that develops operating torque by its location within the fields of electromagnets that are excited by the input quantities.
PSRC

induction disc (of a relay): A form of relay armature in the shape of a disc that usually serves the combined function of providing an operating torque by its location within the fields of an electromagnet excited by the input quantities and a restraining force by motion within the field of a permanent magnet.
PSRC

induction loop (of a relay): A form of relay armature consisting of a single turn or loop that develops operating torque by its location within the fields of electromagnets that are excited by the input quantities.
PSRC

inherent transient recovery voltage: The transient recovery voltage (TRV) produced by the circuit with no modifying effect of the switching device.
HVCB, Swg

NOTE — The magnitude of the TRV for a given circuit and voltage is affected by the degree of current asymmetry. Symmetrical current usually produces the highest TRV magnitudes and is used as the basis for TRV rated values. An asymmetrical current normally reduces the TRV magnitude from the symmetrical current case.

inhibit: To prevent a specific event from occurring.
SUB

initial transient recovery voltage (ITRV): A component of the transient recovery voltage that appears in the very short time immediately after current interruption. The initial transient recovery voltage is a result of traveling waves on the substation bus adjacent to the circuit-switching device.
HVCB, Swg

initiating relay: A programming relay whose function is to constrain the action of dependent relays until after it has operated.
PSRC

injected current: The current that flows through the test circuit breaker from the voltage source of a current injection circuit when this circuit is applied to the test circuit breaker.
HVCB, Swg

injected-current frequency: The frequency of the injected current.
HVCB, Swg

injection time: The time with respect to the power frequency current zero when the voltage circuit is applied.
HVCB, Swg

input (to a relay): A physical quantity or quantities to which the relay is designed to respond.
PSRC

NOTES:

1 — A physical quantity that is not directly related to the prescribed response of a relay (though necessary, to or in some way affecting the relay operation), is not considered part of input.

2 — Time is not considered a relay input, but it is a factor in performance.

inside air temperature: *See*: **average inside air temperature (of enclosed switchgear).**

instantaneous: A qualifying term indicating that no delay is purposely introduced in the action of the device.
PSRC; LVSwgD; HVCB, Swg

instantaneous phase or ground trip element: *See*: **instantaneous**and **direct-acting overcurrent trip device.**

installed life: The interval from installation to removal, during which the equipment or component thereof may be subject to design service conditions and system demands.
PSRC

NOTE — Equipment may have an installed life of 40 years with certain components changed periodically; thus, the installed life of the components would be less than 40 years.

instrument switch: A switch used to connect or disconnect an instrument, or to transfer it from one circuit or phase to another. *Examples*: Ammeter switch, voltmeter switch.
SwgA

insulation: A material having the property of an insulator used to separate parts of the same or different potential.
HVF, Swg

insulator unit: An insulator assembled with such metal parts as may be necessary for attaching it to other insulating units or device parts.
HVF, Swg; HVS, Swg

integral unit substation: A unit substation in which the incoming, transforming, and outgoing sections are manufactured as a single compact unit.
SwgA

integrator (as applied to relaying): A transducer whose output wave form is substantially the time integral of its input wave form.
PSRC

interconnecting channel (of a supervisory system): The transmission link, such as the direct wire, carrier, or microwave channel (including the direct current, tones, etc.) by which supervisory control or indication signals or selected telemeter readings are transmitted between the master station and the remote station or stations, in a single supervisory system.
SUB

interlock: A device actuated by the operation of some other device with which it is directly associated, to govern succeeding operations of the same or allied devices.
HVS, Swg; LVSwgD; HVCB, Swg

NOTE — An interlock system is a series of interlocks applied to associated equipment in such a manner as to prevent or allow operation of the equipment only in a prearrangedsequence. Interlocks are classified into three main divisions: mechanical interlocks, electrical interlocks, and key interlocks, based on the type of interconnection between the associated devices.

intermediate contacts (of a switching device): Contacts in the main circuit that part after the main contacts and before the arcing contacts have parted.
LVSwgD; HVCB, Swg

interphase rod or shaft: A component of a switch-operating mechanism designed to connect two or more poles of a multipole switch for group operation.
HVS, Swg

interposing relay (of a supervisory system): An auxiliary relay at the master or remote station, the contacts of which serve: (1) to energize a circuit (for closing, opening, or other purpose) of an element of remote station equipment when the selection of a desired point has been completed and when suitable operating signals are received through the supervisory equipment from the master station; or (2) to connect in the circuit the telemeter transmitting and receiving equipment, respectively, at the remote and master stations.
SUB

NOTE — The interposing relays are considered part of a supervisory system.

interrogative supervisory system: A system whereby the master station controls all operations of the system, and whereby all indications are obtained on a master station request or interrogation basis.
SUB

NOTE — The normal state is usually one of continuous interrogation or polling of the remote stations for changes in status.

interrupter: An element designed to interrupt specified currents under specified conditions.
HVS, Swg; LVSwgD; HVCB, Swg

interrupter blade (of an interrupter switch): A blade used in the interrupter for breaking the circuit.
HVS, Swg

interrupter switch: An air switch, equipped with an interrupter, for making or breaking specified currents, or both.
HVS, Swg

NOTE — The nature of the current made or broken or both may be indicated by suitable prefix; that is load-interrupter switch, fault-interrupter switch, capacitor-current interrupter switch, etc.

interrupting aid: An interrupting device that can be attached to an air switch to improve its interrupting capability.
HVS, Swg

interrupting (breaking) current: The current in a pole of a switching device at the instant of the initiation of the arc.
HVCB, Swg

interrupting tests: Tests that are made to determine or check the interrupting performance of a switching device.
HVF, Swg; LVSwgD; HVCB, Swg

interrupting (total break) time (of a mechanical switching device): The interval between the time when the actuating quantity of the release circuit reaches the operating value, the switching device being in a closed position, and the instant of arc extinction on the primary arcing contacts.
LVSwgD; HVCB, Swg

NOTES:

1 — Interrupting time is numerically equal to the sum of opening time and arcing time.

2 — In multipole devices, interrupting time may be measured for each pole or for the device as a whole, in which latter case, the interval is measured to the instant of arc extinction in the last pole to clear.

interruption to service: The isolation of an electrical load from the system supplying that load, resulting from an abnormality in the system.
PSRC

inverse-time delay: A qualifying term indicating that there is purposely introduced a delaying action, the delay decreasing as the operating force increases.
LVSwgD; HVCB, Swg

inverse-time relay: A relay in which the input quantity and operating time are inversely related throughout at least a substantial portion of the performance range. See Fig 1.
PSRC

NOTE — Types of inverse-time relays are frequently identified by such modifying adjectives as "definite minimum time," "moderately," "very," and "extremely" to identify relative degree of inverseness of the operating characteristics of a given manufacturer's line of such relays.

island: That part of a power system consisting of one or more power sources and load that is, for some period of time, separated from the rest of the system.
PSRC

isolated-phase bus: A bus in which each phase conductor is enclosed by an individual metal housing separated from adjacent conductor housings by an air space.
SwgA

NOTE — The bus may be self-cooled or may be forced-cooled by means of circulating a gas or liquid.

isolating time (of a sectionalizer): The time between the cessation of a current above the minimum actuating current value that caused the final counting and opening operation and the maximum separation of the contacts.
R and S, Swg

isolator: *See:* **disconnecting or isolating switch**

knife switch: A form of switch in which the moving element, usually a hinged blade, enters or embraces the stationary contact clips.
LVSwgD

NOTE — In some cases, however, the blade is not hinged and is removable.

latch: An attachment used to hold a fuse or switch in the closed position.
HVF, Swg

latching current (of a switching device): The making current during a closing operation in which the device latches or the equivalent.
HVCB, Swg

latching relay: A relay that is so constructed that it maintains a given position by means of a mechanical latch until released mechanically or electrically.
PSRC

LC auxiliary switch: *See:* **auxiliary switch** and **LC contact.**

LC contact: A latch-checking contact that is closed when the operating mechanism linkage is relatched after an opening operation of the switching device.
HVCB, Swg

leakage distance of external insulation: *See:* **creepage distance.**

lens distance relay: A distance relay that has an operating characteristic comprising the common area of two intersecting circular relay characteristics. See Fig 2(f).
PSRC

level detector (as applied to relaying): A device that produces a change in output at a prescribed input level.
PSRC

lifting eye (fuse holder, fuse unit, or disconnecting blade): An eye provided for receiving a fuse hook or switch hook for inserting the fuse or disconnecting blade into and for removing it from the fuse support.
HVF, Swg

lifting-insulator switch: A switch in which one or more insulators remain attached to the blade, move with it, and lift it to the open position.
HVS, Swg

line-closing switching-surge factor: The ratio of the line-closing switching-surge maximum voltage to the crest of the normal-frequency line-to-ground voltage at the source side of the closing switching device immediately prior to closing.
HVCB, Swg

line-closing switching-surge maximum voltage: The maximum transient crest voltage to ground measured on a transmission line during a switching surge which results from energizing that line.
HVCB, Swg

line tap (in respect to system protection): A connection to a line with equipment that does not feed energy into a fault on the line in sufficient magnitude to require consideration in the relay plan.
PSRC

line terminal (in respect to system protection): A connection to a line with equipment that can feed energy into a fault on the line in sufficient magnitude to require consideration in the relay plan and that has means for automatic disconnection.
PSRC

linear-impedance relay: A distance relay for which the operating characteristic on an *R-X* diagram is a straight line.
PSRC

NOTE — It may be described by the equation $Z = K/\cos(\theta-\alpha)$ ωηερε K and α are constants and θ is the phase angle by which the input voltage leads the input current.

link-break cutout: A load-break fuse cutout that is operated by breaking the fuse link to interrupt the load current.
HVF, Swg

liquid-filled fuse unit: A fuse unit in which the arc is drawn through a liquid.
HVF, Swg

live-front switchboard: A switchboard that has exposed live parts on the front.
SwgA

live parts: Those parts that are designed to operate at voltage different from that of the earth.
HVF, Swg; HVS, Swg; HVCB, Swg; SwgA

live tank switching device: A switching device in which the vessel(s) housing the interrupters) is at a potential above ground.
HVCB, Swg

load: The true or apparent power consumed by power utilization equipment performing its normal function.
HVCB, Swg

load-break cutout: A cutout with means for interrupting load currents.
HVF, Swg

load-indicating automatic reclosing equipment: Automatic reclosing equipment that provides for reclosing the circuit interrupter automatically in response to sensing of predetermined conditions of the load circuit.
SUB

NOTE — This type of automatic reclosing equipment is generally used for direct-current load circuits.

load-indicating resistor: A resistor used, in conjunction with suitable relays or instruments, in an electric circuit, for the purpose of determining or indicating the magnitude of the connected load.
SUB

load-interrupter switch: An interrupter switch designed to interrupt currents not in excess of the continuous-current rating of the switch.
R and S, Swg

NOTES:

1 — It may be designed to close and carry abnormaI or short-circuit currents as specified.

2 — In international (IEC) practice a device with such performance characteristics is called a switch.

load restoration: The process of scheduled load restoration when the abnormality causing load shedding has been corrected.
PSRC

load shedding: The process of deliberately removing preselected loads from a power system in response to an abnormal condition in order to maintain the integrity of the system.
PSRC

load-shifting resistor: A resistor used in an electric circuit to shift load from one circuit to another.
LVSwgD

local backup: A form of backup protection in which the backup protective relays are at the same station as the primary protective relays.
PSRC

lockout-free (as applied to a recloser or sectionalizer): A general term denoting that the lockout mechanism can operate even though the manual operating level is held in the closed position.
R and S, Swg

NOTE — When used as an adjective modifying a device, the device has this operating capability.

lockout mechanism (of an automatic circuit recloser): A device that locks the contacts in the open position following the completion of a predetermined sequence of operations.
R and S, Swg

lockout operation (of a recloser): An opening operation followed by the number of closing and opening operations that the mechanism will permit before locking the contacts in the open position.
R and S, Swg

lockout relay: An electrically reset or hand-reset auxiliary relay whose function is to hold associated devices inoperative until it is reset.
PSRC

log: A printed record of data.
SUB

long-time-delay phase trip element: A direct-acting trip device element that functions with a purposely delayed action (seconds).
LVSwgD

loop-service (ring) feeder: A feeder that supplies a number of separate loads distributed along its length and that terminates at the same bus from which it originated.
SUB

loss-of-excitation relay: A relay that compares the alternating voltages and currents at the terminal of a synchronous machine and operates to produce an output if the relationship between these quantities indicates that the machine has substantially lost its field excitation.
PSRC

low-level testing: Mechanical testing performed to determine natural frequencies and dampings of complete assemblies, subassemblies, or components.
SUB

low-pressure contact (area contact): A contact in which the pressure is such that stress in the material is well below the elastic limit of both contact surface materials, such that conduction is a function of area.
HVF, Swg

low-voltage ac power circuit breaker: See NOTE (3) under **circuit breaker**

low-voltage integrally fused power circuit breaker: An assembly of a general-purpose ac low-voltage power circuit breaker and integrally mounted current-limiting fuses that together function as a coordinated protective device.
LVSwgD

low-voltage protection: *See:* **undervoltage protection**

lumped capacitive load: A lumped capacitance that is switched as a unit.
HVCB, Swg

magnetic (as applied to a switching device): A term indicating that interruption of the circuit takes place between contacts separable in an intense magnetic field.
HVCB, Swg; LVSwgD

NOTE — With respect to contactors, this term indicates the means of operation.

magnetic air circuit breaker: *See:* **magnetic** and NOTE (2) under **circuit breaker.**

main circuit: All the conducting parts of the gas-insulated substation assembly included in the circuits that its switching devices are designed to close or open, or that are connected to these circuits.
SUB

main contacts (of a switching device): Contacts that carry all or most of the main current.
HVS, Swg; LVSwgD; HVCB, Swg

main ground bus: A conductor or system of conductors that provides for connecting all designated metallic components of the gas-insulated substation to station ground (ground grid).
SUB

main (primary) switchgear connections: Those that electrically connect together devices in the main circuit, or connect them to the bus, or both.
LVSwgD, SwgA

main protection: *See:* **primary protection.**

maintenance interval: The period, defined in terms of real time, operating time, number of operating cycles, or a combination of these, during which satisfactory performance is expected without maintenance or adjustments.
SwgA

maintenance operation device: A removable device for use with power-operated circuit breakers that is used for manual operation of a de-energized circuit breaker during maintenance only.
LVSwgD; HVCB, Swg

NOTE — This device is not to be used for closing the circuit breaker on an energized circuit.

making current (of a switching device): The value of the available current at the time the device closes.
HVS, Swg; LVSwgD; HVCB, Swg

NOTES:

1 — Its rms value is measured from the envelope of the current wave at the time of the first major current peak.

2 — The making current may also be expressed in terms of instantaneous value of current, in which case it is measured at the first major peak of the current wave. This is designated peak making current.

malfunction: The loss of capability to initiate or sustain a required function, often a protective action, or the initiation of undesired spurious action.
SUB; PSRC; SwgA

NOTE — A. certain degree of equipment degradation may be acceptable in one system and not in another. In such cases, an evaluation of the equipment or device application must include a determination that the degree of relay contact bounce, changes in device calibration, or degradation of pressure-retaining boundaries are within acceptable limits.

manual control: Control in which the main devices under control, whether manually or power operated, are controlled by an attendant.
SUB; HVCB, Swg

manual lockout device: A device that holds the associated device inoperative unless a predetermined manual function is performed to release the locking feature.
LVSwgD; HVCB, Swg

manual operation: Operation by hand without the use of any other source of power.
HVS, Swg; LVSwgD; HVCB, Swg; R and S, Swg

manual trip device: A device that is connected to the tripping linkage and that can be operated manually to trip a switching device.
HVCB, Swg; LVSwgD

manually release-free (trip-free): *See:* **mechanically release-free (trip-free) (1).**

margin: The difference between the demonstrated capability of the equipment and that required in service for specific conditions.
SwgA; PSRC

master station (of a supervisory system): The station from which remotely located units of switchgear or other equipment are controlled by supervisory control or that receives supervisory indications or selected telemeter readings.
SUB

master station supervisory equipment: That part of a (single) supervisory system that includes all necessary supervisory control relays, keys, lamps, and associated devices located at the master station for selection, control, indication, and other functions to be performed.
SUB

master terminal unit (MTU): Refers to the master station of a supervisory control system.
SUB

maximum design voltage:

1) **of a device.** The highest voltage at which the device is designed to operate.
   HVCB, Swg
2) **of a relay.** The highest root-mean-square (rms) or dc voltage at which a relay is designed to be energized continuously.
   PSRC

mean time between failure (MTBF): The time interval (hours) that may be expected between failures of a piece of operating equipment.
SUB

mean time to repair (MTTR): The time interval (hours) that may be expected to return failed equipment to proper operation.
SUB

measurand: A physical or electrical quantity, property, or condition that is to be measured.
SUB

mechanical interchangeability (of fuse links): The characteristic that permits the designs of various manufacturers to be interchanged physically so they fit into and withstand the tensile stresses imposed by various types of prescribed cutouts made by different manufacturers.
HVF, Swg

mechanical operation (of a switch): Operation by means of an operating mechanism connected to the switch by mechanical linkage.
HVS, Swg

NOTE — Mechanically operated switches may be actuated either by manual, electrical, or other suitable means.

mechanical switching device: A switching device designed to close and open one or more electric circuits by means of guided separate contacts.
LVSwgD

NOTE — The medium in which the contacts separate may be designated by suitable prefix; that is, air, gas, oil, etc.

mechanically delayed over current trip: *See:* **mechanically delayed release (trip)** and **overcurrent release (trip).**

mechanically delayed release (trip): A release delayed by a mechanical device.
LVSwgD

mechanically release-free (trip-free) (as applied to a switching device): A term indicating that the release can open the device even though (1) in a manually operated switching device the operating lever is being moved toward the closed position; or (2) in a power-operated switching device, such as solenoid- or spring-actuated types, the operating mechanism is being moved toward the closed position either by continued application of closing power or by means of a maintenance closing lever.
LVSwgD; HVCB, Swg

mechanically reset relay: *See:* **hand-reset relay (mechanically reset relay).**

mechanism (of a switching device): The complete assembly of levers and other parts that actuates the moving contacts of a switching device.
LVSwgD; HVCB, Swg

melting-speed ratio (of a fuse): A ratio of the current magnitudes required to melt the current-responsive element at two specified melting times.
HVF, Swg

NOTES:

1 — Specification of the current wave shape is required for time less than one-tenth of a second.

2 — The lower melting time in present use is 0.1 s, and the higher minimum melting current times are 100 s for low-voltage fuses and 300 or 600 s, whichever specified, for high-voltage fuses.

melting time (of a fuse): The time required for overcurrent to sever the current-responsive element.
HVF, Swg

memory action (of a relay): A method of retaining an effect of an input after the input ceases or is greatly reduced, so that this input can still be used in producing the typical response of the relay.
PSRC

NOTE — For example, memory action in a high-speed directional relay permits correct response for a brief period after the source of voltage input necessary to such response is short-circuited.

metal-clad switchgear: Metal-enclosed power switchgear characterized by the following necessary features:

1) The main switching and interrupting device is of the removable (drawout) type arranged with a mechanism for moving it physically between connected and disconnected positions and equipped with self-aligning and self-coupling primary disconnecting devices and disconnectable control wiring connections.
2) Major parts of the primary circuit, that is, the circuit switching or interrupting devices, buses, voltage transformers, and control power transformers, are completely enclosed by grounded metal barriers that have no intentional openings between compartments. Specifically included is a metal barrier in front of or a part of the circuit-interrupting device to ensure that, when in the connected position, no primary circuit components are exposed by the opening of a door.
3) All live parts are enclosed within grounded metal compartments.
4) Automatic shutters that cover primary circuit elements when the removable element is in the disconnected, test, or removed position.

5) Primary bus conductors and connections are covered with insulating material throughout.
6) Mechanical interlocks are provided for proper operating sequence under normal operating conditions.
7) Instruments, meters, relays, secondary control devices, and their wiring are isolated by grounded metal barriers from all primary circuit elements with the exception of short lengths of wire such as at instrument transformer terminals.
8) The door through which the circuit-interrupting device is inserted into the housing may serve as an instrument or relay panel and may also provide access to a secondary or control compartment within the housing.

SwgA

NOTES:

1 — Auxiliary vertical sections may be required for mounting devices or for use as bus transition.

2 — The term *metal-clad* (as applied to switchgear assemblies) is correctly used only in connection with switchgear conforming fully to the definition for metal-clad switchgear. Metal-clad switchgear is metal-enclosed, but not all metal-enclosed switchgear can be correctly designated as metal-clad.

metal-enclosed (as applied to a switchgear assembly or components thereof): Surrounded by a metal case or housing, usually grounded.
SwgA

metal-enclosed bus: An assembly of conductors with associated connections, joints, and insulating supports within a grounded metal enclosure. The conductors may be either rigid or flexible.
SwgA

NOTE — In general, three basic types of construction are used: nonsegregated-phase, segregated-phase, and isolated-phase.

1) **nonsegregated-phase bus.** A bus in which all phase conductors are in a common metal enclosure without barriers between phases.
   When associated with metal-clad switchgear, the primary bus and connections shall be covered with insulating material equivalent to the switchgear insulation system.
2) **segregated-phase bus.** A bus in which all phase conductors are in a common metal enclosure but are segregated by metal barriers between phases.
3) **isolated-phase bus.** A bus in which each phase conductor is enclosed by an individual metal housing separated from adjacent conductor housing by an air space. The bus may be self-cooled or may be forced-cooled by means of circulating a gas or liquid.

metal-enclosed interrupter switchgear: Metal-enclosed power switchgear that includes the following equipment as required: (1) interrupter switches, (2) power fuses, (3) bare bus and connections, (4) instrument transformers, and (5) control wiring and accessory devices. The interrupter switches and power fuses may be of the stationary or removable type. When of the removable type, mechanical interlocks are provided to ensure a proper and safe operating sequence.
SwgA

metal-enclosed low-voltage power circuit breaker switchgear: Metal-enclosed power switchgear of multiple or individual enclosure that includes the following equipment as required:

1) Low-voltage power circuit breaker (fused or unfused)
2) Bare bus and connections
3) Instrument and control power transformers
4) Instruments, meters, and relays, and
5) Control wiring and accessory devices.

The low-voltage power circuit breakers are contained in individual grounded metal compartments and controlled either remotely or from the front of the panels. The circuit breakers may be of the stationary or removable type. When of the removable type, mechanical interlocks are provided to ensure a proper and safe operating sequence.
SwgA

metal-enclosed power switchgear: A switchgear assembly completely enclosed on all sides and top with sheet metal (except for ventilating openings and inspection windows) containing primary power circuit switching or interrupting devices, or both, with buses and connections, and may include control and auxiliary devices. Access to the interior of the enclosure is provided by doors or removable covers.
SwgA

NOTE — Metal-clad switchgear, station-type cubicle switchgear, metal-enclosed interrupter switchgear, and low-voltage power circuit-breaker switchgear are specific types of metal-enclosed power switchgear.

metallic enclosure: A grounded leaktight enclosure that contains the compressed insulating gas and associated electrical equipment.
SUB

mho relay: A distance relay for which the inherent operating characteristic on an *R-X* diagram is a circle that passes through the origin.
PSRC

NOTE — The operating characteristic may be described by the equation $Z = K\cos(\theta-\alpha)$ where K and α are constants and θ is the phase angle by which the input voltage leads the input current.

microwave-pilot protection: A form of pilot protection in which the communication means between relays is a beamed microwave radio channel.
PSRC

milliroentgen (mR): The amount of X-radiation that produces $2.58 \cdot 10^{-1}$ coulomb per kilogram of air.
R and S, Swg

mimic bus: A single-line diagram of the main connections of a system constructed on the face of a switchgear or control panel, or assembly.
SwgA

minimum clearance between poles (phases): The shortest distance between any live parts of adjacent poles (phases).
HVF, Swg; HVS, Swg; LVSwgD

NOTE — Cautionary differentiation should be made between clearance and spacing or center-to-center distance.

minimum clearance to ground: The shortest distance between any live part and adjacent grounded parts.
HVF, Swg; HVS, Swg; LVSwgD

minimum melting current: The smallest current at which a current responsive fuse element will melt at any specified time.
HVF, Swg

mobile unit substation: A unit substation mounted and readily movable as a unit on a transportable device.
SwgA

modal participation factor: The magnitude of each structural mode (natural frequency) that participates to compose the final dynamic response of the system. Each participation factor is a function of the system mass distribution and the generalized mode shape at each natural frequency.
SwgA

mode shape: A plot of the displacements of various points in the vibrating structure at a particular instant in time.
SUB

NOTE — With each natural frequency of a vibrating structure, there is associated a characteristic mode shape.

modem: A modulator/demodulator device that converts serial binary digital data to and from the signal form appropriate for the respective communication channel.
SUB

modified circuit transient recovery voltage: The circuit transient recovery voltage modified in accordance with the normal-frequency recovery voltage and the asymmetry of the current wave obtained on a particular interruption.
HVCB, Swg

NOTE — This voltage indicates the severity of the particular interruption with respect to recovery-voltage phenomena.

modified impedance relay: An impedance form of distance relay for which the operating characteristic of the distance unit on an *R-X* diagram is a circle having its center displaced from the origin.
PSRC

NOTE — It may be described by the equation

$$Z^2 = 2K_1 Z_{\cos}(\theta - \alpha) = K_2^2 - K_1^2$$

where K_1, K_2, and α are constants and θ is the phase angle by which the input voltage leads the input current.

modified inherent transient recovery voltage: The transient recovery voltage (TRV) that results from the interaction of a circuit (that produces the inherent TRV) and the impedance (capacitors, resistors, etc.) of an interrupting device without the modifying effects of an arc and its voltage. Modifying impedances, such as capacitors and resistors, are sometimes included as part of a switching device to modify the TRV.
HVCB, Swg

moisture resistant: Not readily injured by exposure to a moist atmosphere.
HVS, Swg; SwgA

molded-case circuit breaker: One that is assembled as an integral unit in a supporting and enclosing housing of molded insulating material.
LVSwgD

momentary current: The current flowing in a device, an assembly, or a bus at the major peak of the maximum cycle as determined from the envelope of the current wave.
HVS, Swg; HVCB, Swg

NOTE — The current is expressed as the rms value, including the dc component, and may be determined by the method shown in IEEE C37.09-1979 [4].

monitoring relay: A relay that has as its function to verify that system or control-circuit conditions conform to prescribed limits.
PSRC

mounting position (of a switch or fuse support): The position determined by and corresponding to the position of the base of the device.
HVF, Swg; HVS, Swg

NOTE — The usual positions are: (1) horizontal upright, (2) horizontal underhung, (3) vertical, and (4) angle.

moving contact: A conducting part that bears a contact surface arranged for movement to and from the stationary contact.
HVS, Swg; HVCB, Swg

muffler (of a fuse): An attachment for the vent of a fuse, or a vented fuse, that confines the arc and substantially reduces the venting from the fuse.
HVF, Swg

multifrequency test: A broad-band test motion, simulating a typical seismic motion, that can produce a simultaneous response from all applicable modes of a multi-degree-of-freedom system.
SwgA

multiple feeder: A feeder that is connected to a common load in multiple with one or more feeders from independent sources.
SUB

multiplexer:
1) A device that allows the interleaving of two or more signals to a single line or terminal.
2) A device for selecting one of a number of inputs and switching its information to the output.

SUB

multipole fuse: *See:* NOTE (2) under **pole (pole unit) (of a switching device or fuse).**

multipole operation (of a circuit breaker or switching device): A description term indicating that all poles of the device are linked mechanically, electrically, or by other means such that they change state (open or close) substantially simultaneously. Devices may have capability for multipole opening, multipole closing, or both.
HVCB, Swg

multirestraint relay: A restraint relay so constructed that its operation may be restrained by more than one input quantity.
PSRC

natural frequency (mechanical): The frequency or frequencies at which a body vibrates due to its own physical characteristics (mass, shape), and elastic restoring forces brought into play when the body is distorted in a specific direction and then released while restrained or supported at specific points.
SwgA

negative-phase-sequence relay: A relay that responds to the negative-phase-sequence component of a polyphase input quantity.
PSRC

network limiter: An enclosed fuse for disconnecting a faulted cable from a low-voltage network distribution system and for protecting the unfaulted portions of that cable against serious thermal damage.
LVSwgD

network master relay: A relay that functions as a protective relay by opening a network protector when power is back-fed into the supply system and as a programming relay by closing the protector in conjunction with the network phasing relay when polyphase voltage phasors are within prescribed limits.
PSRC, LVSwgD

network phasing relay: A monitoring relay that has as its function to limit the operation of a network master relay so that the network protector may close only when the voltages on the two sides of the protector are in a predetermined phasor relationship.
PSRC, LVSwgD

network protector: An assembly comprising a circuit breaker and its complete control equipment for automatically disconnecting a transformer from a secondary network in response to predetermined electrical conditions on the primary feeder or transformer, and for connecting a transformer to a secondary network either through manual control or automatic control responsive to predetermined electrical conditions on the feeder and the secondary network.
LVSwgD

NOTE — The network protector is usually arranged to connect automatically its associated transformer to the network when conditions are such that the transformer, when connected, will supply power to the network and to automatically disconnect the transformer from the network when power flows from the network to the transformer.

network restraint mechanism: A device that prevents opening of a network protector on transient power reversals that either do not exceed a predetermined value or persist for a predetermined time.
LVSwgD

network tripping and reclosing (networking) equipment: A piece of equipment that automatically connects its associated power transformer to an ac network when conditions are such that the transformer, when connected, will supply power to the network and that automatically disconnects the transformer from the network when power flows from the network to the transformer.
SUB, LVSwgD

neutral relay: A relay that responds to quantities in the neutral of a power circuit.
PSRC

nominal system voltage: A nominal value assigned to designate a system of a given voltage class.
LVSwgD; HVCB, Swg

NOTE — See ANSI C84.1-1989 [1].

nonautomatic opening (nonautomatic tripping): The opening of a switching device only in response to an act of an attendant.
LVSwgD; HVCB, Swg; SwgA

nonautomatic operation: Operation controlled by an attendant.
LVSwgD

noncontinuous enclosure: A bus enclosure in which the consecutive sections of the enclosure for the same phase conductor are electrically insulated from each other.
SUB

NOTE — This construction prevents longitudinal currents from flowing beyond each enclosure section. This design is no longer in common usage.

nondisconnecting fuse: An assembly consisting of a fuse unit or fuseholder and a fuse support having clips for directly receiving the associated fuse unit or fuseholder, which has no provision for guided operation as a disconnecting switch.
HVF, Swg

nonenclosed switches, indoor or outdoor: Switches designed for service without a housing restricting heat transfer to the external medium.
HVS, Swg

nonmechanical switching device: A switching device designed to close or open, or both, one or more electric circuits by means other than by separable mechanical contacts.
LVSwgD

nonrenewable (one-time) fuse or fuse unit: A fuse or fuse unit not intended to be restored for service after circuit interruption.
HVF, Swg

nonsegregated-phase bus: A bus in which all phase conductors are in a common metal enclosure without barriers between the phases.
SwgA

NOTE — When associated with metal-clad switchgear, the primary bus conductors and connections are covered with insulating material throughout.

nonself-restoring insulation: That which loses its insulation properties or does not recover them completely, after a disruptive discharge caused by the application of a test voltage. Insulation of this kind is generally, but not necessarily, internal insulation.
HVCB, Swg

nonvented fuse: A fuse without intentional provision for the escape of arc gases, liquids, or solid particles to the atmosphere during circuit interruption.
HVF, Swg

nonventilated enclosure: An enclosure so constructed as to provide no intentional circulation of external air through the enclosure.
SwgA

NOTE — Doors or removable covers are usually gasketed and humidity control may be provided by filtered breathers.

normal frequency: The frequency at which a device or system is designed to operate.
LVSwgD; HVCB, Swg

normal-frequency dew withstand voltage: The normal-frequency withstand voltage applied to insulation completely covered with condensed moisture.
HVF, Swg; HVCB, Swg

NOTE — *See:* **normal-frequency withstand voltage.**

normal-frequency dry withstand voltage: The normal-frequency withstand voltage applied to dry insulation.
HVCB, Swg

NOTE — *See:* **normal-frequency withstand voltage.**

normal-frequency line-to-line recovery voltage: The normal-frequency recovery voltage, stated on a line-to-line basis, that occurs on the source side of a three-phase circuit-interrupting device after interruption is complete in all three poles.
HVCB

normal-frequency pole-unit recovery voltage: The normal-frequency recovery voltage that occurs across a pole unit of a circuit-interrupting device upon circuit interruption.
HVCB, Swg

normal-frequency recovery voltage: The normal-frequency rms voltage that occurs across the terminals of an ac circuit-interrupting device after the interruption of the current and after the high-frequency transients have subsisted.
HVF, Swg; LVSwgD; HVCB, Swg

NOTE — For determination of the normal-frequency recovery voltage, see IEEE C37.09-1979 [4].

normal-frequency wet withstand voltage: The normal-frequency withstand voltage applied to wetted insulation.
HVF, Swg

NOTE — *See:* **normal-frequency withstand voltage.**

normal-frequency withstand voltage: The normal-frequency voltage that can be applied to insulation under specified conditions for a specified time without causing flashover or puncture.
HVF, Swg; LVSwgD

NOTES:

1 — This value is usually expressed as a root-mean-square (rms) value.

2 — *See also:* **normal-frequency, dew withstand voltage, normal-frequency dry withstand voltage, and normal-frequency wet withstand voltage.**

notching relay: A programming relay in which the response is dependent upon successive impulses of the input quantity.
PSRC

octave: The interval between two frequencies that have a frequency ratio of two. For example, 1 to 2, 2 to 4, 4 to 8 Hz, etc.
PSRC, SwgA

offset (as used in data acquisition): A predetermined value modifying the actual value so as to improve the integrity of the system, for example, the use of a 4 mA signal to represent zero in a 4 mA to 20 mA system.
SUB

offset (as applied to a distance relay): The displacement of the operating characteristic on an *R-X* diagram from the position inherent to the basic performance class of the relay. See Fig 2.
PSRC

NOTE — A relay with this characteristic is called an offset relay.

offset (outboard) bearing (air switch): A component of a switch-operating mechanism designed to provide support for a torsional operating member and a crank that provides reciprocating motion for switch operation.
HVS, SWg

oil cutout (oil-filled cutout): A cutout in which all or part of the fuse support and its fuse link or disconnecting blade are mounted in oil with complete immersion of the contacts and the fusible portion of the conducting element (fuse link), so that arc interruption by severing of the fuse link or by opening of the contacts will occur under oil.
HVF, Swg

oil-immersible current-limiting fuse: A current-limiting fuse unit suitable for application requiring total or partial immersion directly in oil or other dielectric liquid of a transformer or switchgear.
HVF, Swg

oil switch: See NOTE under **mechanical switching device.**

oilless circuit breaker: See NOTE (2) under **circuit breaker.**

one minus cosine (1 − cosine) envelope (of a transient recovery voltage): A voltage-versus-time curve of the general form e_2 E_2 (1 − Cos Kt) in which e_2 represents the transient voltage across a switching device pole unit, reaching its crest E_2 at a time T_2.
HVCB, Swg

one-third octave: The interval between two frequencies that have a frequency ratio of the cube root of two. For example, 1 to 1.26, 1.26 to 1.59, 1.59 to 2.0 Hz, etc.
PSRC

open cutout: A cutout in which the fuse clips and fuseholder, fuse unit, or disconnecting blade are exposed.
HW, SWg

open-fuse trip device: A device that operates to open (trip) all poles of a switching device in response to the opening, or absence, of one or more fuses integral to the switching device on which the device is mounted. After operating, the device prevents closing of the switching device until a reset operation is performed.
PSRC; HVF, Swg; LVSwgD

open line wire charging current: Current supplied to an unloaded open-wire line.
R and S, Swg

NOTE — Current is expressed in rms amperes.

open-link cutout: A cutout that does not employ a fuseholder and in which the fuse support directly receives an open-link fuse link or a disconnecting blade.
HVF, Swg

open-link fuse link: A replaceable part or assembly comprised of the conducting element and fuse tube, together with the parts necessary to confine and aid in extinguishing the arc and to connect it directly into the fuse clip of the open-link fuse support.
HVF, Swg

open-link fuse support: An assembly of base or mounting support, insulators or insulator unit and fuse clips for directly mounting an open-link fuse link and for connecting it into the circuit.
HVF, Swg

open operation (of a switching device): The movement of the contacts from the normally closed to the normally open position.
LVSwgD; HVCB, Swg

NOTE — The letter O signifies this operation: Open.

open-phase protection: A form of protection that operates to disconnect the protected equipment on the loss of current in one phase conductor of a polyphase circuit, or to prevent the application of power to the protected equipment on the absence of one or more phase voltages of a polyphase system.
PSRC

open-phase relay: A polyphase relay designed to operate when one or more input phases of a polyphase circuit are open.
PSRC

open switchgear assembly: An assembly that does not have enclosures as part of the structure.
SwgA

opening eye (of a fuse holder, fuse unit, or disconnecting blade): An eye provided for receiving a fuse hook or switch hook for opening and closing the fuse.
HVF, Swg

opening operating time (of a switch): The interval of time it takes during switch operation to move from the fully closed to the fully open position.
HVS, Swg

opening operation (of a switching device): *See:* **open operation (of a switching device).**

opening time (of a mechanical switching device): The interval of time between the time when the actuating quantity of the release circuit reaches the operating value, and the instant when the primary arcing contacts have parted. Any time delay device forming an integral part of the switching device is adjusted to its minimum setting or, if possible, is cut out entirely for the determination of opening time.
LVSwg; HVCB, Swg

NOTE — The opening time includes the operating time of an auxiliary relay in the release circuit when such a relay is required and supplied as part of the switching device.

opening time (of a sectionalizer): *See:* **isolating time (of a sectionalizer.)**

operating basis earthquake (OBE): That earthquake which could reasonably be expected to affect the plant site during the operating life of the plant; it is that earthquake which produces the vibratory ground motion for which those features of the nuclear plant necessary for continued operation without undue risk to the health and safety of the public are designed to remain functional.
PSRC, SwgA

operating characteristic (of a relay): The response of the relay to the input quantities that result in relay operation.
PSRC

operating duty (of a switching device): A specified number and kind of operations at stated intervals.
HVCB, Swg

operating mechanism (of a switching device): The part of the mechanism that actuates all the main-circuit contacts of the switching device either directly or by the use of pole-unit mechanisms.
LVSwgD; HWF, Swg; HVCB, Swg

operating time (of a relay): The time interval from occurrence of specified input conditions to a specified operation.
PSRC

operating voltage: The voltage of the system on which a device is operated.
HVCB, Swg

NOTE — This voltage, if alternating, is usually expressed as an rms value.

operation (of a switching device): Action of the parts of the device to perform its normal function.
HVS, Swg; LVSwgD

operation indicator (of a relay): *See:* **target (operation indicator) (of a relay).**

operational tests: Tests conducted in a qualification program to demonstrate operational capability.
PSRC

out of step: A system condition in which two or more synchronous machines have lost synchronism with respect to one another and are operating at different average frequencies.
PSRC

out-of-step protection: A form of protection that separates the appropriate parts of a power system, or prevents separation that might otherwise occur, in the event of loss of synchronism.
PSRC

outdoor: Designed for use outside buildings.
HVF, Swg; HVS, Swg; HVCB, Swg; SwgA

outdoor enclosure: An enclosure for outdoor application designed to protect against weather hazards such as rain, snow, or sleet.
SwgA; HVCB, Swg

NOTE — Condensation is minimized by use of space heaters.

outrigger (of a switching-device terminal): An attachment that is fastened to or adjacent to the terminal pad of a switching device to maintain electrical clearance between the conductor and other parts or, when fastened adjacent, to relieve mechanical strain on the terminal, or both.
HVS, Swg

overcurrent protection: A form of protection that operates when current exceeds a predetermined value.
PSRC

overcurrent relay: A relay that operates when its input current exceeds a predetermined value.
PSRC

overcurrent release (trip): A release that operates when the current in the main circuit is equal to or exceeds the release setting.
LVSwgD

overcurrent trip device, direct-acting: *See:* **direct-acting overcurrent trip device.**

overhead line charging current: Current supplied to an unloaded overhead line.
HVS, Swg

NOTE — Current is expressed in rms amperes.

overreach (of a relay): The extension of the zone of protection beyond that indicated by the relay setting.
PSRC

overreaching protection: A form of protection in which the relays at one terminal operate for faults beyond the next terminal. They may be constrained from tripping until an incoming signal from a remote terminal has indicated whether the fault is beyond the protected line section.
PSRC

overspeed protection: A form of protection that operates when the speed of rotation exceeds a predetermined value.
PSRC

overtravel (of a relay): The amount of continued movement of the responsive element after the input is changed to a value below pickup. See Fig 3.
PSRC

over voltage relay: A relay that operates when its input voltage exceeds a predetermined value.
PSRC

overvoltage release (trip): A release that operates when the voltage of the main circuit is equal to or exceeds the release setting.
LVSwgD

pad-mounted: A general term describing equipment positioned on a surface-mounted pad located outdoors. The equipment is usually enclosed with all exposed surfaces at ground potential.
R and S, Swg

panel: A unit of one or more sections of flat material suitable for mounting electric devices.
SwgA

panel control: An assembly of man-machine interface devices.
SUB

panel-frame mounting (of a switching device): Mounting on a panel frame in the rear of a panel with the operating mechanism on the front of the panel.
LVSwgD

parallel-connected capacitance (as applied to interrupter switches): Capacitances are defined to be parallel-connected when the crest value of inrush current to the capacitance being switched exceeds the switch inrush current capability for single capacitance.
R and S, Swg; HVS, Swg

parallel feeder: A feeder that operates in parallel with one or more feeders of the same type from the same source.
SUB

NOTE — These feeders may be of the stub-, multiple-, or tie-feeder type.

partial-automatic station: A station that includes protection against the usual operating emergencies, but in which some or all of the steps in the normal starting or stopping sequence, or in the maintenance of the required character of service, must be performed by a station attendant or by supervisory control.
SUB

partial-automatic transfer (or throw-over) equipment: Equipment that automatically transfers load to another (emergency) source of power when the original (preferred) source to which it has been connected fails, but that will not automatically retransfer the load to the original source under any conditions.
SUB

NOTE — The restoration of the load to the preferred source from the emergency source upon the reenergization of the preferred source after an outage may be of the continuous-circuit restoration type or the interrupted-circuit restoration type.

partial discharge: A localized electric discharge resulting from ionization in an insulation system when the voltage stress exceeds the critical value. This discharge partially bridges the insulation between electrodes.
R and S, Swg

peak instantaneous sound pressure level: Maximum unweighted positive or negative pressure peak value reached by an impulsive sound wave at any time during the period of observation. Unit: decibel (dB). For the purpose of this standard, readings can be considered as peak instantaneous sound pressure level if the C-weighting is used and the response time of the instrument is 50 μs less. Peak instantaneous sound pressure level is sometimes referred to as impact noise.
HVCB, Swg

peak let-through characteristic curve (of a current-limiting fuse): *See:* **current-limiting (peak let-through or cutoff) characteristic curve.**

peak let-through cutoff current (of a current-limiting fuse): The highest instantaneous current passed by the fuse during the interruption of the circuit.
HVF, Swg

peak overvoltages (for current-limiting fuses): The peak value of the voltage that can exist across a current-limiting fuse during its arcing interval.
HVF, Swg

percentage differential relay: A differential relay in which the designed response to the phasor difference between incoming and outgoing electrical quantities is modified by a restraining action of one or more of the input quantities.
PSRC

NOTE — The relay operates when the magnitude of the phasor difference exceeds the specified percentage of one or more of the input quantities.

performance characteristic (of a device): An operating characteristic, the limit or limits of which are given in the design test specifications.
HVF, Swg; HVCB, Swg

periodic-automatic-reclosing equipment: A piece of equipment that provides for automatically reclosing a circuit-switching device a specified number of times at specified intervals between reclosures.
SUB; R and S, Swg

NOTE — This type of automatic reclosing equipment is generally used for ac circuits.

periodic monitoring: The process of sampling the state of some phenomenon at a sample interval greater than one second.
SUB

permissive (as applied to a relay system): A general term indicating that functional cooperation of two or more relays is required before control action can become effective.
PSRC

phase-balance relay: A relay that responds to differences between quantities of the same nature associated with different phases of a normally balanced polyphase circuit.
PSRC

phase-comparison protection: A form of pilot protection that compares the relative phase-angle position of specified currents at the terminals of a circuit.
PSRC

phase delay (as applied to relaying): An equal delay of both the leading and trailing edges of a locally generated block.
PSRC

phase-failure protection: *See:* **open-phase protection** and **phase-undervoltage protection.**

phase grouping: The same phase of a number of circuit breakers' poles is grouped in an adjacent configuration along the line of the same row.
SUB

phase relay: A relay that by its design or application is intended to respond primarily to phase conditions of the power system.
PSRC

phase-reversals relay: *See:* **negative-phase-sequence relay.**

phase-selector relay: A programming relay whose function is to select the faulted phase or phases, thereby controlling the operation of other relays or control devices.
PSRC

phase-sequence relay: A relay that responds to the order in which the phase voltages or currents successively reach their maximum positive values.
PSRC

phase-sequence reversal protection: A form of protection that prevents energization of the protected equipment on the reversal of the phase sequence in a polyphase circuit.
PSRC

phase spacing (of a fuse or switching device): The distance between center-lines of the current-carrying parts of the adjacent poles of the switching device.
HVF, Swg

phase-undervoltage protection: A form of protection that disconnects or inhibits connection of the protected equipment on deficient voltage in one or more phases of a polyphase circuit.
PSRC

phase-undervoltage relay: A relay that operates when one or more phase voltages in a normally balanced polyphase circuit are less than a predetermined value.
PSRC

phasing voltage (of a network protector): The voltage across the open contacts of a selected phase.
LVSwgD

NOTE — This voltage is equal to the phasor difference between the transformer voltage and the corresponding network voltage.

pickup (of a relay): The action of a relay as it makes designated response to progressive increase of input. As a qualifying term, the state of a relay when all response to progressive increase of input has been completed. Also used to identify the minimum value of an input quantity reached by progressive increases that will cause the relay to reach the pickup state from reset.
PSRC,LVSwgD

NOTE — In describing the performance of relays having multiple inputs, pickup has been used to denote contact operation, in which case pickup value of any input is meaningful only when related to all other inputs.

pilot protection: A form of line protection that uses a communication channel as a means to compare electrical conditions at the terminals of a line.
PSRC

pilot wire protection: Pilot protection in which a metallic circuit is used for the communicating means between relays at the circuit terminals.
PSRC

pneumatic operation: Power operation by means of compressed gas.
HVCB, Swg

pneumatically release-free (trip-free) (as applied to a pneumatically operated switching device): A term indicating that by pneumatic control the switching device is free to open at any position in the closing stroke if the release is energized.
HVCB, Swg

NOTE — This release-free feature is operative even though the closing control switch is held closed.

point (for supervisory control or indication or telemeter selection): All of the supervisory control or indication devices in a system, exclusive of the common devices, in the master station and in the remote station that are necessary for

1) Energizing the closing, opening, or other circuits of a unit, or set of units of switchgear or other equipment being controlled, or
2) Automatic indication of the closed or open or other positions of the unit, or set of units of switchgear or other equipment for which indications are being obtained, or
3) Connecting a telemeter transmitting equipment into the circuit to be measured and to transmit the telemeter reading over a channel to a telemeter receiving equipment.

SUB

NOTE — A point may serve for any two or all three of the purposes described above; for example, when a supervisory system is used for the combined control and indication of remotely operated equipment, point (for supervisory control) and point (for supervisory indication) are combined into a single control and indication point.

point equipment (point): Elements of a supervisory system, exclusive of the basic common equipment, that are peculiar to and required for the performance of a discrete supervisory function. (*See:* **supervisory control functions.)**

1) **alarm point.** Station (remote or master, or both) equipment that inputs a signal to the alarm function.
2) **accumulator point.** Station (remote or master, or both) equipment that accepts a pulsing digital input signal to accumulate a total of pulse counts.
3) **analog point.** Station (remote or master, or both) equipment that inputs an analog quantity to the analog function.
4) **control point.** Station (remote or master, or both) equipment that operates to perform the control function.
5) **indication (status) point.** Station (remote or master, or both) equipment that accepts a digital input signal for the function of indication.
6) **sequence of events point.** Station (remote or master, or both) equipment that accepts a digital input signal to perform the function of registering sequence of events.
7) **telemetering selection point.** Station (remote or master, or both) equipment for the selective connection of telemetering transmitting equipment to appropriate telemetering receiving equipment over an interconnecting communication channel. This type of point is more commonly used in electromechanical or stand-alone type of supervisory control.
8) **spare point.** Point equipment that is not being utilized, but is fully wired and equipped.

9) **wired point.** Point for which all common equipment, wiring, and space are provided. To activate the point requires only the addition of plug-in hardware.
10) **space-only point.** Point for which cabinet space only is provided for future addition or wiring and other necessary plug-in equipment.

SUB

NOTE — A point may serve for one or more of the purposes described above, for example, when a supervisory system is used for combined control and supervision of remotely operated equipment, a point for supervisory control and point for supervisory indication may be combined into a single control and indication point.

polarization (as applied to a relay): The input that provides a reference for establishing the direction of system phenomena such as direction of power or reactive flow, or direction to a fault or other disturbance on a power system.
PSRC

pole disagreement relay: A protective relay designed to monitor currents in the three poles of a device, such as a circuit breaker, to verify the integrity of the electrical continuity of all its phases.
PSRC

pole (pole unit) (of a switching device or fuse): That portion of the device associated exclusively with one electrically separated conducting path of the main circuit of the device.
LVSwgD; HVCB, Swg

NOTES:

1 — Those portions that provide a means for mounting and operating all poles together are excluded from the definition of a pole.

2 — A switching device or fuse 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.) and provided, in the case of a switching device, that the poles are or can be coupled in such a manner as to operate together.

pole-unit mechanism (of a switching device): That part of the mechanism that actuates the moving contacts of one pole.
LVSwgD; HVS, Swg; HVCB, Swg

polling (data request): The process by which a data acquisition system selectively requests data from one or more of its remote terminals. A remote terminal may be requested to respond with all, or a selected portion of, the data available.
SUB

polyphase (as applied to a relay): A descriptive term indicating that the relay is responsive to polyphase alternating electrical input quantities.
PSRC

NOTE — A multiple-unit relay with individual units responsive to single-phase electrical inputs is not a polyphase relay even though the several single-phase units constitute a polyphase set.

positive-phase-sequence relay: A relay that responds to the positive-phase-sequence component of a polyphase input quantity.
PSRC

post-arc current: The current that flows through the arc gap of a circuit breaker immediately after current zero, and that has a substantially lower magnitude than the test current.
HVCB, Swg

post-fault (event): A qualifying term that refers to an interval beginning with the clearing of a fault.
PSRC

power (used as an adjective): A general term, used, by reason of specific physical or electrical characteristics, to denote application or restriction or both, to generating stations, switching stations or substations. The term may also denote use or application to energy purposes as contrasted with use for control purposes.
HVF; Swg; LVSwgD; HVCB, Swg

power circuit protector: An assembly consisting of a modified lower-voltage power circuit breaker, which has no direct-acting tripping devices, with a current-limiting fuse in series with the load terminals of each pole.
LVSwgD

power fuse: A fuse consisting of an assembly of a fuse support and a fuse unit or fuseholder that may or may not include the refill unit or fuse link.
HVS, Swg

NOTE — The power fuse is identified by the following characteristics:
1) Dielectric withstand basic impulse insulation level (bil) strengths at power levels.
2) Application primarily in stations and substations.
3) Mechanical construction basically adapted to station and substation mountings.

power operation: Operation by other than hand power.
HVF, Swg; LVSwgD; HVCB, Swg

power relay: A relay that responds to a suitable product of voltage and current in an electric circuit. (*See:* **active power relay** and **reactive power relay.**)
PSRC

power service protector: An assembly consisting of a modified low-voltage power circuit breaker, which has no direct-acting tripping devices, with a current-limiting fuse connected in series with the load terminals of each pole.
LVSwgD

power switchboard: A type of switchboard including primary power-circuit switching and interrupting devices together with their interconnections.
SwgA

NOTE — Knife switches, fuses, and air circuit breakers are the commonly used switching and interrupting devices.

pre-fault (event): A qualifying term that refers to an interval ending with the inception of a fault.
PSRC

pressure relay: A relay that responds to liquid or gas pressure.
PSRC

prestrike: The initiation of current between the contacts during a closing operation before the contacts have mechanically touched.
HVCB, Swg

primary (used as an adjective):
1) First to operate; for example, primary arcing contacts, primary detector.
2) First in preference; for example, primary protection.
3) Referring to the main circuit as contrasted to auxiliary or control circuits; for example, primary disconnecting devices.
4) Referring to the energy input side of transformers, or the conditions (voltages) usually encountered at this location; for example, primary unit substation.

LVSwgD; HVCB, Swg

primary: An equipment or subsystem that normally contributes to system operation. *See:* **backup.**
SUB

primary arcing contacts (of a switching device): The contacts on which the initial arc is drawn and the final current, except for the arc-shunting-resistor current, is interrupted after the main contacts have parted.
LVSwgD; HVCB, Swg

primary detector (or sensing element or initial element): The first system element or group of elements that responds quantitatively to the measurand and performs the initial measurement operation. A primary detector performs the initial conversion or control of measurement energy and does not include transformers, amplifiers, shunts, resistors, etc., when these are used as auxiliary means.
SUB

primary disconnecting devices (of a switchgear assembly): Self-coupling separable contacts provided to connect and disconnect the main circuits between the removable element and the housing.
SwgA; LVSwgD

primary protection (as applied to a relay system): First-choice relay protection in contrast with backup relay protection.
PSRC

primary switchgear connections: *See:* **main (primary) switchgear connections.**

primary unit substation: *See:* NOTE under **unit substation.**

product relay: A relay that operates in response to a suitable product of two alternating electrical input quantities.
PSRC

production tests (for switchgear): Those tests made to check the quality and uniformity of the workmanship and materials used in the manufacture of switchgear or its components.
HVF, Swg; LVSwgD; HVCB, Swg

programmable equipment: A remote or master station having one or more of its operations specified by a program contained in a memory device.
SUB

programmer: An arrangement of operating elements or devices that initiates, and often controls, one or a series of operations in a given sequence.
SUB

programming relay: A relay whose function is to establish or detect electrical sequences.
PSRC

proof (used as a suffix): So constructed, protected, or treated that successful operation is not interfered with when the devices is subjected to the specified material or condition.
HVS, Swg; HVF, Swg

proof testing: That test used to qualify equipment for a particular application or to a particular requirement.
SwgA

prospective current of a circuit (with respect to a switching device situated therein): *See:* **available (prospective) current (of a circuit with respect to a switching device situated therein).**

prospective short-circuit current (at a given point in a circuit): *See:* **available (prospective) short-circuit current (at a given point in a circuit).**

prospective short-circuit test current (at the point of test): *See:* **available (prospective) short-circuit test current (at the point of test).**

protective gap: A gap placed between live parts and ground to limit the maximum overvoltage that may occur.
HVS, Swg

protective relay: A relay whose function is to detect defective lines or apparatus or other power system conditions of an abnormal or dangerous nature and to initiate appropriate control circuit action.
PSRC

NOTE — A protective relay may be classified according to its input quantities, operating principle, or performance characteristics.

protocol: A strict procedure required to initiate and maintain communication.
SUB

pulse accumulator (or register) (of a telemeter system): A device that accepts and stores pulses and makes them available for readout on demand.
SUB

pulse (relaying): A brief excursion of a quantity from its initial level.
PSRC

pulse-type telemeter: A telemeter that employs characteristics of intermittent electric signals other than their frequency as the translating means.
SUB

NOTE — These pulses may be utilized in any desired manner to obtain the final indications, such as periodically counting the total number of pulses; or measuring their "on" time, their "off" time, or both.

pump-free control: *See:* **antipump (pump-free) device.**

qualification testing (seismic): Testing of the complete assembly or subassemblies to determine acceptability by applying an actual input that has a test response spectrum equal to or larger than the design earthquake response spectrum (either ground or floor response spectrum).
SUB

qualified life: The period of time for which satisfactory performance can be demonstrated for a specific set of service conditions.
PSRC

NOTE — The qualified life of a particular equipment item may be changed during its installed life where justified.

quantization error: The amount that the digital quantity differs from the analog quantity.
SUB

quick-break: A term used to describe a device that has a high contact opening speed independent of the operator.
HVS, Swg

quick-make: A term used to describe a device that has a high contact closing speed independent of the operator.
HVS, SWg

quiescent supervisory system: A supervisory system that is normally alert but inactive, and transmits information or control signals only when a change in status occurs at the remote station or when a demand operation is initiated at the master station.
SUB

radio-influence tests: Tests that consist of the application of voltage and the measurement of the corresponding radio-influence voltage produced by the device being tested.
HVF, Swg; HVCB, Swg

random failure: Any failure whose cause and/or mechanism makes its time of occurrence unpredictable.
PSRC

rate-of-change protection: A form of protection in which an abnormal condition causes disconnection or inhibits connection of the protected equipment in accordance with the rate of change of current, voltage, power, frequency, pressure, etc.
PSRC

rate-of-change relay: A relay that responds to the rate of change of current, voltage, power, frequency, pressure, etc.
PSRC

rate-of-rise current tripping: *See:* **rate-of-rise release (trip).**

rate-of-rise release (trip): A release that operates when the rate of rise of the actuating quantity in the main circuit exceeds the release setting.
LVSwgD

rated: A qualifying term that, applied to an operating characteristic, indicates the designated limit or limits of the characteristic for application under specified conditions.
LVSwgD; HVCB, Swg

NOTE — The specific limit or limits applicable to a given device is specified in the standard for that device, and included in the title of the rated characteristic, that is, rated *maximum* voltage, rated frequency *range*, etc.

rated asymmetrical making current: The maximum rms current, at rated frequency, including the dc component, against which a device is required to close and latch under specified conditions.
R and S, Swg

rated capacitive switching current: The rms symmetrical value of the highest capacitive load current that a device is required to make and interrupt at a rated maximum voltage as part of its designated operation duty cycle.
R and S, Swg

NOTE — The capacitive switching current rating should be at least 135% of the rated capacitor bank. The excess current can be caused by harmonics, overvoltage, or plus tolerance in the capacitor kvar.

rated fault-closing current: The highest rms total current, including the dc component, that the device shall be required to close at rated maximum voltage and rated frequency and carry for a specified time under specified conditions.
HVS, Swg; HVCB, Swg

rated frequency: The power frequency at which a device is designed to operate.
R and S, Swg

rated high-frequency transient making current: The peak value of the high-frequency current, with specified damping, against which a device is required to close and latch under specified conditions.
R and S, Swg

rated short-circuit withstand current: The maximum rms total current that it can carry momentarily without electrical, thermal, or mechanical damage or permanent deformation. The current shall be the rms value, including the dc component, at the major peak of the maximum cycle as determined from the envelope of the current wave during a given test time interval.
SwgA

rated transient inrush frequency: The highest frequency of the transient inrush current of a designated operating duty.
R and S, Swg

rating: The designated limit(s) of the rated operating characteristic(s) of a device.
PSRC; HVF, Swg; LVSwgD

NOTE — Such operating characteristics as current, voltage frequency, etc., may be given in the rating.

ratio-type (position-type) telemeter: A telemeter that employs the relative phase position between, or the magnitude relation between, two or more electrical quantities as the translating means.
SUB

NOTE — Examples of ratio-type telemeters include ac or dc position matching systems.

reach (of a relay): The extent of the protection afforded by a relay in terms of the impedance or circuit length as measured from the relay location.
PSRC

NOTE — The measurement is usually to a point of fault, but excessive loading or system swings may also come within reach or operating range of the relay.

reactance relay: A linear-impedance form of distance relay for which the operating characteristic of the distance unit on an *R-X* diagram is a straight line on constant reactance.
PSRC

NOTE — The operating characteristic may be described by either equation $X = K$, or $Z\sin\theta = K$, where K is a constant, and θ is the angle by which the input voltage leads the input current. See Fig 2(b).

reactive power relay: A power relay that responds to reactive power.
PSRC

receiver relay: An auxiliary relay whose function is to respond to the output of a communications set such as an audio, carrier, radio, or microwave receiver.
PSRC

reclosing fuse: A combination of two or more fuseholders, fuse units, or fuse links mounted on a fuse support or supports, mechanically or electrically interlocked, so that one fuse can be connected into the circuit at a time and the functioning of that fuse automatically connects the next fuse into the circuit, with or without intentionally-added time delay, thereby permitting one or more service restorations without replacement of fuse links, refill units, or fuse units.
HVF, Swg

reclosing interval (of an automatic circuit recloser): The open-circuit time between an automatic opening and the succeeding automatic reclosure.
R and S, Swg

reclosing relay: A programming relay whose function is to initiate the automatic reclosing of a circuit breaker.
PSRC

reclosing time (of a circuit breaker): The interval between the time when the actuating quantity of the release (trip) circuit reaches the operating value (the breaker being in the closed position) and the reestablishment of the circuit on the primary arcing contacts on the reclosing stroke.
HVCB, Swg; LVSwgD

reconditioning (switchgear): A general term covering the process of maintaining existing power switchgear equipment in operating condition as recommended by the manufacturer's instructions, using only the original manufacturer's recommended replacement parts, without altering the original design.
HVCB, Swg; SwgA; LVSwgD

recovery voltage: The voltage that occurs across the terminals of a pole of a circuit-interrupting device upon interruption of the current.
HVF, Swg

redundancy: The quality of a relaying system that allows a function to operate correctly, without degradation, irrespective of the failure or state of one portion, since another portion performs the same function (not to be confused with backup).
PSRC

refill unit (of a high-voltage fuse unit): An assembly comprised of a conducting element, the complete arc-extinguishing medium, and parts normally required to be replaced after each circuit interruption to restore the fuse unit to its original operating condition.
HVF, Swg

refresh rate: The number of times in each second that the information displayed on a non-permanent display, for example, a crt, is rewritten or reenergized.
SUB

regulating relay: A relay whose function is to detect a departure from specified system operating conditions and to restore normal conditions by acting through supplementary equipment.
PSRC

reignition: A resumption of current between the contacts of a switching device during an opening operation after an interval of zero current of less than $^1/_4$ cycle at normal frequency.
HVS, Swg; HVCB, Swg

relay: An electrical device designed to respond to input conditions in a prescribed manner and after specified conditions are met to cause contact operation or similar abrupt change in associated electric control circuits.
PSRC; HVCB, Swg

NOTES:

1 — Inputs are usually electrical, but may be mechanical, thermal, or other quantities or a combination of quantities. Limit switches or similar simple devices are not relays.

2 — A relay may consist of several relay units, each responsive to specified inputs with the combination providing the desired overall performance characteristic of the relay.

relay backup: The part of the backup protection that operates in the event of failure of the primary relays.
PSRC

relay, interposing: A device that enables the energy in a high-power circuit to be switched by a low-power control signal.
SUB

relay system: An assembly that usually consists of measuring units, relay logic, communications interfaces, computer interfaces, and necessary power supplies.
PSRC

relay unit:

1) A subassembly of parts.
   NOTE — The combination of several relay elements constitutes a relay unit.
2) An assembly of relay elements that in itself can perform a relay function.

PSRC

NOTE — One or more relay units constitute a relay.

release-delay (trip-delay) setting: A calibrated setting of the time interval between the time when the actuating value reaches the release setting and the time when the release operates.
LVSwgD

release-free (as applied to a mechanical device): *See:* **trip-free.**
HVCB, Swg; R and S, Swg

release-free in any position: *See:* **trip-free.**
HVCB, Swg; R and S, Swg

release-free relay: *See:* **trip-free relay (release-free relay).**

release (trip) coil (of a mechanical switching device): A coil used in the electromagnet that initiates the action of a release (trip).
LVSwgD; HVCB, Swg

release (trip) setting: A calibrated point at which the release is set to operate.
LVSwgD

release (tripping) delay (of a mechanical switching device): Intentional time-delay introduced into contact parting time in addition to opening time.
LVSwgD; HVCB, Swg

NOTE — In devices employing a shunt release, release delay includes the operating time of protective and auxiliary relays external to the device. In devices employing direct or indirect release, release delay consists of intentional delay introduced into the function of the release.

release (tripping mechanism) (of a mechanical switching device): A device, mechanically connected to a mechanical switching device, that releases the holding means and permits the opening or closing of the switching device.
LVSwgD; HVCB, Swg

reliability (of a relay or relay system): A measure of the degree of certainty that the relay, or relay system, will perform correctly.
PSRC

NOTE — Reliability denotes certainty of correct operation together with assurance against incorrect operation from all extraneous causes. *See also:* **dependability (of a relay or relay system)** and **security (of a relay or relay system).**

remote backup: A form of backup protection in which the protection is at a station or stations other than that which has the primary protection.
PSRC

remote control: Control of a device from a distant point.
SUB

NOTE — Remote control may be over (1) direct wire, or over (2) other types of interconnecting channels such as carrier-current or microwave, or by (3) supervisory control or by (4) mechanical means.

remote data logging: An arrangement for the numerical representation of selected telemetered quantities on log sheets or paper or magnetic tape, or the like, by means of an electric typewriter, teletype, or other suitable devices.
SUB

remote indication: Indication of the position or condition of remotely located devices.
SUB

NOTE — Remote indication may be over (1) direct wire, or over (2) other types of interconnecting channels such as carrier-current or microwave, or by (3) supervisory indication or by (4) mechanical means.

remote manual operation: *See:* **indirect manual operation (of a switching device).**

remote operation: *See:* **remotely controlled operation.**

remote release: *See:* **remote trip (remote release).**

remote station (of a supervisory system): A remotely located station wherein units of switchgear or other equipment are controlled by supervisory control or from which supervisory indications or selected telemeter readings are obtained.
SUB

remote-station supervisory equipment: The part of a (single) supervisory system that includes all supervisory control relays and associated devices located at the remote station for selection, control, indication, and other functions to be performed.
SUB

remote terminal unit (RTU): The remote station equipment of a supervisory system.
SUB

remote trip (remote release): A general term applied to a relay installation to indicate that the switching device is located physically at a point remote from the initiating protective relay, device, or source of release power or all these.
PSRC

NOTE — This installation is commonly called transfer trip when a communication channel is used to transmit the signal for remote tripping.

remotely controlled operation: Operation of a device by remote control.
HVS, Swg; HVCB, Swg

removable element (of a switchgear assembly): The portion that normally carries the circuit-switching and circuit-interrupting devices and the removable part of the primary and secondary disconnecting devices.
LVSwgD; SwgA

renewable (field-renewable) fuse or fuse unit: A fuse or fuse unit that, after circuit interruption, may be restored readily for service by the replacement of the renewal element, fuse link, or refill unit.
HVF, Swg

renewal element (of a low-voltage fuse): The part of a renewable fuse that is replaced after each interruption to restore the fuse to operating condition.
LVSwgD

renewal parts: Those parts that must be replaced during maintenance as a result of wear.
LVSwgD; HVCB, Swg

repeatability: The measure of agreement among multiple readings of an output for the same value of input, made under the same operating conditions, approaching from the same direction, using full-range traverses.
SUB

replica temperature relay: A thermal relay whose internal temperature rise is proportional to that of the protected apparatus or conductor, over a range of values and durations of overloads.
PSRC

representative sample: Production/prototype equipment used in a qualification program which is equivalent to that for which qualification is sought in terms of design, function, materials, and manufacturing techniques and processes.
PSRC

reproductibility: *See:* **repeatability.**

required response spectrum (RRS): The response spectrum issued by the user or the user's agent as part of the specifications for proof testing, or artificially created to cover future applications. The RRS constitutes a requirement to be met.
PSRC, SwgA

reset interval (of an automatic circuit recloser or automatic line sectionalizer): The time required, after a counting operation, for the counting mechanism to return to the starting position of that counting operation.
R and S, Swg

reset (of a relay): The action of a relay as it makes designated response to decreases in input. As a qualifying term, reset denotes the state of a relay when all response to decrease of input has been completed. Reset is also used to identify the maximum value of an input quantity reached by progressive decreases that will permit the relay to reach the state of complete reset from pickup.
PSRC

NOTE — In defining the designated performance of relays having multiple inputs, reset describes the state when all inputs are zero and also when some input circuits are energized, if the resulting state is not altered from the zero-input condition.

reset time (of a relay): The time interval from occurrence of specified conditions to reset.
PSRC

NOTE — When the conditions are not specified it is intended to apply to a picked-up relay and to be a sudden change from picked value of input to zero input.

reset time (of an automatic circuit recloser or automatic line sectionalizer): The time required, after one or more counting operations, for the counting mechanism to return to the starting position.
R and S, Swg

residual relay: A relay so applied that its input, derived from external connections of instrument transformers, is proportional to the zero-phase-sequence component of a polyphase quantity.
PSRC

resistance relay: A linear-impedance form of distance relay for which the operating characteristic on an *R-X* diagram is a straight line of constant resistance.
PSRC

NOTE — The operating characteristic may be described by the equations $R = K$ or $Z\cos\theta = K$, where K is a constant, and θ is the angle by which the input voltage leads the input current.

resistant (used as a suffix): So constructed, protected, or treated that damage will not occur readily when the device is subjected to the specified material or condition.
HVF, Swg; HVS, Swg

resolution: The least value of the measured quantity that can be distinguished.
SUB

resonance (mechanical): A dynamic condition that occurs when any forcing frequency of mechanical vibration coincides with one of the natural frequencies of the structure.
SUB

NOTE — In a plot of the response of the structure (acceleration, velocity, displacement) versus forcing frequency for a constant forcing input, it would be seen that as the forcing frequency approaches one of the natural frequencies, the response

increases until it is at a maximum at the natural frequency. The response of the structure at resonance may be much greater than the input, depending on the damping.

response (of a device or system): A quantitative expression of the output as a function of the input under conditions that must be explicitly stated.
PSRC

NOTE — The response characteristic, often presented graphically, gives the response as a function of some independent variable such as frequency or time.

response spectrum: A plot of the maximum response of single-degree-of-freedom bodies at a damping value expressed as a percent of critical damping of different natural frequencies when these bodies are rigidly mounted on the surface of interest (that is, on the ground for the ground response spectrum or on the floor for the floor response spectrum) when that surface is subjected to a given earthquake's motion as modified by intervening structures.
SUB; PSRC; SwgA

restraint relay: A relay so constructed that its operation in response to one input is restrained or controlled by a second input.
PSRC

restrike: A resumption of current between the contacts of a switching device during an opening operation after an interval of zero current of $^1/_4$ cycle at normal frequency or longer.
HVS, Swg; HVCB, Swg

reverse-current relay: A relay that operates on a current flow in a dc circuit in a direction opposite to a predetermined reference direction.
PSRC

reverse-current release (trip): A release that operates upon reversal of the direct current in the main circuit from a predetermined direction.
R and S, Swg

reverse-power tripping: *See:* **reverse-current release (trip).**

rotating-insulator switch: A switch in which the opening and closing travel of the blade is accomplished by the rotation of one or more insulators supporting the conducting parts of the switch.
HVS, Swg

routine tests (for switchgear): *See:* **production tests (for switchgear).**

row arrangement: Circuit-breaker pole units that are installed in a consecutive mode, thus physically forming a continuous line. The natural expansion of the substation would normally continue in the direction of the row. Arrangements can have two, three, four, or more rows in parallel configuration.
SUB

***R-X* diagram.:** A graphic presentation of the characteristics of a relay unit in terms of the ratio of voltage to current and the phase angle between them.
PSRC

NOTE — For example, if a relay just operates with 10 V and 10 A in phase, one point on the operating curve of the relay would be plotted as 1 ω on the *R* axis (i.e., $R = 1$, $X = 0$, where *R* is the abscissa and *X* is the ordinate). See Fig 2.

safe shutdown earthquake (SSE): That earthquake which produces the maximum vibratory ground motion for which certain structures, systems, and components are designed to remain functional. These structures, systems, and components are those necessary to ensure (1) the integrity of the reactor coolant pressure boundary, and (2) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures comparable to the guideline exposures of Code of Federal Regulations, Title 10, Part 100 (December 5, 1973).
PSRC; SwgA

scan cycle: The time in seconds required to obtain a collection of data (for example, all data from one remote, all data from remotes, and all data of a particular type from all remotes).
SUB

scan (interrogation): The process by which a data acquisition system interrogates remote stations of points for data.
SUB

seal-in relay: An auxiliary relay that remains picked up through one of its own contacts which bypasses the initiating circuit until deenergized by some other device.
PSRC; HVCB, Swg

secondary (used as an adjective):
1) Operates after the primary device; for example, secondary arcing contacts.
2) Second in preference.
3) Referring to auxiliary or control circuits as contrasted with the main circuit; for example, secondary disconnecting devices, secondary and control wiring.
4) Referring to the energy output side of transformers or the conditions (voltages) usually encountered at this location; for example, secondary fuse, secondary unit substation.

LVSwgD

secondary and control wiring (small wiring): Wire used with switchgear assemblies for control circuits and for connections between instrument transformers' secondaries, instruments, meters, relays, or other equipment.
LVSwgD

secondary arcing contacts (of a switching device): The contacts on which the arc of the arc-shunting-resistor current is drawn and interrupted.
LVSwgD; SwgA

secondary disconnecting devices (of a switchgear assembly): Self-coupling separable contacts provided to connect and disconnect the auxiliary and control circuits between the removable element and the housing.
LVSwgD; SwgA

secondary fuse: A fuse used on the secondary-side circuits of transformers.
HVF, Swg

NOTE — In high-voltage fuse parlance such a fuse is restricted for use on a low-voltage secondary distribution system that connects the secondaries of distribution transformers to consumers' services.

secondary unit substation: See NOTE under **unit substation.**

sectionalizer: *See:* **automatic line sectionalizer.**

sector impedance relay: A form of distance relay that by application and design has its operating characteristic limited to a sector of its operating circle on the *R-X* diagram. See Fig 2(a).
PSRC

security (of a relay or relay system): That facet of reliability that relates to the degree of certainty that a relay or relay system will not operate incorrectly.
PSRC

segregated-phase bus: One in which all phase conductors are in a common metal enclosure, but are segregated by metal barriers between phases.
SwgA

selective opening (tripping): The application of switching devices in series such that (of the devices carrying fault current) only the device nearest the fault will open and the devices closer to the source will remain closed and carry the remaining load.
LVSwgD; R and S, Swg

selective overcurrent trip: *See:* **selective release (trip) and overcurrent release (trip).**

selective overcurrent tripping: *See:* **selective opening (tripping) and overcurrent release (trip).**

selective pole switching: The practice of tripping and reclosing one or more poles of a multipole circuit breaker without changing the state of the remaining pole(s), with tripping being initiated by protective relays that respond selectively to the faulted phases.
HVCB, Swg

NOTE — Circuit breakers applied for selective pole switching must inherently be capable of individual pole opening.

selective release (trip): A delayed release with selective settings that will automatically reset if the actuating quantity falls and remains below the release setting for a specified time.
LVSwgD

selectivity (of a protective system): A general term describing the interrelated performance of relays and breakers, and other protective devices; complete selectivity being obtained when a minimum amount of equipment is removed from service for isolation of a fault or other abnormality.
PSRC

selector switch: A switch arranged to permit connecting a conductor to any one of a number of other conductors.
HVS, Swg

self-reset relay (automatic reset relay): A relay that is so constructed that it returns to its reset position following an operation after the input quantity is removed.
PSRC

self-restoring insulation: Insulation that completely recovers its insulating properties after a disruptive discharge caused by the application of a test voltage. Insulation of this kind is generally, but not necessarily, external insulation.
HVCB, Swg

semi-flush-mounted device: A device in which the body of the device projects in front of the mounting surface a specified distance between the distance specified for flush-mounted and surface-mounted devices.
SwgA

semi-high-speed low-voltage dc power circuit breaker: *See:* **circuit breaker, semi-high-speed low-voltage dc power.**

sequence filter: *See:* **sequence network.**

sequence network: An electrical circuit that produces an output proportional to one or more of the sequence components of a polyphase system of voltages or currents, e.g., positive sequence network, negative sequence network, or zero-sequence network.
PSRC

serial communication: A method of transmitting information between devices by sending all bits serially over a single communication channel.
SUB

series coil sectionalizer: A sectionalizer in which main circuit current impulses above a specified value, flowing through a solenoid or operating coil, provide the energy required to operate the counting mechanism.
R and S, Swg

series overcurrent tripping: *See:* **direct release (series trip)** and **overcurrent release (trip).**

series-trip recloser: A recloser in which main-circuit current above a specified value, flowing through a solenoid or operating coil, provides the energy necessary to open the main contacts.
R and S, Swg

series undercurrent tripping: *See:* **direct release (series trip)** and **undercurrent release (trip).**

set (used as a verb): To position the various adjusting devices so as to secure the desired operating characteristic.
PSRC, LVSwgD

NOTE — Typical adjustment devices are taps, dials, levers, and scales suitably marked, rheostats that may be adjusted during tests, and switches with numbered positions that refer to recorded operating characteristics.

setting (used as a noun): The desired characteristic, obtained as a result of having set a device, stated in terms of calibration markings or of actual performance bench marks such as pickup current and operating time at a giving value of input.
PSRC; LVSwgD

NOTE — When the setting is made by adjusting the device to operate as desired in terms of a measured input quantity, the procedure may be the same as in calibration. However, since it is for the purpose of finding one particular position of an adjusting device, which in the general case may have several marked positions that are not being calibrated, the term *setting* is to be preferred over the term *calibration*.

setting error: The departure of the actual performance from the desired performance resulting from errors in adjustment or from limitations in testing or measuring techniques.
PSRC; LVSwgD

setting limitation: The departure of the actual performance from the desired performance resulting from limitations of adjusting devices.
PSRC, LVSwgD

short circuit: An abnormal connection (including an arc) of relatively low impedance, whether made accidentally or intentionally, between two points of different potential.
LVSwgD; HVCB, Swg

NOTE — The term *fault* or *short-circuit fault* is used to describe a short circuit.

short-line-fault transient recovery voltage: The transient recovery voltage obtained when a circuit-switching device interrupts a nearby fault on the line.
HVCB, Swg

NOTE — Short-line-fault transient recovery voltage differs from terminal fault conditions in that the length of line adds a high-frequency saw-tooth component to the transient recovery voltage. As the distance to the fault becomes greater, the amplitude of the saw-tooth component increases, the rate of rise of the saw-tooth component decreases, and the fault current decreases.

The increased amplitude adversely affects the interrupting capability of the circuit-switching device while the decrease in the rate of rise and the decrease in current makes interruption easier. The effects are not proportional and a distance is reached where interruption is most severe even though the current is less than for a terminal fault. The critical value varies considerably with the type of circuit-switching device (oil, air-blast, gas-blast, etc.), and with the particular design. The critical distance may be in the order of a mile at the higher voltages. The critical distance is less as lower voltages are considered.

short-time current: The current carried by a device, an assembly, or a bus for a specified short-time interval.
HVS, Swg; LVSwgD; HVCB, Swg

short-time-delay phase or ground trip element: A direct-acting trip device element that functions with a purposely delayed action (measured in milliseconds).
LVD

short-time rating of a relay: The highest value of current or voltage or their product that the relay can stand, without injury, for specified short-time intervals (for ac circuits, rms total value including the dc component is to be used). The rating recognizes the limitations imposed by both the thermal and electromagnetic effects.
PSRC

shunt (air switch): A flexible electrical conductor comprised of braid, cable, or flat laminations designed to conduct current around the mechanical joint between two conductors.
R and S, Swg

shunt capacitor bank current: Current, including harmonics, supplied to a shunt capacitor bank.
HVCB, Swg

NOTE — Current is expressed in rms amperes.

shunt release (trip): A release energized by a source of voltage.
LVSwgD

NOTE — The voltage may be derived either from the main circuit or from an independent source.

shunt-trip recloser: A recloser in which the tripping mechanism, by releasing the holding means, permits the main contacts to open, with both the tripping mechanism and the contact opening mechanism deriving operating energy from other than the main circuit.
R and S, Swg

shutter (of a switchgear assembly): A device that is automatically operated to completely cover the stationary portion of the primary disconnecting devices when the removable element is either in the disconnected position, test position, or has been removed.
SwgA

side-break switch: One in which the travel of the blade is in a plane parallel to the base of the switch.
HVS, Swg

signal circuit: Any circuit other than input voltage circuits, input current circuits, power supply circuits, or those circuits that directly or indirectly control power circuit breaker operation.
PSRC

signal relay: *See:* **alarm (signal) relay.**

signature: Those characteristics of a waveform that help identify an event or conditions.
PSRC

silver-surfaced or equivalent: Metallic materials having satisfactory long-term performance that operate within the temperature rise limits established for silver-surfaced electrical contact parts and conducting mechanical joints.
LVSwgD; HVCB, Swg; SwgA

sine sweep test: A sinusoidal input with continuously varying frequency covering the range of interest.
SwgA

single-breakswitch: One that opens each conductor of a circuit at one point only.
LVSwgD

single capacitance (as applied to interrupter switches): A capacitance is defined to be a single capacitance when the crest of its inrush current does not exceed the switch inrush current capability for single capacitance.
HVS, Swg

single-element fuse: A fuse having a current-responsive element comprising one or more parts with a single fusing characteristic.
HVF, Swg

single-pole switching: The practice of tripping and reclosing one pole of a multipole circuit breaker without changing the state of the remaining poles, with tripping being initiated by protective relays that respond selectively to the faulted phase.
HVCB, Swg

NOTE — Circuit breakers used for single-pole switching must inherently be capable of individual pole opening. (2) In most single-pole switching schemes,it is the practice to trip all poles for any fault involving more than one phase.

single throw (switching device): A qualifying term used to indicate that the device has an open and a closed circuit position only.
LVSwgD

slant voltage (multiple voltage) ratings of a distribution cutout: A pair of maximum voltage ratings assigned to a distribution cutout intended primarily for application on three-phase solidly grounded neutral (multigrounded) systems where construction conditions are such that two cutouts will normally operate in series to clear phase-to-phase faults. In applying these cutouts, the system line-to-line voltage must be equal to or less than the maximum voltage rating to the right of the slant (/), and the system line-to-ground voltage must be equal to or less than the maximum voltage rating to the left of the slant (/).
HVF, Swg

NOTE — Slant voltage rated cutouts may be used in single-phase applications where the normal frequency recovery voltage across the cutout does not exceed the maximum voltage rating to the left of the slant (/).

slant voltage rated (multiple voltage rated) distribution cutout: A distribution cutout intended primarily for application on three-phase solidly grounded neutral (multigrounded) systems where prescribed conditions exist.
HVF, Swg

sleet hood (of a switch): A cover for the contacts to prevent sleet from interfering with successful operation of the switch.
HVS, Swg

small wiring: *See:* **secondary and control wiring (small wiring).**

solid-material fuse unit: A fuse unit in which the arc is drawn through a hole in solid material.
HVF, Swg

solid-state relay (or relay unit): A static relay or relay unit constructed exclusively of solid-state components.
PSRC

sound level: Weighted sound-pressure level obtained by the use of a metering characteristic and the weightings A, B, C (or other), as specified. The weighting used must be indicated. For the purpose of this standard, C weighted sound level is the same as sound pressure level (SPL). Unit: decibel (dB A, B, or C.
HVCB, Swg

sound-pressure level (SPL): Twenty times the logarithm to the base 10 of the ratio of the pressure of a sound to the reference sound pressure. Unless otherwise specified, the effective rms pressure to be used. The reference sound pressure is 20 μPa. Unit: decibel (dB).
HVCB, Swg

spacer insulator: A spacer insulator as used in a gas-insulated system is an insulator used to support the inner conductor in the enclosure.
SUB

spare point (for supervisory control or indication or telemeter selection): A point that is not being utilized but is fully equipped with all of the necessary devices for a point.
SUB

speed ratio (of a fuse): *See:* **melting-speed ratio (of a fuse).**

spike (as applied to relaying): An output signal of short duration and limited crest derived from an alternating input of specified polarity.
PSRC

NOTE — The duration of a spike usually does not exceed 1 ms.

split-winding protection: A form of differential protection in which the current in all or part of the winding is compared to the normally proportional current in another part of the winding.
PSRC

spring operation: Stored-energy operation by means of spring-stored energy.
LVSwgD; HVCB, Swg

squaring amplifier (as applied to relaying): A circuit that produces a block.
PSRC

squelch circuit: A circuit for preventing production of an unwanted output in the absence of a signal having predetermined characteristics.
PSRC

standard operating duty: *See:* **operating duty (of a switching device).**

standard reference position (of a contact): The nonoperated or de-energized position of the associated main device to which the contact position is referred.
LVSwgD

NOTE — Standard reference positions of typical devices are as shown below:

Device	Standard Reference Position
Circuit breaker	Main contacts open
Disconnecting switch	Main contacts open
Relay	De-energized position
Contactor	De-energized position
Valve	Closed position

standard response spectrum (SRS): A required response system (RRS) that is artificially created to cover the standard testing of relays and whose shape is defined. The SRS may be terminated at any convenient frequency above 35 Hz.
PSRC

startup (of a relay): The action of a relay as it just departs from complete reset. Startup is also used as a qualifying term to identify the minimum value of the input quantity that will permit this condition.
PSRC

static relay (or relay unit): A relay or relay unit in which the designed response is developed by electronic, solid-state, magnetic or other components without mechanical motion.
PSRC

NOTE — A relay that is composed of both static and electro-mechanical units in which the designed response is accomplished by static units may be referred to as a static relay.

station:

1) **master (of a supervisory system).** The entire complement of devices, functional modules, and assemblies that are electrically interconnected to effect the master station supervisory functions. The equipment includes the interface with the communication channel, but does not include the interconnecting channel.
   During communication with one or more remote stations, the master station is the superior in the communication hierarchy.
2) **remote (of a supervisory system).** The entire complement of devices, functional modules, and assemblies that are electrically interconnected to effect the remote station supervisory functions. The equipment includes the interface with the communication channel, but does not include the interconnecting channel.
   During communication with a master station, the remote station is the subordinate in the communication hierarchy.

SUB

NOTE — Examples of station equipment include:

1) *Hardwired*. Station supervisory equipment which is comprised entirely of wired-logic elements.
2) *Firmware*. Station supervisory equipment which uses hardware logic programmed routines in a manner similar to computer. The routines can only be modified by physically exchanging logic memory elements.
3) *Programmable*. Station supervisory equipment which uses software routines.
4) *Semiautomatic*. A station that requires both automatic and manual modes to maintain the required character of service.
5) *Submaster.* A station that can perform as a master station on one message transaction and as a remote station on another message transaction.

station, automatic: A station that operates in automatic control mode.
SUB

NOTE — An automatic station may go in and out of operation in response to predetermined voltage, load, time, or other conditions, or in response to a remote or locally manually operated control device.

station check (supervisory check, status update): The automatic selection, in a definite order, of all the supervisory alarm and indication points associated with one remote station or all remote stations of a system, and the transmission of all the indications to the master station.
SUB

station ground: A ground grid or any equivalent system of grounding electrodes buried beneath or adjacent to the gas-insulated substation that determines the rise of ground-voltage level relative to remote earth and controls the distribution of voltage gradients within the gas-insulated substation area during a fault.
SUB

station identification: A sequence of signal elements used to identify a station.
SUB

station-type cubicle switchgear: Metal-enclosed power switchgear characterized by the following required features:

1) The main switch and interrupting device is of the stationary mounted type, composed of a primary circuit compartment and a secondary or mechanism compartment; arranged with gang-operated isolating switches that are mechanically interlocked with the main switching and interrupting device.
2) Each phase for the major parts of the primary circuit switching or interrupting devices, buses, and line-to-ground potential transformers is completely enclosed (or segregated) by grounded metal barriers that have no intentional openings between compartments. Specifically included are mechanically interlocked doors in front of or a part of the primary circuit compartment of the circuit switching and interrupting device so that when the group operated isolating switches are closed, no primary parts can be exposed by the attempted opening of the interlocked doors.
3) All live parts are enclosed within grounded metal compartments.
4) Primary bus conductor and connections are bare.
5) Mechanical interlocks are provided for proper operating sequence under normal operating conditions.
6) Secondary control devices and their wiring are isolated by grounded metal barriers from all primary circuit elements with the exception of short lengths of wire, such as at instrument transformer terminals.
7) The doors to the secondary or mechanism compartment of the primary switching or interrupting device are to provide access to the secondary or control equipment within the housing without danger of exposure to the primary circuit parts.

SwgA

NOTE — Auxiliary vertical sections may be required for mounting devices or for use as bus transition.

stationary contact member: A conducting part having a contact surface that remains substantially stationary.
HVS, Swg; LVSwgD; HVCB, Swg

stationary-mounted device: One that cannot be removed except by the unbolting of connections and mounting supports.
LVSwgD; SwgA

NOTE — Compare with drawout-mounted device.

status: Information describing a logical state of a point or equipment.
SUB

stick (hook) operation: Manual operation of a switching device by means of a switch stick.
HVS, SWg

stored-energy indicator: An indicator which visibly shows that the stored-energy mechanism is in the charged or discharged position.
LVSwgD; HVCB, Swg

stored-energy operation: 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.
LVSwgD; HVCB, Swg

NOTE — This kind of operation may be subdivided according to: (1) how the energy is stored (spring, weight, etc.), (2) how the energy originates (manual, electric, etc.), and (3) how the energy is released (manual, electric, etc.).

strain element (strain wire) (of a fuse): That part of the current-responsive element that is connected in parallel with the fusible element in order to relieve it of tensile strain.
HVF, Swg

NOTE — The fusible element melts and severs first, and then the strain element melts during circuit interruption.

striking distance: The shortest distance, measured through air, between parts of different polarities.
HVCB, Swg

stub-multiple feeder: A feeder that operates as either a stub or a multiple feeder.
SUB

stub (radial) feeder: A feeder that connects a load to its only source of power.
SUB

stud (of a switching device): A rigid conductor between a terminal and a contact.
LVSwgD; HVCB, Swg

subassembly: One or more compartments that comprise the gas-insulated substation assembly.
SUB

submersible: So constructed as to be successfully operable when submerged in water under specified conditions of pressure and time.
HVS, Swg, SwgA

submersible entrance terminals (cableheads) (of distribution oil cutouts): A hermetically sealable entrance terminal for the connection of cable having a submersible sheathing or jacket.
HVS, Swg

submersible fuse (subway oil cutout): *See:* **submersible** and **fuse.**

subsurface switch: A submersible switching assembly suitable for application in a below-grade enclosure that does not allow space for personnel access.
R and S, Swg

sudden-pressure relay: A relay that operates by the rate of rise in pressure of a liquid or gas.
PSRC

sulfur hexafluoride (SF_6): A gaseous dielectric for high-voltage power applications having characteristics as specified in ASTM D 2472-92 [3].
SUB

supervisory control: A form of remote control comprising an arrangement for the selective control of remotely located units by electrical means over one or more common interconnecting channels.
SUB

supervisory control data acquisition system: A system operating with coded signals over communication channels so as to provide control of remote equipment (using typically one communication channel per remote station). The supervisory system may be combined with a data acquisition system, by adding the use of coded signals over communication channels to acquire information about the status of the remote equipment for display or for recording functions.
SUB

supervisory control functions: Equipment governed by this standard that comprises one or more of the following functions:

1) **alarm function.** The capability of a supervisory system to accomplish a predefined action in response to an alarm condition.
2) **analog function.** The capability of a supervisory system to accept, record, or display, or do all of these, an analog quantity as presented by a transducer or external device. The transducer may or may not be a part of the supervisory control system.

3) **control function.** The capability of a supervisory system to selectively perform manual operation, automatic operation, or both (singularly or in selected groups), of external devices. Control may be either analog (magnitude or duration) or digital.
4) **indication (status) function.** The capability of a supervisory system to accept, record, or display, or do all of these, the status of a device. The status of a device may be derived from one or more inputs giving two or more states of indication.
    a) **two-state indication.** Only one of the two possible positions of the supervised device is displayed at a time. Such display may be derived from a single set of contacts.
    b) **three-station indication.** Indication in which the transitional state or security indication as well as the terminal positions of the supervised device is displayed. Such a display is derived from at least two sets of initiating contacts.
    c) **multistate indication.** Only one of the predefined states (transitional or discrete, or both) is indicated at a time. Such a display is derived from multiple inputs.
    d) **indication with memory.** An indication function with the additional capability of storing single or multiple changes of status that occur between scans.
    e) **accumulator function.** The capability of a supervisory system to accept and totalize digital pulses and make them available for display or recording or both.
5) **sequence of events function.** The capability of a supervisory system to recognize each predefined event, associate a time of occurrence with each event, and present the event data in order of occurrence of the events.

SUB

supervisory indication: A form of remote indication comprising an arrangement for the automatic indication of the position or condition of remotely located units by electrical means over one or more common interconnecting channels.

SUB

supervisory station check: The automatic selection in a definite order, by means of a single initiation of the master station, of all of the supervisory points associated with one remote station of a system; and the transmission to the master station of indications of positions or conditions of the individual equipment or device associated with each point.

SUB

supervisory system: All control indicating and associated with telemetering equipment at the master station and all of the complementary devices at the remote station or stations.

1) **continuous update.** A system in which the remote station continuously updates indication and telemetering to the master station regardless of action taken by the master station. The remote station may interrupt the continuous data updating to perform a control operation.
2) **polling.** A system in which the master interrogates each remote to ascertain if there has been a change since the last interrogation. Upon detection of a change, the master may request data immediately.
3) **quiescent.** A system that is normally alert but inactive and transmits information only when a change in indication occurs at the remote station or when a command operation is initiated at the master station.
4) **scanning.** A system in which the master controls all information exchange. The normal state is usually one of repetitive communication with the remote stations.

SUB

supervisory system check: The automatic selection in a definite order, by means of a single initiation at the master station, of all supervisory points associated with all of the remote stations in a system; and the transmission to the master station of indications of positions or conditions of the individual equipment or device associated with each point.

SUB

supervisory telemeter selection: A form of remote telemeter selection comprising an arrangement for the selective connection of telemeter transmitting equipment to an appropriate telemeter receiving equipment over one or more common interconnecting channels.

SUB

support components: The components that give additional strength and rigidity or both to the bus enclosure and are basic subassemblies of the enclosure.
SwgA

surface-mounted device: A device, the entire body of which projects in front of the mounting surface.
SwgA

surface operable: A term indicating that an underground switch and its accessories are operable from above grade.
R and S, Swg

susceptance relay: A mho type of distance relay for which the center of the operating characteristic on the *R-X* diagram is on the *X* axis.
PSRC

NOTE — The equation that describes such a characteristics $Z = K\sin\theta$, where K is a constant and θ is the phase angle by which the input voltage leads the input current.

susceptibility (electromagnetic): The characteristic of any equipment that results in an undesired response to an electromagnetic field.
PSRC

swing rack cabinet: An assembly enclosed at the top, side, and rear with front hinged door for front access having a swing open frame for equipment mounting (e.g., nominal 19-in wide chassis and subpanel assemblies).
PSRC, SwgA

switch: *See:* **switching device (switch).**

switch inrush current capability for single capacitance (as applied to interrupter switches): This capability is a function of the rated switching current, for single capacitance, the rated differential capacitance voltage (minimum) and the maximum design voltage of the switch.
HVS, Swg

NOTE — This can be calculated from the equation:

Capability, in Peak Amperes =

$$\sqrt{2} I_C \sqrt{1 + \frac{0.8160 E_m}{\Delta V_{min}}}$$

where

I_c = Rated switching current for single capacitance
ΔV_{min} = Rated differential capacitance voltage, minimum
E_m = Switch rated maximum voltage, in volts, rms

switch stick (switch hook): A device with an insulated handle and a hook or other means for performing stick operation of a switching device.
HVS, Swg

switchboard: A type of switchgear assembly that consists of one or more panels with electric devices mounted thereon, and associated framework.
SwgA

NOTE — Switchboards may be classified by function, that is, power switchboards or control switchboards. Both power and control switchboards may be further classified by construction as defined.

switched way: A way connected to the bus through a switch.
R and S, Swg

switchgear: A general term covering switching and interrupting devices and their combination with associated control, metering, protective, and regulating devices; also assemblies of these devices with associated interconnections, accessories, enclosures, and supporting structures, used primarily in connection with the generation, transmission, distribution and conversion of electric power.
SwgA

switchgear assembly: An assembled piece of equipment (indoor or outdoor) including, but not limited to, one or more of the following: switching, interrupting, control, metering, protective, and regulating devices; together with their supporting structures, enclosures, conductors, electric interconnections, and accessories.
SwgA

switching current: The value of current expressed in rms symmetrical amperes that the power circuit breaker element of the circuit protector interrupts at the rated maximum voltage and rated frequency under the prescribed test conditions.
LVSwgD

switching device (switch): A device designed to close or open, or both, one or more electric circuits.
HVF, Swg; HVS, Swg; HVCB, Swg

NOTES:

1 — The term *switch* in international (IEC) practice refers to a mechanical switching device capable of opening and closing rated continuous load current.

2 — *See:* **mechanical switching device and non-mechanical switching device.**

switching structure: An open framework supporting the main switching and associated equipment, such as instrument transformers, buses, fuses, and connections. It may be designed for indoor or outdoor use and may be assembled with or without switchboard panels carrying the control equipment.
SwgA

symmetrical component (ac component) (of a total current): That portion of the total current that constitutes the symmetry.
LVSwgD; HVCB, Swg

synchronism-check relay: A verification relay whose function is to operate when two input voltage phasors are within predetermined limits.
PSRC

synchronizing relay: A programming relay whose function is to initiate the closing of a circuit breaker between two ac sources when the voltages of these two sources have a predetermined relationship of magnitude, phase angle, and frequency.
PSRC

synchronous operation (opening or closing): Operation of a switching device in such a manner that the contacts are closed or opened at a predetermined point on a reference voltage or current wave.
HVCB, Swg

NOTE — Synchronous operation applied on multiphase circuits may require that closing or opening of the contacts of each pole be responsive to a different reference.

synthetic test: A test in which the major part of, or the total current, is obtained from one source (current circuit), and the major part of, or all of the transient recovery voltage from a separate source or sources (voltage circuit).
HVCB, Swg

system time: A coordinated value of time maintained at stations throughout the power system.
SUB

tag: A visual indication, usually at the master station, to indicate that a device has been cleared for field maintenance/ construction purposes and is not available for control or data acquisition.
SUB

tapped way: Away solidly connected to the bus.
R and S, Swg

target (operation indicator) (of a relay): A supplementary device operated either mechanically or electrically, to indicate visibly that the relay has operated or completed its function.
PSRC

NOTES:

1 — A mechanically operated target indicates the physical operation of the relay.

2 — An electrically operated target, when not further described, is actuated by the current in the control circuit associated with the relay and hence indicates not only that the relay has operated but also that it has completed its function by causing current to flow in the associated control circuit.

3 — A shunt-energized target only indicates operation of the relay contact and does not necessarily show that current has actually flowed in the associated control circuit.

telemetering:

1) Transmission of measurable quantities using telecommunication techniques.
   a) **current-type telemeter.** A telemeter that employs the magnitude of a single current as the translating means.
   b) **frequency-type telemeter.** A telemeter that employs the frequency of a periodically recurring electric signal as the translating means.
   c) **pulse-type telemeter.** A telemeter that employs characteristics of intermittent electric signals, other than their frequency, as the translating means.
   d) **ratio-type telemeter.** A telemeter that employs the relative phase position between, or the magnitude relation between, two or more electrical quantities as the translating means.
      NOTE — Examples of ratio-type telemeters include ac or dc position-matching system.
   e) **voltage-type telemeter.** A telemeter that employs the magnitude of a single voltage as the translating means.
2) **analog.** Telemetering in which some characteristic of the transmitter signal is proportional to the quantity being measured.
3) **digital.** Telemetering in which a numerical representation is generated and transmitted; the number being representative of the quantity being measured.

SUB

telephone-type relay: A type of electromechanical relay in which the significant structural feature is a hinged armature mechanically separate from the contact assembly. This assembly usually consists of a multiplicity of stacked leaf-spring contacts.
PSRC

temperature relay: A relay whose operation is caused by specified external temperature.
PSRC

NOTE — *Compare with:* **thermal relay.**

temperature-rise tests: Tests to determine the temperature rise, above ambient of various parts of the tested device when subjected to specified test quantities.
HVF, Swg; LVSwgD

NOTE — The test quantities may be current, load, etc.

terminal:

1) A point in a system or communication network at which data can either enter or leave.
2) An input/output device capable of transmitting entries to and obtaining output from the system of which it is a part, for example, cathode ray tube (crt) terminal.

SUB

terminal block (terminal board): An insulating base equipped with terminals for connecting secondary and control wiring.
HVCB, Swg; SwgA

terminal chamber: A metal-enclosed container that includes all necessary mechanical and electrical items to complete the connections to other equipment.
SwgA

terminal connector: *See:* **terminal.**

terminal pad: A usually flat conducting part of a device to which a terminal connector is fastened.
HVF, Swg; HVS, Swg; HVCB, Swg

terminal (terminal connector): A connector for attaching a conductor to electrical apparatus.
HVF, Swg; LVSwgD; HVCB, Swg; SwgA

test:

1) **certified design.** A test performed on a production model specimen of a generic type of equipment to establish a specific performance parameter of that genre of equipment. The condition and results of the test are described in a document that is signed and attested to by the testing engineer and other appropriate, responsible individuals.
2) **data**
   a) The recorded results of test.
   b) A set of data developed specifically to test the adequacy of a computer run or system. They may be actual data taken from previous operations or artificial data created for this purpose.
3) **point.** A predefined location with in equipment or routines at which a known result should be present if the equipment or routine is operating properly.

SUB

test cabinet (for a switchgear assembly): An assembly of a cabinet containing permanent electric connections, with cable connections to a contact box arranged to make connection to the secondary contacts on an electrically operated removable element, permitting operation and testing of the removable element when removed from the housing. It includes the necessary control switch and closing relay, if required.
SwgA

test circuit breaker: The circuit breaker under test.
HVCB, Swg

test enclosure (for low-voltage ac power circuit breakers): A single-unit enclosure used for test purposes for a specific frame-size circuit breaker, which conforms to the manufacturer's recommendation for minimum volume, minimum electrical clearances, effective areas and locations of ventilation openings, and configuration of connections to terminals.
LVSwgD

test position (of a switchgear assembly removable element): That position in which the primary disconnecting devices of the removable element are separated by a safe distance from these in the housing, and some or all of the secondary disconnecting devices are in operating contact.
LVSwgD, SwgA

NOTES:

1 — A set of test jumpers or mechanical movement of secondary disconnecting devices may be used to complete all secondary connections for test in the test position. This may correspond with the disconnected position.

2 — Safe distance, as used here, is a distance at which the equipment will meet its withstand ratings, both power frequency and impulse, between line and load stationary terminals and phase-to-phase and phase-to-ground on both line and load stationary terminals with the switching device in the closed position.

test response spectrum (TRS): The response spectrum that is constructed using analysis or derived using spectrum analysis equipment based on the actual motion of the shake table.
PSRC, SwgA

test switch (test block): A combination of connection studs, jacks, plugs, or switch parts arranged conveniently to connect the necessary devices for testing instruments, meters, relays, etc.
SwgA

thermal relay: A relay whose operation is caused by heat developed within the relay as a result of specified external conditions.
PSRC

NOTE — *Compare with:* **temperature relay.**

thermally delayed overcurrent trip: *See:* **thermally delayed release (trip)** and **over-current release (trip).**

thermally delayed release (trip): A release delayed by a thermal device.
LVSwgD

threshold current (of a current-limiting fuse): A current magnitude of specified wave shape at which the melting of the current-responsive element occurs at the first instantaneous peak current for that wave shape.
HVF, Swg

NOTE — The current magnitude is usually expressed in rms amperes.

threshold ratio (of a current-limiting fuse): The ratio of the threshold current to the fuse current rating.
HVF, Swg

tie feeder: A feeder that connects together two or more independent sources of power and has no tapped load between the terminals.
SUB

NOTE — If a feeder has any tapped load between the two sources, it is designated as a multiple feeder.

tight (used as a suffix): So constructed that the specific material is excluded under specified conditions.
PSRC; HVS, Swg; HVS, Swg; SwgA

tilting-insulator switch: One in which the opening and closing travel of the blade is accomplished by a tilting movement of one or more of the insulators supporting the conducting parts of the switch.
HVS, Swg

time:

1) **response.** The time between initiating some operation and obtaining results.
2) **settling.** Time required by channel or terminal equipment to reach an acceptable operating condition.

SUB

time-current characteristic (of a fuse): *See:* **fuse time-current characteristic.**

time-current tests (of a fuse): *See:* **fuse time-current tests.**

time dial (time lever) (of a relay): An adjustable, graduated element of a relay by which, under fixed input conditions, the prescribed relay operating time can be varied.
PSRC

time history: The trace of acceleration, velocity, or displacement as a function of time that the ground, the floor of a building, or a point of support experiences due to an earthquake.
SUB

time-overcurrent relay: An overcurrent relay in which the input current and operating time are inversely related throughout a substantial portion of the performance range.
PSRC

time-undervoltage protection: A form of undervoltage protection that disconnects the protected equipment upon a deficiency of voltage after a predetermined time interval.
PSRC

timer, watchdog: A form of interval timer that is used to detect a possible malfunction.
SUB

timing relay (or relay unit): An auxiliary relay or relay unit whose function is to introduce one or more time delays in the completion of an associated function.
PSRC

tongs, fuse: Tongs provided with an insulating handle and jaws. Fuse tongs are used to insert the fuseholder or fuse unit into the fuse support or to remove it from the support.
HVF, Swg

torque control (of a relay): A method of constraining the pickup of a relay by preventing the torque-producing element from developing operating torque until another associated relay unit operates.
PSRC

torsional mechanism: An operating mechanism that transfers rotary motion by torsion through a pipe or shaft from the operating means to open or close the switching device.
HVS, Swg

total (asymmetrical) current: The combination of the symmetrical component and the dc component of the current.
LVSwgD; HVCB, Swg

total clearing time (of a fuse): *See:* **clearing time (2).**

transactor: A magnetic device with an air-gapped core having an input winding that is energized with an alternating current and having an output winding which produces a voltage that is a function of the input current.
PSRC

NOTE—The term *transactor* is a contraction of the words transformer and reactor.

transfer switch (a high-voltage switch): A switch arranged to permit transferring a conductor connection from one circuit to another without interrupting the current.

1) A tandem transfer switch is a switch with two blades, each of which can be moved into or out of only one contact.
2) A double-blade double-throw transfer switch is a switch with two blades, each of which can be moved into or out of either of two contacts.

HVS, SWg

NOTE—In contrast to high-voltage switches, many low-voltage, control and instrument transfer switches interrupt current during transfer. *Compare with:* **selector switch.** *Also compare with:* **automatic transfer (or throw-over) equipment** that connects a load to an alternate source after failure of an original source.

transfer trip: A form of remote trip in which a communication channel is used to transmit a trip signal from the relay location to a remote location.
PSRC

transformer overcurrent tripping: *See:* indirect release (trip) (of a switching device) and overcurrent release (trip).

transformer undercurrent tripping: *See:* indirect release and undercurrent release.

transformer voltage (of a network protector): The voltage between phases or between phase and neutral on the transformer side of a network protector.
LVSwgD

transient blocking: A circuit function that blocks tripping during the interval in which an external fault is being cleared.
PSRC

transient inrush current: Current that results when a switching device is closed to energize a capacitance or an inductive circuit.
HVCB, Swg

NOTE—Current is expressed by the highest peak value in amperes and frequency in hertz.

transient overvoltage: The peak voltage during the transient conditions resulting from the operation of a switching device.
HVCB, Swg

NOTE—The location and units of measurement are specified in apparatus standards. *Compare with:* transient overvoltage ratio (factor).

transient overvoltage ratio (factor): The ratio of the transient overvoltage to the closed-switching device operating line-to-neutral peak voltage with the load connected.
HVCB, Swg

NOTE—The location of measurement is specified in the apparatus standards.

transient recovery voltage (TRV): The voltage transient that occurs across the terminals of a pole of a switching device upon interruption of the current.
HVF, Swg; HVCB, Swg

NOTE—TRV is the difference between transient voltages to ground occurring on the terminals. The term *transient recovery voltage* is usually designated as TRV, and may refer to inherent TRV, modified inherent TRV, or actual TRV as defined elsewhere. In a multiple switching device, the term is usually applied to the voltage across the first pole to interrupt. For switching devices having several interrupting units in series, the term may be applied to the voltage across units or groups of units.

transient recovery voltage rate: The rate at which the voltage rises across the terminals of a pole of a circuit-switching device upon interruption of the current.
HVCB, Swg

NOTE—The transient recovery voltage rate is usually determined by dividing the voltage at one of the crests of the TRV by the time from current zero to that crest. In case no definite crest exists, the rate may be taken to some stated value usually arbitrarily selected as a certain percentage of the crest value of the normal-frequency recovery voltage. In case the transient is an exponential function, the rate may also be taken at the point of zero voltage. It is the rate of rise of the algebraic difference between the transient voltages occurring on the terminals of the switching device upon interruption of the current. The transient recovery voltage rate may be a circuit transient recovery voltage rate or a modified circuit transient recovery voltage rate, or an actual transient recovery voltage rate according to the type of transient from which it is obtained. When giving actual transient recovery voltage rates, the points between which the rate is measured should be definitely stated.

transient response (of a relay): The manner in which a relay, relay unit, or relay system responds to a sudden change in the input.
PSRC

transition compartment: The compartment specifically designed for joining gas-insulated substation equipment of different design or manufacture. This compartment provides the necessary transition for the current-carrying conductor and the gas enclosure.
SUB

transitional mode: The change from the non-operating to the operating mode, caused by switching the input to the relay from the non-operating to the operating input, or vice versa.
PSRC

transmissibility: Ratio of the response at any one point in the equipment to the input of the equipment at a single frequency.
SwgA

transmitter (radio): A device or circuit that generates high-frequency electric energy, controlled or modulated, which can be radiated by an antenna.
PSRC

transverse (differential) mode voltage: The voltage at a given location between two conductors of a group.
PSRC

travel (of a relay): The amount of movement in either direction (towards pickup or reset) of a responsive element.
PSRC

NOTE—Travel may be specified in linear, angular, or other measure.

trip (used as a noun)[4]:

1) A release that initiates either an opening or a closing operation or other specified action.
2) A release that initiates an opening operation only.
3) A complete opening operation.
4) The action associated with the opening of a circuit breaker or other interrupting device.

PSRC

trip (used as a verb)[4]:

1) To release in order to initiate either an opening or a closing operation or other specified action.
2) To release in order to initiate an opening operation only.
3) To initiate and complete an opening operation.

PSRC

trip or tripping (used as an adjective)[4]:

1) Pertaining to a release that initiates either an opening or a closing operation or other specified action.
2) Pertaining to a release that initiates an opening operation only.
3) Pertaining to a complete opening operation.

LVSwgD; HVCB, Swg

trip coil: *See:* **release (trip) coil (of a mechanical switching device).**

trip delay setting: *See:* **release-delay (trip-delay) setting.**

trip device (opening release), impulse: A trip device that is designed to operate only by the discharge of a capacitor into its release (trip) coil and is utilized on high speed circuit breakers to produce tripping times that are independent of *di*/*dt*.
LVSwgD

trip-free: The capability of a switching device to have the moving contacts return to and remain in the opening position when the opening operation is initiated after the initiation of the closing operation, even if the

[4]All terms employing *trip, tripping,* or their derivatives are referred to the term that expresses the intent of the usage.

closing force and command are maintained.
HVCB, Swg; R and S, Swg

NOTES

1—To ensure proper breaking of the current that may be established, it may be necessary for the contacts to momentarily reach the closed position.

2—If the release circuit is completed through an auxiliary switch, electrical release will not take place until such auxiliary switch is closed.

trip-free relay (release-free relay): An auxiliary relay whose function is to open the closing circuit of an electrically operated switching device so that the opening operation can prevail over the closing operation.
PSRC, HVCB, Swg

trip setting: *See:* **release (trip) setting.**

tripping delay: *See:* **release (tripping) delay (of a mechanical switching device).**

tripping mechanism: *See:* **release (tripping mechanism) (of a mechanical switching device).**

trussed blade (of a switching device): A blade that is reinforced by truss construction to provide stiffness.
HVS, Swg

tube (of a fuse): *See:* **fuse tube.**

undercurrent relay: A relay that operates when the current is less than a predetermined value.
PSRC

undercurrent release (trip): A release that operates when the current in the main circuit is equal to or less than the release setting.
R and S, Swg

undercurrent tripping: *See:* **undercurrent release (trip).**

underreaching protection: A form of protection in which the relays at a given terminal do not operate for faults at remote locations on the protected equipment, the given terminal being cleared either by other relays with different performance characteristics or by a transferred trip signal from a remote terminal similarly equipped with underreaching relays.
PSRC

undervoltage protection (low-voltage protection): A form of protection that operates when voltage is less than a predetermined value.
PSRC, LVSwgD

undervoltage relay: A relay that operates when its voltage is less than a predetermined value.
PSRC

undervoltage release (trip): A release that operates when the voltage of the main circuit is equal to less than the release setting.
LVSwgD, HVCB, Swg

undervoltage tripping: *See:* **undervoltage release (trip).**

unit (of a relay): *See:* **relay unit.**

unit operation (CO) (of a circuit breaker): *See:* **close-open operation (of a switching device).**

unit operation (of a recloser): An interrupting operation followed by a closing operation. The final interruption is also considered one unit operation.
R and S, Swg

unit substation: A substation consisting primarily of one or more transformers mechanically and electrically connected and coordinated in design with one or more switchgear or motor control assemblies or combination thereof.
HVCB, Swg

NOTE—A unit substation may be described as *primary* or *secondary* depending on the voltage rating of the low-voltage section: *primary*, more than 1000 V; *secondary*, 1000 V and below.

universal fuse links: Fuse links that, for each rating, provide mechanical and electrical interchangeability within prescribed limits over the specified time-current range.
HVF, Swg

update: The process of modifying or reestablishing data with more recent information.
SUB

uptime: The time during which a device or system is capable of meeting performance requirements.
SUB

vaportight: So enclosed that vapor will not enter the enclosure.
HVF, Swg

vent (of a fuse): The means provided for the escape of the gases developed during circuit interruption.
HVF, Swg

NOTE—In distribution oil cutouts, the vent may be an opening in the housing or an accessory attachable to a vent opening in the housing with suitable means to prevent loss of oil.

vented fuse (or fuse unit): A fuse with provision for the escape of arc gases, liquids, or solid particles to the surrounding atmosphere during circuit interruption.
HVF, Swg

ventilated enclosure: An enclosure provided with means to permit circulation of sufficientair to remove an excess of heat, fumes, or vapors.
SwgA

NOTE—For outdoor applications ventilating openings or louvres are usually filtered, screened, or restricted to limit the entrance of dust, dirt, or other foreign objects.

verification relay: A monitoring relay restricted to functions pertaining to power-system conditions and not involving opening circuit breakers during fault condition.
PSRC

NOTE—Such a relay is sometimes referred to as a check or checking relay.

vertical-break switch: A switch in which the travel of the blade is in a plane perpendicular to the plane of the mounting base. The blade in the closed position is parallel to the mounting base.
HVS, Swg

vertical reach switch: A switch in which the stationary contact is supported by a structure separate from the hinge-mounting base. The blade in the closed position is perpendicular to the hinge-mounting base.
RVS, Swg

vertical rod or shaft: A component of a switch-operating mechanism designed to transmit motion from an operating handle or power operator to a switch offset bearing or bell crank.
HVS, Swg

vertical section: That portion of the switchgear assembly between two successive vertical delineations. It may contain one or more units.
SwgA

vertical switchboard: A control switchboard composed only of vertical panels.
SwgA

NOTE—This type of switchboard may been closed or have an open rear. An enclosed vertical switchboard has an overall sheet-metal enclosure (not grille) covering back and ends of the entire assembly, access to which is usually provided by doors or removable covers.

vibrating-contact machine regulator: A regulator that varies the excitation of an electric machine by changing the average time of engagement of vibrating contacts in the field circuit.
LVSwgD

vibration relay: A relay that responds to the magnitude and frequency of a mechanical vibration.
PSRC

visible corona: A luminous discharge due to ionization of the air surrounding a device, caused by voltage gradient exceeding a certain critical value.
HVS, Swg

voltage balance relay: A balance relay that operates by comparing the magnitudes of two voltage inputs.
PSRC

voltage circuit: That part of the synthetic test circuit from which the major part of the test voltage is obtained.
HVCB, Swg

voltage class, rated nominal: The voltage to which operating and performance characteristics are referred.
LVSwgD

voltage, exciter-ceiling: The maximum voltage that may be attained by an exciter under specified conditions.
LVSwgD

voltage-injection method: A synthetic test method in which the voltage circuit is applied to the test circuit breaker after power frequency current zero.
HVCB, Swg

voltage-phase-balance protection: A form of protection that disconnects or prevents the connection of the protected equipment when the voltage unbalance of the phases of a normally balanced polyphase system exceed a predetermined amount.
PSRC

voltage, rated maximum interrupting of main contacts: The maximum dc voltage, including voltage induced in the machine field by current in the machine armature, at which the field discharge circuit breaker main contacts are required to interrupt the excitation source current. The magnitude of the dc component of the total voltage across the main contacts is equal to the displacement of the axis.
LVSwgD

voltage, rated short-time of main contacts: The highest dc voltage at which the circuit-breaker main contacts are required to interrupt exciter short-circuit current.
LVSwgD

voltage rating of a relay: The voltage at a specified frequency that may be sustained by the relay for an unlimited period without causingany of the prescribed limitations to be exceeded.
PSRC

voltage relay: A relay that responds to voltage.
PSRC

voltage restraint: A method of restraining the operation of a relay by means of a voltage input that opposes the typical response of the relay to other inputs.
PSRC; R and S, Swg

voltage-type telemeter: A telemeter that employs the magnitude of a single voltage as the translating means.
SUB

volts per hertz relay: A relay whose pickup is a function of the ratio of voltage to frequency.
PSRC

water vapor (moisture content): The amount of water in parts per million by volume that is in the gaseous state and mixed with the insulating gas. Water vapor content may vary with temperature.
SUB

way: A three-phase circuit entrance to a switch or bus; or for single-phase switches, single-phase entrance to a switch or bus.
R and S, Swg

withstand voltage: The specified voltage that, under specified conditions, can be applied to insulation without causing flashover or puncture.
LVSwgD

zero period acceleration: The peak acceleration experienced by a rigid, single-degree-of-freedom oscillator when it is subjected to the design earthquake either directly to its base or through an intervening structure.
SUB; SwgA

NOTE—Generally, a body can be considered rigid, for seismic excitation purposes, if its natural frequency is greater than 30 Hz. The peak acceleration for a body with a natural frequency greater than 30 Hz is the same as that of a body with an infinitely high natural frequency, or conversely, a body with an infinitely small period (zero period). On a response spectrum, the zero period acceleration is also equal to the asymptotic value of acceleration.

zero-phase-sequence relay: A relay that responds to the zero-phase-sequence component of a polyphase input quantity.
PSRC

zone (of a relay): *See:* **reach (of a relay).**

zone of protection (for relays): That segment of a power system in which the occurrence of assigned abnormal conditions should cause the protective relay system to operate.
PSRC