

Glossary of Terms

AC

(Alternating Current) Alternating current is electric current that alternates between a positive maximum value and a negative maximum value at a characteristic frequency, usually 50 or 60 cycles per second (Hertz).

AC Generator

AC generator is the preferred term for referring to a generator that produces alternating current (AC). See Alternator and Generator.

Acoustic Material

Acoustic material is any material considered in terms of its acoustic properties, especially its properties of absorbing or deadening sound.

Active Power

Active power is the real power (kW) supplied by the generator set to the electrical load. Active power creates a load on the set's engine and is limited by the power of the engine and efficiency of the generator. Active power does the work of heating, lighting, turning motor shafts, etc.

Air Circuit Breaker

An air circuit breaker automatically interrupts the current flowing through it when that current exceeds the trip rating of the breaker. Air is the medium of electrical insulation between electrically live parts and grounded (earthed) metal parts. Also see Power Circuit Breaker.

Air Cooled Engine

The engine of the generator is cooled only by air blown across it by a fan.

Annunciator

An annunciator is an accessory device used to give remote indication of the status of an operating component in a system. Annunciators are typically used in applications where the equipment monitored is not located in a portion of the facility that is normally attended. The NFPA has specific requirements for remote annunciators used in some applications, such as hospitals.

Alternator

Alternator is another term for AC generator.

Alternator Strip Heater

A small heater element mounted permanently in the generators winding or control box to provide a warm, moisture free environment. These are popular in coastal areas or where extreme cold may hamper controls from operating.

Amortisseur Windings

The amortisseur windings of a synchronous AC generator are the conductors embedded in the pole faces of the rotor. They are connected together at both ends of the poles by end rings. Their function is to dampen waveform oscillations during load changes.

Ampacity

Ampacity is the safe current-carrying capacity of an electrical conductor in amperes as defined by code.

Ampere

The ampere is a unit of electric current flow. One ampere of current will flow when a potential of one volt is applied across a resistance of one ohm.

Annunciator

An annunciator is the device that signals to the operator the condition of the generator. Typically, a standby generator includes some form of alarm light if the generator fails to perform as required, this is an annunciator. Horns, lights, bells all come under this category. Most manufacturers include some type of "local" annunciation which implies the device(s) are at the generator. Most also offer "remote" annunciation which mounts separate to the generator.

Apparent Power

Apparent power is the product of current and voltage, expressed as kVA. It is real power (kW) divided by the power factor (PF).

Armature

The armature of an AC generator is the assembly of windings and metal core laminations in which the output voltage is induced. It is the stationary part (stator) in a revolving-field generator.

ATS (Automatic Transfer Switch)-

Required by law when a generator is connected to a home or building when the normal power is provided by a Utility Company.

Authority Having Jurisdiction

The authority having jurisdiction is the individual with the legal responsibility for inspecting a facility and approving the equipment in the facility as meeting applicable codes and standards.

Backup Protection

Backup protection consists of protective devices which are intended to operate only after other protective devices have failed to operate or detect a fault.

Base Load

Base load is that portion of a building load demand which is constant. It is the “base” of the building demand curve.

Black Start

Black start refers to the starting of a power system with its own power sources, without assistance from external power supplies.

Block Heater/Oil Heater

Used to keep the engine block warm during periods when the engine is not running. Typically thermostatically controlled to only operate during temperatures below 40 degrees and wired to a Utility supply.

Bumpless Transition

Bumpless transition is make-before-break transfer of an electrical load from one source to another where voltage and frequency transients are kept to a minimum.

Bus

Bus can refer to the current-carrying copper bars that connect the AC generators and loads in a paralleling system, to the paralleled output of the AC generators in a system or to a feeder in an electrical distribution system.

CARB (California Air Research Board)

A state run board and regulatory agencies that now govern exhaust emissions from engines. The engines may be in cars, other equipment or generators. The overall effect is to reduce pollution.

Circuit

A circuit is a path for an electric current across a potential (voltage).

Circuit Breaker

A circuit breaker is a protective device that automatically interrupts the current flowing through it when that current exceeds a certain value for a specified period of time. See Air Circuit Breaker, Main Breaker, Molded Case Circuit Breaker and Power Circuit Breaker.

Contactor

A contactor is a device for opening and closing an electric power circuit.

Continuous Load

A continuous load is a load where the maximum current is expected to continue for three hours or more (as defined by the NEC for design calculations).

Continuous Power Rating

The continuous power rating is applicable for supplying power continuously to a load up to 100 percent of the base load engine rating for unlimited hours. No sustained overload capability is available at this rating. This rating is applicable for utility base load operation. In these applications, generator sets are operated in parallel with a utility source and run under constant loads for extended periods of time. (Equivalent to Continuous Power in accordance with ISO8528, ISO3046, AS2789, DIN6271 and BS5514.)

Cross Current Compensation

Cross current compensation is a method of controlling the reactive power supplied by AC generators in a paralleling system so that they share equally the total reactive load on the bus without significant voltage droop.

CT

(Current Transformer) Current transformers are instrument transformers used in conjunction with ammeters, control circuits and protective relaying. They usually have 5 ampere secondaries.

Current

Current is the flow of electric charge. Its unit of measure is the ampere.

Current Limiting Fuse

A current limiting fuse is a fast-acting device that, when interrupting currents in its current-limiting range, will substantially reduce the magnitude of current, typically within one-half cycle, that would otherwise flow.

Cycle

A cycle is one complete reversal of an alternating current or voltage—from zero to a positive maximum to zero again and then from zero to a negative maximum to zero again. The number of cycles per second is the frequency.

dB/dB(A) Scale

The decibel (dB) scale used in sound level measurements is logarithmic. Sound level meters often have several decibel weighting scales (A, B,C). The A-scale, dB(A), is the most commonly used weighting scale for measuring the loudness of noise emitted from generator sets.

Delta Connection

Delta connection refers to a three-phase connection in which the start of each phase is connected to the end of the next phase, forming the Greek letter D. The load lines are connected to the corners of the delta.

Demand Factor

The demand factor is the ratio of actual load to the potential total connected load.

Deviation Factor

The deviation factor is the maximum instantaneous deviation, in percent, of the generator voltage from a true sine wave of the same RMS value and frequency.

Dielectric Strength

Dielectric strength is the ability of insulation to withstand voltage without rupturing.

Direct Current (DC)

Direct current is current with no reversals in polarity.

Differential Relay

A differential relay is a protective device which is fed by current transformers located at two different series points in the electrical system. The differential relay compares the currents and picks up when there is a difference in the two which signifies a fault in the zone of protection. These devices are typically used to protect windings in generators or transformers.

Efficiency (EFF)

Efficiency is the ratio of energy output to energy input, such as the ratio between the electrical energy input to a motor and the mechanical energy output at the shaft of the motor.

Electronic (Isochronous) Governor-

A device that returns the engines speed to a nearly constant value. For generators, engine speed relates to the frequency, so a generator that always returns to 60 hertz (plus or minus a tolerance of .5%) does have an advantage over a mechanical governor that can vary the frequency typically up to 5%.

Emergency System

An emergency system is independent power generation equipment that is legally required to feed equipment or systems whose failure may present a life safety hazard to persons or property.

Energy

Energy is manifest in forms such as electricity, heat, light and the capacity to do work. It is convertible from one form to another, such as in a generator set, which converts rotating mechanical energy into electrical energy. Typical units of energy are kW•h, Btu (British thermal unit), Hp•h, ft•lbf, joule and calorie.

Exciter

An exciter is a device that supplies direct current (DC) to the field coils of a synchronous generator, producing the magnetic flux required for inducing output voltage in the armature coils (stator). See Field.

Fault

A fault is any unintended flow of current outside its intended circuit path in an electrical system.

Field

The generator field (rotor) consists of a multi-pole electromagnet which induces output voltage in the armature coils (stator) of the generator when it is rotated by the engine. The field is energized by DC supplied by the exciter.

Free Field (Noise Measurements)

In noise measurements, a free field is a field in a homogeneous, isotropic medium (a medium having the quality of transmitting sound equally in all directions) which is free of boundaries. In practice, it is a field in which the effects of the boundaries are negligible in the region of interest. In the free field, the sound pressure level decreases 6 dB each doubling of the distance from a point source.

Frequency

Frequency is the number of complete cycles per unit of time of any periodically varying quantity, such as alternating voltage or current. It is usually expressed as (Hz) Hertz or CPS (cycles per second).

Frequency Regulation

Frequency regulation is a measure that states the difference between no-load and fullload frequency as a percentage of full-load frequency.

Generator

A generator is a machine which converts rotating mechanical energy into electrical energy. See AC generator.

GFP

(Ground Fault Protection) A ground fault protection system is a system designed to limit the damage to equipment from line-to-ground fault currents.

Governor

A governor is a device on the engine which controls fuel to maintain a constant engine speed under various load conditions. The governor must have provision for adjusting speed (generator frequency) and speed droop (no load to full load).

Ground

A ground is a connection, either intentional or accidental, between an electrical circuit and the earth or some conducting body serving in place of the earth.

Grounding

Grounding is the intentional connection of the electrical system or the electrical equipment (enclosures, conduit, frames etc.) to earth.

Grounded Neutral

A grounded neutral is the intentionally grounded center point of a Y-connected, fourwire generator, or the mid-winding point of a single phase generator.

Ground Return

Ground return is a method of ground fault detection that employs a single sensor (CT) encircling the main bonding jumper between the power system neutral and ground. This device in itself is not capable of locating the faulted circuit but when used in conjunction with ground fault sensors on all feeders and source connections, can provide bus fault protection when properly coordinated (delayed).

Harmonics

Harmonics are voltage or current components which operate at integral multiples of the fundamental frequency of a power system (50 or 60 Hertz). Harmonic currents have the effect of distorting the shape of the voltage wave form from that of a pure sine wave.

Hertz (Hz)

The term Hertz is the preferred designation for cycles per second (CPS).

Hunting

Hunting is a phenomenon that can occur upon load changes in which the frequency or the voltage continues to rise above and fall below the desired value without reaching a steady-state value. It is caused by insufficient damping.

Insulation

Insulation is non-conductive material used to prevent leakage of electric current from a conductor. There are several classes of insulation in use for generator construction, each recognized for a maximum continuous-duty temperature.

kVA

(kilo-Volt-Amperes) kVA is a term for rating electrical devices. A device's kVA rating is equal to its rated output in amperes multiplied by its rated operating voltage. In the case of three-phase generator sets, kVA is the kW output rating divided by 0.8, the rated power factor. kVA is the vector sum of the active power (kW) and the reactive power (kVAR) flowing in a circuit.

kVAR

(kilo-Volt-Amperes Reactive) kVAR is the product of the voltage and the amperage required to excite inductive circuits. It is associated with the reactive power which flows between paralleled generator windings and between generators and load windings that supply the magnetizing currents necessary in the operation of transformers, motors and other electromagnetic loads. Reactive power does not load the generator set's engine but does limit the generator thermally.

kW

(kilo-Watts) kW is a term used for power rating electrical devices and equipment. Generator sets in the United States are usually rated in kW. kW, sometimes called active power, loads the generator set's engine.

kW•h

(kilo-Watt-hour) This is a unit of electric energy. It is equivalent to one kW of electric power supplied for one hour.

Lagging Power Factor

Lagging power factor in AC circuits (a power factor of less than 1.0) is caused by inductive loads, such as motors and transformers, which cause the current to lag behind the voltage. See Power Factor.

Leading Power Factor

Leading power factor in AC circuits (0.0 to -1.0) is caused by capacitive loads or overexcited synchronous motors which cause the current to lead the voltage. See Power Factor.

Leg

A leg is a phase winding of a generator, or a phase conductor of a distribution system.

Line-To-Line Voltage

Line-to-line voltage is the voltage between any two phases of an AC generator.

Line-To-Neutral Voltage

In a 3-phase, 4-wire, Y-connected generator, line-to-neutral voltage is the voltage between a phase and the common neutral where the three phases are tied together.

Load Factor

The load factor is the ratio of the average load to the generator set power rating.

Low Voltage

In the context of this manual, low voltage refers to AC system operating voltages from 120 to 600 VAC.

Main Breaker

A main breaker is a circuit breaker at the input or output of the bus, through which all of the bus power must flow. The generator main breaker is the device, usually mounted on the generator set, that can be used to interrupt generator set power output.

Medium Voltage

In the context of this manual, medium voltage refers to AC system operating voltages from 601 to 15,000 VAC.

Molded Case Circuit Breaker

A molded case circuit breaker automatically interrupts the current flowing through it when the current exceeds a certain level for a specified time. Molded case refers to the use of molded plastic as the medium of electrical insulation for enclosing the mechanisms and for separating conducting surfaces from one another and from grounded (earthed) metal parts.

Motoring

In paralleling applications, unless a generator set is disconnected from the bus when its engine fails (usually as a result of a fuel system problem), the generator will drive (motor) the engine, drawing power from the bus. Reverse power protection which automatically disconnects a failed set from the bus is essential for paralleling systems. Also, in certain applications such as elevators, the load can motor the generator set if insufficient additional load is present.

NEC

(National Electrical Code) This document is the most commonly referenced general electrical standard in the United States.

NEMA

(National Electrical Manufacturers Association)

Neutral

Neutral refers to the common point of a Y-connected AC generator, a conductor connected to that point or to the mid-winding point of a single-phase AC generator.

NFPA

(National Fire Protection Association)

Nonlinear Load

A nonlinear load is a load for which the relationship between voltage and current is not a linear function. Some common nonlinear loads are fluorescent lighting, SCR motor starters and UPS systems. Nonlinear loads cause abnormal conductor heating and voltage distortion.

Octave Band

In sound pressure measurements (using an octave band analyzer), octave bands are the eight divisions of the measured sound frequency spectrum, where the highest frequency of each band is twice that of its lowest frequency. The octave bands are specified by their center frequencies, typically: 63, 125, 250, 500, 1,000, 2,000, 4,000 and 8,000 Hz (cycles per second).

Ohm

The ohm is a unit of electrical resistance. One volt will cause a current of one ampere to flow through a resistance of one ohm.

One-Line Diagram

A one-line diagram is a schematic diagram of a three-phase power distribution system which uses one line to show all three phases. It is understood when using this easy to read drawing that one line represents three.

Out-Of-Phase

Out-of-phase refers to alternating currents or voltages of the same frequency which are not passing through their zero points at the same time.

Overload Rating

The overload rating of a device is the load in excess of the nominal rating the device can carry for a specified length of time without being damaged.

Overshoot

Overshoot refers to the amount by which voltage or frequency exceeds the nominal value as the voltage regulator or governor responds to changes in load.

Parallel Operation

Parallel operation is the operation of two or more AC power sources whose output leads are connected to a common load.

Peak Load

Peak load is the highest point in the kilowatt demand curve of a facility. This is used as the basis for the utility company's demand charge.

Peak Shaving

Peak shaving is the process by which loads in a facility are reduced for a short time to limit maximum electrical demand in a facility and to avoid a portion of the demand charges from the local utility.

Phase

Phase refers to the windings of an AC generator. In a three-phase generator there are three windings, typically designated as A-B-C, R-S-T or U-V-W. The phases are 120 degrees out of phase with each other. That is, the instants at which the three phase voltages pass through zero or reach their maximums are 120 degrees apart, where one complete cycle is considered 360 degrees. A single-phase generator has only one winding.

Phase Angle

Phase angle refers to the relation between two sine waves which do not pass through zero at the same instant, such as the phases of a three-phase generator. Considering one full cycle to be 360 degrees, the phase angle expresses how far apart the two waves are in relation to a full cycle.

Phase Rotation

Phase rotation (or phase sequence) describes the order (A-B-C, R-S-T or U-V-W) of the phase voltages at the output terminals of a three-phase generator. The phase rotation of a generator set must match the phase rotation of the normal power source for the facility and must be checked prior to operation of the electrical loads in the facility.

Pitch

Pitch is the ratio of the number of generator stator winding slots enclosed by each coil to the number of winding slots per pole. It is a mechanical design characteristic the generator designer may use to optimize generator cost versus voltage wave form quality.

Pole

Pole is used in reference to magnets, which are bipolar. The poles of a magnet are designated North and South. Because magnets are bipolar, all generators have an even number of poles. The number of poles determines how fast the generator will have to be turned to obtain the specified frequency. For example, a generator with a 4-pole field would have to be run at 1800 rpm to obtain a frequency of 60 Hz (1500 rpm for 50 Hz). Pole can also refer to the electrodes of a battery or to the number of phases served by a switch or breaker.

Power Circuit Breaker

A power circuit breaker is a circuit breaker whose contacts are forced closed via a spring-charged, over-center mechanism to achieve fast closing (5-cycle) and high withstand and interrupting ratings. A power circuit breaker can be an insulated case or power air circuit breaker.

Power

Power refers to the rate of performing work or of expending energy. Typically, mechanical power is expressed in terms of horsepower and electrical power in terms of kilowatts. One kW equals 1.34 hp.

Power Factor (PF)

The inductances and capacitances in AC circuits cause the point at which the voltage wave passes through zero to differ from the point at which the current wave passes through zero. When the current wave precedes the voltage wave, a leading power factor results, as in the case of capacitive loads or overexcited synchronous motors. When the voltage wave precedes the current wave, a lagging power factor results. This is generally the case. The power factor expresses the extent to which the voltage zero differs from the current zero. Considering one full cycle to be 360 degrees, the difference between the zero points can then be expressed as an angle. Power factor is calculated as the cosine of the angle between zero points and is expressed as a decimal fraction (.8) or as a percentage (80%). It is the ratio of kW and kVA. In other words $kW = kVA \times PF$.

Prime Power Rating

The prime power rating is applicable when supplying electric power in lieu of commercially purchased power. Prime power is available for an unlimited number of annual operating hours in variable load applications. Applications requiring any utility parallel operation at constant load are subject to running time limitations. In variable load applications, the average load factor should not exceed 70 percent of the Prime Power Rating. A 10 percent overload capability is available for a period of 1 hour within a 12 hour period of operation, but not to exceed 25 hours per year. The total operating time at the Prime Power Rating must not exceed 500 hours per year. (Equivalent to Prime Power in accordance with ISO8528 and Over Load Power in accordance with ISO3046, AS2789, DIN6271 and BS5514.)

Radio Interference

Radio interference refers to the interference with radio reception caused by a generator set.

Radio Interference Suppression

Radio interference suppression refers to the methods employed to minimize radio interference.

Reactance

Reactance is the opposition to the flow of current in AC circuits caused by inductances and capacitances. It is expressed in terms of ohms and its symbol is X.

Reactive Power

Reactive power is the product of current, voltage and the sine of the angle by which current leads or lags voltage and is expressed as VAR (volts-amperes-reactive).

Real Power

Real power is the product of current, voltage and power factor (the cosine of the angle by which current leads or lags voltage) and is expressed as W (watts).

Resistance

Resistance is the opposition to the flow of current in DC circuits. It is expressed in ohms and its symbol is R.

RMS

(Root Mean Square) The RMS values of a measured quantity such as AC voltage, current and power are considered the “effective” values of the quantities. See Watt.

Rotor

A rotor is the rotating element of a motor or generator.

RPM

(Revolutions Per Minute)

SCR

(Silicon Controlled Rectifier) A SCR is a three-electrode solid-state device which permits current to flow in one direction only, and does this only when a suitable potential is applied to the third electrode, called the gate.

Selective Coordination

Selective coordination is the selective application of overcurrent devices such that short circuit faults are cleared by the device immediately on the line side of the fault, and only by that device.

Service Entrance

The service entrance is the point where the utility service enters the facility. In low voltage systems the neutral is grounded at the service entrance.

Short Circuit

A short circuit is generally an unintended electrical connection between current carrying parts.

Shunt Trip

Shunt trip is a feature added to a circuit breaker or fusible switch to permit the remote opening of the breaker or switch by an electrical signal.

Sine Wave

A sine wave is a graphical representation of a sine function, where the sine values (usually the y axis) are plotted against the angles (x axis) to which they correspond. AC voltage and current wave shapes approximate such a curve.

Soft Loading

Soft loading refers to the ramping of load onto or off of a generator in a gradual fashion for the purpose of minimizing voltage and frequency transients on the system.

Sound

Sound is considered both in terms of the sound pressure waves travelling in air (pressures superimposed on the atmospheric pressure) and the corresponding aural sensation. Sound can be “structure-borne”, that is, transmitted through any solid elastic medium, but is audible only at points where the solid medium “radiates” the pressure waves into the air.

Sound Level Meter

A sound level meter measures sound pressure level. It has several frequencyweighted decibel (dB) scales (A, B, C) to cover different portions of the range of measured loudness. Sound level meters indicate RMS sound, unless the measurements are qualified as instantaneous or peak sound level.

Sound Pressure Level (SPL)

Sound pressure level refers to the magnitude of the pressure differential caused by a sound wave. It is expressed on a dB scale (A,B,C) referenced to some standard (usually 10-12 microbars).

Standby Power Rating

The standby power rating is applicable to emergency power applications where power is supplied for the duration of normal power interruption. No sustained overload capability is available for this rating. (Equivalent to Fuel Stop Power in accordance with ISO3046, AS2789, DIN6271 and BS5514.) This rating is applicable to installations served by a reliable normal utility source. This rating is only applicable to variable loads with an average load factor of 80 percent of the standby rating for a maximum of 200 hours of operation per year. In installations served by unreliable utility sources (where outages last longer and occur more frequently), where operation will likely exceed 200 hours per year, the prime power rating should be applied. The standby rating is only applicable to emergency and standby applications where the generator set serves as the back-up to the normal utility source. No sustained utility parallel operation is permitted with this rating. For applications requiring sustained utility parallel operation, the prime power or base load rating must be utilized.

Standby System

A standby system is an independent power system that allows operation of a facility in the event of normal power failure.

Star Connection

See Wye Connection.

Starting Current

The initial value of current drawn by a motor when it is started from standstill.

Stator

The stator is the stationary part of a generator or motor. See Armature.

Surge

Surge is the sudden rise in voltage in a system, -usually caused by load disconnect.

Surge Suppressor

Surge suppressors are devices capable of conducting high transient voltages. They are used for protecting other devices that could be destroyed by the transient voltages.

Synchronization

In a paralleling application, synchronization is obtained when an incoming generator set is matched with and in step to the same frequency, voltage, and phase sequence as the operating power source.

Synchronous Generator

A synchronous generator is an AC generator having a DC exciter. Synchronous generators are used as stand-alone generators for emergency power and can also be paralleled with other synchronous generators and the utility system.

Telephone Influence Factor (TIF)

The higher harmonics in the voltage wave shape of a generator can cause undesirable effects on telephone communications when power lines parallel telephone lines. The telephone influence factor is calculated by squaring the weighted RMS values of the fundamental and the non-triple series of harmonics, adding them together and then taking the square root of the sum. The ratio of this value to the RMS value of the no-load voltage wave is called the **Balanced TIF**. The ratio of this value to three times the RMS value of the no-load phase-to-neutral voltage is called the **Residual Component RIF**.

Transformer

A transformer is a device that changes the voltage of an AC source from one value to another.

Undershoot

Undershoot refers to the amount by which voltage or frequency drops below the nominal value as the voltage regulator or governor responds to changes in load.

Utility

The utility is a commercial power source that supplies electrical power to specific facilities from a large central power plant.

Volt

The volt is a unit of electrical potential. A potential of one volt will cause a current of one ampere to flow through a resistance of one ohm.

Voltage Dip

Voltage dip is the dip in voltage that results when a load is added, occurring before the regulator can correct it, or resulting from the functioning of the voltage regulator to unload an overloaded engine-generator.

Voltage Regulation

Voltage regulation is a measure that states the difference between maximum and minimum steady-state voltage as a percentage of nominal voltage.

Voltage Regulator

A voltage regulator is a device that maintains the voltage output of a generator near its nominal value in response to changing load conditions.

Watt

The watt is a unit of electric power. In direct current (DC) circuits, wattage equals voltage times amperage. In alternating current (AC) circuits, wattage equals effective (RMS) voltage times effective (RMS) amperage times power factor times a constant dependent on the number of phases. 1,000 watts equal one kW.

Wye Connections

A Wye connection is the same as a star connection. It is a method of interconnecting the phases of a three-phase system to form a configuration resembling the letter Y. A fourth (neutral) wire can be connected at the center point.

Zero Sequence

Zero sequence is a method of ground fault detection that utilizes a sensor (CT) that encircles all the phase conductors as well as the neutral conductors. The sensor will produce an output proportional to the imbalance of current ground fault in the circuit. This output is then measured by a relay to initiate circuit breaker tripping or ground fault alarm.

Zones of Protection

Zones of protection are defined areas within a distribution system that are protected by specific groups of protective sensing and interrupting devices.