Jargon Buster

The no-nonsense guide to generating sets for specifiers, students and engineers

ISSUE 5



WHO ARE AMPS?

AMPS is The Association of Manufacturers and Suppliers of Power generating Systems. We are the recognised voice of the generating set industry representing world leading manufacturers and suppliers in the UK and across Europe.

Our members design, commission, manufacture and maintain generating sets, power generation systems and components which are trusted globally for emergency backup, standby, prime power and numerous other applications.

Our members vary in scale from global FTSE 100-listed companies to micro businesses, but what all have in common is a commitment to the generating set industry and an understanding that raising standards, ensuring best-practice and safeguarding the future of our sector is best realised through a professional trade body promoting a culture of co-operation and teamwork.

AMPS was incorporated in 1989 and has been providing technical guidance, lobbying support, networking opportunities and best-practice assistance for our members, the industry and all those who need our input – including National Grid, the Department for Business and Trade and EUROPGEN – ever since.

If you need a generating set, you need an AMPS member. To find out more about our work please visit **www.amps.org.uk**

AMPS TECHNICAL COMMITTEE

The Technical Committee is a collective of technically minded experts from within the AMPS Membership. Together, they provide a formidable resource and wide range of invaluable services to AMPS Members, the power generation industry and the wider world.

This remit includes:

- Acting as a technical and knowledge-sharing resource to answer member queries and concerns
- Providing information and guidance to the likes of the National Grid, UK Government and European Parliament (via Europgen)
- Conducting research into the latest regulations, applications and technologies
- Using their expertise to deliver authoritative papers, white papers and publications
- Being part of the consultation process for important industry changes such as G59 grid code legislation

AMPS Members are fortunate to have anytime access to their knowledge, as well as the opportunity to join the Technical Committee if they have their own expertise to offer.

If you would like more information about the Technical Committee please contact **amps@amps.org.uk**

Mission Statement:

> **To help our members influence, communicate and understand the relevant technical standards for our industry**



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WELCOME TO THE 5TH EDITION OF JARGON BUSTER



Due to popular demand and universal interest, we are pleased to announce the release of the fifth edition of the AMPS Jargon Buster in virtual format. The Jargon Buster has long been a favoured publication with consultants, members, and customers alike, so we are delighted to launch this amended version for all to use. Whether you are an apprentice, an engineer, a consultant, or a buyer, we believe the Jargon Buster has information that can assist you in understanding the workings and terminology around generators.

It is an easy-to-use source of information that can be downloaded from the AMPS website and has been reviewed by our Technical Committee to ensure it is the most updated industry version available. We hope you make use of it and, as always, we welcome feedback and updates on how we can make it even better in the future.

David Oates,
AMPS Director General

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Why join AMPS?

1. UNDERSTANDING AMPS

Did you know….

Our members are amongst the most successful exporters of diesel & gas engine driven electrical generating systems in the world.

…And here are 9 more good reasons to join AMPS

2. INFLUENCING

Would association with an organisation renowned for quality and professionalism improve your exporting prospects?

Did you know…

- Our members are amongst the most successful exporters of diesel & gas engine driven electrical generating systems in the world
- AMPS Director General is the chair of EUROPGEN – the European Generating Set Association; and AMPS are associate members of EGSA – the Electrical Generating Systems Association of America; and BEAMA – the British Electrotechnical and Allied Manufacturers Association
- AMPS Technical Committee provide a formidable resource and wide range of invaluable services to AMPS Members, the power generation industry and the wider world

3. PROMOTING

Are you looking to access exciting business development opportunities or raise your profile in new markets?

Did you know…

- As a member you will have unlimited opportunity to network with over 110 respected companies at a range of events throughout the year including Annual Conference and Awards Dinner plus informal activities such as Golf Days
- AMPS regularly features and shares news about its members on the website, social media and the quarterly AMPS Power Magazine
- Frequent opportunities to attend exhibitions as both visitors and exhibitors as members of the AMPS network
- Member Directory – Make it easy for your customers to find your business by featuring in the popular essential directory – in print and online

4. CONNECTING

Would you benefit from sharing ideas and co-operating on new initiatives?

Did you know…

- Our monthly bulletins and quarterly magazines provide a unique opportunity to build partnerships with like minded businesses
- Affiliated with Key Associations (see point 6 below)
- Technical Committee – Join and gain access to our expert technical committee that meets 4 times a year. The committee also releases expert guides for end-users, specifiers and members

5. DEVELOPING

Would access to up-to-date technical legislation or quality based training strengthen your expertise?

Did you know…

- Our technical meetings provide input to Standards and Regulation bodies and provide the latest information on EU Directives and BSI, ISO and IEC Standards
- You could benefit from regular exchanges of technical information between members
- AMPS Training – a complete industry driven course for generating set technicians to help bridge the Knowledge Gap

6. BELONGING

Would you like to be part of an organisation that is the respected voice in the industry?

Did you know…

- Member Logo – Display the AMPS member logo on your website and materials as a hallmark of quality and commitment to the industry
- AMPS members are part of an invaluable network of key industry decision makers
- From feature articles in the trade press to press release stories taken up in the biggest national newspapers, AMPS marketing team works hard to further the standing of the sector
- Affiliated with Key Associations – We have established ties with the REA, CIBSE, FMJ, BIFM, CEA and FMA so that our members can benefit from networking, expertise and joint events

7. CELEBRATING

- AMPS Conference – An annual industry highlight where AMPS Members and guests gather to discuss and resolve issues – and celebrate achievement
- AMPS Awards

8. SUPPORTING

- Ask AMPS
- Tech Committee

9. GIVING

- Charity support
- Partnerships with organisations such as Primary Engineer; developing the next generation of engineers

10. PIONEERING

Influencing diverse areas such as grid codes, legislation, regulations and standards. For example RoHS, where AMPS are currently working on obtaining relief from the requirements to remove lead from engine bearings. Work is also being performed on consultations for WEEE, Machinery Directive, Medium Combustion Power Directive, NRMM Stage V engine emissions and Outdoor Noise Directive. New Grid Codes such as RfG are also being negotiated.

If you have any questions about joining AMPS then please don't hesitate to contact us by email, phone or mail using the details below. If you prefer, we'll even send a member of AMPS to your head office to discuss the benefits of joining face-to-face.

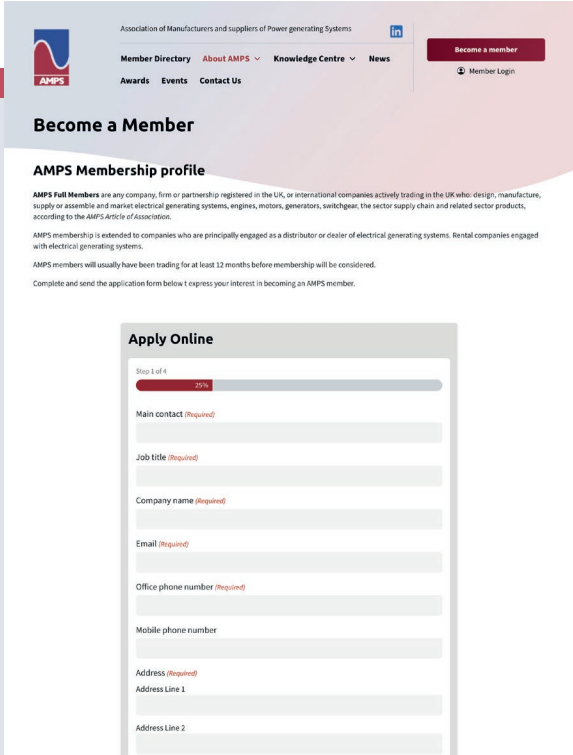
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WANT TO BECOME A MEMBER?

Simply visit
www.amps.org.uk/join-amps
and fill out the form online

www.amps.org.uk



10 Good reasons to consider when specifying a gen set

1. What is the application?

What kind of generating set is required? What type do you need? There are many, and clarity at the outset helps you look in the right places, and saves you time. Is it for mobile use, or permanently installed? Is it for standby use as a back-up to the mains, or will it be the prime source of electricity? Is it to be used occasionally or constantly in use? Residential or commercial, and so on, these are all considerations that assist you with identifying the right supplier and finding the right solution.

2. What power is required?

Knowing the application is a starting point, but equally to specify any generating set can only be done by establishing how much power that it (or they) are required to provide. There are many ways of calculating power requirements, from simply adding up the connected load, to calculating its diversity of use over time, to considerations of the maximum demand.

You should consider power in terms of both real (kWe) and apparent (kVA) power, the difference is known as the power factor* and generating sets are specified by convention at 0.8pf – so a 500 kVA Generating Set may only provide 400 kWe of power. In considering the power, you should also consider the way in which the power is required.

Generating sets can only provide a portion of their rating in a single go (known as a load step) – if you require a lot of power all at one step, this may affect the size of the generating set or you may find it more economic to consider staging the power demand. Some equipment – e.g. motors and pumps – also have differing loads when they are first started (a typical motor may present a load six times of its running current and two and a half times its running power); this must also be considered.

*A more detailed definition may be found in the Frequently Used Industry Terms section which starts on page 11.

3. What performance characteristics are required?

Electrical equipment is sensitive to changes in supply, both in terms of voltage and frequency. When specifying a generating set you need to know how sensitive your equipment is and what disturbance level it can withstand. Generating sets are supplied at a number of performance classes which define their stability for voltage and frequency under steady load conditions and also under conditions of changing load.

Detail is given on these classes in BS ISO 8528 Part 1 (a summary of these standards can be found on pages 54-60).

4. What rating is required?

Engines have different power ratings depending on how they are to be used. An engine will have a different rating if it is to be used constantly rather than if it is to be used only occasionally in emergency situations. The basic ratings are known as:

- COP (Continuous Operating Power)
- PRP (Prime Rate Power)
- LTP (Limited Time Power)
- ESP (Emergency Stand-by Power

The difference between these four ratings for an engine can be as high as 30% of the engine rating. It is therefore important that you select the right rating for your application. Details on these ratings are given in BS ISO 8528 Part 1 (page 55).

5. What fuel is the generating set to use?

Generating sets can be powered by a wide variety of fuels including Diesel, BioDiesel, Petrol, Natural Gas and LPG. The most common fuel for standby power is diesel, owing principally to storage stability, cost and availability.

The type of fuel determines the type of engine. N.B. Particular care must be taken with BioDiesel or BioDiesel-blends as it can degrade in storage and cause the generating set to fail. Special fuel cleaning or 'polishing' may be considered (page 16).

6. What are the ambient conditions?

The ambient temperature, and altitude and even humidity in coastal locations, will affect the performance of a generating set and its constituent components.

High temperatures and altitudes can limit power whilst low temperatures can result in difficulties in starting. The full range of ambient conditions over which the generating set is expected to operate must be taken into consideration.

7. What autonomy is the generating set required to have?

The autonomy of a generating set is how long it is expected to be able to run, with or without human intervention. It is normally expressed in hours against load (e.g. the generating set must run for 72 hours at Full Load). This affects the size of fuel storage (and therefore the physical size of the generating set

as a whole) and other aspects such as cooling and lubricating oil systems.

8. What standards or regulations is the generating set required to comply with?

A key consideration for any generating set is what standards it is required to comply with. For generating sets being supplied into the EU, many of these will be product-based and encompassed under the requirements of CE Marking, such as the Machinery Directive, Low Voltage Directive, and more (reference to these and others can be found on pages 54-60). In addition it is important to know of others which are specific to an application or locale-based, such as emissions, noise or fuel storage regulations, especially where generating sets are to parallel (synchronize) with the main utility.

9. What are the requirements of the physical environment that the generating set is to go in?

Generating sets have many inherent hazards. It is therefore important that where they are to be sited or installed is considered. Generating sets may increase the fire risks, due to presence of heat and fuels – how will that be managed? Building Regulations give much guidance on installation of generating sets in buildings, and state what must be achieved; indeed planning permission may be required. They cause environmental risks due to the stored fluids, fuel, coolant etc. How will this be managed?

In the UK, the Pollution Prevention Guidelines give much guidance on this subject. Generating sets produce hot exhaust gases – where will these be discharged to prevent risk to people or the environment? They are very noisy – what noise can be accepted on site or remote from the site? Much legislation applies to this both in the UK and across Europe. They require access for maintenance and fuel deliveries etc. – how will this be managed?

10. How is the generating set to electrically interface with the site?

The generating set has to be connected to the physical equipment it is to support. What are the basic requirements of this – what voltage, what frequency? Will the interface be automatic, manually operated, and will there be paralleling with other sources of generation? Another generating set or the mains? Regardless it is also essential that the electrical protection of the generating set, the equipment it is connected to and people using it are considered and appropriately provided for.

It is essential that all electrical work is carried out by suitably qualified personnel. It will involve determining what protective devices are required, together with arrangements for protective earthing, neutral earth referencing. When supplies from different sources are present (e.g. a generating set and the mains supply); they can never be allowed to operate in parallel to a piece of equipment without appropriate switching equipment permitting them to do so.

Our member companies join AMPS for many reasons but commitment to the Trade Association is a good indication that they are also committed to the industry and their reputation. If you need advice, information or suppliers then approaching AMPS is probably your best first step.

AMPS

GOT A QUESTION ON POWER GENERATION?

www.amps.org.uk

Frequently Used Industry Terms A-B

Term	Definition
AC generator	Electrical generator that produces alternating current (correct term).
Active power	AC power with a unity power factor. measured in Watts.
Air Circuit Breaker	Circuit breaker using air as the arc extinguishing media (ACB). see also Circuit Breaker.
Alternator	Electrical generator that produces alternating current (non-preferred, obsolete term).
Amortisseur winding	See Damper Winding
Analogue controls	Controls using variable voltage or current to pass information.
Apparent Power	The product of current and voltage in an alternating current circuit which has a reactive element.
Approved Body	UKAS accredits conformity assessment bodies (CABs) to enable them to be appointed as Approved Bodies where required for UKCA certification. The term 'Approved Body' includes other categories of appointment such as Designated Body, Technical Assessment Body (TAB) and Recognised Third-Party Organisation (RTPO).
Arc Flash	Arc Flash is the result of a rapid release of energy due to an arcing fault between a conductor and another conductor or neutral or a ground. During an arc fault the air is the conductor. Arc faults are generally limited to systems where the bus voltage is in excess of 120 volts. Lower voltage levels normally will not sustain an arc. An arc fault is similar to the arc obtained during electric welding and the fault has to be manually started by something creating the path of conduction or a failure such as a breakdown in insulation.
Armature	The assembly of windings and iron core in which the generator output is produced. Sometimes referred to as the Stator to avoid confusion.
Asynchronous	Term applied to motors or generators which operate at a speed not fixed by poleage and the supply frequency. (i.e. an induction generator or induction motor). See Slip
ATEX	ATEX is an acronym for a series of EU Directives describing what equipment and work environment is allowed in an environment with an explosive atmosphere. The ATEX 137 workplace directive 99/92/EC has been enacted in the UK as DSEAR. The term ATEX has been derived from the French: Atmospheriques Explosives.
Attenuators	Devices for reduction of the emission of sound.
Auto Transformer Starter	Transformer switching arrangement to reduce voltage applied to an electric motor during starting.
Automatic Mains Failure	Referring to the duty of a generating set to start and take over the load on indication of mains electricity failure. Also often referring to the build of control panel used, e.g. AMF Panel.
Automatic Transfer Switch	A device used to automatically switch a power supply from normal to emergency when a power failure occurs (ATS).
Automatic Voltage Regulator	Device used to control the voltage of an ac generator by sensing the terminal voltage and varying the field current.
AVR droop	AVR voltage reference is reduced as VAr increases.
Backup protection	Type of protection intended to operate only after the main protective device(s) has failed to operate.

Frequently Used Industry Terms B-C

Term	Definition
Bar	The bar is a metric unit of pressure, but not part of the International System of Units (SI)., where the equivalent is now pascal (1 bar = 1000000 Pa)
Base load	The portion of load of a generator or building which is constant. Alternatively referring to a constant generator output when in parallel with the grid
Bedplate	Metal fabricated structure to support the engine, generator, radiator etc. of a generating set or other plant. Also known as a baseplate
Berm	Ridge or embankment separating two areas. Often used alongside rivers as flood prevention. Also used around sites to provide visual and noise separation. A continuous berm enclosing an area is a bund.
BioDiesel	Diesel fuel with all or part content derived from vegetable and / or animal oils.
Black start	Refers to starting of a power system without the use of an external power source. (But internal power such as dc control and start power is available)
Bonding	Bonding is the connection of two or more conductive objects to one another by means of a conductor such as a wire
Brown out	An intentional or unintentional drop in voltage in the utility mains power supply. Intentional brownouts are used for load reduction in an emergency. The reduction may last for minutes or hours, as opposed to short-term voltage sag (or dip) lasting seconds caused by other factors. It is known that such voltage drops can be harmful to certain sensitive electrical devices, such as computers; therefore accentuating the importance of a resilient back up regime including a generating set for a business.
Bulk tank	A large storage tank from which the generating set may take its immediate supply of fuel. The bulk tank generally is the receiving tank for fresh fuel supply. The bulk tank may be used to provide a supply to a day tank, then to the generating set.
Bund	In civil engineering terms, a wall or bank enclosing an area, often to provide secondary containment. Often seen around tank farms. See also Berm
Bunding	Bunding, also called a bund wall, is a constructed retaining wall or bank around storage, to provide secondary containment in the event of leaks etc. Generally seen around large tank farms, but can be used around smaller tanks. Smaller tanks can have integral bunds, often called twin skin or twin wall tanks or "self bunded tanks". Bunding of fuel tanks is generally required for tank volumes above 200 litres. Containerised generating sets are often bunded by sealing of the container floor.
Busbar	Copper or aluminium (usually rigid) conductors of rectangular, square, round or hollow section, to inter-connect high current circuits in a switchboard or building.
CE Marking	CE stands for "Conformité Européenne" - European Certification Standards and Markings. Not all products must have CE marking. It is compulsory only for most of the products covered by the New Approach Directives. It is forbidden to affix CE marking to other products. It must be noted that a CE marking does not indicate that a product have been approved as safe by the EU or by another authority. It does not indicate the origin of a product either. CE Marking confirms that the Product complies with all applicable EU product legislation.
Check Synchroniser	Synchroniser used to check the operation of automatic or manual synchronisation. See Synchroniser

Frequently Used Industry Terms C-D

Term	Definition
Circuit	An electrical circuit is a path in which electrons from a voltage or current source flow. Thus the circuit must be a closed loop. In general an electrical circuit is an interconnection of electrical elements such as resistors, inductors, capacitors, transmission lines, switches etc. with a power source and a closed loop return path for the current.
Circuit Breaker	A protective device to interrupt the flow of current in a circuit when the current level exceeds a certain value. (CB). It is normally rated to interrupt fault current. Many devices include the protection relay etc. to make this an automatic circuit breaker.
Close Fit	A generic term for an enclosure or canopy which is designed to fit onto the base frame of the generating set; these may be sound proofed or simply weather protected.
Combined Cycle Gas Turbine	Power plant (CCGT) where the exhaust heat from the turbine(s) is turned into steam which us is used to generate power in a steam turbine. Thereby increasing the overall efficiency of the plant.
Combined Heat and Power	Use of a generating set or sets for the purpose of utilising the heat produced (via the exhaust and the radiator) as well as producing electricity. Thereby increasing the overall efficiency of the plant.
Commutator	A rotary electrical switch in dc electrical generators which periodically reverses the current direction between the rotor and the stationary circuit, in order to provide steady direct current. Similarly used in dc motors.
Compound generator	A generator whose excitation system takes elements of both voltage and current, or derivatives of these in order to give the required level of excitation to the main field.
Connection Agreement	A contract between the Distribution Network Operator and the Generator, which includes the specific technical requirements for the Power Generating Module and the relevant requirements for the Power Generating Facility.
Connection Point	The interface at which the Power Generating Module or Generator's Installation is connected to a Distribution Network, as identified in the Connection Agreement.
Contactor	An electrically operated heavy current switching device. Unlike a Circuit Breaker, a contactor is not intended to interrupt a fault current
Container	Usually taken to mean an ISO Shipping Container, often used as an Enclosure for a Generating Set and / or its ancillaries. Also known as an Intermodal Container.
Cross current compensation	System whereby the current loading of a generator in parallel with another is used to adjust the excitation of the second generator, so that the two generators share the load current equally, with minimum impact on the combined voltage level.
Current transformer	A current transformer (CT) will produce a current, in its isolated secondary circuit proportional to the current in the main circuit being measured. Standard currents in the secondary are 1 A and 5 A at the rated primary current.
Cycle	The complete reversal of an alternating current or voltage, from zero to positive maximum down to negative maximum and back to zero.
Damper winding	Windings embedded in the pole faces of a synchronous generator, whose function is to dampen oscillations of the rotor due to cyclic irregularity and effect of load changes. A more common term for amortisseur winding.
Day tank	A small storage tank from which the generating set takes its immediate supply of fuel. Often built into the skid of the generator

Frequently Used Industry Terms D

Term	Definition
Deflection tolerance	Term used in specifying vibration mounts.
Delta	Usually associated with a winding connection configuration of a transformer or electrical rotating machine, where the three phase-coils are connected in series in a Δ (delta) configuration. There are a number of connection options for both 3 and 4 wire circuits e.g. open delta, Edison delta, (sometime referred to as high-leg delta or red-leg delta), and jack-leg delta etc. A two coil 3 wire connection would be an Open Delta.
Designated Standards	Lists of standards that businesses can use to show their products, services or processes comply with essential requirements of GB legislation for UKCA. These are issued by the Office for Product Safety & Standards (OPSS)
Deviation factor	The maximum instantaneous deviation of a generator voltage waveform, as a percentage of the true sine wave of the same RMS value.
Dielectric strength	The maximum electric strength that an insulating material can withstand intrinsically without breaking down, i.e. without experiencing failure of its insulating properties.
Diesel bug	The generic term for the microbial growth found within fuel systems and fuel storage tanks. Formed of a variety of different strains of fungi and bacteria. Can be associated with fuels containing a biodiesel fraction
Diesel rotary UPS	A diesel engine driven generating set which includes an electric motor driven heavy flywheel and AC generator. In normal operation the motor drives the flywheel/AC generator. When the mains supply fails the diesel engine is started and takes over from the motor, to drive the flywheel/AC generator. The heavy flywheel keeps the system stable whilst the engine is starting up.
Differential protection relay	Relay operated when the current differential between two points of an electrical circuit exceeds a predetermined value. Used to detect faults in generator and transformer windings
Direct current	Current flow in one direction only i.e. no reversal of polarity.
Directive (European)	A directive is a legal act of the European Union, which requires member states to achieve a particular result without dictating the means of achieving that result. It can be distinguished from regulations which are self-executing and do not require any implementing measures.
Double skin	Non preferred term. See Bunding
Droop speed control	Term used in the generating set industry to indicate the action of a generating set when put under load. As in 'AVR Droop' above or speed (frequency) droop when the prime mover is under load. The setting of which are critical as generating sets can be operated in parallel running in 'droop'.
Dump Line	Refers to the safeguarding method of using a pipe work system to 'dump' fuel away from a day tank when there is a potential fire risk.
Duty assist	An arrangement where two (or more) generating sets are configured to provide mutual support in case of one piece failing to operate or needing assistance to achieve a required target: If one generating set fails to operate or cannot achieve a required target, the second (and subsequent) generating set will operate.
Duty standby	An arrangement where two (or more) pieces of equipment, e.g. fuel transfer pumps, are configured to provide mutual support in case of one piece failing to operate: If one piece fails to operate, the other one will operate. One piece is duty, the other(s) is standby to the duty piece. See also Duty assist.

Frequently Used Industry Terms E-F

Term	Definition
Earth fault	Failure of electrical insulation between live conductors and earth. May be considered for detection in “restricted” areas of a circuit or “unrestricted” i.e. occurrence of a fault anywhere within a circuit.
Electricity Storage	Electricity Storage in the electricity system is the conversion of electrical energy into a form of energy which can be stored, the storing of that energy, and the subsequent reconversion of that energy back into electrical energy.
Electronic governor	Electronic device to control and maintain the speed of an engine. Usually done by monitoring the output of a tachogenerator or magnetic pick-up, and feeding a proportional output to an actuator which controls the engine fuel supply. See Governor
Emission level stages	European emission standards for new nonroad diesel engines (Fixed & variable speed). Currently we are using Stage 5.
Enclosure	A general term, but often mean as the acoustic cover over a Generating Set
Engine governing	Engine speed control (see Governor) which may be mechanical, hydraulic or electronic.
Engine starting	12 or 24 V dc electric, air, hydraulic, spring.
E-stop	Emergency stop (push button)
Euronorm	European Standards which must be transposed into Member State's Standards - see BS EN acronym.
European Directive	See Directive (European)
Exciter	A secondary generator or winding that provides DC power for excitation of the main field of a synchronous AC generator.
Exhaust Gas Recirculation	In internal combustion engines, exhaust gas recirculation (EGR) is a nitrogen oxide (NOx) emissions reduction technique used in petrol/gasoline and diesel engines. EGR works by recirculating a portion of an engine's exhaust gas back to the engine cylinders. This dilutes the O2 in the incoming air stream and provides gases inert to combustion to act as absorbents of combustion heat to reduce peak in-cylinder temperatures. NOx is produced in a narrow band of high cylinder temperatures and pressures.
Exhaust silencer	Device to reduce the noise level of an engine exhaust system
Fault Ride Through	The capability of Power Generating Modules to be able to remain connected to the Distribution Network and operate through periods of Low Voltage at the Connection Point caused by secured faults.
Fault Tree Analysis	Fault Tree Analysis. To model, in a diagrammatic format, the sequence of events that can develop in a system as a consequence of combinations of basic events which may lead to system error or an unsafe mode. This works from top down, ass opposed to failure mode and effects analysis (FMEA) which works from bottom up.
Faulty Synchronising	If synchronising occurs outside relatively small limits, then the transient currents and torques resulting from the acceleration can damage the generator and prime mover. In severe cases, destruction of the generating set can result. Often called crash synchronising. This can also occur on generating sets running in parallel with a utility supply as a result of a failure to detect a loss of utility with the result that when the utility supply resumes, the two supplies are out-of-phase. Can also occur with excessively long ride-through times that exceed critical fault clearance time.

Frequently Used Industry Terms F-G

Term	Definition
Feed & Return	Method of using a feed & return pipe work back to the bulk storage tank (see 'Bulk tank'), where the fuel can be maintained and quality monitored. Particularly relevant with the growth in use of biofuels where there is a potential degradation of quality if the fuel is stored for long periods of time (see 'Fuel polishing'). Some diesel engines return a considerable amount of fuel to the storage tank, as it is used for cooling and lubrication of the fuel system. Also known as Flow & Return pipes.
Field	A permanent or electromagnet whose magnetic field induces voltage in the armature coils of a generator.
Fill point cabinet	A cabinet, often wall mounted or free standing, with connections and equipment to allow remote filling of a storage tank.
Fire protection systems	From a simple drop weight fire valve in the fuel line to full fire suppression systems; a system is in place to react in the event of a fire; cut off the flow of combustible material (e.g. fuel) to an area or a machine and shut down the affected components or may suppress the fire with either water, foam or an inert gas.
Fire rated enclosure/ section building	An enclosure constructed to meet a fire regulation i.e. BS476 4 hour fire rating or Offshore fire rating i.e. A60 i.e. 60 minutes integrity with a max temperature rise from one side to other of 1400 C.
Free field measurement	Measurement of sound in an environment in which the effect of reflective boundaries can be considered negligible.
Frequency	The number of cycles of an alternating current or sound wave in a given time i.e. Hz or cycles per second.
Frequency regulation	The degree of variation in frequency of a generating set form no-load to fully loaded state.
Fuel Lines	Pipelines from an engine to a fuel tank or from one fuel tank to another fuel tank.
Fuel polishing	The removal of water, sediment, non-combustible particulate matter and microbial contamination to below levels stated in ASTm D975 (Standard Specification for Diesel Fuel Oils) while re suspending combustible particulate matter to maintain ASTm standards for heating value, lubricity, and cetane number. See Diesel Bug.
Full electronic authority engine control	Full authority digital engine control (FADEC) having no form of manual override available, placing full authority over the operating parameters of the engine in the hands of the computer. If a total FADEC failure occurs, the engine fails. If the engine is controlled digitally and electronically but allows for manual override, it is considered solely an EEC (electronic engine controller) or ECU (Electronic Control Unit).
G10	Republic of Ireland (Eire) code for paralleling with the mains utility supply
G5/4-1	An Energy Networks Association (ENA) document specifying the limits for harmonic distortion on utility supplies.
G59	An Energy Networks Association (ENA) document specifying the connection and protection requirements for the connection of a generator, above 16 Amps per phase, to the Distribution Network.
G83	An Energy Networks Association (ENA) document specifying the connection and protection requirements for the connection of a generator, below 16 Amps per phase, to the Distribution Network.

Frequently Used Industry Terms G-I

Term	Definition
G98	An Energy Networks Association (ENA) document specifying the connection and protection requirements for the connection of a generator, above 16 Amps per phase, to the Distribution Network under the RfG Directive.
G99	An Energy Networks Association (ENA) document specifying the connection and protection requirements for the connection of a generator, below 16 Amps per phase, to the Distribution Network under the RfG Directive.
G99/1	Requirements for the connection of generation equipment in parallel with public distribution networks in Northern Ireland on or after 27 April 2019
G100	An Energy Networks Association (ENA) document specifying the Technical Requirements for Customer Export Limiting Schemes
Gas powered	Gas fuelled generating set – differing gas types for differing applications.
Gas Safe	Gas Safe Register is the only official gas registration body of gas businesses and engineers in the United Kingdom, Isle of Man and Guernsey. By law all gas businesses must be on the Gas Safe Register. www.gassaferegister.co.uk
Generating Set	A generating set is a piece of equipment that converts mechanical energy obtained from an external source into electrical energy as the output
Generating Unit	Any apparatus which produces electricity.
Generator	A person who generates electricity under licence or exemption under the Electricity Act 1989 (as amended by the Utilities Act 2000 and the Energy Act 2004) and whose Power Generating Facility is directly or indirectly connected to a Distribution Network.
Generator Breaker	Breaker used for connecting and breaking a generator circuit
Global System for Mobile Communications	Global System for Mobile Communications, (GSM), originally Groupe Spécial Mobile), is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile phones.
Governor	A device for controlling fuel to the engine to maintain speed under varying load conditions or a pre-set speed droop from no-load to full load conditions.
Hall effect sensor	A transducer that varies its output voltage in response to a magnetic field.
Harmonics	A component of a periodic wave with a frequency that is a multiple of the frequency of the original wave.
Harmonised Standards	Standards which give a 'presumption of conformity' to EU Regulations and Directives as published in the Official Journal of the EU
High Voltage (HV)	A voltage exceeding 1000 V AC or 1500 V DC between conductors,
Hunting	A term which can relate to speed or voltage, and which occurs after a control function change, causing the controlled element to continue to oscillate about the desired set value. Usually the result of insufficient damping in the control.
Hydrogen	A colourless, odourless, highly flammable gas, the chemical element of atomic number 1

Frequently Used Industry Terms I-L

Term	Definition
Hydrogen Colours	Hydrogen gas is colourless, but different colours are used to describe it based on its origin and production process. There is no commonly accepted 'standard' defining this but currently these colours include: Blue hydrogen: Produced from natural gas using steam methane reforming (SMR) with CCUS technology to achieve 90-95% carbon removal/reduction. Gray hydrogen: Produced from natural gas using SMR, but without CCS and is the dirtiest. Green hydrogen: Produced using renewable energy sources like wind or solar power by electrolysis. Turquoise hydrogen: Produced from methane pyrolysis. Pink hydrogen: Produced from nuclear power.
Impedance	Total of resistive, capacitive and inductive elements of a circuit.
Independent Distribution Network Operator	An IDNO designs, builds, owns and operates a distribution network, which is an extension of an existing DNO network. They typically build network for new developments such as business parks and residential areas.
Inrush current	Initial instantaneous current drawn by transformers, motors, capacitors or current- using equipment on the application of a supply voltage. Causes of these high currents vary with different types of equipment.
Insulation	Non conductive material used between phases or phase to earth to prevent current leakage. Generally classified in Classes of temperature withstand capability. For generators and motors, classes F and H are currently used. Temperature rises typically are: Class H @ 125 C over 40 C; Class F @ 105 C over 40 C; Class B @ 80 C over 40 C.
IP rating	Degree of protection provided by enclosures to ingress of particles, solid foreign objects and moisture.
Isochronous governor	Engine governor that maintains a set steady state speed without droop i.e. irrespective of load
Kilo-volt-ampere (k)VA	1000 VA. A term used for rating of an electrical circuit, which is the product of the circuit maximum current and voltage rating. Also known as apparent power.
Kilo-volt-ampere reactive (kVAr)	1000 VAr. A term used for the rating of a purely inductive or capacitive circuit, which is the product of the circuit maximum current and voltage rating. Generally used in the context of that part of the generator output which is not giving true, or active, power, and that current which flows between generators in parallel.
Kilo-watt (kW)	1000 watts. Unit used for power rating of electrical devices.
Kilo-watt-hour	1000 watt-hours. The unit of electrical energy equal to the use of one kW for the period of one hour.
Knocking	Knocking (pinking) in spark-ignition internal combustion engines occurs when combustion of the air/fuel mixture in the cylinder does not occur correctly following ignition by the spark plug, and some of the mixture explodes. Knocking can result in damage to the engine.
Load acceptance	% of the rated set load that can be applied to a generator set and is capable of accepting in one step, and recovering from to within defined parameters.

Frequently Used Industry Terms M-N

Term	Definition
Load balancing	Common term used to describe best practice of balancing the load evenly across 3 phases where possible. With reference to the Negative Phase Sequence entry below it must be noted that for 3-phase generators the load must be balanced within the negative phase sequence rating of the generator otherwise overheating of the generator can occur.
Load bank	Resistance and/or inductors to provide load for generating set(s) for test purposes. Usually the resistance / inductance units are transportable.
Load factor	The ratio of average load to the generating set power rating.
Load step	Normally a percentage load applied to a generating set.
Low Voltage (LV)	A voltage normally exceeding extra-low voltage (50 V) but not exceeding 1000 V AC or 1500 V DC between conductors
Lube oil make up system	All engines consume lubricating oil when they run. Therefore, the autonomy of an engine (time for which the engine can run without requiring intervention) is determined by how much oil in the engine is available to be consumed. To supplement this, a lube oil make up system can be added. This normally consists of a small lubricating oil tank connected to the engine with a make up valve. The make up valve provides a slow feed of oil to the engine to match the consumption of oil. It is important for any engine that the autonomy of the lubricating oil system matches or exceeds the autonomy of the fuel system.
Magnetic pick up	A device that detects the speed of a prime mover, typically an engine or turbine. They are the communication link between the engine and an electronic governor control. The MPU is installed next to a flywheel ring gear which is made of a material that reacts to a magnetic field. As each tooth of the ring gear passes within 0.75mm to 1.0mm of the MPU, the tooth interrupts the MPU's magnetic field, and an alternating voltage is developed. The frequency of this voltage is translated by the speed control into a signal that accurately depicts the speed of the prime mover.
Main set breaker	The main breaker is the circuit breaker through which the full power of the generating set flows.
Mains breaker	A circuit breaker that is usually positioned at the electricity services intake of a premises and which may be interlocked with a generator circuit breaker to form a changeover from mains to generator power. Also known as the Utility Breaker
make before break	An arrangement for electrical switchgear whereby two switching devices close to make a circuit in parallel before one switching device opens. This as a term often relates to parallel electrical power supplies, for arrangements where when changing from one power supply to another, there is no interruption between supplies. Note that it is extremely important when considering parallel AC electrical supplies that consideration is made to ensure that the supplies are synchronised. This means making sure that voltages, phase angles and frequencies are matched. Parallel coupling of supplies that are not synchronised may be hazardous.
mechanical bridge	A support for power cabling, fuel lines, exhaust, radiator etc.
meg-ohm	A unit used in defining the level of insulation in terms of its resistance to current leakage.
Methane Number	The methane number (MN) describes the knocking resistance of a fuel gas (See Knocking). It is defined by the ratio of a mixture of hydrogen (H) and methane (CH_4) which has the same knocking tendency as that fuel gas. The definition is MN 100 for methane CH_4 and MN 0 for hydrogen. In the UK, mains natural gas has a methane number of 80.
Method Statement	A document that details how a particular working process will be conducted in a safe manner, typically used for construction or installation procedures.

Frequently Used Industry Terms N-P

Term	Definition
Midel	A less environmentally harmful insulation / cooling oil for use in electrical transformers
motoring	This is the term applied when a generator remains connected to a network or other generators but its drive engine fails to deliver power - the generator set continues to run with the generator now driving the engine, i.e. the generator now becomes a motor. See Reverse power.
moulded case circuit breaker	A circuit breaker which is enclosed in a plastic insulating case and which trips when the current exceeds a pre-determined value for a given time.
N+1 / N+N	Operational configurations where levels of redundancy of equipment are included in the design. N+1 applies to installations where however many pieces of a given type of equipment are required for operational reasons, one additional unit is supplied for redundancy e.g. for a site that requires three generating sets to support the load, a fourth would also be supplied. N+N applies to installations where, however, many pieces of a given type of equipment are required for operational reasons, as many again are supplied for redundancy e.g. for a site that requires three compressors, six are supplied. N+N equates to 100% redundancy of supply.
Negative phase sequence current	In any three phase system, the currents that make up the system can be resolved to positive, negative and zero phase sequence phases. Thus the positive sequence components produce a normal rotating field; the negative sequence components create a counter-rotating field and the zero sequence components produce an oscillating field that does not rotate. Negative sequence components are an important consideration of unbalanced ratings for generators as these cause heating, particularly in the field components.
Noise Pollution	A term often used to refer to the inherent noise of any machines, near to buildings, people, etc. which may require treatment to reduce its effect, and maybe a key design consideration.
Nominative reference	Reference documents which are cited in the text in such a way that some or all of their content constitutes requirements of the document
Non-Linear Load	A load in which there is a non-linear relationship between current and voltage. Commonly the result of electronic switching during the cycle in the load circuits, such as with SCR controllers. E.g. switch mode supplies, VSDs. See also harmonics.
Normally closed/open contact	Description of the status of a relay contact when the relay is de-energised.
Notified Body	Notified Bodies are designated by the Competent Authorities of each EU and EEA Member State and are notified (hence 'notified bodies') by the European Commission.
Octave band	Frequency range where the highest frequency is double the lowest, with eight bands 63 Hz, 125 Hz, 250 Hz etc. being used most frequently to analyse and quantify sound.
Offset Fill Point	Remote or low-level fill points added to tanks to make the filling process easier. This is especially recommended for tanks where direct-filling could cause safety issues (see 'Fillpoint cabinet').
Ohm	The SI derived unit of electrical resistance; The ohm is defined as an electrical resistance between two points of a conductor when a constant potential difference of 1 volt, applied to these points, produces in the conductor a current of 1 ampere
Oil Circuit Breaker	Circuit Breaker with the contacts enclosed in a tank of oil (OCB) (obsolete device, but many thousands remain in service world wide)
Open Coupled	The AC generator has its shaft extension coupled to the engine flywheel without a mechanical tie between the generator frame and the engine flywheel housing. Generally, the generator has two bearings.

Frequently Used Industry Terms P

Term	Definition
Out-of-phase	Referring to alternating currents or voltages of the same frequency, which are not passing through their zero points at the same time.
Overload	Term referring to the amount by which an electrical circuit is exceeding its rating.
Overshoot / overspeed	The amount by which voltage or frequency exceeds the nominal value following a load change, or when starting the generator.
Parallel operation	Operating two or more generators, or generators and network together to supply a common load, or just to supply power to the grid / utility.
PAT test	Portable (electrical) appliances test
Peak lopping	Load dependent Automatic Starting of Power Generation equipment. To reduce the load on the system by running the Generating Plant in Parallel with the Mains supply to maintain a fixed import load from the mains.
Peak Shaving	Power generation equipment running in parallel with the grid, producing a fixed amount of kW and kvars
Permit to Work	Formal, written specifications for controlling risks when carrying out hazardous work, usually for non-routine activities that require special precautions to control the hazards.
Pipe-In-Pipe	Pipe system specifically designed for the conveyance of fuel or other liquid, designed to contain leaks. The interstitial space between the inner and outer pipe can be used with a leak detection system to guard against potential leaks in to the environmental (see 'Double skin').
PLC controls	Programmable Logic Controller - a programmable hardware control system which includes digital and analogue inputs and outputs.
Point Of Common Coupling	The point on a Distribution Network, electrically nearest the Customer's Installation, at which other Customers are, or may be, connected.
Pole	Generally refers to the magnetic poles of field assembly of a generator or motor. It can also refer to the electrodes of a DC battery or the number of contacts on a contactor or circuit breaker.
Pole slip	Condition where the generator field strength is unable to hold the rotor in phase with the stator against the torque being supplied by the engine. The rotor is then driven by the prime mover until it is attracted to the next pole position. The transient torques can cause severe damage or destruction of the machine. See Faulty Synchronising.
Positive phase sequence current	Element of fault current vector in same phase sequence as the supply voltage.
Power factor	Power Factor is only relevant in AC circuits, and in its simplest form it is the ratio of kW to kV A. Therefore, the result is a number between 0 and 1, and is usually given to 2 decimal places. Refer to Power Factor page.
Power Factor Control	Control of generator power factor when in parallel operation by means of varying the excitation.
Power Generating Facility (PGF)	A facility that converts primary energy into electrical energy and which consists of one or more Power Generating Modules connected to a Network at one or more Connection Points.

Frequently Used Industry Terms R-S

Term	Definition
Primary Injection	"A primary injection test set injects a multiple of the fault rated current of the breaker, through the breaker while measuring the trip time. This type of test involves the entire circuit – current transformer primary and secondary windings, relay coils, trip and alarm circuits, and all intervening wiring are checked. Another way to look at this is a primary injection test tests the breaker as close to a real-world scenario as practical while secondary injection tests the timing and function of the trip unit alone. See also Secondary Injection."
Prime Mover	A machine which converts a source of energy into mechanical power. It can be a turbine, steam, gas or hydro, a diesel engine or a spark ignition gas engine, amongst others.
Prime power	The maximum power which a generating set is capable of delivering continuously whilst supplying a variable load when operating for an unlimited number of hours per year under the agreed operating conditions with the maintenance intervals and procedures being carried out as prescribed by the manufacturer. The permissible average power over 24 hours of operation must not exceed 70% of the Prime Power agreed by the engine manufacturer. As stated in BS ISO 8528.
Radiator	Typically, heat exchangers used to transfer thermal energy from one medium to another for the purpose of cooling fluids flowing in circuits around an engine including the water jacket cooling the engine; a charge air circuit used to cool directly the compressed air from an engine turbochargers, prior to entry into the engine for combustion; a secondary water circuit on engines fitted with water cooled charge air coolers (WCCAC). It must be remembered the radiator needs airflow across the unit to get rid of the heat dissipated from the fluids. This airflow is generated from a fan which can be fitted directly onto the engine, by one fitted onto the radiator and driven from the engine via belts or ones fitted onto an electric motor remote from the generating set.
Ratings	The output of a generating set relating to its use as defined in BS ISO 8528 as – Continuous Power (COP) Prime Power (PRP) Limited-time Running Power (LTP) Emergency Standby Power (ESP)
Ratiometric	Input circuit that can be configured to be digital, resistive, 4-20mA or 0-10V.
Reactance	Opposition of a circuit to a change in electric current due to inductance or capacitance.
Real time clock	A computer clock that calculates the present time. Not to be confused with hardware clocks in computers which time the device but may not calculate in world time.
Regulation (European)	A regulation is a legal act of the European Union that becomes immediately enforceable as law in all member states simultaneously. Regulations can be distinguished from directives which, at least in principle, need to be transposed into national law.
Restricted Earth Fault Protection	Electrical protection normally consisting of current transformers in each phase and in the connection between neutral and ground of a generator or transformer. Protection will operate for an earth fault in the zone (Restricted), but not for phase to phase faults, nor to a fault outside the zone. See unrestricted earth fault protection.
Reverse power	Power absorbed by a generator from a paralleled system due to engine failure. Active power absorbed by a generator from the connected system. This may be another paralleled generator, the utility supply or possibly a motor such as a crane hoist that is being driven by the load.
Risk Assessment	An examination of the potential risks in the workplace, with the aim of assessing whether enough precautions have been put in place to prevent harm. A risk assessment focuses on the relationship between the worker, the work being carried out, the equipment being used and the conditions of the working environment.

Frequently Used Industry Terms S

Term	Definition
Root mean square	mathematical term for establishing the effective voltage or current of an AC Circuit. (RMS) It is calculated by summing the square(s) of the waveform over time, then taking the square root of the sum. For a sine wave, this is 0.707 of the peak value.
Rotor	a rotating part of a machine. E.g. of an electrical generator or motor
SAE Flange	Flange format often used for the mechanical connection between engines and generators. Specification is SAE J617.
Safety integrity level	Safety integrity level (SIL) (SIL) is defined as a relative level of risk-reduction provided by a safety function, or to specify a target level of risk reduction. In simple terms, SIL is a measurement of performance required for a safety instrumented function (SIF). In the BS EN 61508 standard, four SILs are defined, with SIL 4 the most dependable and SIL 1 the least
Secondary containment	A safeguarding method used to prevent unplanned releases of hazardous liquids such as diesel fuel into uncontrolled areas, typically used when referring to fuel pipe work and fuel storage (see 'Bunding').
Secondary Injection	A secondary injection test injects a ratio of the fault rated current of the breaker directly into the trip unit and measures how long it takes the breaker to trip. Another way to look at this is a primary injection test tests the breaker as close to a real-world scenario as practicable while secondary injection tests the timing and function of the trip unit. See also Primary Injection
Selective Catalytic Reduction	A means of after treatment of turbo charged petrol, diesel and gas engine exhaust gas emissions. They are The method is used to remove Nitrogen Oxides (NOx) and help reduce the amount of particulate matter in emissions which are known to directly damage health and convert the nitrox oxide to nitrogen and water vapour to cause less harm to the environment.
Self-excited generator	A generator whose excitation system takes power from its own output.
Separately excited generator	A generator whose excitation system takes power from a separate source. Usually a secondary permanent magnet generator or exciter.
Short term operating reserve	Short Term Operating Reserve (STOR) is a service for the provision of additional active power from generation and/or demand reduction for National Grid.
Shunt trip	A feature added to circuit breakers in order to remotely trip the breaker from an externally derived signal; such as a generator controller or switchgear control system.
Single bearing	The AC generator has one bearing at the non drive end.
Single bearing close coupled	A Generating Set where the ac generator has no bearing at the Drive End (i.e. end of the rotor driven by the engine) and the ac generator rotor is supported by the engine bearing at the engine drive end. (See Twin bearing open coupled)
Slip	The difference between synchronous and actual speed of an induction generator or motor
Slipring	An electromechanical device that allows the transmission of electrical power or signals from a stationary to a rotating structure. Traditionally used on generators to supply field current to the rotor, before the development of brushless exciters.
Sodium hexafluoride	Gas (SF6) used as an insulation and arc quenching medium in switchgear. Now being withdrawn due to its ozone layer depletion properties
Solid state controls	Electronic control (switching) devices e.g. transistors, thyristors.

Frequently Used Industry Terms S-T

Term	Definition
Sound power level	Sound level expressed in terms of power as logarithmic ratio (dB) relative to reference power level of 10-12 W. This quantifies the acoustic energy emitted.
Sound power vs pressure levels	The sound power level indicates the total acoustic energy that a machine, (in our industry a generating set/s), radiates to its environment. The sound pressure level is a measure of the effect of the energy of an acoustic source (or a collection of sources) and depends upon factors such as the distance to and size of the source(s) and acoustic properties of the surroundings of that source. The sound power level of a machine is a fixed value, where the sound pressure level always depends on position and environment. The abbreviations for the figures are: SI (International System of Units) only contains units for pressure and power, not for levels. Levels are described in ISO standards, using the following abbreviations or descriptors: Sound pressure level – LpA, sound power level – LwA. The A relates to an 'A-weighting' frequency spectrum which is added to an unweighted sound level where the decibel values of sounds at low frequencies are reduced, to approximate how the human hearing system processes sound.
Sound pressure level	Sound level expressed in terms of pressure as logarithmic ratio (dB) relative to reference pressure level of 2.10-5 Pa. This quantifies what may be heard.
Speed droop	Governor speed reference is reduced as load (or fuelling) increases.
Star - delta starter	Device for switching electric motor windings to reduce starting current.
Star connection	The 3 windings are connected in a star configuration. The winding ends opposite the phase outputs are all connected together. The star point can be used as a neutral, and can be connected to ground (Earth)
Starting current	High current drawn by an electric motor during starting.
Stator	The stationary winding assembly of an AC generator or exciter.
Sub-transient reactance	Initial reactance of generator at the instant of short circuit fault condition.
Surge	A term applied to both current and voltage, it refers to an exceptionally high increase in the quantity over a very short time period. Usually the result of load switching or lightning strikes.
Surge suppressor	A general term used for a device to prevent externally promoted voltage surges from destroying other devices. Commonly employed on the exciters of brushless generators to prevent rotating diode failure.
Synchronisation	The act of matching the voltage magnitude, frequency and zero crossing times (phase), of two alternating current sources for the purposes of connecting them in parallel.
Synchroniser	Instrument which detects whether two periodic motions are in synchronism. In power generation, an instrument that checks that two wave forms are aligned prior to the breaker closing
Synchronising Breaker	Breaker with the closing circuit controlled by a synchronising device. It may be the Generator Breaker and / or the breaker(s) connecting to the utility.
Synchronous reactance	measure of generator magnetic stiffness.
Système International	the International System of Units, abbreviated SI from the French name, Le Système International d'Unités
Telephone Influence Factor	Related to non sinusoidal voltage waveform, and the magnetic linkage between power and telephone cables, it is measure of the influence of the generated waveform on telephone operation. (TIF)

Frequently Used Industry Terms T-Z

Term	Definition
Thermistor	Temperature dependant resistor
Thermocouple	Bi-metal junction producing signal voltage proportional to temperature
Thermostat	Device which switches at a designed temperature - used to control temperature of a medium e.g. air ambient, coolant temperature.
Time constant	Normally the time taken for a system to rise or fall exponentially to approximately 63% of the difference between its old and new value.
Transducer	Device to convert one form of energy to another. In power generation, often a device found at the boundary between the mechanical systems and the control and monitoring system. E.g. pressure, temperature, position transducers. Also used to convert voltage, current and power etc. Output is analogue (4-20mA) or digital signals.
Transformer	Device which transfers electrical energy between circuits by electromagnetic induction.
Transient reactance	Transitional reactance of generator following sub transient stage of fault.
Transition Fitting	Typically used to describe a polyethylene electro-fusion or spigot jointed fitting with a steel thread or flanged connection. Giving a fast, simple method of transitioning to connections on tanks (see 'Day tank' and 'Bulk tank'), pumps, generators and other system apparatus.
Triads	Half Hour Peaks of mains power demand, which incur highest energy costs. Can be used to determine when local onsite power generation should be used to power their loads.
Twin bearing	The AC generator has two bearings, rather than one bearing as is common in the generating set industry.
Twin bearing open coupled	The AC generator has two bearings with its shaft extension coupled to the engine flywheel without a mechanical tie between the generator frame and the engine flywheel housing. (See single bearing close coupled)
Undershoot	Refers to the amount by which frequency or voltage drops below the nominal value as a result of load changes.
Unrestricted Earth Fault Protection	Protection where a current transformer is fitted in the neutral connection to earth. Protection will operate for any earth fault in the network. Thus it is “unrestricted”. Often used as back up protection, with a timer, to prevent nuisance tripping.
Vacuum Circuit Breaker	Circuit Beaker with vacuum as the arc quenching medium (VCB).
Varistor	A resistance which has a significant change in value when a certain level of supply voltage is reached - used as voltage surge suppression.
Vibration mounts	Often referred to as anti-vibration mounts, (AVM) to reduce transmission of vibration from a generating set to the foundations. Types may be open, closed, spring, rubber etc.
Volt	The unit of electrical potential (V).
Volt free contact	A term used to describe a digital control signal used to interface between systems. The indicating system opens or closes a relay contact to provide a circuit. The "ends" of the circuit are left available for the receiving system to use with a voltage of its choice. It is important when specifying a volt free contact that the intended voltage and current to be used on the circuit is known to ensure that the circuit is rated appropriately..

Frequently Used Industry Terms Z

Term	Definition
Voltage dip	The temporary drop in generator voltage that occurs when a load is connected, before the control system responds and corrects it. Also known as Voltage sag.
Voltage regulation	The allowed difference between maximum and minimum steady state voltage as a percentage of the nominal voltage.
Voltage regulator	Device for maintaining voltage between the allowed limits for varying load conditions. Generally used for a generator output.
Zero sequence phase sequence current	Element of fault current vector with no phase sequence rotation.
Zone	Generally the term used for identification of areas of hazardous environment under the ATEX Directives. The purpose of defining zones is to ensure employees and the public are protected from fires and explosion and provide a level of risk assessment. Also refer to DSEAR.
Zone 0	Explosive atmosphere with gas or vapour present continuously, for long periods or frequently due to malfunctions, typically more than 1000 hours per year – no motors allowed in Zone 0.
Zone 1	Explosive gas or vapour likely to occur due to expected malfunctions, typically between 10 and 1000 hours per year – flameproof or increased safety motors are allowed in Zone 1
Zone 2	Explosive gas or vapour unlikely to occur, or if it does is likely to only be of short duration and not during normal duty, typically less than 10 hours per year – increased safety or non-sparking motors are allowed in Zone 2.
Zone 20	Permanent presence of combustible dust - motors not allowed.
Zone 21	Ignition proof motors approved and certified by a Notified Body can be used – presence of combustible dust only by accident, but not during normal duty.
Zone 22	Dust ignition proof motors approved by a Notified Body or the manufacturer can be used.

Power Factor Explained

Power Factor is only relevant in AC circuits, and in its simplest form it is the ratio of kW to kVA. Therefore, the result is a number between 0 and 1, and is usually to 2 decimal places.

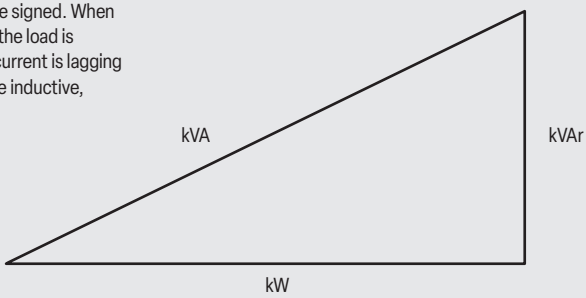
Power Factor can be represented by a clock face, where power factor 1 (1.00) is the 12 o'clock position. 0 can be either side of the 12 o'clock position, either at 9 o'clock or 3 o'clock depending on which way the kVArs are flowing in reference to the kW. The number isn't signed and is usually accompanied by leading or lagging. i.e. the current is leading or lagging the voltage.

Power Factor is caused by kVArs which are signed. When a generator is producing (positive) kVArs the load is inductive, such as a motor, and thus the current is lagging the voltage. Terms used to explain this are inductive, lagging and over excitation.

When a generator is absorbing (Negative) kVArs the load is capacitive such as fluorescent lighting and long cable runs, and thus the current is leading the voltage. Terms used to explain this are capacitive, leading and under excitation.

If the generator is feeding a purely resistive load, such as a heating element, there are no kVArs, and the power factor is 1, also known as unity. This is when kW = kVA

kVArs are always at 90 Deg to the kW and can be represented by the below diagram:

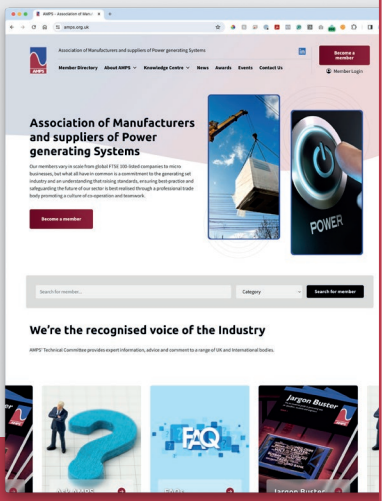


The cosine of the angle between kVA and kW (cos ϕ) is the Power Factor

Our information is your power

The AMPS website provides a wealth of Power Generation information whatever you're looking for, wherever you are.

- *Searchable Member Directory that's updated throughout the year*
- *The Latest Power Generation news*
- *Information on the most important industry events and exhibitions*
- *Gain access to technical papers and ask the Technical Committee questions*
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Definitions

Parameter	Designation	Unit
Volts	V or U	V (Volts) sometimes known as (E) electrical difference
Voltage between line to neutral	V_{L-N}	V (Volts)
Voltage between line to line	V_{L-L}	V (Volts)
Current	I	A (Amps)
Resistance	R	Ω (Ohms)
Frequency	f	Hz (Hertz)
Power	P	W (Watts)
The magnitude of real power in units of Watts (W)	|P|	W (Watts)
Reactive Power	Q	VAr (Volts Amps Reactive)
Apparent power	|S|	VA (Volts Amps)
Power Factor	Pf (nominal value 0.8pf)	Dimensionless with the range -1 to +1
Inductance	L	H (Henrys)
Capacitance	C	F (Farads)
Impedance	XL or XC Inductive or Capacitive	Ω (Ohms)
Phase angle of current relative to voltage in degrees	Φ (Pronounced Phi)	Degrees
Square root of 3	√3 (1.732)	3 phase calculations

Equations, Formulae and Conversions

Ohm's Law	
$V = I \cdot R$	$I = V / R$
$R = V / I$	

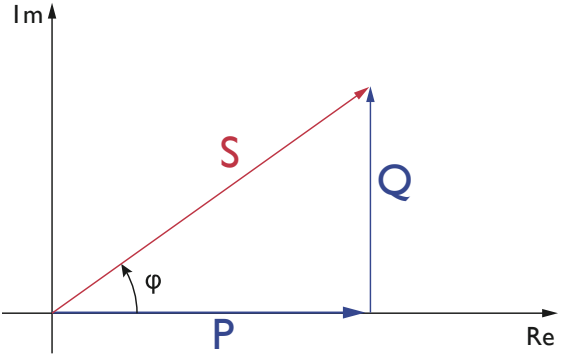
Voltage relationships in balanced 3 phase systems	
$V_{L-L} = V_{L-N} \cdot \sqrt{3}$	$V_{L-N} = V_{L-L} / \sqrt{3}$

Single phase power	
$P = V \cdot I \cdot Pf$	$\|S\| = V \cdot I$
$V = P / (I \cdot Pf)$	$Pf = P / S$
$I = P / (V \cdot Pf)$	$\|P\| = \|S\| \cdot \cos \Phi$
$Pf = P / (V \cdot I)$	$P = R \cdot I^2$

Three phase power in balanced systems
$P = 3 \cdot V_{L-N} \cdot I \cdot Pf$
$V_{L-N} = P / (3 \cdot I \cdot Pf)$
$I = P / (3 \cdot V_{L-N} \cdot Pf)$
$Pf = P / (3 \cdot V_{L-N} \cdot I)$
$P = \sqrt{3} \cdot V_{L-L} \cdot I \cdot Pf$
$V_{L-L} = P / (\sqrt{3} \cdot I \cdot Pf)$
$I = P / (\sqrt{3} \cdot V_{L-L} \cdot Pf)$
$Pf = P / (\sqrt{3} \cdot V_{L-L} \cdot I)$
$\|S\| = 3 \cdot V_{L-N} \cdot I)$
$Pf = P / S$
$\|P\| = \|S\| \cdot \cos \Phi$

Equations, Formulae and Conversions

GRAPHICAL REPRESENTATION OF THE RELATIONSHIP BETWEEN Q, P, S AND Φ.



Speed and frequency

RPM = (Hz . 60) / pole-pairs

Hz = (RPM . pole-pairs) / 60

Pole-pairs = (Hz . 60) / RPM

Mag-PU-frequency =
(RPM . number-of-teeth) / 60

Unit conversions

100 kilopascals (kpa) = 1 Bar

1 Bar = 14.5 Pounds per Square Inch (PSI)

100° degrees Centigrade = 212° Fahrenheit

0° Centigrade = 32° Fahrenheit

1 Imperial Gallon = 4.54 litre

1 Imperial Gallon = 1.2 US Gallon

FORMULAS

TO FIND	SINGLE-PHASE	THREE-PHASE	DIRECT CURRENT
Kilowatts	$\frac{I \times E \times PF}{1000}$	$\frac{I \times E \times 1.732 \times PF}{1000}$	$\frac{I \times E}{1000}$
kVA	$\frac{I \times E}{1000}$	$\frac{I \times E \times 1.732}{1000}$	———
Horsepower (Output)	$\frac{I \times E \times \%EFF \times PF}{746}$	$\frac{I \times E \times 1.732 \times \%EFF \times PF}{746}$	$\frac{I \times E \times \%EFF}{746}$
Amperes when Horsepower is known	$\frac{HP \times 746}{E \times \%EFF \times PF}$	$\frac{HP \times 746}{1.732 \times E \times \%EFF \times PF}$	$\frac{HP \times 746}{E \times \%EFF}$
Amperes when Kilowatts is known	$\frac{kW \times 1000}{E \times PF}$	$\frac{kW \times 1000}{1.732 \times E \times PF}$	$\frac{kW \times 1000}{E}$
Amperes when kVA is known	$\frac{kVA \times 1000}{E}$	$\frac{kW \times 1000}{1.732 \times E}$	———

E = Volts I = Amperes %EFF = Percent Efficiency PF = Power Factor

USEFUL FORMULAS

BTUs x 777.5 = foot pounds
BTUs x 3.93 + 10,000 = horsepower hours
BTUs x 2.93 + 10,000 = kilowatt hours

Equations, Formulae and Conversions

CONVERSION FACTORS NO_x EMISSION

The table below indicates a number of conversion factors for the NOx emission of **Natural Gas** fuelled engines.

mg/Nm³ (1)	1	0.487	$\frac{5.07}{20.95 - x}$
ppm (1)	8,4336	1	$\frac{10.41}{20.95 - x}$
gr/GJ (2)	$\frac{20.95 - x}{5.07}$	$\frac{20.95 - x}{10.41}$	1
Multiply →	mg/Nm³ (1)	ppm (1)	gr/GJ (2)

(1) at x% O_2 content (example; TA Luft refers at 5% O_2)

(2) at the Natural Gas calorific value of 31,650 kJ/Nm³

NOx values indicated in ppm and mg/Nm³ refer to dry gas and at a certain O_2 percentage.

NOx is calculated as NO_2

Example:

$$200 \text{ gr/GJ} = 200 \times \frac{20.95 - 16}{10.412} \quad 95.08 \text{ ppm at } 16\% O_2$$

$$= 200 \times \frac{20.95 - 16}{5.07} \quad 95.27 \text{ mg/Nm}^3 \text{ at } 16\% O_2$$

Conversion with differing residual oxygen content (as per "TA Luft")

$$E_{TA\text{-}L} = E_i \times \frac{21 - 5}{21 - i}$$

Example:

300 mg/Nm³ at 0% O_2 equals $300 \times \frac{21 - 5}{21 - i}$ = 228.57 mg/Nm³ at 5% O_2

Equations, Formulae and Conversions

BASIC FORMULA

With:

U : Voltage between phases; Volts (V)

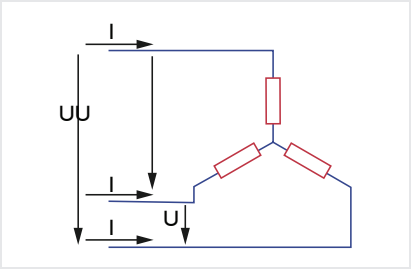
I : Line current; Amperes (A)

P : Active power; Kilowatts (kW)

Q : Reactive power; (kVAr)

S : Rated power; (kVA)

η : Efficiency



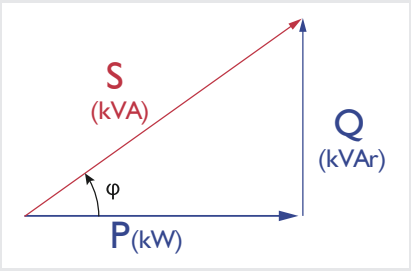
Basic Formula

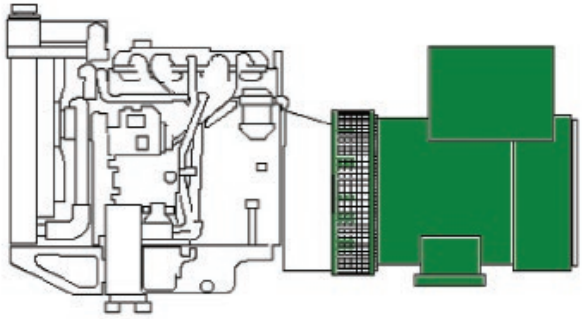
$S = U \cdot I \cdot \sqrt{3}$

$P = U \cdot I \sqrt{3} \cdot \cos(\phi)$

$P = U \cdot I \sqrt{3} \cdot \sin(\phi)$

$S^2 = P^2 + Q^2$





ac generator:

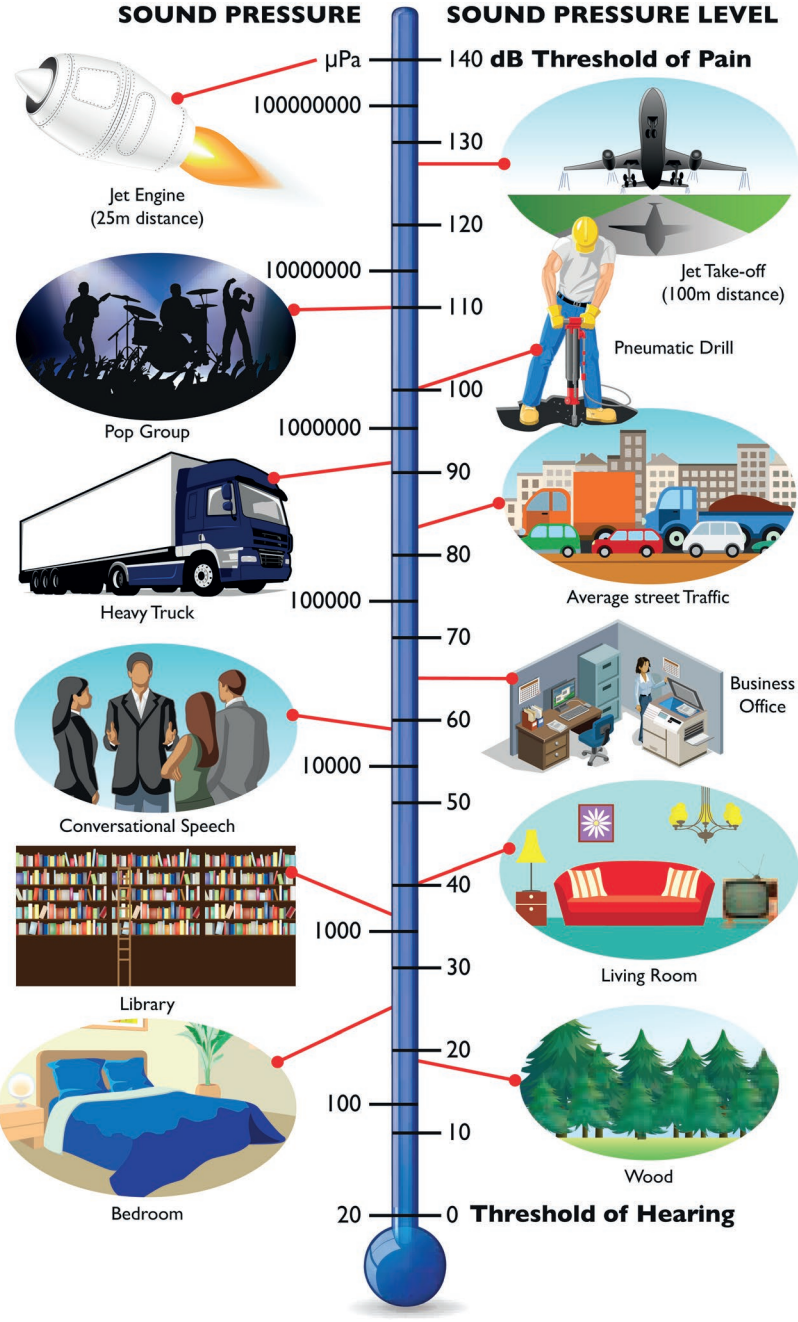
kWe = kVA x cos (ϕ)

kWe = kWm x η

$$kVA = \frac{kWe}{PF} = \frac{kWm \times \eta}{PF}$$

- *The active power (kW, speed) is given by the prime mover (i.e. engine).*
- *The reactive power (kVAr, volts, amps) is given by the ac generator A.V.R.*

Sound Levels – a Handy Guide



IP (Ingress Protection) – a Handy Guide

The IP Code or Rating is the internationally recognised system under IEC60529, relating to the physical defence against objects and water or other liquids entering into the generator (alternator) and other parts of the generating set and protecting it (and people) from its immediate environment.

Expressed as IP21, IP43, IP44, etc. the first number denoted the level of protection against objects entering the machine or touching anything live (electricity) or moving (fans, etc), and the second number relates to protection against liquids. The higher the number, the more protection is provided.

Level	Solids	Object Size Protected Against	Effective Against	Liquids	Protected Against	Effective Against
IP	0	–	No protection against contact and ingress of objects.	0	Not protected	–
IP	1	>50mm	Any large surface of the body, such as the back of the hand, but no protection against deliberate contact with a body part.	1	Dripping water	Vertically dripping water, shall have no harmful effect.
IP	2	>12.5mm	Fingers or similar objects.	2	Dripping water when falling up to 15°	Water falling at up to 15° shall have no harmful effect.
IP	3	>2.5mm	Tools, thick wires, etc.	3	Spraying water	Water falling as a spray at any angle up to 60°.
IP	4	>1mm	Most wires, screws, etc.	4	Splashing water	Water splashing at any direction, and some limited ingress shall have no harmful effect.
IP	5	Dust protected	Ingress of dust is not entirely prevented but it must not enter in sufficient quantity to interfere with the satisfactory operation of the equipment.	5	Water jets	Low pressure water jets at any direction (hose pipes).
IP	6	Dust tight (totally enclosed)	No ingress of dust; complete protection against contact.	6	Powerful water jets	High pressure water jets at any direction (Pressure Washers).

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Frequently Used Industry Acronyms A-C

Acronym	Definition
ac	Alternating Current
ACB	Air Circuit Breaker
ACoP	Approved Code of Practice (HSE)
ACS	Accredited Certification Scheme. The National Accredited Certification Scheme for individual gas fitting operatives came in August 1998 to replace an earlier scheme
AFDD	Arc-Flash Detection Device
ALARP	As Low As Reasonably Practicable
AMF	Automatic Mains Failure
AMP	Accident Management Plan
AMPS	The Association of Manufacturers of Power generating Systems.
AQA	Air Quality Assessment
AREP	Auxiliary (Winding) Regulation Excitation Principle
ASCR	Application Site Condition Report
ATEX	Atmospheriques Explosives.
ATS	Automatic Transfer Switch
AVM	Anti Vibration Mount
AVR	Automatic Voltage Regulator
BAT	Best Available Technology / Techniques.
BATNEEC	Best Available Techniques Not Entailing Excessive Costs , sometimes referred to as best available technology (BAT), was introduced in 1984 into European Economic Community law with Directive 84/360/EEC.
BOO	Build own operate
BOP	Balance of plant (auxiliary plant associated with the main generating set. Used mainly for large power stations)
BREF	BAT Reference Document
BS	British Standard
BS EN	British Standard Harmonised with European Standards (Euronorm)
BS ISO	British Standard adopted from ISO
CAA	Clean Air Act 1993 (First Introduced in1956)
CAB	Conformity Assessment Body
CAN	Controller area network. Communications protocol typically used in engine control units
CAS numbers	A CAS Registry Number® is used to provide a unique, identifier for chemical substances. CAS is a division of the American Chemical Society.

Frequently Used Industry Acronyms C-D

Acronym	Definition
CB	Circuit Breaker
CC	Constant current
CCA	Climate Change Agreement
CCGT	Combined Cycle Gas Turbine
CCTV	Closed Circuit Television
CD	Committee Draft
CDM	Construction Design & Management. UK regulations issue by HSE concerning aspects of construction projects.
CDV	Committee Draft for Vote
CE	"Conformité Européenne" – European Certification Standards and Markings. Not all products must bear the CE marking. Only those product categories subject to specific Directives that provide for the CE marking are required to be CE marked.
CEMS	Continuous Emission monitoring system
CGT	Controlled Gate Thyristor
CHP	Combined Heat and Power
CLP	Classification, Labelling and Packaging of Substances and Mixtures
CNG	Compressed Natural Gas
COBRA	Cabinet Office Briefing Room A
COM	European Commission
COMAH	Control Of Major Accident Hazards Regulations
COP	Continuous Power. A generating set power rating in accordance with ISO8528 rating definition: Constant (100%) load for unlimited running hours
CoP	Code of Practice
COSHH	Control of Substances Hazardous to Health
CPP	Construction Phase Plan
CT	Current Transformer
CV	Constant Voltage
D	Motor marking indicating certification against dust ingress
DALI	Digitally addressable lighting interface
dB	decibel
dBA	Weighted unit of sound closely corresponding to the response of the human ear (see above)
dBZ	dBZ stands for decibel relative to Z

Frequently Used Industry Acronyms D-E

Acronym	Definition
dc	Direct Current
DE	Drive End
DEF	Diesel Exhaust Fluid - exhaust after-treatment
DFIG	Double Fed Induction Generator - typically used for wind turbines
DG	Diesel Generator or Distributed Generator
DIL	Dynamic Insertion Loss (acoustic performance of a silencer with gas flow)
DIP	Dust Ignition Proof motors - used in areas of combustible dust
DIS	Draft International Standard
DMX	Digital Multiplexing
DNO	Distribution Network Operator
DOC	Diesel Oxidation Catalyst
DoC	Declaration of Conformity
DOL	Direct-on-line
DPF	Diesel Particulate Filter - exhaust after-treatment
DSEAR	The Dangerous Substances and Explosive Atmospheres Regulations
DSO	Distribution System Operator
DSR	Demand Side Response
DTC	Diagnostic trouble codes (particularly referring to CAN)
DVR	Digital Voltage Regulator
E- stop	Emergency stop (push button)
ECM	Engine Control Module (transposable with ECU)
ECU	Engine Control Unit (transposable with ECM)
EEC	Electronic engine controller
EExd	Designates flameproof motor enclosure - Zone 1 use BS EN 60079 refers
EExde	Designates flameproof motor increased safety box - Zone 1 use
EExe	Designates a motor enclosure alternative to non-sparking or flameproof - Zone 1 or Zone 2 use
EExna	Designates lowest level of non-sparking motor - Zone 2 use only
EExp	Designates pressurised enclosure, which can be purged and can be filled with inert gas - highest protection level for hazardous areas in the chemical and mineral oil industry
EExpe	Pressurised motor with increased safety terminal box
EFC	Electronic Fuel Control

Frequently Used Industry Acronyms E-F

Acronym	Definition
EFF1	Highest level of motor efficiency in European classification
EGHE	Exhaust Gas Heat Exchanger
EGR	Exhaust Gas Recirculation
EGS	Engine Governing System (Caterpillar engines)
EHSR	Essential Health and Safety Requirements as referred to in the Machinery Directive. Not a term used in the UK
ELV	Emission limit value
EMC	Electro-Magnetic Compatibility
EMP	Emissions Management Plan
EMP	Electro Magnetic Pulse
EMS	Environmental Management System
EN	Euronorm (European Standards) which must be transposed into Member State's Standards - see BS EN
EP	Environmental Permit
EPD	Explosion Protection Document (ATEX requirement, not in DSEAR)
ERA	Environmental Risk Assessment
ESA ICoP	A series of Industry Codes of Practice issued by ESA covering Landfill Gas extraction and Power Generation with relation to DSEAR.
ESD	Emergency shutdown device
ETR	Energise To Run
ETS	Energise To Stop
ETSI	European Telecommunications Standards Institute
EUT	Equipment Under Test
FADEC	Full Authority Digital Engine Control
FAME	Fatty Acid Methyl Ester, the most common form of BioDiesel
FAT	Field Acceptance Test
FAT	Factory Acceptance Test
FDIS	Final Draft International Standard
FIMS	Functional Identified Maintenance Systems
FMEA	Failure Mode and Effects Analysis
FPE	Front Panel Editor (when referring to an electronic controllers setting editor)
FPP	Fire Prevention Plan

Frequently Used Industry Acronyms F-L

Acronym	Definition
FRT	Fault ride through
FSD	Full scale deflection (maximum display of a metering device)
GA	General Arrangement (Drawing)
GFCI	Ground Fault Circuit Interrupter
GIUSP	Gas Industry Unsafe Situations Procedures
GOV	Engine governor
GPS	Global Positioning System
GSM	Global System for Mobile Communications
GUI	Graphic User Interface
HAZLOC	Abbreviation for hazardous location, as defined by NFPA
HAZOP	Hazard and Operability Study
HHV	Higher Heat Value (of fuel)
HSF	Health and Safety File
HTM	Health Technical Memorandum
HV	High Voltage. Voltages above 1000 V ac or 1500 V dc
HVO	Hydrated Vegetable Oil
IBC	Intermediate Bulk Containers
IDMT	Inverse Definite Minimum Time. Characteristic of a Protection Relay
IDNO	Independent Distribution Network Operator
IDT	Inverse Definite Time. Characteristic of a Protection Relay
IGBT	Insulated Gate Bipolar Transistor
IP	Ingress Protection
IPPC	Integrated Pollution Prevention and Control
IS	Intrinsically safe
ISBN	International Standard Book Number(ing)
L90,T	Unweighted version of LA90,T
LA90,T	Sound pressure level in dBA exceeded for 90% of the time period T(quietest 10% level), defined as the Background Sound Level in BS4142
LAeq,T	Sound pressure level in dBA logarithmically averaged over the time period T (to give equivalent average energy, biased towards higher levels due to logarithmic averaging process)
LASER	Light amplification by stimulated emission of radiation

Frequently Used Industry Acronyms L-M

Acronym	Definition
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LEQ	Equivalent continuous sound level
Leq,T	Unweighted version of LAeq
LEZ	Low Emission Zone or Clean Air Zone (CAZ) aims to reduce pollution levels and improve air quality. Part of the UK Governments Air Quality Plan
LHV	Lower Heat Value (of fuel)
LiON	Lithium ion battery, commonly used in home electronics but more recently in vehicles and utility scale energy storage
LNG	Liquefied Natural Gas
LOLER	Lifting Operations and Lifting Equipment Regulations
Lp	Sound pressure level (logarithmic ratio relative to 20 µPa)
LPG	Liquid Petroleum Gas
LTP	The maximum power available, under agreed operating conditions, for which the generating set is capable of delivering for up to 500 hours of operation per year with the maintenance intervals and procedures being carried out as prescribed by the manufacturer. As stated in BS ISO 8528.
LV	Low Voltage - voltages below 1 000 V ac or 1 500 V dc
LVRT	Low Voltage Ride Through
Lw	Sound power level (logarithmic ratio relative to 10-12W)
MAWP	Maximum Allowable Working Pressure
MCB	Miniature Circuit Breaker
MCCB	Moulded Case Circuit Breaker
MCERTS	Monitoring Certification Scheme
MCPD	Medium Combustion Plant Directive
MN	Methane Number
MOV	Metal Oxide Varistor
MPU	Magnetic Pick Up
MSC	MultiSet communications link
MSDS	Material Safety Data Sheet
MTTF, MTBF & MTTR	Mean time between failures (MTBF) is the predicted elapsed time between inherent failures of a mechanical or electronic system, during normal system operation. MTBF can be calculated as the arithmetic mean (average) time between failures of a system. The term is used for repairable systems, while mean time to failure (MTTF) denotes the expected time to failure for a non-repairable system

Frequently Used Industry Acronyms N-P

Acronym	Definition
MV	Medium Voltage. Term not used in UK
N+1 / N+N	N+1 redundancy is a form of resilience that ensures system availability in the event of component failure
NB	Notified Body
NDE	Non Drive End
NEBOSH	The National Examination Board in Occupational Safety and Health
NG	Natural Gas
NiCAD	Nickel Cadmium
NMP	Noise Management Plan
NMVOC	Non-Methane Volatile Organic Compounds
NRMM	Non Road Mobile Machinery
NSB	National Standards Body (BSI is the UK's NSB)
NTS	Non-Technical Summary
O&M Manual	Operation & Maintenance Manual
OCB	Oil Circuit Breaker
OEM	Original Equipment Manufacturer
OHSAS	Occupational Health and Safety Assessment Series
OMP	Odour Management Plan
ONAN	Oil Natural Air Natural. The normal transformer construction with internal oil circuit and external air circuit by natural circulation, not forced circulation
PAT	Portable Appliance Testing
PCI	Pre-Construction Information. The pre-construction information is a document required on construction projects under CDM. See also, CDM.
PCM	Partially Complete Machinery
PCSR	Pre-construction safety report
PDM	Pulse duration modulation
pf	Power Factor
PII	Professional Indemnity Insurance
PLC	Programmable Logic Controller
PM number	PM (particulate matter) micrometres diameter, usually limits are considered for PM 10 and PM 2.5. The Air Quality Standards Regulations 2010 stipulate limits in µg/m3
PMG	Permanent Magnet Generator. Used for the power supply for a generator AVR

Frequently Used Industry Acronyms P-R

Acronym	Definition
PPE	Personal Protective Equipment
PPG	Pollution Prevention Guidelines (Withdrawn)The Environment Agency no longer provides 'good practice' guidance
PRP	The maximum power which a generating set is capable of delivering continuously whilst supplying a variable load when operating for an unlimited number of hours per year under the agreed operating conditions with the maintenance intervals and procedures being carried out as prescribed by the manufacturer. The permissible average power over 24 hours of operation must not exceed 70% of the Prime Power agreed by the engine manufacturer. As stated in BS ISO 8528.
PSCC	Prospective Short Circuit Current
PSSR	Pressure Systems Safety Regulations 2000
PSU	Power Supply Unit
PT	Potential transformer. Same as VT
PT100	RTD where its characteristics gives 100 ohms at 0 deg C
PT1000	RTD where its characteristics gives 1000 ohms at 0 deg C
PUWER	Provision and Use of Work Equipment Regulations
PVC	Polyvinyl chloride
PWM	Pulse width modulation
QA	Quality assurance
QC	Quality control
R & D	Research and Development
R.O.C.O.F	Rate of change of Frequency (detection of mains failure when in parallel with the mains). Also written as RoCoF
RAMS	Risk Assessment and Method Statement
RCBO	Residual current operated circuit-breakers with integral overcurrent protection (see RCD)
RCCB	Residual current operated circuit-breakers without integral overcurrent protection (see RCD)
RCD	Residual Current Device. An RCD is a sensitive safety device that switches off electricity automatically if there is a fault. Used as a control to reduce the risk of electric shock and protect installations against fire. See also RCCB & RCBO
RDF	Refuse Derived Fuel
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals. Under REACH, companies need to identify and manage the risks created by the substances they manufacture and market.
REGS	Regulations - as in 'the wiring regs'
RIC	Reciprocating Internal Combustion (Engine)
RICE	Reciprocating Internal Combustion Engine

Frequently Used Industry Acronyms R-S

Acronym	Definition
RIDDOR	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations. The legal requirements for reporting specific injuries, including fatal, major and over 7-day, plus diseases and dangerous events at work.
RMS	Root Mean Square
RoRo	Roll-on Roll-off vehicle ferry
RPM	Revolutions Per Minute
RPS	Regulatory Position Statement.
RTC	Real time clock
RTD	Resistance Temperature Detector
SAT	Site Acceptance Test
SCADA	Supervisory Control And Data Acquisition
SCIP	SCIP is the database for information on Substances of Concern In articles as such or in complex objects (Products) established under the Waste Framework Directive (WFD). Not transposed into GB.
SCR	Silicon Controlled Rectifier - thyristor
SCR	Selective Catalytic Reduction - exhaust after-treatment
SDS	Safety Data Sheet (See MSDS)
SF6	Sodium Hexafluoride
SFAIRP	So Far As Is Reasonably Practicable. It Is a legal duty of every employer to ensure health safety and welfare - so far as is reasonably practicable. See also, ALARP.
SHTN	Scottish Hospital Technical Note
SI	Systeme Internationale
SI	Statutory Instrument
SIL	Static Insertion Loss (acoustic performance of a silencer with no gas flow)
SIL	Safety integrity level
SMPS	Switched-Mode Power Supply
SMS	Short Message Service, part of GSM services
SOLAS	Safety of Life at Sea
SPL	Sound Pressure Level (obsolete term, now superseded by Lp)
SRF	Solid Recovered Fuel
SRI	Sound Reduction Index (reduction in sound level resulting from transmission through a material)
STOR	Short Term Operating Reserve

Frequently Used Industry Acronyms S-W

Acronym	Definition
SWL	Safe Working Load. Marked on lifting equipment, the safe working load is a maximum load which should not be exceeded. See also, LOLER.
TBT	Toolbox Talk. Toolbox talks are short safety discussions. They usually happen on the job and are focused on a single safety topic.
TCP	Transmission control protocol
TE&T	(Statutory) Thorough Examination and Testing
TFT	Thin film transistor (used in LCD displays)
TIF	Telephone Influence Factor
TSO	Transmission system operator
UKCA	UK Conformity Assessed
ULEZ	Ultra-Low Emissions Zone
UPS	Uninterruptible Power Supply
VFD	Variable Frequency Drive. Same as VSD but used in the USA
VOC	Volatile Organic Compounds
VSD	Variable Speed Drive
VT	Voltage transformer - same as PT
W/L	Warning Lamp in DC charging alternators
WAHR	Work at Height Regulations. Employers and those in control of any work at height activity must make sure work is properly planned, uses the right type of equipment, is supervised and carried out by competent people
WHRU	Waste Heat Recovery Unit (heat exchanger)
WIMES	Water Industry Mechanical and Electrical Specification

Units of measurement

SI UNITS

The recommended practical system of units of measurement is the International System of Units (Système International d'Unités) with the international abbreviation SI.

The SI system is maintained by the International Bureau of Weights and Measures (BIPM)

There are two classes of units in the SI: base units and derived units. The base units provide the reference used to define all the measurement units of the system, whilst the derived units are products of base units and are used as measures of derived quantities:

The seven SI base units, which comprise:

Base quantity	Symbol for dimension	SI unit	Unit Symbol
amount of substance	N	mole	mol
electric current	I	ampere	A
length	L or l	metre	m
luminous intensity	Iv	candela	cd
mass	M or m	kilogram	kg
thermodynamic temperature	Θ or T	kelvin	K
time	T or t	second	s

Named units derived from SI base units

Name	Symbol	Quantity	Expressed in terms of other SI units	Expressed in terms of SI base units
coulomb	C	electric charge or quantity of electricity		s·A
degree Celsius	°C	temperature relative to 273.15 K		K
farad	F	electric capacitance	C/V	kg−1·m−2·s4·A2
henry	H	inductance	Wb/A	kg·m2·s−2·A−2
hertz	Hz	frequency		s−1
joule	J	energy, work, heat	N·m	kg·m2·s−2
lumen	lm	luminous flux	cd·sr	cd
lux	lx	illuminance	lm/m2	m−2·cd
newton	N	force, weight		kg·m·s−2
ohm	Ω	electric resistance, impedance, reactance	V/A	kg·m2·s−3·A−2
pascal	Pa	pressure, stress	N/m2	kg·m−1·s−2
radian	rad	angle		m·m−1
siemens	S	electrical conductance	A/V	kg−1·m−2·s3·A2
steradian	sr	solid angle		m2·m−2
tesla	T	magnetic flux density	Wb/m2	kg·s−2·A−1
volt	V	voltage (electrical potential difference), electromotive force	W/A	kg·m2·s−3·A−1
watt	W	power, radiant flux	J/s	kg·m2·s−3
weber	Wb	magnetic flux	V·s	kg·m2·s−2·A−1

Summary of Performance Classes

The performance of generating sets in respect of voltage and frequency stability and transient behaviour under load conditions is dictated by BS ISO 8528-1: 2005. Here follows a short summary of the performance classes defined in that document. AMPS publishes a full guide to this document and all the BS ISO 8528 series – please contact for further information.

FREQUENCY REGULATION

Note: Performance in this class will be affected by voltage.

Class G1

Frequency droop = <8%, steady state 2.5%.

18% transient frequency change on rejection of full rated load, recovering to the steady state frequency band within 10 seconds.

15% transient frequency change when maximum load step is applied, recovering to the steady state frequency band within 10 seconds.

Class G2

Frequency droop = <5%, steady state 1.5%.

12% transient frequency change on rejection of full rated load, recovering to the steady state frequency band within 5 seconds.

10% transient frequency change when maximum load step is applied, recovering to the steady state frequency band within 5 seconds.

Class G3

Frequency droop = <3%, steady state 0.5%.

10% transient frequency change on rejection of full rated load, recovering to the steady state frequency band within 3 seconds.

7% transient frequency change when maximum load step is applied, recovering to the steady state frequency band within 3 seconds.

Class G4

Special.

To be specified by the customer if better than the classes stated.

Summary of Performance Classes

VOLTAGE REGULATION

Note: Performance in this class will be affected by frequency.

Class G1

Steady state ±5% at rated frequency, voltage and power factor.

25% transient voltage dip recovering to 95% of the rated voltage within 2.5 seconds when the maximum load step is applied.

Typical:

15% transient voltage dip recovering to 95% of the rated voltage within 1.5 seconds when a zero to 35% load step is applied.

Class G2

Steady state ±2.5% at rated frequency, voltage and power factor.

20% transient voltage dip recovering to 97% of the rated voltage within 1.5 seconds when the maximum load step is applied.

Typical:

15% transient voltage dip recovering to 97% of the rated voltage within 0.5 seconds when a zero to 60% load step is applied.

Class G3

Steady state ±1% at rated frequency, voltage and power factor.

15% transient voltage dip recovering to 99% of the rated voltage within 1.5 seconds when the maximum load step is applied.

Typical:

15% transient voltage dip recovering to 99% of the rated voltage within 0.5 seconds when a zero to 60% load step is applied.

Class G4

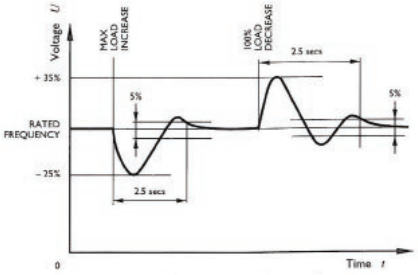
Special.

To be specified by the customer if better than the classes stated.

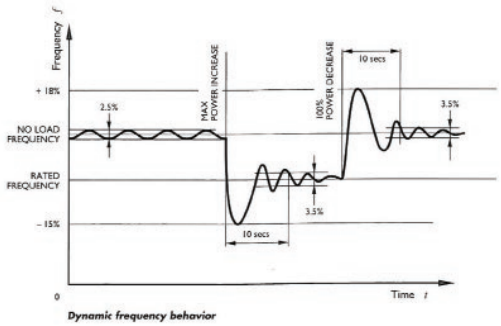
Operating Limits of Performance Classes

TABLE 1 OPERATING LIMITS OF PERFORMANCE CLASS G1

General application for generating sets with COP (continuous power) rating definition. Intended for manual load switching where load acceptance limits are not important and where no particular transient performance is required.



Transient voltage characteristics without quadrature-current compensation voltage droop

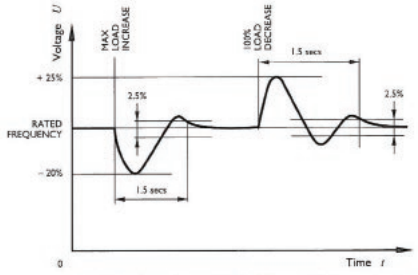


Dynamic frequency behavior

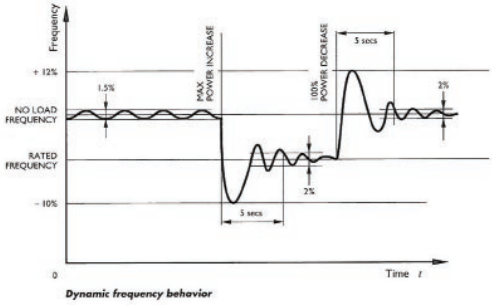
Table 1
Operating limits of performance class G1

TABLE 2 OPERATING LIMITS OF PERFORMANCE CLASS G2

Generally for generating sets with PRP (prime power) or LTP (limited time running power) definition. Intended for use where loads acceptance limits are necessary important and voltage characteristics are similar to commercially available power.



Transient voltage characteristics without quadrature-current compensation voltage droop



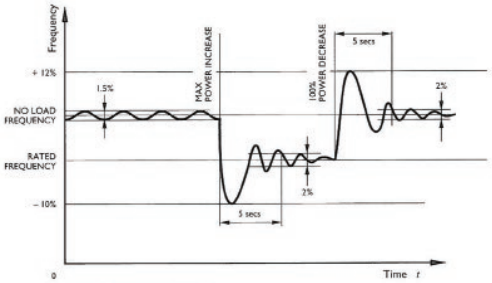
Dynamic frequency behavior

Table 2
Operating limits of performance class G2

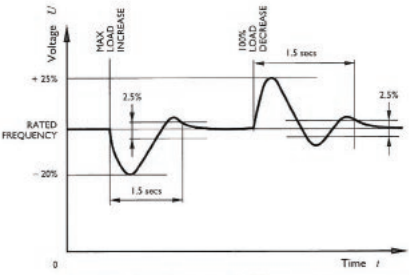
Operating Limits of Performance Classes

TABLE 3 OPERATING LIMITS OF PERFORMANCE CLASS G3

General application for generating sets with PRP (prime power) or LTP (limited time running power) definition. Intended for typical mains failure and/or emergency back-up where load acceptance limits are important and transient characteristics for voltage and frequency are more precise.



Dynamic frequency behavior

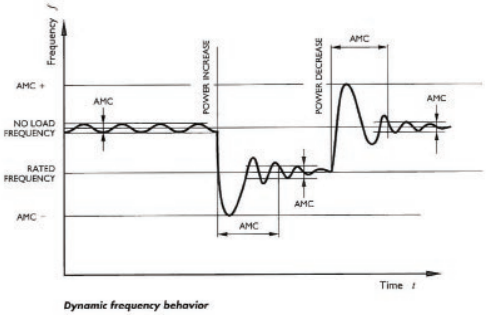


Transient voltage characteristics without quadrature-current compensation voltage droop

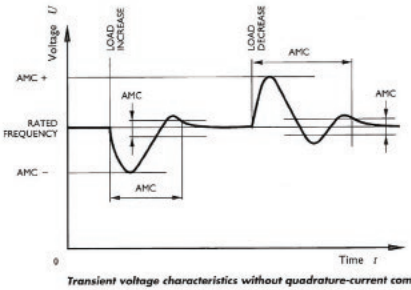
Table 3
Operating limits of performance class G3

TABLE 4 OPERATING LIMITS OF PERFORMANCE CLASS G4

The generating set shall satisfy the operating limits of the performance Classes of ISO 8528 Part 5, where these are applicable or as agreed between the customer and manufacturer.



Dynamic frequency behavior



Transient voltage characteristics without quadrature-current compensation voltage droop

AMC = by agreement between manufacturer and customer.

Table 4
Operating limits of performance class G4

Associations and Organisations

Organisation	Description	Website	Country
ACEA	European Car Manufacturers Association	www.acea.auto/	EU
ACER	Agency for the Cooperation of (European) Energy Regulators	www.acer.europa.eu	Europe
ACTAD	Advisory Committee On Electricity Transmission And Distribution (division of IEC)	www.iec.ch/	International
AEM	Association of Equipment Manufacturers	www.aem.org	USA
AFNOR	Association Française de Normalisation (French National Standards Body)	www.afnor.org/en	Fra
AMPS	The Association of Manufacturers of Power generating Systems.	www.amps.org.uk	UK
ANEC	European Association for the Co-ordination of Consumer Representation in Standardisation	www.anec.eu	EU
ASME	American Society of Mechanical Engineers	www.asme.org	US
ASTA	Association of Short-circuit Testing Authorities	www.intertek.com/	International
ASTM	American Society for Testing and Materials	www.astm.org	US
BIPM	the International Bureau of Weights and Measures (Bureau International des Poides et Mesures - BIPM)	http://www.bipm.org	International
BRE	Building Research Establishment	https://bregroup.com/	UK
BSI	British Standards Institution	www.bsigroup.com/en-GB/	UK
CEA	Construction Equipment Association	www.thecea.org.uk	UK
CEA	Combustion Engineers Association	www.cea.org.uk	UK
CECE	Committee for European Construction Equipment		Europe
CEEMET	European Association of Employers of the Metal, Engineering and Technology-Based Industries	www.ceemet.org	EU
CEMA	European Agricultural Machinery Manufacturers Association	www.cema-agri.org/	Europe
CEMEP	Forum for European electrical motor manufacturers providing classification of motors based on energy efficiency - designated by EFF1, EFF2, or EFF3, EFF1 being most efficient	www.cemep.eu	Europe
CEN	European Committee for Standardization	www.cen.eu	Europe
CENELEC	European Committee for Electro-technical Standardisation	www.cenelec.eu	Europe
CESAR	Construction and Agricultural Equipment Security and Registration scheme	www.cesarscheme.org	UK
CHAS	Contractors Health and Safety Assessment Scheme	www.chas.co.uk	UK
CIBSE	Chartered Institution of Building Service Engineers	www.cibse.org	UK

Associations and Organisations

Organisation	Description	Website	Country
CIGRE	Conseil International des Grands Réseaux Électriques (International Council On Large Electric Systems)	www.cigre.org	International
CIMAC	The International Council on Combustion Engines	http://www.cimac.com/	International
CISPR	Comité International Spécial des Perturbations Radioélectriques (English: International Special Committee on Radio Interference) - part of IEC	www.iec.ch/emc/iec_emc/iec_emc_players_cispr.htm	International
CITB	Construction Industry Training Board	www.citb.co.uk	UK
CONCAWE	Concawe was established in 1963 by a small group of leading oil companies to carry out research on environmental issues relevant to the oil industry. It is a division of FuelsEurope	www.concawe.eu/	EU
CONIAC	The Construction Industry Advisory Committee (CONIAC) advises HSE and relevant stakeholders of emerging health and safety developments and risks in the construction industry.		UK
CONIAN	Construction Industry Advisory Network - sub group of CONIAC		UK
CSCS	Construction Skills Certification Scheme	www.cscs.uk.com/	UK
DAERA	Department of Agriculture, Environment and Rural Affairs	www.daera-ni.gov.uk	NI
DBT	Department for Business and Trade	www.gov.uk/government/organisations/department-for-business-and-trade	UK
Dcode	Distribution Code	www.dcode.org.uk/	UK
DEFRA	Department for Environment Food & Rural Affairs	https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs	UK
DESNZ	Department for Energy Security and Net Zero	www.gov.uk/government/organisations/department-for-energy-security-and-net-zero	UK
DIN	Deutsches Institut für Normung (German National Standards Body)	www.din.de/en	Ger
DNV	Det NorskeVeritas	www.detnorskeveritas.com	International
DSIT	Department for Science, Innovation & Technology	www.gov.uk/government/organisations/department-for-science-innovation-and-technology	UK

Associations and Organisations

Organisation	Description	Website	Country
EA	Environment Agency	www.gov.uk/government/organisations/environment-agency	UK
ECHA	European Chemical Agency	https://echa.europa.eu	EU
EEMUA	The Engineering Equipment and Materials Users Association	www.eemua.org	INT
EFC	Electro Federation Canada (previously CEMA)	http://www.electrofed.com/	Canada
EGMF	The European Garden Machinery Industry Federation	https://www.egmf.org	EU
EGSA	Electrical Generating Systems Association	www.egsa.org	USA
EI	Energy Institute	www.energyinst.org	UK
ENA	Energy Networks Association	www.energynetworks.org	UK
ENTSO-E	European Network of Transmission System Operators for Electricity	www.entsoe.eu	Europe
ENTSO-G	the European Network of Transmission System Operators for Gas	www.entsog.eu	Europe
ESA	Environmental Services Association	http://www.esauk.org	UK
ETSI	European Telecommunications Standards Institute	www.etsi.org	EU
EU	European Union	https://europa.eu/european-union/index_en	EU
EUGINE	European Engine Power Plants Association	http://www.eugine.eu	Europe
EURAMET	The European Association of National Metrology Institutes	http://www.euramet.org	Europe
Euromot	The European Association of Internal Combustion Engine Manufacturers	www.euromot.org	Europe
Europgen	European Generating Set Association	www.europgen.eu	Europe
FM	Factory Mutual Research Insurance and approvals company	www.fmglobal.com	USA
FMA	Facilities Management Association	www.fmassociation.org.uk	UK
FuelsEurope	Association of fuel producers and refiners in Europe	www.fuelseurope.eu/	EU
GAMBICA	Association for the Instrumentation, Control and Automation Industry in the UK	www.gambica.org.uk/	UK
GEMA	Gas and Electricity Markets Authority	www.ofgem.gov.uk	UK
GHS	UN's Globally Harmonized System of classification and labelling of chemicals in the workplace	https://unece.org/about-ghs	UN
GLA	Greater London Authority	www.london.gov.uk/	UK

Associations and Organisations

Organisation	Description	Website	Country
HSE	Health and Safety Executive	www.hse.gov.uk	UK
IDGTE	See IPowerE		UK
IEA	International Energy Agency	www.iea.org	International
IEC	International Electrotechnical Commission	www.iec.ch	International
IEEE	Institution of Electrical and Electronic Engineers	www.ieee.org	USA
IET	Institution of Engineering Technology	www.theiet.org	UK
IGEm	Institution of Gas Engineers and Managers	www.igem.org.uk	UK
IOA	Institute of Acoustics	www.ioa.org	UK
IOSH	The Institution of Occupational Safety and Health	https://iosh.com	UK
IPowerE	The Institution of Power Engineers (previously IDGTE)	https://ipowere.org	UK
ISO	International Organisation for Standardisation	www.iso.org	International
NAM	National Association of Manufacturers	www.nam.org	USA
NCSC	The National Cyber Security Centre	www.ncsc.gov.uk	UK
NEBOSH	National Examination Board in Occupational Safety and Health	www.nebosh.org.uk	UK
NEC	The National Electrical Code is developed by NFPA's Committee on the NEC. Work on the NEC is sponsored by the National Fire Protection Association. The NEC is approved as an American national standard by the American National Standards Institute (ANSI). It is formally identified as ANSI/ NFPA 70.	www.nfpa.org	USA
NEmA	National Electrical Manufacturers Association	www.nema.org	USA
NFPA	National Fire Protection Agency	www.nfpa.org	USA
NG	National Grid. Own and operate the 400kV electricity transmission system in England and the high pressure gas transmission system in Great Britain	www2.nationalgrid.com	UK
NGESO	NGESO is the Electricity System Operator for the GB National Electricity Transmission System (NETS)	www.nationalgrideso.com	UK
NPL	National Physical Laboratory	http://www.npl.co.uk	UK
NSAI	National Standards Authority of Ireland	https://www.nsai.ie	RoI
ODELIA	Outdoor Equipment Noise Limit Assessment. On 1 April 2015, the European Commission launched a study to assess the OND scope and noise limit values. The Commission selected a consortium called 'Odelia' (Outdoor Equipment Noise Limit Assessment). It is composed of TNO (Netherlands Organisation for Applied Scientific Research) together with TUEV Nord Gp and Imamoter.		EU

Associations and Organisations

Organisation	Description	Website	Country
OEKO	OEKO Insitut e.V. – A consultant organisation to the European Commission specialising in the Restriction on Hazardous Substances in Electrical and Electronic Equipment Directive (RoHS).	www.oeko.de/en/	Germany
OFGEM	Office of Gas and Electricity Markets	www.ofgem.gov.uk	UK
OFTEC	Oil Firing Technical Association	www.oftec.org.uk	UK
OHEEG	Off Highway Engines and Equipment Group (OHEEG), of which AMPS is a member.	www.smmt.co.uk/	UK
ORGALIME	European Engineering Industries Association	www.orgalime.org	Europe
OS	Ordnance Survey	https://shop.ordnancesurvey.co.uk/	UK
OSHA	Occupational Safety and Health Administration	www.osha.gov	USA
SAE	Society of Automotive Engineers	www.sae.org	USA
SEPA	The Scottish Environment Protection Agency	www.sepa.org.uk	UK
SMMT	The Society of Motor Manufacturers and Traders	www.smmt.co.uk/	UK
SONI	(Electricity Transmission) System Operator for Northern Ireland	www.soni.ltd.uk/	NI
SSIP	Safety Schemes in Procurement. SSIP is an umbrella body for assessment schemes. If you have health and safety accreditation from SSIP members such as CHAS, Acclaim or Safe Contractor, you have satisfied the criteria for all other SSIP members schemes.	https://ssip.org.uk	UK
UKAS	United Kingdom Accreditation Service	www.ukas.com	UK
UKRI	UK Research and Innovation	www.ukri.org	UK
UL	Underwriters Laboratories.	www.ul.com	USA
UNECE	United Nations Economic Commission for Europe	www.unce.org	International
VCA	Vehicle Certification Agency	www.vehicle-certification-agency.gov.uk	UK
VDI	"Verein Deutscher Ingenieure e.V. (The Association of German Engineers)"	www.vdi.eu	Ger
WAMITAB	Waste Management Industry Training and Advisory Board (Part of CIWM)	https://ciwmquals.co.uk/	UK
WHO	World Health Organization	www.who.int	International
WIMES	The Water Industry Mechanical and Electrical Specifications	www.pumpcenter.org	UK

Common Industry Standards

Reference	Acronym	Title
Common Industry Standards		
2000/14/EC	OND	Outdoor Noise Directive. 2005/88/EC as amended. Noise emission in the environment by equipment for use outdoors (OND)
2004/26/EC	NRMM	Non Road Mobile Machinery Regulation. The Non-Road Mobile Machinery contains seven Regulations. The main Regulation is 97/68/EC. The amendments of the Regulation include the following: 2002/88/EC 2004/26/EC 2006/105/EC 2010/26/EU 2011/88/EU 2012/46/EU
2006/42/EC	MD	Machinery Directive – Safety (see below)
2006/66/EC	BD	Battery Directive. (see below)
2010/75/EU	IED	The Industrial Emissions Directive
2011/65/EU	RoHS 2	Restriction of Hazardous Substances (RoHS 2) Directive
2012/19/EU	WEEE	Waste Electrical and Electronic Equipment (WEEE) Directive.
2014/30/EU	EMC	Electro-magnetic compatibility (EMC) Directive.
2014/35/EU	LVD	The Low Voltage Directive (LVD). Also note standard BS EN 60204-1 Safety of machinery – Electrical equipment of machines – General requirements.
2014/68/EU	PED	Pressure Equipment Directive replacing the original "PED" 97/23/EC
2016/631/EC	RfG	Requirements for generators Regulation - new connection standards for generators
80/181/EEC		Units of measurement
2023/1230/EU	MR	Machinery Regulation which will replace 2006/42/EC Machinery Directive (MD)
2023/1542/EU	BR	Battery Regulation concerning batteries and waste batteries, amending Directive 2008/98/EC and Regulation (EU) 2019/1020 and repealing Directive 2006/66/EC

Reference	Title
British Standards	
BS 0	A standard for standards - Principles of standardization
BS AU 228 (ISO 7468)	Nominal dimensions and tolerances of flywheel housings for reciprocating internal combustion engines
BS EN 349	Safety of machinery – Minimum gaps to avoid crushing parts of the human body
BS EN 547-1	Safety of machinery. Human body measurements. Principles for determining the dimensions required for openings for whole body access into machinery
BS EN 547-2	Safety of machinery. Human body measurements. Principles for determining the dimensions required for access openings

Common Industry Standards

Reference	Title
BS EN 547-3	Safety of machinery. Human body measurements. Anthropometric data.
BS EN 614-1	Safety of machinery. Ergonomic design principles. Terminology and general principles
BS ISO 668	Series 1 freight containers. Classification, dimensions and ratings
BS 799-5	Oil burning equipment. Carbon steel oil storage tanks. Specification.
BS EN 953	Safety of machinery. Guards. General requirements for the design and construction of fixed and moveable guards
BS EN 1037	Safety of machinery – Prevention of unexpected start up.
BS EN ISO 2553	Welding and allied processes - Symbolic representation on drawings
BS 2869	Fuel oils for agricultural, domestic and industrial engines and boilers. Specification
BS ISO 3046-1	Reciprocating internal combustion engines – Performance. Part 1: Declaration of power, fuel and lubricating oil consumptions, and test methods - Additional requirements for engines for general use.
BS ISO 3046-3	Reciprocating internal combustion engines - Specification for test measurements.
BS ISO 3046-4	Reciprocating internal combustion engines - Speed governing.
BS ISO 3046-5	Reciprocating internal combustion engines - Torsional vibrations
BS ISO 3046-6	See BS 5514-6:1992
BS EN ISO 3744	Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane.
BS 4142	Methods for rating and assessing industrial and commercial sound
BS ISO 4406	Hydraulic fluid power. Fluids. Method for coding the level of contamination by solid particles.
BS 5266	Code of practice for emergency lighting
BS 5410 -1	Code of practice for oil firing. Installations up to 45 kW output capacity for space heating and hot water supply purposes.
BS 5410-2	Code of practice for oil firing. Installations of 44kW and above output capacity for space heating, hot water and steam supply purposes.
BS 5410-3	Code of practice for oil firing. Installations for furnaces, kilns, ovens, oil-fuelled generators and other industrial purposes
BS 5514-6, ISO 3046-6	Reciprocating internal combustion engines. Performance. Specification for overspeed protection
BS 5839	Collection: Fire detection and alarm systems for buildings
BS 6423	Code of practice for maintenance of electrical switchgear and controlgear for voltages above 1 'kV and up to and including 36 'kV
BS ISO 6826	Reciprocating internal combustion engines - Fire protection.

Common Industry Standards

Reference	Title
BS 7375	Distribution of electricity on construction and demolition sites. Code of practice
BS 7430	Code of Practice for protective earthing of electrical installations.
BS 7671	Requirements for Electrical Installations. IET wiring regulations, 17th edition
BS 7698-10, ISO 8528-10	Reciprocating internal combustion engine driven alternating current generating sets. Measurement of airborne noise by the enveloping surface method.
BS 7909	Code of practice for temporary electrical systems for entertainment and related purposes
BS 8233	Guidance on sound insulation and noise reduction for buildings
BS ISO 8528-1	Reciprocating internal combustion engine driven generating sets - Rating and performance
BS ISO 8528-2	Reciprocating internal combustion engine driven generating sets - Engines.
BS ISO 8528-3	Reciprocating internal combustion engine driven generating sets - AC generators.
BS ISO 8528-4	Reciprocating internal combustion engine driven generating sets - Controlgear and switchgear.
BS ISO 8528-5	Reciprocating internal combustion engine driven generating sets - Generating sets.
BS ISO 8528-6	Reciprocating internal combustion engine driven generating sets - Test methods.
BS ISO 8528-7	Reciprocating internal combustion engine driven generating sets - Technical declarations
BS ISO 8528-8	Reciprocating internal combustion engine driven generating sets - Requirements and tests for low power generating sets
BS ISO 8528-9	Reciprocating internal combustion engine driven generating sets - Measurement and evaluation of mechanical vibrations
BS ISO 8528-10	Reciprocating internal combustion engine driven generating sets - Measurement of airborne noise.
BS ISO 8528-12	Reciprocating internal combustion engines driven generating sets - Emergency power supply to safety services.
BS ISO 8528-13	Reciprocating internal combustion engine driven alternating current generating sets - Safety
BS EN ISO 9000	Collection: Quality control standards.
BS EN ISO 12100	Safety of machinery – General principles for design – Risk assessment and risk reduction.
BS EN 12601	Reciprocating internal combustion engine driven generating sets. Safety.
BS EN ISO 12937	Methods of test for petroleum and its products. BS 2000-438. Petroleum products. Determination of content. Coulometric Karl Fischer titration method
BS EN ISO 13732-1	Ergonomics of the thermal environment. Methods for the assessment of human responses to contact with surfaces. Hot surfaces
BS EN ISO 13849-1	Safety of machinery. Safety-related parts of control systems. General principles for design.
BS EN ISO 13850	Safety of machinery - Emergency stop function. Principles for design

Common Industry Standards

Reference	Title
BS EN ISO 13857	Safety of machinery. Safety distances to prevent hazard zones being reached by upper and lower limbs
BS EN ISO 14001	Collection British Standard for Environmental Management.
BS ISO 15550	Internal combustion engines - Determination and method for the measurement of engine power - General requirements
BS EN ISO 15614	Collection: Specification and qualification of welding procedures for metallic materials.
BS EN ISO 15867:	Intermediate bulk containers (IBCs) for non-dangerous goods — Terminology
BS OHSAS 18001 collection	British Standard for Occupational Health & Safety management Systems
BS EN ISO/IEC 27001	Information technology. Security techniques. Information security management systems. Requirements
BS EN 50110	Collection: Operation of electrical installations
BS EN 50160	Voltage characteristics of electricity supplied by public electricity networks.
BS EN 50581	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
BS EN 60076	Collection; Power Transformers
BS EN 60079	Electrical Surface Heating
BS EN 60204-1	Safety of machinery. Electrical equipment of machines. General requirements
BS EN 60204-11	Safety of machinery. Electrical equipment of machines. Requirements for HV equipment for voltages above 1000 V a.c. or 1500 V d.c. and not exceeding 36 kV
BS EN 60309	Collection: Plugs socket-outlets and couplers for industrial purposes
BS EN 61310-1	Safety of machinery – Indication, marking and actuation – Part 1: Requirements for visual, auditory and tactile signals.
BS EN 61310-2	Safety of machinery – Indication, marking and actuation – Part 2: Requirements for marking.
BS EN 60422	Monitoring and maintenance guide for mineral insulating oils in electrical equipment
BS EN 61439	Collection: Low-voltage switchgear and controlgear assemblies
BS EN 60445	Basic and safety principles for man-machine interface, marking and identification. Identification of equipment terminals, conductor terminations and conductors
BS EN 60529	Degrees of protection provided by enclosures (IP code) (IEC 529:1989).
BS EN 60947-1	Low-voltage switchgear and controlgear. General rules.
BS EN 60947-6-1	Low-voltage switchgear and controlgear. Multiple function equipment. Transfer switching equipment.

Common Industry Standards

Reference	Title
BS EN 61310-1	Safety of machinery – Indication, marking and actuation – Part 1: Requirements for visual, auditory and tactile signals.
BS EN 61310-2	Safety of machinery – Indication, marking and actuation – Part 2: Requirements for marking.
BS EN 61439-1	Low-voltage switchgear and controlgear assemblies. General rules.
BS EN 61439-2	Low-voltage switchgear and controlgear assemblies. Power switchgear and controlgear assemblies.
BS EN 61508	Collection: Functional safety of electrical/electronic/ programmable electronic safety-related systems.
BS EN 62305	Collection: Code of practice for protection of structures against lightning
BS EN IEC 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances
BS EN ISO 80000-1	Collection: Quantities and units.
International Electrotechnical Commission	
IEC 60034	Collection: Rotating electrical machines
IEC 60034-1	Rotating electrical machines - Rating and performance
IEC 60034-18-21	Rotating electrical machines - Functional testing of Insulation systems
IEC 60034-22	Rotating electrical machines - AC generators for reciprocating internal combustion (RIC) engine driven generating sets
IEC 61000	Collection: Electromagnetic compatibility (EMC).
IEC 62271	Collection: High voltage switchgear and controlgear
CISPR / IEC	
CISPR 14-1	Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emission
CISPR 15	Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
UK Law	
CDM	The Construction Design & Management (CDM) Regulations. UK regulations issued by HSE concerning Design and Management aspects of construction projects.
DSEAR	The Dangerous Substances and Explosive Atmospheres Regulations
EA	Electricity Act 1989
EaWR	Electricity at Work Regulations 1989
ESQCR	Electricity Safety, Quality and Continuity Regulations

Common Industry Standards

Reference	Title
GSMR	Gas Safety Management Regulations
HASAWA	Health and Safety at Work etc Act 1974
MHSWR	Management of Health and Safety at Work Regulations
PPE	The Personal Protective Equipment at Work Regulations 1992
PPG	Pollution Prevention Guidelines (WITHDRAWN). The Environment Agency no longer provides 'good practice' guidance
LOLER	Lifting Operations and Lifting Equipment Regulations
Energy Networks Association	
G5/4-1	An Energy Networks Association (ENA) document specifying the limits for harmonic distortion on utility supplies.
G10	Republic of Ireland (Eire) code for paralleling with the mains utility supply
G59/3	Engineering guidance and recommendations G59/3, relating to the connection of generating plant to the distribution systems of licensed Distribution Network Operators. (Existing plant only)
G83	Engineering guidance and recommendations for the connection of small scale embedded generators (up to 16A per phase) in parallel with public low voltage distribution networks. (Existing plant only)
G98	An Energy Networks Association (ENA) document specifying the connection and protection requirements for the connection of a generator, above 16 Amps per phase, to the Distribution Network under the RfG Directive.
G99	An Energy Networks Association (ENA) document specifying the connection and protection requirements for the connection of a generator, below 16 Amps per phase, to the Distribution Network under the RfG Directive.
G100	An Energy Networks Association (ENA) document specifying Technical Requirements for Customer Export Limiting Schemes
Institution of Gas Engineers and Managers	
IGE/UP/1	Strength testing, tightness testing and direct purging of industrial and commercial gas installations.
IGE/UP/2	Installation pipework on industrial and commercial premises
IGE/UP/3	Gas Utilization Procedures: Gas fuelled spark ignition and dual fuelled engines
Energy Institute (Institute of Petroleum)	
IP395	The test procedure for determining the Total Viable Count of microbial content within fuel oils (also known as Diesel Bug)
IP438	International Standard – The Karl Fischer method of determining the water content of fuel and lubricating oils (identical to BS EN ISO 12937:2001, BS 2000-438:2001).

Common Industry Standards

Reference	Title
Society of Automotive Engineers	
SAE J617	Engine Flywheel Housing and Mating Transmission Housing Flanges. This references ISO 7648:1987 Flywheel Housings for Reciprocating Internal Combustion Engines - Nominal Dimensions and Tolerances.
SAE J1939	Collection: Serial Control and Communications Heavy Duty Vehicle Network. The standard originally used for communication and diagnostics among vehicle components, and adopted widely by diesel engine manufacturers due to the increasing adoption of the engine Electronic Control Unit (ECU), and therefore found in a range of diesel-powered applications such as vehicles (on- and off-road), marine propulsion, power generation and construction.
Environmental Services Association	
ESA ICoP 1	Industry Code of Practice: DSEAR Implementation for the Waste Management Industry
ESA ICoP 2	Industry Code of Practice: Area Classification for Landfill Gas Extraction, Utilisation and Combustion
Health and Safety Executive	
The HSE publishes numerous guides and other documents on its website. Some directly relevant documents are listed here:	
HSE 482	Electrical safety of independent low voltage ac: Portable and mobile generators and connected systems (information document)
NDG247	Electrical safety for entertainers
American National Standards Institute (ANSI)	
C37-2	Standard for Electrical Power System Device Function Numbers, Acronyms, and Contact Designations
IET	
ISBN-13: 978-1-78561-432-3	IET Practitioner's Guide to Temporary Power Systems
IEC	
IEC 60479	Collection: Guide to effects of current on human beings and livestock

International Agreements

Organisation	Description
Basel Convention	The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, usually known as the Basel Convention, is an international treaty that was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries (LDCs).
Bonn Agreement	The Bonn Agreement is a European environmental agreement. Following several oil spills in 1969, the coastal nations of the North Sea formed the Bonn Agreement to ensure mutual cooperation in the avoidance and combating of environmental pollution.
CLRTAP	The Convention on Long-Range Transboundary Air Pollution, often abbreviated as Air Convention or CLRTAP, is intended to protect the human environment against air pollution and to gradually reduce and prevent air pollution, including long-range transboundary air pollution. It is implemented by the European Monitoring and Evaluation Programme (EMEP), directed by the United Nations Economic Commission for Europe (UNECE).
Copenhagen Accord	The Copenhagen Accord is a document which delegates at the 15th session of the Conference of Parties (COP 15) to the United Nations Framework Convention on Climate Change agreed to "take note of" at the final plenary on 18 December 2009. The Accord, drafted by, on the one hand, the United States and on the other, in a united position as the BASIC countries (China, India, South Africa, and Brazil), is not legally binding and does not commit countries to agree to a binding successor to the Kyoto Protocol, whose round ended in 2012.
Frankfurt Agreement	In line with the signing of the Vienna Agreement (ISO-CEN) and the Frankfurt Agreement (IEC-CENELEC), CEN and CENELEC cooperate closely with ISO and IEC, respectively, in the creation of standards and new standards projects are always jointly planned in order to avoid replication of results.
Kyoto Principal	The Kyoto Protocol is an international treaty which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits state parties to reduce greenhouse gas emissions, based on the scientific consensus that (part one) global warming is occurring and (part two) it is extremely likely that human-made CO2 emissions have predominantly caused it.
London Convention	The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972, commonly called the "London Convention" or "LC '72" and also abbreviated as Marine Dumping, is an agreement to control pollution of the sea by dumping and to encourage regional agreements supplementary to the Convention. It covers the deliberate disposal at sea of wastes or other matter from vessels, aircraft, and platforms. It does not cover discharges from land-based sources such as pipes and outfalls, wastes generated incidental to normal operation of vessels, or placement of materials for purposes other than mere disposal, providing such disposal is not contrary to aims of the Convention
Montreal Protocol	The Montreal Protocol on Substances that Deplete the Ozone Layer, also known simply as the Montreal Protocol, is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion.
Paris Agreement	The Paris Agreement is an agreement within the United Nations Framework Convention on Climate Change (UNFCCC), dealing with greenhouse-gas-emissions mitigation, adaptation, and finance, signed in 2016.
Ramsar Convention	The Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat is an international treaty for the conservation and sustainable use of wetlands.

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Stockholm Convention	The Stockholm Convention on Persistent Organic Pollutants is an international environmental treaty, signed in 2001 and effective from May 2004, that aims to eliminate or restrict the production and use of persistent organic pollutants (POPs).
United Nations Charter	The Charter of the United Nations is the founding document of the United Nations. It was signed on 26 June 1945, in San Francisco, at the conclusion of the United Nations Conference on International Organization, and came into force on 24 October 1945.
Vienna Agreement	In line with the signing of the Vienna Agreement (ISO-CEN) and the Frankfurt Agreement (IEC-CENELEC), CEN and CENELEC cooperate closely with ISO and IEC, respectively, in the creation of standards and new standards projects are always jointly planned in order to avoid replication of results.
Vienna Convention	The Vienna Convention for the Protection of the Ozone Layer is a multilateral environmental agreement signed in 1985 that provided frameworks for international reductions in the production of chlorofluorocarbons due to their contribution to the destruction of the ozone layer, resulting in an increased threat of skin cancer.
ADR	European Agreement Concerning the International Carriage of Dangerous Goods by Road
ICAO TI	The International Civil Aviation Organization Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO TI) augment the broad principles governing the international transport of hazardous materials by air contained in Annex 18 to the Convention on International Civil Aviation.
MARPOL	International Convention for the Prevention of Pollution from Ships (includes engine exhaust emissions)
SOLAS	The International Convention for the Safety of Life at Sea, 1974. This includes the mandatory provisions governing the carriage of dangerous goods in packaged form, which shall comply with the relevant provisions of the International Maritime Dangerous Goods (IMDG) Code

Notes

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