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Diesel Generator Frequently Asked Questions

There is never a silly question so if it is not covered here feel free to ask us at info@excelpowerltd.co.uk

What is a generator?

A generator is a device for locally producing electrical energy on-demand. In the UK this is mainly used as back-up to the mains electricity supply and will automatically start and provide electricity for as long as the outage lasts.

A generator's main component is a compression ignition engine, much like that in a truck, that spins an alternator. This alternator contains a rotating mass of copper (rotor) and a stationary magnetic field (stator). When the rotor spins within the magnetic field it produces electricity at the alternator terminals.

This is, of course, a simplistic statement and many other processes and controls are required to produce stable electricity at the correct voltage and frequency.

How are generators sized?

Generators are sized in several different ways depending on the requirements of the site and load to be covered. For example some customers may require that the generator provides back-up for the entire site but others may only require 'essential' loads to be generator backed.

It is also necessary to consider the type of load that will be applied to the unit. For example UPS loads have some harmonic content (especially older UPS's) and the generator must be sized to cope with this type of load. Motors and pumps are another load that will affect the performance of the generator during starting.

Another aspect to consider is the nature of the engine chosen. Some turbo-charged engines have a relatively low initial load step capability – it is sometimes necessary to oversize the unit to cope with the required site load. Though careful thought of which loads to apply and whether to stagger the re-application of the loads can make a significant difference to the overall cost of the installation.

Excel Power can provide full support and selection assistance and will be happy to discuss the various options available.

What is the difference between kW and kVA?

Generators are sized in both kW and kVA; where the kW is the real and actual power available and the kVA is the maximum apparent power that the generator is designed to handle.

The maximum kW output of the generator is easy to establish by looking at the maximum mechanical kW output of the engine and then multiplying by the efficiency of the alternator. This then gives kWe.

All generators are designed and rated at 0.8 power factor lagging and this is the difference between kWe and kVA – for example: - 1000kVA generator at 0.8pf = 800kWe. So we know that the generator is able to provide 800kWe and the components are correctly selected, it is able to accept a kVA figure of 1000.

In reality the power factor is a function of the load. Some loads are resistive and do not pass any power back to the supply – these are consumption loads and the factor will be close to 1 – therefore an 800kWe set will supply 800kVA.

Some loads are capacitive – they absorb load and return some power back to the supply. This is when the power factor drops and your generator must be able to cope with the additional power within the alternator windings.

Understanding the impact of loads on the generator and the correct selection of components is key in not under (or over) sizing the generator.

What is the duty rating and how is it selected?

The generator sets are designed and built by Excel Power depending on the application or 'duty' requirements. This is specified under the relevant standard – ISO8528: -

ESP – Limited Time Running Power (old timers, like me will think of 'standby power') – This is designed to be used where there is an established mains electricity supply and the generator will acts as a standby to that supply. This is available for as long as the loss of mains power lasts and no overload is available.

PRP – Prime Power – This is designed to be used as the main supply of power as an alternative to mains supply. This must be at variable load and usually no more than an average of 70% load. It is possible to apply a 10% overload for one hour in any twelve hour period.

It is quite usual for a customer or consultant to specify Prime Power unit when a standby rated unit would be acceptable (and possibly smaller and cheaper). The load profile and the reliability of the mains supply should be studied before final selection.

There are other ratings that are used for specialist applications and are not normally used in the UK.

What should be considered before installing the generator?

Generators are potentially large machines and as such there are a few considerations: -

Indoors or outdoors – If there is sufficient space within a building it may be advantageous to install the unit within the building. Planning permission is potentially easier, vandalism, theft and lack of external space is all overcome with an internal installation.

However in most cases it is impossible to use valuable floor space within a building and an external installation is required. This too has many advantages such as purchasing a 'packaged' unit, easy installation and, most likely, less disruption to the running of the building during installation.

With either of these installation methods there are several things to consider: -

Space planning - is required, not just for the generator itself, but for air flow, cooling, maintenance and plant replacement.

Foundations / floor loading – generators are heavy. They must be installed on a flat level surface; a concrete plinth is normal for external applications.

Exhaust – diesel engines can be smoky especially during initial start-up. This is normally handled by installing an exhaust stack or flue. This can be routed outside the building or within an internal riser.

How much fuel does a diesel generator use and how is it stored?

Different engines have different efficiencies but as a very rough rule of thumb a modern engine uses around 210 litres per hour per 1000kVA. So a 100kVA uses around 21 litres / hour, 200kVA uses 42 litres / hour and so on. Each generator data sheet has the precise fuel consumption figures.

Each generator (up to 800kVA) has an internal fuel tank; normally to run for around 6 to 8 hours. We can extend this running time by adding additional bulk storage tanks. All fuel installations must be in accordance with EU environmental legislation, such as dual skinned pipe work where appropriate.

How noisy are generators and how can this be reduced?

Unsilenced generators are very noisy – to the point of being hazardous to health so noise reduction equipment is always required.

If a set is being installed within a building then the structure must be able to absorb the noise power but at the same time it is necessary to ventilate the unit for cooling and combustion air, thus potentially allowing noise to escape. Careful design of the entire system is required to ensure the unit operates correctly and also reduces the noise to acceptable limits.

External units will be installed within an acoustic canopy or, for the larger units, an acoustic container. These are 'packaged' units that have been designed and tested at our works and therefore all parameters are already known.

How do UPS systems and generators work together?

Generators are not uninterruptible, or in other words, there is a break in supply when the automatic transfer switch changes from mains supply to generator supply and vice-versa. The UPS bridges this gap and provides continuous uninterrupted power to the critical loads during this process.

Generators generally provide a much longer back-up time than a UPS system, as batteries can be expensive to purchase, maintain and replace. The generator can therefore reduce the amount of autonomy required for the UPS system.

It is normal for the generator to supply an 'essential' distribution board and the UPS to be fed from this board. There are normally other loads (such as data centre air conditioning) that are essential but can withstand a short, 10-15 second, break in supply.

As previously mentioned some UPS systems have negative effects on generators (and vice-versa) so it is always beneficial to design an integrated system with a single point of responsibility.

Is there anything else we should know?

Service and maintenance – by the very critical nature of the installation and the potential losses that would result if there were a failure, it is essential that the generator is fully serviced and maintained. Excel Power offer a comprehensive maintenance and emergency response service that can be applied to any generator.

Excel Power would be happy to assist with any aspect of generator and UPS projects - from feasibility studies, site surveys and site load monitoring we are happy to provide advice.