

20 - Generators/In-House Design & Build

Advanced

Diesel Generators from 6 to 3000kVA

Our standard modular generators are mounted on heavy duty steel skids and are delivered ready to run. Up to around 700kVA (dependent on the model), our standard generators are supplied with an integrated base fuel tank (day tank) which would provide 4-8 hours operation at 100 percent of the machine's load capability. Numerous control options are available including load sharing, remote operation and synchronised/parallel operation. As standard, a key-start or automatic-start control panel would be mounted on the generator to allow for manual operation or for integration into an existing control system.

A standard generator enclosure is not always suitable for a given project. Here at Advanced we have a complete manufacturing facility enabling us to design and build acoustic and weatherproof canopies for almost any model of diesel or gas generator. You can choose a generator from our substantial stock, enquire on the availability of other generator models or even free issue your own generator to enable us to manufacture an appropriate noise control system and/or weatherproof enclosure.

Advanced Projects

At Advanced we are frequently faced with large scale projects. Whether this is a one-off multi-Megawatt project, or a multi-site high volume contract, we have the experience and expertise to deliver your project to your specification on time and on budget.

One-off multi-component: hospital projects demand a lot of attention and specialist ability to meet the standards required. Every stage is carefully monitored for time scale and performance; there is no margin for error. Advanced has a proven ability to perform to the stringent criteria of this market sector.

Single site multi-component: data centre projects require containerised generators and fuel supply systems that are supplied by Advanced in a coordinated and reliable manner. By producing everything in house Advanced is able to provide a more organised and unified approach and ensure the every stage is planned, controlled, and delivered to the highest standard.

Multi-site multi-component: in the telecoms market a single contract can cover a multitude of products within one specification, and high volume varied orders for call-off. Managing these contracts requires tight planning and efficiency. At Advanced, our spacious factory allows us to maintain a large inventory of pre-prepared items, and our large and specialist workforce is streamlined to increase productivity and reduce expense for our valued clients.

In-House Design & Build Facilities

At Advanced we are specialists in ultra low noise level packaging, reaching 60dBA at one metre or below. With our design and build capability, Advanced is the obvious choice for high quality products on demanding projects, serving sectors such as data centres, hospitals, telecoms, media and broadcasting, military and emergency services.

To ensure a generator installation meets the demands of the consumer it is highly recommended that a professional generator company is involved in the process from start to finish. Please call us now to find out how our design and fabrication facilities can help lower the cost of your generator installation.

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Diesel Generators



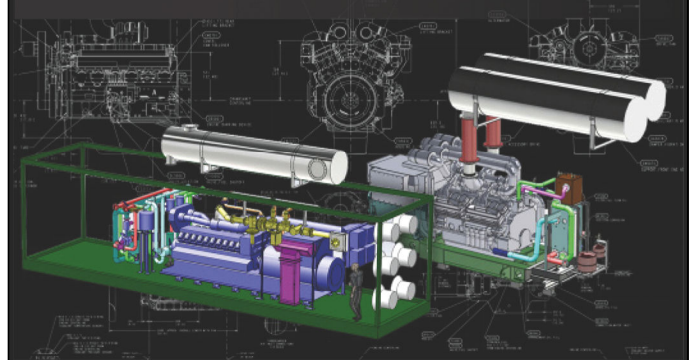
Data Centre & Large Projects



Generator Installation



In House 3D Design & Manufacture



Diesel Generators
& Bespoke Acoustic Enclosures

Modular Enclosures & Bespoke Acoustic Solutions

For nearly 20 years Advanced Diesel Engineering have supplied diesel generators for standby and prime power operation. From design and manufacture to installation and commissioning, Advanced provide generators for a wide range of applications including prison security, hospital emergency power, and data centre standby systems. Operating from our factory near Wakefield, we employ a large team of highly skilled 2D and 3D design engineers who utilise a combination of traditional CAD methods and the latest 3D CAD technology, with the aid of DSS Solidworks™.

Large Projects

Specialising in large projects, we design and manufacture modular sub stations and bespoke power plants for the most demanding and power critical applications.

An Advanced sub station or power plant protecting the mains supply would typically include:

Engine & Alternator (Generator)

High power, EU or GB manufactured, diesel or gas generator from our substantial stock or purchased to order from our well established network of suppliers.

HV Transformer & Mains Integration

Commonly an 11kV oil or resin filled transformer with a local switch disconnector would be utilised to convert the mains supply to 400V. Connected to the mains/generator change over panel, this supply is monitored for inconsistency or failure and when required, the standby generator will start automatically.

Control & Monitoring

Alarms and warnings include output rating, engine temperature, engine over speed, common shutdown, and oil status. Optional features for remote operation and monitoring can include SMS text warnings and procedural text messages reporting the current system status. All of these features can be integrated with most existing building management systems.

Free Standing Distribution Panels

Situated over pre-installed cable trenches, the outgoing fused panels distribute the generator-protected mains power to site facilities.

Bulk Fuel Storage

A localised fuel supply, typically designed to allow at least 72 hours uninterrupted operation.

Bespoke Silencing / Acoustic Modular Buildings

Reliability of power is the most important factor in power generation, however, the maximum noise level is a very important consideration during any generator installation. For many years Advanced has specialised in the design and manufacture of silenced and weatherproof containment for generators, pump systems, rotary converters and other noisy machinery.

If you require an acoustic solution for noisy machinery, Advanced can design, manufacture, install and maintain a weatherproof and secure enclosure.

Advanced enclosures are designed to provide noise attenuation adhering to all relevant noise pollution regulations at the site of installation.

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Diesel Generators
& **Bespoke Acoustic Enclosures**

88 - Power Management & G59

Advanced Diesel Engineering Ltd Common Generator Related Questions

Why do some sites or buildings have more than one generator running in parallel?

The most common reason is redundancy; if one generator fails the other is capable of supporting site load. This is described as N+N redundancy where N = site nominal load and the number following the + sign is the level of redundancy, in this case also Nominal. Where multiple units are required due to other factors, X number of units could be required to cope with nominal load. Some redundancy could be afforded by an additional unit to cater for a single unit failure. For example 5x 400kVA units would be required to supply a theoretical 2MVA load, an additional 400kVA unit would give immunity to a single unit failure (effectively a spare unit), described as N+1 redundancy.

Space factors and noise also dictate to a certain degree if multiple sets are to be used in lieu of one single large generating set but often load profile is overlooked. It is highly undesirable that a Diesel generator should run at below 30% of its maximum capability as engine degradation becomes evident, similarly overloading is to be avoided.

Generally a 70% duty average over any 24hr period, with a maximum single load step of 60%, is recommended and accepted as being the norm, giving spare power headroom for motor starts and system inrush whilst maintaining demand well above the 30% low power damage threshold. If the site is such that power demand falls to little or negligible load during the night or at weekends, a long term outage could lightly load the generator for a similarly long period.

A site with the intention of joining the STOR scheme may match embedded generation capability to the maximum allowable site export capability (usually the substation rating) to maximise STOR revenue. The site may only have a site demand of 25-30% of substation capacity due to expansion allowance resulting in an oversized generator. Multiple generators with lower capacity, which are intelligently brought online to match demand in these scenarios, will better maintain gen-set utilisation.

What is STOR?

Short Term Operating Reserve is a strategy whereby a site, which has embedded generating equipment of 3MW or above, can offer to provide additional active power to the National Grid distribution infrastructure to reduce demand or even contribute to the power available on the Grid. This is typically required at certain times of the year and would be required to provide power within four hours of instruction by 'the grid'. To qualify for STOR status, the power would also have to be maintained for at least a two hour period. A generator to mains synchronising (no break transfer) system is required if site disruption or energy exportation is required.

What is "Island Mode"?

Any site and electrical load system can be considered "islanded" when no mains utility supply is being used to power the site electrical load, just as if the site was on an island. The generators supply all customer loads and neither the load or the generators are connected to the utility supply.

What is "Embedded Generation"?

Embedded generation (also referred to as 'distributed generation') enables the user to generate and use their own electricity, via renewable sources, green energy and other on-site power generation equipment. If you do produce surplus electricity, this can be sold back to the local provider and then distributed back into the national grid.



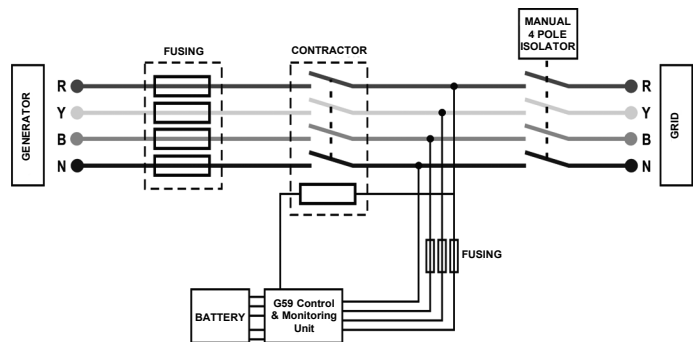
Whether utilising embedded generation for self sufficiency, to lower bills or as a method of providing power in a mains failure, the G59/2 Engineering Recommendation provides the guidance and technical requirements for allowing producers of surplus electricity to make this power available to other grid users.

What is G59, G59-1 or G59-2?

The proper title is ER G59 or Engineering Recommendation G59. G59 is a generic term, G59-1 is the old recommendation and G59-2 is the current requirement. The document refers to the recommendations and guidelines for connecting embedded generation to utility supplies for long and short term duration. Power distribution was traditionally one way, from the power station source at high voltage and distributed in lower voltages to end users.

Government policy, environmentally friendly power sources and advantages to the national grid balancing mechanism, led the way to it being desirable to allow small embedded generation sources to be able to feed and contribute power into the grid infrastructure, an infrastructure almost exclusively controlled upstream by the national grid. If an unpredictable and non controlled quantity of wind turbines and embedded generation were to be allowed to feed into the grid, some regulated basic protocols would be needed.

Schematic diagram of a typical G59 system



ER G59 attempts to specify basic functionality requirements to protect both the grid and the embedded power generation.

One of the recommendations within the requirement is for mains failure detection whilst the generator system is in parallel with the mains.

A traditional phase failure relay, sensing voltage only, may not detect a mains failure due to the generator operating in parallel and supplying power at the detection point.

Many manufacturers have specific G59 detection relays that will supervise the system when in parallel, constantly monitoring the mains/generator common voltage and generator output current to detect rapid changes in characteristics which would identify that the mains is no longer present and a mains failure has occurred.

A common misconception is that the G59 relay protects workers upstream if they isolate at MV/HV and commence to work on the network, assuming several downstream generators will keep the equipment live and in a dangerous condition. Firstly any planned outage would where possible, be re-fed via an alternative path on the grid to minimise outage and as a minimum you will be informed if this is not possible. Also a robust safe working practice will test and ensure the bus is dead before commencement of work, thirdly they will earth the power rail at the point on the network on which they are working.

Predominantly the G59 relay protection guards against unplanned system failure for both parties (grid and generator owner). The mains disconnection has to occur quickly for two reasons:

- 1 - If the dead utility network is not disconnected quickly, the site embedded generation will attempt to supply the local surrounding network and fail on over current, making the point of having the generators useless;
- 2 - Depending on where geographically the site is on the distribution network, an attempt to bypass the network fault will be made or auto re-closers on the network will attempt to reconnect power a number of times to see if the fault was temporary (a falling tree for example). Either way, power would reappear on the utility mains causing a crash synchronisation if embedded generation was still attached.

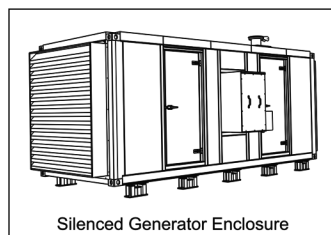
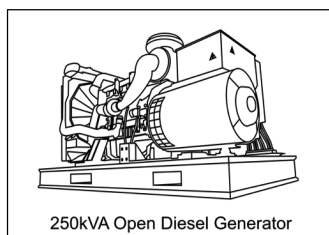


Generator Noise Control

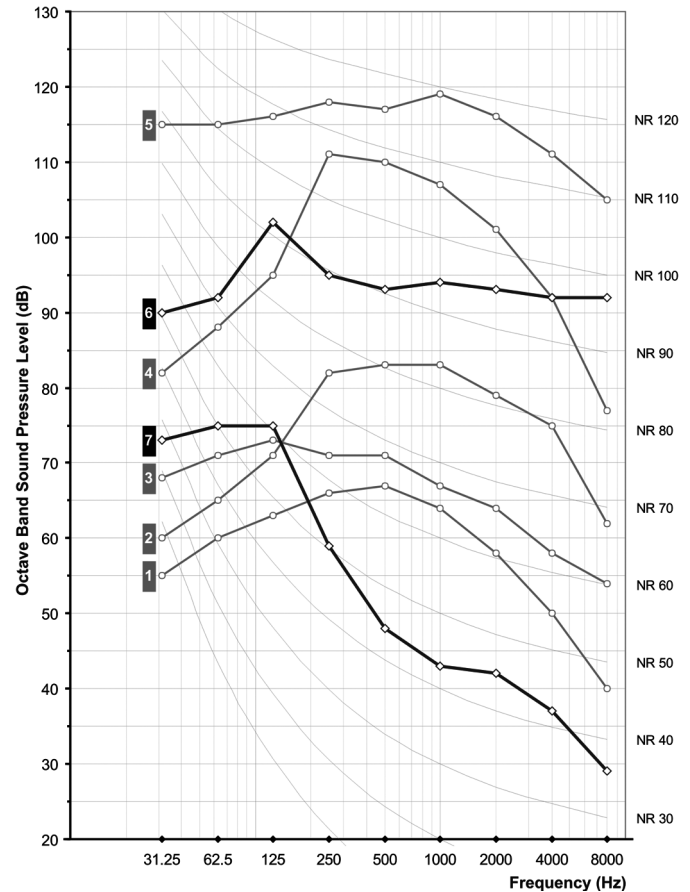
The table (below) and graph (opposite) illustrate typical sound pressure levels in various familiar locations (plots 1-5). Also shown on the graph are two darker plots (6 & 7), these lines are indicating the sound pressure levels of a 250kVA diesel generator before and after silencing at ADE.

	Hz	31.25	62.5	125	250	500	1000	2000	4000	8000
1	Library	55	60	63	66	67	64	58	50	40
2	Loud Stereo Music Player	60	65	71	82	83	83	79	75	62
3	Moderate Ocean Waves	68	71	73	71	71	67	64	58	54
4	Train Horn	82	88	95	111	110	107	101	92	77
5	Rock Concert	115	115	116	118	117	119	116	111	105
6	250kVA Open Diesel Generator	90	92	102	95	93	94	93	92	92
7	250kVA Enclosed Diesel Generator	73	75	75	59	48	43	42	37	29

Comparing the unsilenced values with the silenced generator values it is clear that the higher to mid range frequencies have been attenuated effectively. This drop in sound pressure level is made more clear by comparing the silenced generator plot line to the 'familiar location' plot lines. Above 200Hz the silenced generator levels are below those of a typical loud stereo player, moderate ocean waves and even a typical library.



The peak sound level of the open generator (plot 6) is around 103dB at 125Hz, this obvious peak is indicative of the engine firing and is typical of all combustion engines. Frequencies below 200Hz are more difficult to attenuate, but it is still clear that the sub 200Hz frequencies of the silenced generator are much lower than those of the open generator.

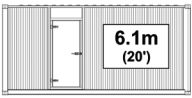
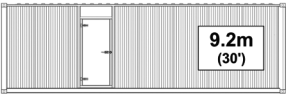



Container Size vs Max. Power Output & Noise Level - from 700 to 2250kVA

TABLE 1

Container Size

ISO high cube

	kVA	dB(A)
stand by	at 1 metre	
	700	85
	825	85
	1100	85
	1400	-
	1675	-
	2250	-
	700	75
	825	75
	1100	75
	1400	85
	1675	-
	2250	-
	700	65
	825	65
	1100	65
	1400	80
	1675	85
	2250	85

All values for both tables are based on Cummins manufactured engines utilising Stamford alternators. Roof mounted exhaust silencers are assumed present. Noise levels listed in both tables assume an end inlet/outlet type, for the cooling air and noise attenuation.

TABLE 1: All system features are installed within the length and width dimensions of the relevant ISO high cube container. The footprint of the container remains unchanged.

TABLE 2

Container Size

With extended attenuation

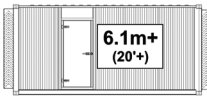
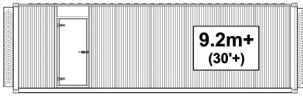

	kVA	dB(A)
stand by	at 1 metre	
	700	80
	825	80
	1100	80
	1400	-
	1675	-
	2250	-
	700	65
	825	65
	1100	65
	1400	80
	1675	-
	2250	-
	700	65
	825	65
	1100	65
	1400	75
	1675	80
	2250	85

TABLE 2: All system features, except for the extended attenuation, are installed within the length and width dimensions of the ISO high cube container. The ISO footprint (lifting/locking blocks) of the container remains unchanged, however, if the extra attenuation extruding from the container end is above 700mm, extra support legs may be required. The length of the extra attenuation varies and can be dependant upon any ancillary generator features installed within the container.

