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Soundproofing and Generators

13 February 2015

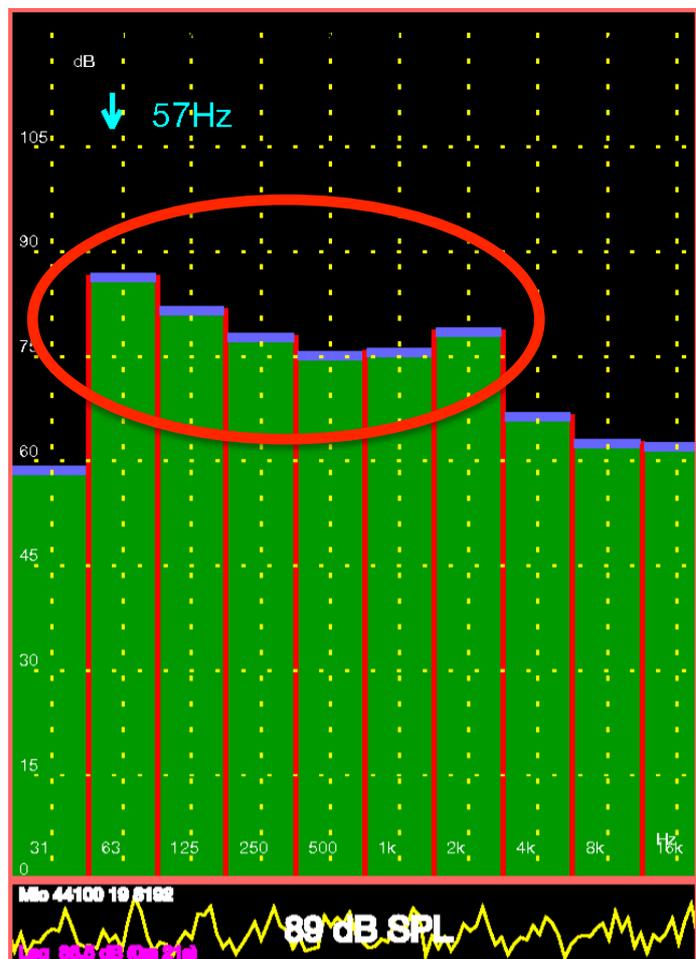
Genesis soundproofing products are often requested to quieten generator noise but the same features outlined below will also make them suitable for other industrial acoustic requirements as well.

The first thing that needs to be understood is the sound signature of a typical generator. We ran an RTA (real time analyser) next to a generator in order to illustrate this point. This measurement was taken during load shedding, in the open air, the generator was mounted on a trailer with no enclosure and the reading was taken at a distance of 1m. Note the sound pressure levels in the low frequency range.

There is a very evident peak from 57Hz to 125Hz, with significantly high SPL through to 2000Hz and a slight drop off after that. This shows us that to effectively deal with generator noise, a product is needed that is especially efficient at dampening low frequencies.

In fact the majority of noise complaints arise because of low frequencies. This is because the wave length is much greater at low frequencies, therefore the noise travels much further than sound in the mid to high frequency range. This is why when there is a loud party a few houses away, you normally can't tell what song is playing but you can clearly hear the bass. The same applies when a taxi drives passed.

Therefore, an acoustic treatment that fails to adequately address the low frequency problem fails altogether.



What are the most important issues to address for generator soundproofing?

1. **Safety:** the products used must be non-combustible. The Genesis LF 125 range of products are non-combustible. Flame retardant products will still burn, they will just burn at a slower rate and may give off poisonous gases when they burn.
2. **High noise reduction coefficient, especially at 125Hz.** The Genesis LF 125 range of products have a sound absorption coefficient ranging from 0.35 for the 50mm thickness to 0.80 for the 100mm thickness – thicker is better!
3. **High density:** This is needed to achieve good sound attenuation. Yes, there are some low-density products out there that offer good sound absorption, but that will not be useful when soundproofing a generator. You need both high sound absorption and high density, both of which the Genesis LF 125 product range have in bucket loads. By the way, higher density does not automatically mean higher sound absorption. Mass law states that for every doubling of the weight, it predicts about 6 DB of sound transmission loss – this is a good thing.
4. **Airflow,** in order to keep the generator at a suitable running temperature. If the generator is going to be enclosed, you must have an industrial grade extraction fan to draw cool air in and to expel the hot air. A plastic bathroom extractor fan from your hardware store is not designed for this. The extraction fan must automatically switch on when the generator starts.
5. **Attenuation of the air inlet and outlet:** It stands to reason that if you just have a big hole for airflow on either side of your enclosure, that the noise will also get out with the air. In order to solve this problem it is best to redirect the air & noise by building an acoustic duct on either side of the enclosure. You want to remove “line of sight between the noise source and the listening position, this is achieved by building the duct at right angles, in other words it should run alongside the enclosure and not stick out like a sore thumb. The duct must be lined with the same acoustic damping materials as the enclosure, so as the air/ noise passed along the length of the duct it loses sound energy.
6. **Isolation of structural vibration:** Ideally the enclosure structure should either be made from a product that does not resonate easily, like 12mm thick Genesis acoustic boards or a suitable anti-vibration product must be installed. Timber and metal structures both transmit vibration very well and this is not helpful, but there is a remedy. Soundamp-E, Damplifier Pro are self adhesive and can be applied directly onto sheet metal or timber – make sure the surface is clean and free of dust. Genesis range of flexible, noise barriers (FNB’s) can be fixed against timber structures with screws or pop rivets. They are available in a 1, 2,5 and 3mm thickness depending on the spec level required and budget. The generator should also stand on an anti-vibration mat, Genesis 12mm board with self adhesive neoprene tape fixed at intervals under the board, is supplied as a part the Genesis soundproofing kit.
7. **Isolation of vibration through the floor:** The generator should be acoustically isolated from the floor by placing it on a thick rubber mat or placing the feet on anti-vibration dampers.
8. **Ease of access** for refuelling and maintenance. Genesis soundproof enclosures are constructed without an internal frame. The four sides of the enclosure are held tightly together with catches, forming a ridged structure. This way, either the side or front panel can be removed easily at any time. The lid is hinged on the back panel.
9. **Good acoustic seals** along the joints. This will prevent unwanted rattles and noise leaks.
10. **Baffle:** You may find that the baffle supplied with your generator is not particularly effective at attenuating the noise from your exhaust, you can try your local motorcycle shop or engineering shop for a better alternative.
11. **Weather proof:** Genesis enclosures include an SABS approved waterproofing kit that is a simple DIY paint on solution. The natural colour of the waterproofing is grey, but it can be painted over to achieve the final colour finish desired. We suggest placing the generator box

under an inclined roof to protect it from the weather and so that if you need to access the generator in rainy weather you don't have to stand in the rain.

What Materials to Avoid When Soundproofing Generators

- Polystyrene: Despite people believing otherwise for reasons I can't understand, polystyrene has very, very poor soundproofing properties.
- Egg boxes: Do I really have to explain? This urban legend persists and I still get people asking me if it works. I think people just desperately want to believe that something that costs them nothing will actually solve all their acoustic problems. There is a good reason chicken farmers don't make a good living on the side doing acoustic treatment. Forget this one and move on.
- All open cell polyurethane foams - even if they are flame retardant. They do not have sufficient density, lack sound absorption in the important 125 Hz range, and are highly flammable and emit toxic gases if they burn. Yes, I know of people this has happened to - don't go there. While we're on the subject, there is a reason bedding shops aren't acoustic experts - all foams are not equal. Acoustic foams are developed for that express purpose and should always come with a certification from an independent lab to prove its credentials.
- All hardware grade, thermal insulation products – they are not designed for soundproofing. The density is far, far too low. We get people who come to us on a weekly basis who have tried this approach and been disappointed.
- Closed cell EVA / EPDM type foams, with regards to lining the inside of the generator enclosure as sound absorbing or sound barrier. They do not absorb noise efficiently and there are better products to damp vibrations. A suitable application is for their use as seals, which is when these products do work well.

Common Scenarios and How Genesis Acoustics can Help

I have no enclosure, what do I do?

Before we can do anything we need to know the following:

- The l, w & h of your generator? Please provide sketch and if necessary show proximity of walls etc.
- E-mail us 2 or 3 photos
- What area and city do you live in? We need this info to calculate courier costs.
 - a) We can provide you with all the acoustic materials but you cut all materials to size and build it yourself, to save on labour costs.
 - b) We provide all materials and install (currently only available in JHB, PTA, CT & PE). We do not do any electrical work.
 - c) We provide all the finished materials and ship door to door, you assemble it and make any further adjustments required (some cutting may be required)
- Materials required:
 - 12mm thick Genesis acoustic board and aluminium edge protectors
 - Genesis LF 125 noise deadeners (either the 50 or 100mm thickness)
 - Genesis non-flammable adhesive
 - Angle iron/aluminium to attach the airflow baffles to the enclosure
 - Catches to secure the panels together
 - Acoustic seals for all the corners, under the bottom of the enclosure, to seal the baffles
 - Extraction fan
 - Waterproofing
 - Paint (not included)

Your own tools, blades, saws, paint brushes etc.

I already have an enclosure, what do I do?

Before we can do anything we need to know the following:

- The l, w & h of your enclosure? Please provide sketch and if necessary show proximity of walls etc.
- E-mail us 2 or 3 photos
- Is your enclosure made out of metal or timber?
- What area and city do you live in? We need this info to calculate courier costs.
 - a) We can provide you with all the acoustic materials but you cut all materials to size and install yourself, to save on labour costs.
 - d) We provide all materials and install (currently only available in JHB, PTA, CT & PE). We do not do any electrical work.
- Materials required:
 - Genesis FNB Flexible noise barrier to line the inside of your enclosure, available in 1mm, 2,5mm and 3mm thicknesses. This option is not self adhesive.
 - Alternatively Soundamp-E or Dampifier Pro. These are both about 2mm thick and are self adhesive.
 - Genesis LF 125 noise deadeners (either the 50 or 100mm thickness)
 - Genesis non-flammable adhesive
 - Extraction fan - if you don't already have one
 - Your own tools, blades, saws, paint brushes etc.

My generator is in a brick and mortar room, what do I do?

Before we can do anything we need to know the following:

- The l, w & h of your room? Please provide sketch/floor plan.
- E-mail photos of each wall & one of the ceiling
- What is the structure of your room: walls, ceiling, roof, door, windows?
- What area and city do you live in? We need this info to calculate courier costs.
 - a) We can provide you with all the acoustic materials but you cut all materials to size and build it yourself, to save on labour costs.
 - b) We provide all materials and install (currently only available in JHB, PTA, CT & PE)
 - c) We provide all the finished materials and ship door to door, you simply assemble it
- Materials required:
 - Genesis LF 125 noise deadeners (either the 50 or 100mm thickness)
 - Genesis non-flammable adhesive
 - Acoustic door seals
 - Acoustic door cover
 - Extraction fan - if you don't already have one
 - Your own tools, blades, saws, paint brushes etc.

Frequently Asked Questions

Will these acoustic materials make my generator completely soundproof?

No they will not. This is not because there is anything wrong with the materials, in fact we believe we are offering the best of what is available, even compared to international standards in the USA and Europe. Soundproofing is scalable just like most things in life and as you might expect costs go up in relation to the level of soundproofing required. The word soundproof does not mean “to block out all sound”.

What difference does a few decibels make?

± 3dB is just perceptible

± 5dB is clearly noticeable

± 10dB is perceived by the human ear as being twice (or half) as loud

As you can see, the decibel system does not work on a simple addition/subtraction scale but on an exponential scale, so 90dBA will seem twice as loud as 80dBA, as perceived by the human ear.

How much of a difference will the soundproofing materials make?

There are too many variables to tabulate every possible scenario and we can't pin these figures down to an exact decibel but it is possible to give the following estimates, if soundproofing materials are supplied by Genesis Acoustics and correctly installed:

Home built enclosure 10 – 20dB STL (sound transmission loss)

Genesis soundproof enclosure 20 – 30dB STL

Soundproof drywall construction 50 – 60dB STL

Brick and mortar 40 – 60 STL

See the specifications supplied on our product data sheets for more information.

Are the materials I need available ex-stock?

Some of the materials are available ex-stock, some materials are made to order and may take up to two weeks for manufacture. Its best to discuss your specific requirement with us and we'll let you know.

Can't I only use the Genesis acoustic boards?

In the construction of your soundproof enclosure you will need both an outer cladding, which is rigid enough to form the structure, can be waterproofed and is not at all porous, this is the function of the Genesis acoustic boards – they do not absorb sound, they help isolate the sound. The Genesis LF 125 range of noise deadeners are designed to efficiently absorb sound energy.

How do I cut the Genesis acoustic boards?

Any conventional woodworking tools can be used and the boards can also be scored and snapped.

Are the Genesis acoustic boards waterproof?

They will never rot like timber or turn to mush if they get wet like gypsum but they will absorb water, therefore they need to be waterproofed.

Can you pre-cut the Genesis acoustic board to my required size?

Yes we can, this service costs an additional 15% on the board price.

Can I mix the 50 and 100mm thickness Genesis LF 125 noise deadeners?

Yes, but only do this is space if the deciding factor, the 100mm thick product is far more efficient in the low frequency range.

How loud/soft do I need to be?

Well remember that your house wasn't completely soundproof before you bought your generator, completely soundproof is unrealistic and not necessary. You need to reduce sound levels to where they are not a nuisance or an irritation to your own family and your neighbours. Even a 10dB drop of noise level from 90dBA to 80dBA will seem half as loud and make a big difference (on paper) but you'll need to drop at least 20 decibels to 70dBA get below the irritation threshold. It also depends on the proximity of your generator to your home and your neighbour – whom you always seemed to get along with so well before you bought the generator. Proximity can play a big role in the cost / type of soundproof structure you choose to build and also how much noise reaches your neighbour. However even if your generator is only running at 75dBA and you quiet it to 60dBA you will still not be legal.

What are the municipal bylaws governing noise levels?

This may differ slightly depending on your local bylaws, so use this table as a guide.

TABLE A1: TYPICAL NOISE RATING LEVELS FOR AMBIENT NOISE IN DISTRICTS (NOISE ZONES)

Type of District	Equivalent Continuous Rating Level for Noise ($L_{Req,T}$) (dBA)					
	Outdoors			Indoors with open windows		
	Day-night ($L_{R,dn}$)	Daytime ($L_{Req,d}$)	Night-time ($L_{Req,n}$)	Day-night ($L_{R,dn}$)	Daytime ($L_{Req,d}$)	Night-time ($L_{Req,n}$)
RESIDENTIAL DISTRICTS						
a) Rural districts	45	45	35	35	35	25
b) Suburban districts (little road traffic)	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
NON RESIDENTIAL DISTRICTS						
d) Urban districts (some workshops, business premises and main roads)	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50