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Information Sheet # 58

Your Reliable Guide for Power Solutions

Material & Designs Used to Sound Attenuate a Generator System

1.0 Introduction:

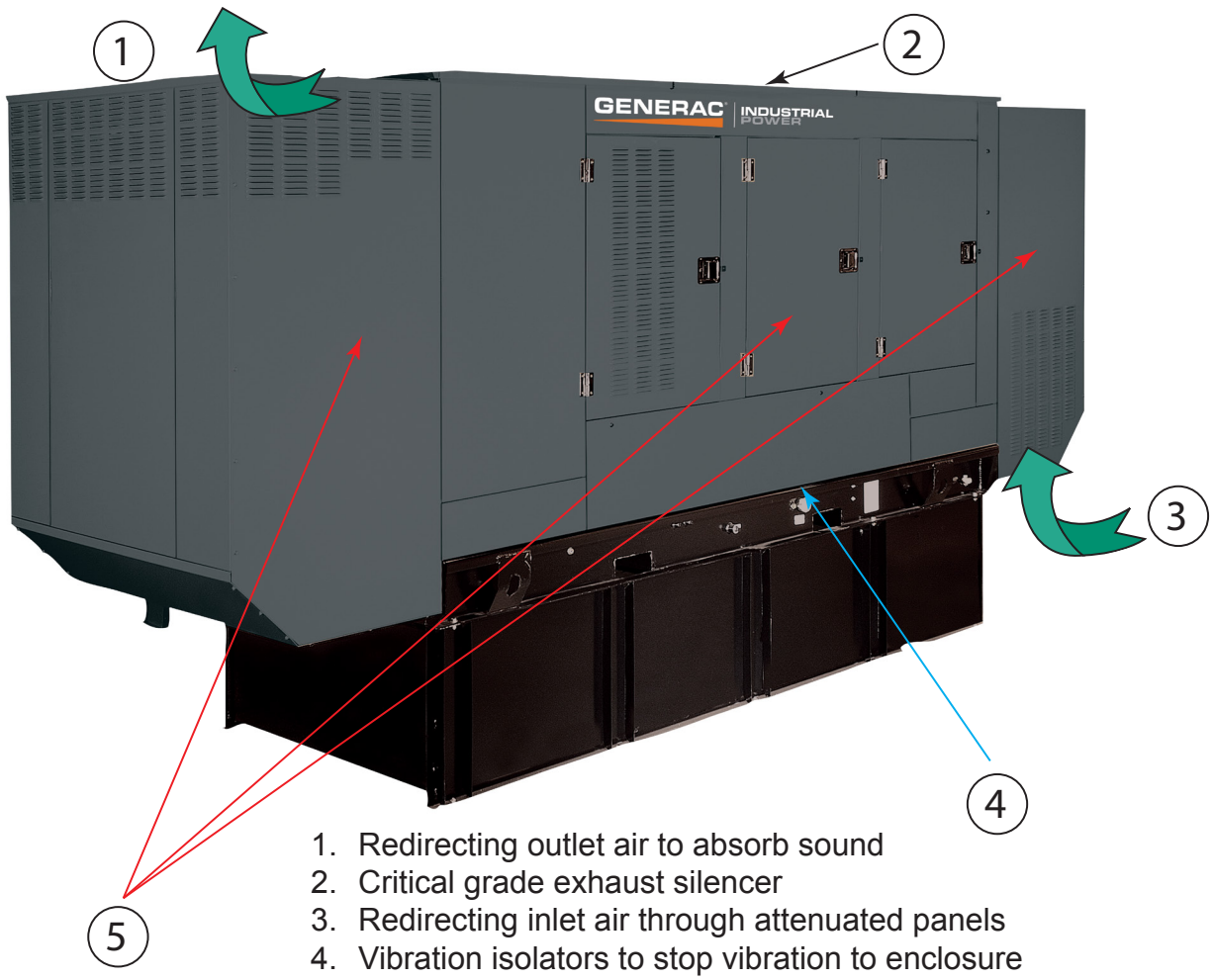
The one disadvantage of diesel powered generator sets is that they produce noise and vibration. Whether the unit runs continuously or only occasionally for standby or emergency duty during utility power outages, their operating sound level must often be reduced to comply with local, state or federal ordinances.

This Information Sheet discusses when sound attenuation of a generator system is required and the type of material and design used to achieve the standards set by various bodies.

2.0 Entities Driving Sound Attenuation of Generator Systems:

Recently, some states and communities have begun to implement property line restrictions to reduce the amount of low-frequency noise that reaches community neighborhoods. As untreated generators can approach levels of 100 dB (A) or more, mitigation is often necessary. The OSHA standard 29 CFR 1910.95 for tolerable noise level of 85 dB(A). *(Continued over)*

Principal Features of Generator Sound Attenuation



1. Redirecting outlet air to absorb sound
2. Critical grade exhaust silencer
3. Redirecting inlet air through attenuated panels
4. Vibration isolators to stop vibration to enclosure
5. Sound attenuated enclosure panels

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The installation information provided in this information sheet is informational in nature only, and should not be considered the advice of a properly licensed and qualified electrician or used in place of a detailed review of the applicable National Electric Codes and local codes. Specific questions about how this information may affect any particular situation should be addressed to a licensed and qualified electrician.

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3.0 Sources of Generator Set Noise:

- Engine noise – mainly mechanical and combustion forces (higher levels for larger HP units)
- Cooling fan noise – which results from the sound of air being moved at high speed across the engine and through the radiator
- Alternator noise – caused by cooling air
- Induction noise – caused by fluctuations in current in the windings that give rise to mechanical noise
- Engine exhaust – with an basic exhaust silencer, can range from 120 to 130 dB(A)
- Structural/mechanical noise – caused by mechanical vibration of various structural parts and components that is radiated as sound

4.0 Noise laws and regulations:

In North America, state and local codes establish the maximum noise levels at the property line. They often call for lower levels during nighttime hours of operation.

5.0 Strategies for reduction of generator set noise:

Most generator sets can be supplied in a suitable metal enclosure that will provide a quieter generator. Additional noise reduction can be achieved through designs including the following:

Acoustic barriers - The enclosure can be supplied in steel, stainless steel, aluminum or carbon steels. The thickness and rigidity affects the effectiveness. Steel with its greater mass and stiffness will provide about 2 to 3 dB(A) better attenuation than aluminum. The latter are normally only specified in coastal areas to combat the salt air. It is important sound paths are eliminated through cracks in doors, access points for exhaust, fuel or electrical wiring. A metal enclosure – called a weather-protected housing, for outdoor installation, will reduce the noise level by at least 10 dB(A) and sometimes may satisfy the location. All access doors should have rubber seals to minimize noise waves escaping in these areas

Isolation mounts - Vibrating equipment creates sound pressure waves (noise) in the surrounding air. Anything connected to the generator set can cause vibrations to the building structure. All such connection points which include the skid base, radiator discharge air ducts, exhaust piping, fuel lines and wiring conduit, require flexible connections to effectively reduce the vibration and noise to be transmitted

Cooling air attenuation - Placement of inlet and outlet attenuation baffles will help reduce the noise produced and carried in the cooling air as it moves across the engine and through the radiator. As large volumes of air movement are required, noise from this source is significant. Dependent on the noise level required, sound attenuation materials are placed on the inside of the enclosure, ducts, and any louvers. Making this air flow travel through a duct with a 90-degree bend, will reduce the high-frequency noise level. Baffles will further absorb some of this noise. If the inlet and exhaust cooling air enter or leave vertically, the noise level at ground level will be further lowered

Exhaust silencers - These come in wide variety of types, physical arrangements and materials. Normally they are grouped into either chamber-type silencers or spiral configuration. The former tend to be more effective. Silencers can be made of rolled steel or stainless steel – if an outdoor installation to prevent corrosion. They are normally supplied in sound attenuation "grades" – termed "industrial", "residential" and "critical" (sometimes called "hospital"). These progressively provide higher levels of noise attenuation - but the more effective the silencer the greater level of back pressure restriction on the engine exhaust.

Acoustical insulation - Sound absorbing materials are readily available on the market for use in sound attenuated enclosures to line the air ducts and the inside of the enclosure walls. Directing noise at these areas covered by sound-absorbing materials can be very effective. It is strongly recommended that these materials be selected with resistance to oil, water and other engine liquids like fuel, oil, battery fluid, and coolant. These materials may be selected by the manufacturer based on such factors as cost, availability, density, flame retardant capability, resistance to abrasion and wear, aesthetics and ease of cleaning.

Close attention must be paid to ensure that any such material does not restrict or impede the requisite cooling air flow volume through the generator, to avoid overheating and/or reduced performance. Heat tests should be conducted with all such insulation in place

Fiberglass - Fiberglass is a highly efficient, lightweight, resilient material that has fine, stable and uniformly textured inorganic glass fibers, bonded together with a non-water soluble and fire retardant thermosetting resin. Any fiberglass insulation will require a facing material.

Rock wool - Rock wool is a mineral inorganic fibrous material that has many excellent properties. It is produced by melting a mix of basalt, limestone and coke in a vertical furnace at very high temperature (about 2,735 degrees F). The molten rock is made into thin fibers through a centrifugal machine. Certain amounts of binder, dust proof oil, silicon oil and mechanical operations are added dependent or properties and usage requirements. This binder is sprayed equally by using a new technology so that the rock wool fiber and binder can be 'tied' together and results in a stable and uniform form. As the product consists of close cross-pattern fibers, most of the sound waves are absorbed by the fibers because of friction. It can be held in place inside the enclosure with 'open' or perforated lightweight metal retaining panels.

Some generator sets can be offered with noise levels as low as 45 dB(A). However, usually the lower the noise level, the higher the cost. Special generators used by film production units have some of the lowest noise levels.

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