

# SOUND SOLUTIONS

## EMERGENCY GENERATORS

No. 3

Emergency generators are a sometimes neglected entity in the noise control efforts in a major building project, because in most projects they are only for emergency use and they seldom operate during the lifetime of the building. However, when they do operate (and local codes usually specify that they must be tested periodically), they generate a tremendous amount of noise which can be a serious problem for occupants in the building and/or near-by neighbors.

Stand-by diesel power generators should be located on grade or below grade levels remote from occupied space whenever possible. If the unit must be located above occupied space, the noise problem can be solved, but the necessary construction may be somewhat expensive. In any case the generator set should be vibration isolated from the building structure with neoprene or steel spring vibration isolators. Properly sized vibration isolators will minimize structure-borne sound transmission into remote areas of the building and minimize troublesome floor vibrations.

The vast majority of emergency generators with electrical outputs greater than 100 KVA are powered by diesel engines. In actuality, it is the diesel engine, not the generator, which is the primary source of noise. The engine noise can be broken down into three major types: 1) exhaust noise, 2) casing radiated noise, and 3) cooling fan noise. General recommendations for treating these three sources of engine noise are presented below.

Noise radiated by the engine block is usually in the 90 to 100 dBA range at a distance of five feet. If the engine is located in a small room with hard walls the noise level may be 5 to 10 dBA higher. The preferred technique of controlling this noise is to prevent it from escaping the generator room boundaries. This usually requires massive wall construction using concrete or steel acoustical panels. Doors and ventilation louvers penetrating the enclosure should be sealed and acoustically rated to meet the overall performance requirements.

Diesel power generators can be supplied with radiators or provisions for remote cooling of the engine block. The typical radiator incorporates a large propeller fan which can generate noise levels around 100 dBA. Obviously, remote cooling is preferred as long as the cooling fluid or cooling tower is not going to create an additional acoustical problem which must be addressed. When a radiator is provided with the generator, that greatly increases the requirement for ventilation air into the generator room. This does not significantly impact the acoustical design, but it will impact the overall cost of the noise control measures because of the increased area of ventilation louver. The decision to go with remote or local cooling is not cut and dry, and should be made on an individual project basis taking all relevant factors into account.

Figure 1 is a sketch illustrating the recommended noise and vibration control measures for a diesel powered emergency generator located on the ground level

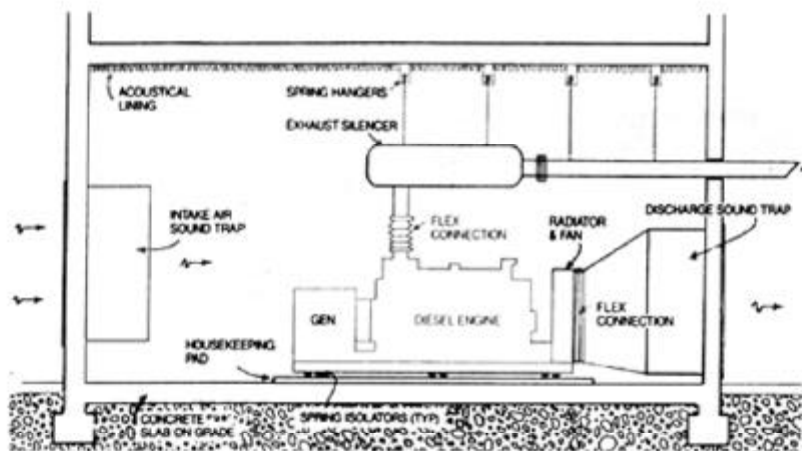


Figure 1.  
Recommended noise control procedures for a diesel powered emergency generator located on grade in an office building.

The exhaust noise is the most significant source of noise in the diesel engine. It is usually the most important also because the exhaust must be vented outside the structure to avoid contamination of the combustion air. Unsilenced exhaust noise levels are usually between 100 and 120 dBA five feet from the exhaust outlet. A variety of exhaust mufflers are available which provide between 10 and 40 dBA noise reduction depending upon the design. The most effective mufflers are classified "critical grade" silencers. Other less effective silencers are classified as "residential grade", "commercial grade", and "industrial grade" in order of decreasing effectiveness. In extremely critical applications it may be necessary to install more than one muffler on the exhaust pipe to meet the acoustical requirements. Great care should be taken in this situation because two or more mufflers can create excessive backpressure on the engine causing reduced performance and/or mechanical failure. In addition, the reader should be cautioned that the noise reduction of two mufflers will not equal twice the noise reduction of one muffler because of the self-generated noise caused by exhaust gases flowing through the muffler.

of a multi-story office building. Important features of the design include vibration isolators between the unit frame and the structure, an exhaust silencer designed to meet community noise ordinances, a flex connection between the engine and the exhaust pipe, inlet and discharge silencers at the ventilation louvers, and acoustical lining in the generator room. Additional noise control measures may be required if the space above the generator room is to be occupied.

As you might imagine, noise control measures for emergency power generators can become somewhat expensive, particularly if the unit is to be located adjacent to occupied space within the building or very near a residential property line. A competent acoustical consultant should be able to advise the owner of the steps which are necessary to meet the required noise levels at minimum cost. An example of an extremely critical situation that I have designed is a hospital system using two 750 KVA diesel generators located underground with the generator exhaust on the property line of an adjacent church. These units are currently operating with acceptable noise levels at the church property line.

The above information has been reviewed and is believed to be accurate, however we assume no responsibility for errors or omissions.

