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PowerHour FAQs

Generator Set Integration — Location, Sound, Vibration and Seismic Recording

Join this Cummins PowerHour and learn how to design your project to ensure a safe and streamlined generator set installation. Additional guidance will be provided to address long-term strategies for service, maintenance, and expansion. Best practices from a variety of global projects will be discussed.

To learn more about generator set integration, please join the Cummins PowerHour webinar:

Following this PowerHour participants should be able to:

- Recognize application requirements impacted by generator set location and vibration
- Describe the impact of seismic certification as it applies to power generation equipment
- Identify key factors that influence perceived sound at the installation level
- Describe common failure modes seen in the field by gaining exposure to real-world applications to increase system reliability and reduce costly design changes

What design considerations should we be aware of for high altitude or high ambient temperature installations?

High altitude is not a significant factor when considering sound and vibration issues, but high altitude is a big concern when selecting the generator. What high altitude does impact is the size of the generator. Generally alternators for high altitude applications have a significant derate, due to the Corona effect. So for high altitude or high ambient applications, you'll want to look at the generator set manufacturer's alternators in the medium to high voltage range.

Of course, for high ambient temperatures, cooling system selection is critical. Most generator set manufacturers will recommend a cooling system based on the specified high ambient temperature. But there are additional factors to consider. Typically, a higher capacity cooling system has higher air flow. For example, on Cummins 3.5 megawatt system, the radiator for a 40°C ambient pushes around 110-115,000 CFM. When you step up to the 50°C radiator, you're looking at around 147,000 CFM. That's for one generator operating at 3.5 megawatts. So there's a substantial increase in CFM when going from 40°C to 50°C ambient.

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This is typical for any generator, regardless of manufacturer. So you have to account for the increased CFM. You need to specify ducting to accommodate the CFM, and you have to size the ducting to accommodate the radiator. Radiators are sized by square footage. You have to consider the required duct size for, say, a 94 sq. ft. radiator.

Is there a difference between the performance of a silencer and a muffler?

The terms silencer and muffler refer to the same component. Typically I would refer to a “silencer” but the two terms are interchangeable.

Also, I often see a “spark arrestor” called out in specifications as part of the silencer. To be honest, most of the time, a spark arrestor is not necessary, particularly with the technology on today’s generator sets. Usually there’s a spark arrestor built into another component, such as the turbo charger. In a non-wastegated turbo charger, there’s no way for anything to make it out of the exhaust system. So there’s no need for a spark arrestor. If you think you may need a spark arrestor, talk with a Cummins application engineer — usually there is another option.

How much does it cost to have IBC certification added to the generator set?

There isn’t a set number or percentage. IBC certification involves several factors. The biggest factor, especially on larger generator sets, is the need for spring-type isolators. Many generator sets, across manufacturers, are IBC-certified to a some level of seismic design force without requiring spring-type isolators. You can install the generator set directly onto the pad and still comply with IBC requirements, as long as the pad is poured correctly.

On the other hand, there are some generator sets that require spring-type isolators to accommodate higher levels of seismic design

force. Depending on the size of the generator, this could be anywhere from 6 to 20 spring-type isolators. Although this is not a significant cost, you need to be aware that this requirement will add cost to the system.

I would encourage you to verify whether or not you really need IBC seismic certification, and if not, do you really need spring-type isolators? The isolators provide vibration reduction that actually isn’t needed for most applications. But if you do need isolators, Cummins can provide them.

Following up on that question, is there a rule-of-thumb for the size of generator above which you do recommend spring isolators?

I see a lot of specifications with a blanket statement saying, “Generator set must be provided with spring-type isolators.” As I stated before, I don’t recommend this because there are instances where isolators are not needed, and they just add additional cost.

Even some large generator sets can be IBC certified without spring-type isolators. As a general rule, we typically see isolators installed on generator sets 750 kW and above. But I challenge you to figure out whether or not you really need them, and work with the generator set manufacturer to see if isolators are recommended for your application.

How large are the 20-second seismic events for seismic certification testing?

In the generator set manufacturer’s certification, you’ll see a specific seismic design force that the generator set is certified to. Typically there’s a targeted level of ground acceleration. That determines how the unit is tested and ultimately what seismic design level it’s certified for. So it varies from certification to certification depending on the specific generator set.

How deep should the pad be for a typical installation?

There are recommended depths based on the size of the anchorage embedment. We recommend that the pad depth be one and a half times the anchorage embedment. So for a 10-inch anchor embedment, you would want a 15-inch pad.

The mass of the pad is another factor. The recommended minimum pad mass is two times the mass of the generator set. This can result in a pretty big pad. Generally we would suggest sizing the width and the length of the pad with a minimum of 12 inches on all sides, and then calculating the depth based on the length, width and generator mass. Most manufacturers will provide a recommendation if requested.

Regarding the VMC engineering scan – does it have to be dated for the year you sell the generator set or is it acceptable if the stamp is two or three years old?

VMC is not the only organization doing certifications; there are several others. So the appearance of the certificate is going to vary depending on which organization did the engineering scan. The certificate will specify what IBC year the certificate is good for. So it might say “IBC 2003, IBC 2006, IBC 2009, 2012, 2015.” What that means is that the calculations were done for the approval for that certificate cover those years of IBC compliance. If you have a question about the validity of the IBC compliance certificate, do work with your generator set manufacturer’s representative to ensure that you have an up-to-date certificate for the generator set in question.

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What are some common sound mitigation strategies?

We recommend silencers for nearly every generator set. If sound is at all a concern, add a silencer. There is a wide variety of silencer grades, so in some cases the basic silencer can be replaced with a higher grade silencer for additional sound reduction, if needed.

On the other hand, as we discussed, the fan and the engine are the biggest contributors to sound level. Just putting a muffler on the engine outside the exhaust system is usually insufficient. Typically intake and discharge louvers are installed on the enclosure or in the equipment room, to substantially reduce the sound caused by the generator set cooling and combustion intake air as well as the radiator discharge air.

The Cummins plant in Fridley is located in close proximity to a residential area. The louvers that are installed in the building equipment room reduce the sound level by about 30 decibels. Those of you who have dealt with this type of situation before understand how big of an impact this is. 30 decibels is incredible, especially when you are talking about four large or four high-ambient generators sets. Intake and discharge sound attenuation louvers are an excellent strategy for sound mitigation.

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