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Session: April 2019

PowerHour FAQs

Specifying Gaseous Generator Sets

This overview of gaseous generator sets reviews generator set capabilities in different applications, including the similarities and differences between diesel and gaseous generators. The features of gaseous generators sets will be described, as well as considerations for project planning and installation.

To learn more about the specifying gaseous generator sets please join the Cummins PowerHour webinar:

Following this PowerHour participants should be able to:

- Recognize the similarities and distinctions between gaseous and diesel generator sets in different applications
- Describe key features and capabilities of gaseous generator sets
- List some key considerations for gaseous generator sets installation

NFPA regulations for emergency generator sets require available on-site fuel for backup. In many areas, the local AHJs will not accept natural gas for that purpose.

It's important to understand exactly what your AHJ requires, and if after doing research you determine natural gas is not an option for that particular location, you'll need to go with a diesel generator set. But don't assume NFPA mandates diesel.

When using natural gas, if a backup fuel supply is required, it is common to have propane tanks on site as a backup fuel source. This does increase safety in case something interrupts the pipeline supply. Your AHJ may be willing to accept propane for backup.

What solution can we recommend to customers who want to store natural gas in the event of a failure of natural gas supply?

A propane tank would be a good solution in this case as well. You can store propane on-site for a really long time, almost indefinitely, and it can also work as a dual-fuel system where the customer can switch between natural gas and propane as needed.

What after-treatment is required for a rich-burn gaseous generator set versus diesel?

Rich-burn gaseous requires more fuel than lean-burn but does provide more diesel-like power. However, rich-burn gaseous after-treatment is less complicated than diesel after-treatment. You may still need a catalyst to reduce the NOx and COx, but you probably would not need a filter to reduce particulate matter, which is required for diesel.

How does a natural gas generator compare in cost to diesel? Is there a kilowatt rating range where a natural gas is more economical? How does a gaseous engine compare in size to a diesel engine with the same rating?

When comparing gaseous generator sets and diesel generator sets, and their relative size and cost, there's typically a break around the 150-kW node. Up until that point, we see similar sizes and costs for both the gas and diesel generator sets. Beyond that point, the two types of generator sets require different types of engines and that affects the cost. In the low-kilowatt range, the gaseous generators usually use off-the-shelf, mass-produced automotive-type engines that are well-suited for standby systems. When we move up into the higher horsepower 200, 500, 750 and 1-megawatt range, a more industrial engine is required to meet the performance and longevity requirements. At that point, the natural gas generator for the same power node may be significantly larger and more expensive than its diesel counterpart.

For example, at the 2-megawatt node, Cummins offers both a gaseous and a diesel system. The gaseous system requires a 91-liter engine, whereas the diesel engine is 60 liters. The significant size difference impacts the cost as well. When comparing costs, it's best to consult with the manufacturer to understand

what products are available, and ask about a natural gas option in addition to the typical diesel generator set.

Can diesel and natural gas generator sets operate in parallel, and how would paralleling work?

Yes, you can parallel diesel and natural gas generators. To do this successfully, you have to understand how the generator controls talk to each other, and you need to plan the loading sequence that will work for your application. If you have a diesel generator set and a lean-burn natural gas generator set, you probably want to have the diesel start first to handle critical loads, and the lean-burn take over after your critical loads are turned on. The generator set manufacturer should be able to help you coordinate the two types of generator sets.

Does one fuel work better than the other for paralleling generator sets?

No, fuel type is not a factor when paralleling generator sets. Paralleling is a function of the generator set controller, so you need to confirm that the generator controllers are capable of paralleling with each other, regardless of the fuel type. You may also have to consider if the winding switches are equal, and the relative start-up times of the generator sets, because gaseous and diesel generator sets have different start-up times.

How do pressure and fuel supply affect the operation of a gaseous generator?

With gaseous generator sets, it's crucial to understand the importance of adequate pressure and flow of fuel during operation. One of the most common problems we see when commissioning or starting gaseous generators is improper regulation of the fuel source. For example, a branch section of the natural gas supply is connected to the generator set and when the

generator is called on to accept the full load in a single step, if the regulators are not properly designed the pressure will not be maintained during that instant transient event. The generator set may stutter or may not be able to recover to full speed as quickly as expected. We can't stress enough the importance of pressure regulation and ensuring that the gaseous fuel supply is properly designed for the gaseous generator set.

What are the international standards for NOx and SOx emissions, as opposed to the EPA standards in the United States?

The EPA has different requirements for natural gas or spark-ignited engines versus diesel engines. Around the globe, there are varying levels of emissions requirements and they are often applied differently for compression-ignition diesel engines and spark-ignited engines. Cummins recommends you work with local experts. We have a network of knowledgeable representatives all over the world who are available to advise you about local regulations. In any case, working with local experts, Cummins can design a system that is compliant for your particular project location.

Are there specific codes for using natural gas generator sets in limited, prime or peak- shaving applications?

I'm not aware of any specific code for gaseous generator set demand response. You would have to refer to the local code for details but as far as I know, there isn't a standard for peak-shaving versus prime applications.

What impact does altitude have on installation considerations for a gaseous generator set?

Altitude affects engine performance, whether it's a diesel or gaseous generator set. If you're looking at a high altitude application, you need

to know exactly what the altitude will be. A de-rate factor applies when running the engine or generator set at high altitude. The generator set manufacturer can explain how the engine will perform at specific altitudes, and when the de-rate factor applies. Altitude affects the alternator and the cooling system as well. The manufacturer is the best source of guidance for high-altitude applications.

In a cold weather location using a propane-fueled generator set, how do you determine if a vaporizer is needed?

With a propane fuel generator set, pressure and flow are still key to the performance of the system. As the ambient temperature decreases, the liquid propane that's stored in the tank vaporizes at a slower rate. There is less ability for that flame to be maintained because there is less pressure available from that liquid fuel being vaporized. As those of you who live in the northern regions of North America may know, when you fire up your propane grill in the middle of winter, the flame is weaker.

The same applies to a gaseous generator set that fueled by a liquid propane tank. The vaporization rate is dependent on ambient temperature and barometric pressure. As a result, it's critical that the propane tank be sized large enough to provide the maximum flow specified on the generator set manufacturer's data sheet at the minimum specified pressure, for the worst-case scenario calling for 100% load acceptance.

The Fuel System chapter of Cummins Application Engineering Manual T030 goes into more detail about ambient temperature versus flow rate, and includes a table to help you decide what size propane tank would be needed to achieve the required vaporization rate. If a larger tank can't meet the vaporization level, you may need a liquid vaporization system to achieve the higher rate.

What does it mean when the model number for a Cummins generator set starts with a “C”. Does this refer to a power rating or an NFPA 110 rating?

The C refers to the ISO 8528 ratings for generator sets. ISO uses four classifications of backup power applications: **ESP** (emergency standby power), **PRP** (prime-rated power), **LTP** (limited time power) and **COP** (continuous operating power). The rating of the generator set varies depending on the requirements of the application. If you'd like to learn more about the ISO 8528 ratings, Cummins has an excellent white paper, **Power Topic #6240**, on the subject, available in Power Suite. <https://mart.cummins.com/imagelibrary/data/assetfiles/0057509.pdf>

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