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PowerHour FAQs

Generator Set Ratings for Data Centers and Other Applications

The first step in designing a successful generator set application is selecting the appropriate generator set rating. This requires understanding the industry standards that define generator set ratings, including ISO 8528-1 as well as other industry-adopted ratings such as the Uptime Institute's generator set rating requirements for Tier III and Tier IV data centers, and the industry's responses to those requirements.

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

Following this PowerHour participants should be able to:

- Define generator set ratings per ISO 8528-1 and identify their appropriate applications
- Recognize industry-adopted ratings outside of ISO 8528-1
- Describe the impact of Uptime Institute Tier certifications on generator set ratings requirements

I'm not familiar with data centers design. When is an Uptime Institute Tier III or Tier IV rating required?

Basically, Uptime certification is required if the owner wants it. Uptime tier ratings are not a code requirement like National Electrical Code or UL. So there's no legal requirement for Uptime certification. Typically, a colocation datacenter owner may want to have Tier III or Tier IV certification to ensure potential clients that their system is reliable and that data center will maintain the certified level of availability. Having Tier IV concurrent maintainability and fault tolerance means that the client's data will always be available and protected. So Tier III or Tier IV certification is necessary when the datacenter owner requires it.

How do Uptime Institute Tier Ratings compare to the former 99.999 availability standard?

Uptime Tier Ratings don't require a specific availability. Tier Ratings do specify levels of redundancy and system topology. The requirements for Tier III is that the system be concurrently maintainable, which means that you can take any single

component offline for maintenance while still providing power for your load. A Tier IV system is one that is fault tolerant and that means that no single fault will interrupt power to the available load. So when Uptime Institute certifies the system as Tier III or Tier IV they're looking at system topology and the generator set capacity to ensure the generator sets meet the criteria.

The Uptime Institute did a study a few years back where they studied a number of sites that met the Tier I, Tier II, Tier III or Tier IV requirements for one year, and determined the availability for the site during the year. Remember, when you say availability, you are accounting for both planned maintenance and unplanned maintenance necessitate by a fault. So when we refer to 99.999 availability, that means the system was down five minutes during that year, accounting for both maintenance and failures.

What the study found was that neither Tier III or Tier IV actually met the 99.999 standard. The Tier III systems availability was 99.98 and Tier IV was 99.99; none of the systems reached the 99.999 goal. It depends on the maintenance procedures for the site and the reliability of all of the individual components. So they decided not to specify a certain level of availability, but rather to specify levels of redundancy in a topology that enables the highest levels of availability.

How can wet stacking cause the generator to fail? Excess moisture can prematurely corrode the exhaust but that alone would not cause the engine to fail.

Wet stacking may reduce the reliability of the generator because of the carbon build-up caused by the unburned fuel. Running at low loads, i.e. less than 30% of the rated power, can cause unburned fuel from the combustion chamber to be released into the exhaust system. The exhaust system includes piping, turbocharger and exhaust valves. When the carbon deposits build up on those components, carbon also builds up on the fuel injectors.

When carbon starts to build up on the fuel injectors, they don't deliver the proper amount of fuel. Sometimes they deliver too much fuel, which leads to even more wet stacking. So as the unburned fuel accumulates, it produces backpressure in the system, especially if it accumulates in the exhaust piping. And the build-up on the turbocharger reduces its efficiency. So, at the end of the day, wet stacking can cause the engine to not run efficiently, and potentially lead to an engine failure if an excessive amount of carbon accumulates on the components.

Does Cummins sizing software account for the ISO rating in the load profile?

Yes, Cummins sizing software does account for ISO rating in the load profile. When you open the sizing application, the first screen gives you a choice of ratings: Standby, Prime, Continuous or Datacenter Continuous. For the load profile, the default assumes that all loads are on continuously while the generator set is running. When you add the individual loads, there is a box you can select to indicate whether these loads are continuous or cycling on and off. So, by selecting or not selecting that box for cyclic load for each load, you can account for that load profile.

Can one of the parallel generator sets drop out if the second generator is not needed to meet the load?

In the scenario you describe, you have N+1 redundancy with two generators in parallel where one generator is sufficient to met the load. So, can one of the paralleled generators drop out if it is not needed to meet the load? The answer depends on whether your certification is for Tier III or Tier IV.

For Tier III certification, one of the generator sets can drop out because Tier III requires only one active power distribution path and the second generator can be standby. But for Tier IV certification you have to have two simultaneously active distribution paths so that if one generator fails, the second generator is already running and ready to take the load.

Remember, with a Tier IV system an unplanned event cannot result in an interruption of power to the load. So if one of the generators fails, the other has to be online to meet Tier IV. So in this N+1 scenario, you cannot take the redundant generator off-line.

For Tier III, the redundant generator has to be present so that the other generator can be taken off-line if necessary, but it doesn't have to be fault tolerant. There can be a brief interruption while the second generator is starting up.

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