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Data Center UL 3223 Standards For Generator Set Systems

1.0 Introduction:

Data centers are critically important hubs for handling data management and storage across all types of commerce and industry. In the 21st century, data centers are an essential element of modern society's infrastructure and failure can result in both critical life and economic situations. While many data center providers have already set themselves a high standard, UL the international safety consulting company, is now offering UL 3223, a comprehensive certification program that looks at all aspects of performance and safety in the data center. It is important to understand how UL 3223 affects the application of generator set systems used by data centers and what specifications are used for generator sets providing power to data centers.

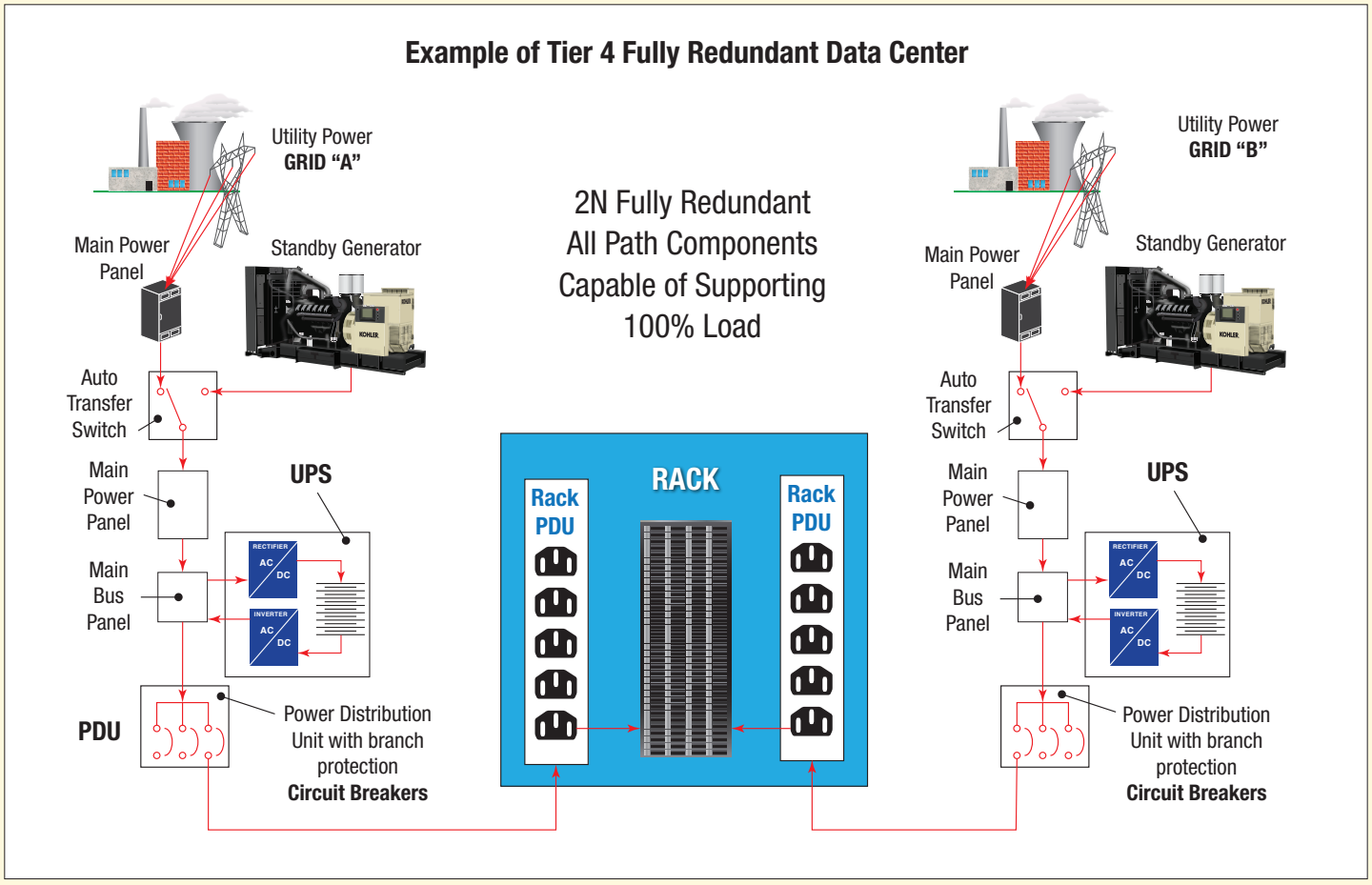
This Information Sheet discusses how UL 3223 affects the application of generator set systems used by data centers and what specifications are used for generator sets providing power to data centers.

2.0 Overview:

In our digital information age, the trend for many years has been towards larger data centers (DC's). Most data management companies set themselves high standards for maintaining a reliable energy supply to DC's. UL, in recognition that despite improvements, there is a rapidly growing global problem with efficient power supplies to DC's, has laid out codes to follow under UL 3223. Global DC's require and use about 3% of total power generation that equates to 40% more than the entire United Kingdom's consumption. This consumption is forecast to double every four years. Some researchers predict global DC's will consume 20% of the earth's energy production by 2025. It is estimated that U.S. DC's now use more than 90 billion kilowatt-hours a year.

Power outages are the leading concern for DC's, with most outages caused by weather. Unplanned failures can result in major financial losses to providers and their customers, especially if their revenues are dependent on internet sales. Even with advances in design, the trend is towards even larger DC's, which are classified as 'hyper scale' data centers, that require more electrical power, as web, streaming, cloud services, and other information technologies are constantly being added.

Example of Tier 4 Fully Redundant Data Center



To fulfill our commitment to be the leading network service provider in the Power Generation Industry, the USA, Inc. team maintains up-to-date technology and information standards on Power Industry changes, regulations and trends. As a service, our **Information Sheets** are circulated on a regular basis, to existing and potential Power Customers to maintain awareness of changes and developments in engineering standards, electrical codes, and technology impacting the Power Generation Industry.

3.0 Standards:

There are no mandatory Federal standards for the industry reliability, but some entities have introduced a number of voluntary regulations for providers that serve to provide assurances to consumers that their stored data will be available and accessible under all circumstances. These standards can serve consumers and indicate differences in the reliability of service.

4.0 Redundancy:

As electrical power is absolutely essential for data centers to function with no downtime, even during utility power outages, particular levels of standby power back-up are expressed as: N + 1, 2N and 2N + 1.

5.0 Defining Definitions for Back-up Power Supply:

- **N + 1 -** The N provides 100% of the principal power back-up support for critical loads with the '+1' as a safeguard to ensure that an uninterruptible power supply (UPS) is always available. However, this is not a fully redundant system, and can still fail as the system is running on common circuitry or feeds one or more points, rather than two completely separate feeds.
- **2N -** This signifies the DC has double the amount of equipment that can run separately with no single points of failure. Thus 2N DC's are more reliable than one with N + 1 as they offer a fully redundant system that can be easily maintained on a regular basis without losing any power to subsequent systems. In the event of an extended utility power outage, a 2N system will keep up and continue to function.
- **2N + 1 -** Some DC's offer this option which is actually double the amount needed, plus an extra piece of equipment as well.

6.0 Overview of UL 3223 For Data Centers:

UL 3223 was introduced in the first quarter of 2018 as a new data center standard, designed as a baseline standard certification to support reliability, maintainability, and security within the colocation/cloud industry. Additional input was given by ESD Consulting. One of the principal challenges for any DC certification program is that to meet the criteria, the industry did not recognize the utility as a critical component. Therefore, a DC owner would need to install continuous generation equipment. However, UL 3223 does include the utility as a critical component; therefore emergency (standby) rated generators will comply. The five principal components of UL 3223 are:

1. **Security -** Due to the increasing number of breaches worldwide, security has become critical in the operation of DC's. Security programs will be evaluated by certified professionals, security documentation reviewed and surveys conducted.
2. **Reliability -** Redundancy plays a large role in a DC's reliability. Designs must include a dual path with uninterruptible power supply batteries and generation. Note! 2N and 2N + 1 system are accepted.
3. **Concurrently maintainable design -** All systems must be able to be taken offline for maintenance work without disruption, both electrically and mechanically. This will be evaluated as required. Also, UL 3223 reviews and evaluates the physical network design for compliance with redundancy and maintainability.
4. **Sustainability design -** DC's use megawatts of power. UL 3223 encompasses corporate responsibility of designing efficient cooling systems that support sustainability initiatives. They are designed to have a power-usage effectiveness (PUE) of 1.5 or lower.
5. **Commissioning -** UL and ESD commissioning agents (CxA's) will evaluate commissioning results at the time of testing for existing DC's. For new DC's, UL 3223 will have CxA's on site to witness commissioning.

7.0 Uptime Institute (UI) Regulations for Generator Systems Within Data Centers:

Founded in 1987 as a private, for-profit entity. UI it is now an independent division of The 451 Group. Its Tier classification concept is a globally recognized standard guiding design and investment in data centers across the world. UI's Tier classification can be used to measure and compare a DC's reliability.

Summary - Uptime Institute Regulations for Generator Systems within Data Centers	
Tier Rating Definition	**Tier 1** requirements are generally used by small businesses and feature: 99.671% uptime, with no redundancy and experience 28.8-hours of downtime per year. **Tier 2 facilities include:** 99.749% uptime, partial redundancy in power and cooling, with 22-hours of downtime per year. **Tier 3 facilities include:** 99.982% uptime, with no more than 1.6-hours of downtime per year, and N + 1 fault tolerant service providing at least 72-hours of power outage protection. **Tier 4 data center (see chart page one) has:** 99.995% uptime per year, 2N + 1 fully redundant infrastructure, 96-hours of power outage protection and with 26.3 minutes of annual downtime.
Generator Ratings	Tier III and IV refer to prime and standby ratings as defined by ISO8528-1. The only such rating that meets ISO definitions at 100% of generator rating is Continuous. ISO Prime states the generator can run continuously if the average load does not exceed 70% of the full prime rating in any 24-hour period. Some generator manufacturers have therefore introduced new ratings for data center applications to better meet the actual maximum data center load profile. These need to be reviewed and approved by the Uptime Institute. Such generators subject to this rating must comply with EPA Tier 2.

8.0 Additional Codes and Regulations To Be Considered:

In addition to UL 3223 and UI regulations, the generator system designer should consider the following applicable codes.

Additional Codes & Standards to be Considered Specific to Generators Applied in Data Center Applications	
EPA	Tier 3 if defined as a stationary standby application.
	Tier 4 Final for mobile, trailer mounted, temporary power.
NEMA	This standard covers switchgear boxes and electrical connections.
NEC	For this application a minimum of "Class F" insulation.
Local Codes	Local codes will cover generator use, sound regulations, and construction site requirements.

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