WHO WE ARE

Incorporated in 1982, CPN Power has operated as national power consultants to the healthcare industry for over 34 years. Providing power quality site audits to determine whether power anomalies are creating medical equipment artifacts or operational issues has been a mainstay of our business. Today, CPN Power continues to offer power quality expertise for healthcare applications along with many additional services including:

- Central UPS Electrical Site Distribution Audits
- Central UPS Existing, Demo, and Proposed Site Distribution Drawings
- Power Quality Monitoring
- Generator Demand Studies
- ATS and Distribution Load Studies
- Interpretation of Power Problems
- Annual Load Bank Testing
- Preventative Maintenance
- UPS System Commissioning
- Battery Testing and Replacement
- CPN Power Utilizes High Sample Rate Power Quality Meters to Provide Highly Detailed Documentation of Load Profiles

CPN Power also provides power products for applications within healthcare, such as:

- Individual and Central UPS Systems
- Critical Branch Central UPS Systems
- Power Conditioners, ATS, Generators, and Transformers
- Smaller 600 VA - 80 kVA UPS Systems

For more than 12 years, CPN Power has focused on providing Central UPS to support:

- Radiology
- Cardiology
- Oncology
- OR Suites
- Hybrid OR Suites

In addition to supporting medical equipment applications, CPN Power offers protection for:

- Laboratory
- Pharmacy
- PACS
- IDF Closets
- MDF Rooms
- Critical Branch
- Clinical Applications

CPN POWER

POWER QUALITY MONITORING AND SITE ELECTRICAL DISTRIBUTION AUDITS

Artifacts, printed circuit board replacement, image quality issues, high repair costs, and X-ray tube failures might all be related to power anomalies creating long-term accumulative component damage. Power quality monitoring and site distribution audits can determine if power problems are impacting the bottom line. Utility deregulation was supposed to lower electrical energy costs, but for most of the country, that has not been the case. Deregulation has created a utility distribution plagued with power issues. In addition, internally generated power quality issues occur in healthcare facilities due to the implementation of electronics, power supplies, UPS, and variable speed (frequency) drives. Some common power anomalies are:

- Voltage Transients
- Voltage Sags
- Grid Switching
- Waveform Distortion
- Electrical Noise
- Low Frequency Noise
- High Ground Current
- High Voltage Harmonics
- Low Frequency Transients
- Time-Dependent Voltage Fluctuations

In some cases, the hospital engineering staff may own power quality monitors, but have little time to learn the meter operation and the power quality knowledge required to resolve power issues. CPN Power can assist Facilities, Clinical, and Biomedical Engineers in determining if power anomalies are the source of problems. Installing power quality meters without knowledge of the site distribution can lead to misdiagnosed issues. For that reason, CPN Power performs site electrical distribution audits combined with power quality data to determine the correct approach toward actual resolution.

GENERATOR DEMAND STUDIES

Generator demand studies are performed to determine the load profile on the individual transfer switches and the total load on the emergency generator. Loads have changed over the years, but demand studies have not. The common approach has been to install kWh or basic power meters recording voltage, current, and power every 5 or 10 minutes. From that data, a power usage curve is generated or a simple chart displaying the power profile at each time interval over the given time period of the study. This approach does provide an average load on the generator, but does not provide realistic data to determine the real current draw on each transfer switch and the overall emergency distribution. This basic approach does not capture peak current activity and voltage sags resulting from peak currents during the monitoring time period.

The use of high sample rate power quality meters installed throughout the emergency distribution offers a completely different picture of the peak momentary current inrush conditions and the voltage regulation while operating on the emergency generator.

Proper data is required for proper planning. Sampling voltage, current, power factor, kW, kVA, and power anomalies 15,360 times per second paints a very different picture for a generator demand study compared to every 5-10 minutes. The generator voltage/current image (Figure 1) displays an average current of 500A with current peaks reaching 900-1000A. The nominal voltage is 282V with voltage sags reaching 240V and voltage surges reaching 300V.

Sampling current every 5-10 minutes might suggest that the current draw is 500 amps, but that is only part of the picture. The peak current conditions must also be taken into account for a complete understanding of the power profile.

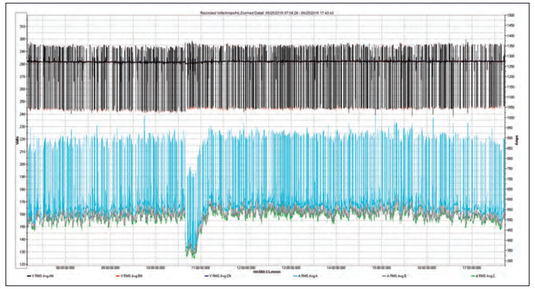


FIGURE 1

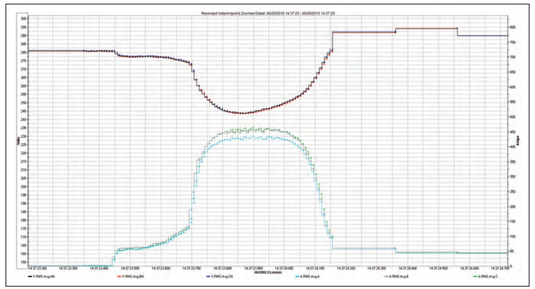


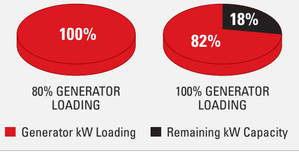
FIGURE 2

The current is constantly peaking up to 800 amps, with some peak current activity reaching 1000 amps. Voltage variations are also displayed for generator operation. As the peak current increases to 900A, the voltage sags from 282V down to 245V (13% sag). These voltage sags exceed the NEMA standard of ±10% voltage variance.

Figure 2 displays a voltage sag (13.8%) resulting from a current peak (450A) from an elevator motor operating during the Generator and ATS demand study. The peak current created the voltage sag due to a large step-load on a highly loaded generator.

Code requires hospitals to remain below 80% loading on the generator capacity. Therefore, the 520 kW/650 kVA generator at this site should be limited to 416 kW/520 kVA. The pie charts (right) display the load on the generator and the remaining capacity based on 80% and 100% generator loading. The average kW values are used in the calculation. The pie charts show that the generator has reached the 80% capacity rating and consideration must be given to increasing the size of the generator, adding another generator, or shedding load. The 13-14% voltage sags during generator operation, due to the high peak current activity, also points to a generator that is overloaded.

NORTH EAST WING GENERATOR



POWER QUALITY STUDIES

THE FIGURES BELOW DISPLAY VARIOUS POWER ANOMALIES CAPTURED DURING DEMAND AND POWER QUALITY STUDIES

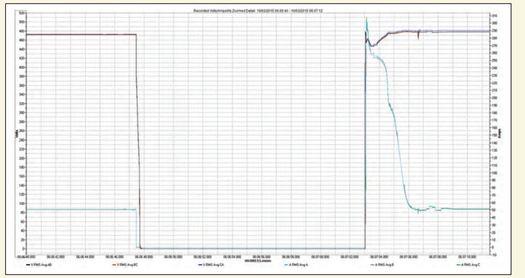


FIGURE 3 displays a utility outage event with a transfer onto the emergency generator.

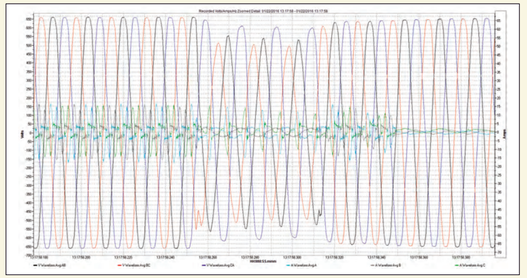


FIGURE 5 displays a utility generated voltage sag event

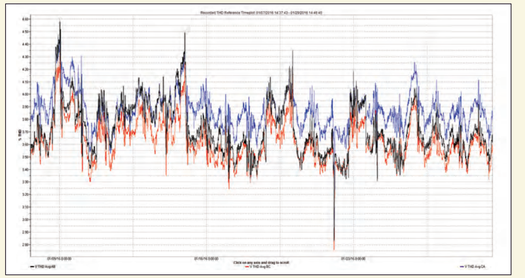


FIGURE 4 displays voltage harmonics on the electrical distribution during a power quality study. The IEEE-519 standard allows up to 5% Total Harmonic Distortion (THD). At 3.8%, the THD at this site was below the IEEE standard, but is high and requires continued monitoring.

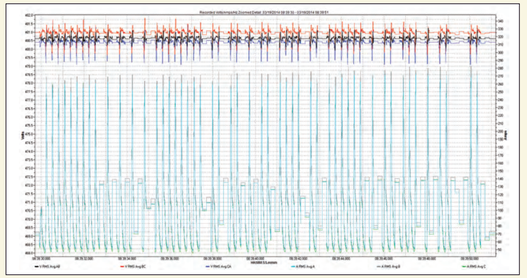


FIGURE 6 displays operation of (1) 1.5T MRI and (1) 3T MRI on the output of a CPN Power 225 kVA UPS System. The 100% current rating of the 225 kVA UPS is 270A. The MRI peak current activity slightly exceeds the 100% loading on the UPS System. With that said, voltage regulation is 0.25% during 100% step load events. This is very tight voltage regulation.

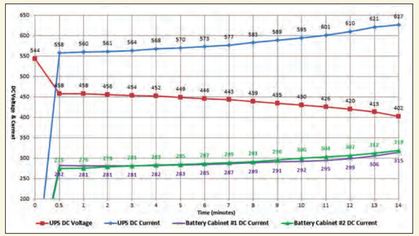
CPN Power, Inc. 800-491-1210 cpnpower.com
CPN Power, Inc. 800-491-1210 cpnpower.com

UPS SYSTEM COMMISSIONING AND ANNUAL LOAD BANK TESTING

CPN Power has the required expertise to offer complete commissioning of the UPS System. Common services include:

- Load Bank Testing
- Infrared Thermography
- Static Bypass Transfers
- Battery Discharge Analysis
- Maintenance Bypass Breaker Operation
- High Sample Rate Monitoring
- Generator/ATS Operation to Assure Proper Overall System Load Protection During an Outage Event

A follow up to initial commissioning of the UPS System is an annual test to ensure proper operation. NFPA requires generators to be load bank tested annually. Good practice would follow suit in providing load bank testing of the UPS System on an annual basis to ensure that the complete emergency distribution system operates as designed during a power outage.



HOSPITAL COMMISSIONING STUDY
Battery Cabinets #1 & #2 Discharge Curve
(UPS load of 251 kW @ time of test - 10:15 am)

HEALTHCARE EXPERTISE

CPN Power, above all else, brings a high standard of expertise in the Healthcare market. With 34 years of practicable experience, CPN Power provides a higher level of service, products, and knowledge than our competitors.

We welcome the opportunity to review the requirements in your facility and look forward to the prospect of assisting you with your engineering and maintenance requirements.

CPN POWER

300 kVA/300 kW UPS HARMONICS AND EFFICIENCY DATA

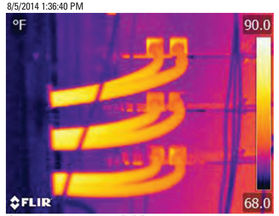
TABLE 4

Partial Load & Full Load Testing	Time Stamp EST Time	Output Ground Current	Input Voltage Harmonics	Input Current Harmonics	Output Voltage Harmonics	UPS Input kW 1750 Meter	UPS Output kW 1750 Meter	Efficiency of UPS System (UPS & Output Transformer)
25% Load (75 kW)	02:35 pm	300 mA	A: 2.4% B: 2.4% C: 2.1%	A: 11.8% B: 13.1% C: 12.8%	A: 0.5% B: 0.5% C: 0.5%	26.1 +28.0 + 25.1 = 79.2 kW	25.2 + 24.7 + 25.4 = 75.3 kW	95.07%
50% Load (150 kW)	02:46 pm	400 mA	A: 2.5% B: 2.5% C: 2.2%	A: 6.1% B: 6.7% C: 6.4%	A: 0.4% B: 0.4% C: 0.4%	51.8 + 54.5 + 51.1 = 157.4 kW	50.9 + 50.0 + 51.3 = 152.2 kW	96.70%
75% Load (225 kW)	02:53 pm	400 mA	A: 2.4% B: 2.4% C: 2.1%	A: 4.5% B: 4.8% C: 4.6%	A: 0.4% B: 0.4% C: 0.4%	76.7 + 79.9 + 75.7 = 232.3 kW	75.1 + 73.7 + 75.9 = 224.7 kW	96.73%
100% Load (295 kW)	03:00 pm	400 mA	A: 2.4% B: 2.4% C: 2.1%	A: 3.7% B: 4.0% C: 3.7%	A: 0.3% B: 0.3% C: 0.3%	101.2 + 104.9 + 100.3 = 306.4 kW	98.8 + 96.8 + 99.8 = 295.4 kW	96.40%

MEASUREMENTS	°F
Sp1	75.5
PARAMETERS	
Emissivity	0.95
Refl. temp.	75.2 °F
Distance	3.8 ft
Atmospheric temp.	71.6 °F
Ext. optics temp.	68 °F
Ext. optics trans.	1
Relative humidity	52%

NOTE
Burn-in Test + 1hr UPS AC Output

8/5/2014 1:36:40 PM



IR_0685.jpg FLIR E40 49034011

LANDING CABINET
(LEFT of UPS Module)

Output Conductor temperature reading taken at the end of the 2 hour extended full load testing.

8/5/2014 1:36:40 PM

DC_0062.jpg FLIR E40

CPN POWER

800-491-1210 | cpnpower.com | info@cpnpower.com
CPN Power, Inc., 556 Marrett Road, Lexington, MA 02421

SERVICE CAPABILITIES

CPN POWER