

A DISCUSSION OF POWER QUALITY

Letter from the CEO

In this latest 'Letter from the CEO,' I want to provoke a discussion on power quality. First, I want to break down the various aspects of power quality and define it, then give you a look into the causes of power quality problems and the consequences of those problems.

Power quality problems can be broadly classified into the following categories:

VOLTAGE SAGS:

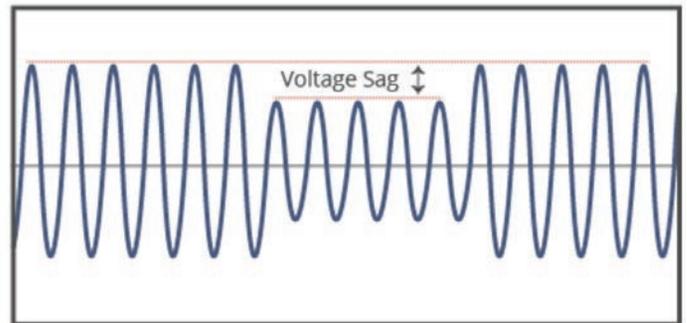
A decrease in the normal voltage level, for durations of 0.5 cycle to 1 minute.

Causes:

- Faults on the transmission or distribution network.
- Faults in consumer's installation.
- Connection of heavy loads and start-up of large motors.

Consequences:

- Malfunction of microprocessor-based control systems that may lead to a process stoppage.



MICRO-INTERRUPTIONS:

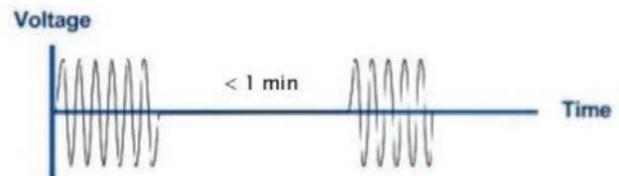
Total interruption of electrical supply for duration ranging from a few milliseconds to one or two seconds.

Causes:

- Opening and automatic re-closure of protection devices.
- Insulation failure, lightning and insulator flashover.

Consequences:

- Tripping of protection devices.
- Loss of information and malfunction of data processing equipment.
- Stoppage of sensitive equipment (such as ASDs (adjustable speed drives), PCs, PLCs (programmable logic controller)).



LONG INTERRUPTIONS:

Total interruption of electrical supply for a duration greater than one to two seconds.

Causes:

- Equipment failure in the power system network.
- Storms and objects (trees, cars, etc.) striking lines or poles, fire.
- Human error, bad coordination or failure of protection devices.

Consequences:

- Stoppage of all equipment.

VOLTAGE SPIKES:

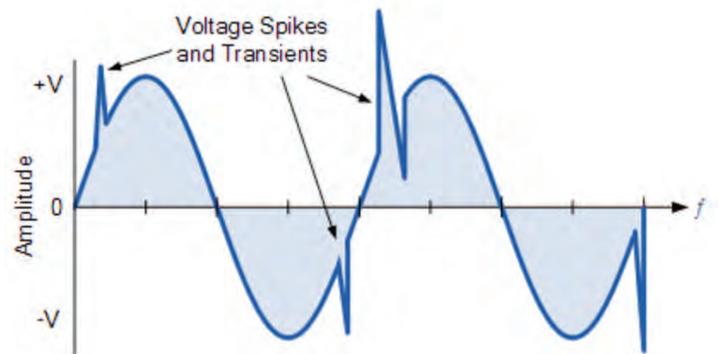
Very fast variation of the voltage value for durations ranging from several microseconds to few milliseconds.

Causes:

- Lightning.
- Switching of lines or power factor correction capacitors.
- Disconnection of heavy loads.

Consequences:

- Destruction of components and insulation materials.
- Data processing errors or data loss.
- Electromagnetic interference.



VOLTAGE SWELLS:

Momentary increase of the voltage that is outside the normal tolerances with duration lasting for more than one cycle and typically less than a few seconds.

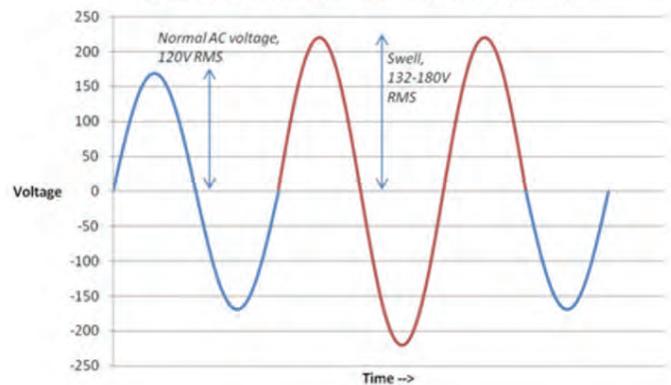
Causes:

- Start/stop of heavy loads.
- Poorly dimensioned power sources.
- Poorly regulated transformers.

Consequences:

- Flickering of lighting and screens.
- Damage or stoppage of sensitive equipment.

Swells are events between 8 thousandths of a second and 1 minute where the voltage is between 110%-180% of normal (i.e. 132V-180V RMS).



HARMONIC DISTORTION:

Known as the most complex power quality problem. Voltage or current waveforms assume non-sinusoidal shape.

Causes:

Classic sources:

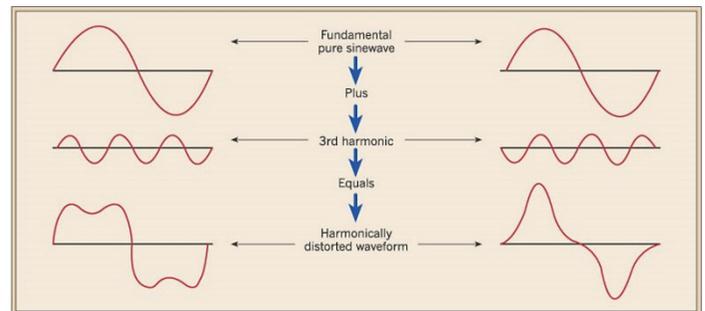
- Electric machines working above the knee of the magnetization curve (magnetic saturation), arc furnaces, welding machines, rectifiers, and DC brush motors.

Modern sources:

- All non-linear loads, such as power electronics equipment including ASDs, switched mode power supplies, data processing equipment, high efficiency lighting.

Consequences:

- Increased probability of occurrence of resonance.
- Nuisance tripping of thermal protections.
- Electromagnetic interference.
- Increase in the losses.
- Loss of efficiency in electric machines (e.g. 5th harmonic).



Now, with a better understanding of the many issues that disturb power quality – Does it really matter?

For those with a lighting control system or whole house automation, both of which frequently have to be serviced because of a power problem, the answer is clearly yes. If you have a home office that relies on digital data stored on servers, the answer is clearly yes. If you are concerned about home security, the answer is clearly yes. I have spoken with a fair number of system integrators, each of which have multiple stories about emergency truck rolls, to ensure their clients could control the lighting within their home. It's certainly not a great use of time and, in most cases, it's not billable.

With the proliferation of Internet based home devices, power quality issues will create many growing and ongoing problems.

WILL POWER QUALITY IMPROVE?

Personally, I don't believe power quality will improve. Utilities have a difficult time building more power plants. The NIMBY's (Not In My Back Yard) and the NOTE's (Not Over There, Either) are making the permitting process increasingly difficult and time consuming. With the intermittent nature of renewable sources, the integration of those sources into the grid exacerbates power quality issues.

SO WHAT CAN BE DONE?

It will become increasingly more imperative to include power conditioning and battery back up in equipment in every system you install. Depending on the complexity, size and sophistication of the system, you will have to determine whether to install the equipment at the device level, the rack level or the electrical panel level. You will also have to decide on the quality and ruggedness of the power quality equipment installed. The more "mission critical" the system, the more robust the power quality equipment should be. Whatever power quality equipment you choose to install, it should have the capability of informing you of its operating capability, such as battery life and the state of the surge protection as a start. This is especially important if you have installed multiple devices or rack level devices. It's crucial to know if they are all in perfect working order. Look around, there are plenty of devices on the market. I would suggest that this is not the place to economize. Of course, I might not be totally objective.



MARKETS SERVED

The RoseWater Energy Storage Hub is perfectly calibrated to serve in several markets including:

- “CEDIA” custom installation/system integration market and channel, which includes audio, home theater, lighting control, automation, networking and communications, and other luxury residential subsystems
- Light commercial installations, e.g. doctors’ and lawyers’ offices and other small business where an Energy Hub can serve the entire premises
- The custom builder/remodeler market, primarily luxury “spec” homes with buyers, as a home upgrade also providing renewable energy to meet green building standards
- Production home builders, who are mostly served by electrical contractors and electrical distribution rather than custom installers, systems integrators, or dealers
- Electrical contractors and electrical distributors, for residential and commercial applications

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