Power Quality Notes

A Monthly Educational Series on Power Quality and Power Conditioning

April, 2008

This Month…

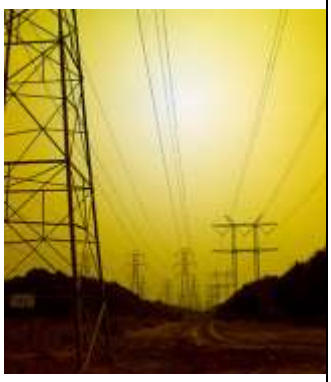
Test Your PQ IQ

How much does poor power quality cost U.S. businesses each year in lost profits?

1) More than $15 billion
2) More than $26 billion
3) More than $120 billion
4) More than $400 billion

See the end of the newsletter for the answer

How's Your Voltage Quality?



Many people feel comfortable talking about "power quality": that all-encompassing term for a myriad of electric power abnormalities or lack thereof. On the other hand, few people use the term "voltage quality". Let's take a closer look at both of these terms.

In electrical terminology, power is a quantity of energy delivered over a period of time, for example kW-hours. Hours are the period of time and kilowatts are proportional to amperage times voltage. The term "quality" as commonly used in "power quality" refers to a degree of excellence or superiority (or, perhaps a lack thereof). So, what can we do to alter the degree of excellence among, time, amperage and voltage?

Obviously, we can't change the characteristics of time. Similarly, we can't substantively change the attributes of electrical current: loads demand a certain amperage and so the current flows. What we are left with is voltage. Of all the components of power, the only one that we can meaningfully influence is voltage.

Voltage can be too high, too low, unstable, the wrong type (AC vs DC) or demonstrate numerous other characteristics that are far from excellent for the required purpose. In fact, there are numerous products available that do nothing more than improve, modify or eliminate certain voltage traits.

This simple exercise has taken us to one point: "power quality" really means "voltage quality". It is easy to see how the terms "power" and "voltage" become interchangeable when used to describe devices such as transformers, conditioners, stabilizer, etc. So – how's your voltage quality?

Application Notes

Mission critical applications and Datacenters are often supported by numerous UPS units, backup generators and redundant incoming power services.

Did you know...

In U.S. datacenter/IT applications, the average* UPS, larger than 5 kVA:

- Operates at a 38% load factor
- Has an efficiency less than 86%
- In total consume more than 7 billion kW-hr of electricity per year.

(*From a December 2005 study of UPS in datacenter applications by the Lawrence Berkeley National Laboratory)

This publication is produced by UST as part of its ongoing commitment to provide the electric industry with educational material and information of current topics related to power quality and power conditioning.

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But, without a working HVAC system, all of this may be for naught. A datacenter will overheat in a matter of minutes without air conditioning and even redundant HVAC systems may not be the complete solution.

Brownouts or chronic low voltages can cause premature pump or fan motor failure due to overheating and unexpected high voltage levels can damage HVAC controls in short order. Redundant HVAC systems may not provide adequate security under these circumstances as all operating systems would likely be subjected to the same voltage problem(s). Keeping a 100% redundant HVAC system offline as an emergency backup would improve security, but it comes at a high cost with lots of complications.

Most datacenters can operate for several minutes without HVAC which is usually enough time to transfer to a secondary utility source or backup generator. This means that energy storage, like a battery or flywheel UPS, is not required for the HVAC.

In these cases, a voltage regulator-type power conditioner can provide simple, efficient and cost effective protection for critical HVAC systems. With very low operating losses and virtually no maintenance – at a fraction of the cost of a UPS – electronic voltage regulators can be inexpensive insurance for those seeking maximum uptime from their datacenter.

Test Your PQ IQ

All the listed answers have been cited by various government and research organizations over the past decade to quantify the cost incurred by U.S. businesses as a result of poor power quality. The large variation in the numbers reported by the studies is driven by the type of power quality problems investigated and the assumptions of who would be affected by such problems. For example, several studies only looked at problems originating on the T&D system and some did not include power outages.

There are tremendous challenges associated with answering the "how much does it cost" question. For example, electrical apparatus, from the smallest relay to the largest automated system, will have a different sensitivity to different power problems. Determining the actual cost of a power problem is problematic since there is such a huge variation between businesses. In one case a power problem lasting less than one second can cost millions of dollars for businesses that have batch operations or long process startup times. In another case, a complete power outage lasting an hour may cost only a few thousand dollars in overtime.

In the end, the "how much does it cost" question is best applied to an individual business to determine to value of avoiding power quality problems. Statistics on national or global costs are largely of interest only to policy makers and marketers.

	When you consider the billions of dollars businesses spend each year to avoid power quality problems, the only conclusion is that the cost of power quality problems is huge! Send your questions or comments to: powerqualitynotes@ustpower.com