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Protecting Medical Equipment from Faulty and Unreliable Electrical Power - Gradian Health Systems

Gradian

6-7 minutes

With our recent addition of [Ismael Cordero](#) to the Gradian team as our new Biomedical Service Manager, this is the first (of hopefully) a number of new blogs regarding biomedical safety and more technical issues involving the UAM. Stay tuned here in the coming months for more on topics like this.

[suboptimal wiring - hospitals](#)

Most of the diagnostic, treatment, and life support devices used in healthcare require electrical alternating current (AC) of consistent quality in order to function properly. AC power supply grids in infrastructure-poor countries can be extremely unreliable with frequent power quality disturbances and power outages. Additionally, suboptimal electrical installations in the medical facilities themselves, including poor wiring and grounding, compounded by poor electrical safety practices, contribute greatly to these problems.

Common power quality disturbances include surges, spikes, swells, sags or brownouts, noise and outages. All of these power disturbances can cripple the equipment and place the care of the patients at risk.

Common power quality disturbances

Surge – a rapid shortterm increase in voltage. Surges often are caused when high power demand devices such as air conditioners turn off and the extra voltage is dissipated through the power line. Since sensitive electronic devices require a constant voltage, surges stress delicate components and cause premature failure.

Spike – an extremely high increase in voltage with a very short duration measured in microseconds. Spikes are often caused by lightning or by events such as power coming back on after an outage. A spike can damage or destroy sensitive electronic equipment. Equipment should be turned off during a power outage. Wait a few minutes after power is restored before turning it on and then turn on one device at a time.

Swell- a short-term increase in voltage. A swell can lead to stressed or damaged electronic components, which cause premature equipment failure.

Sag – also called brownout, is a rapid short-term decrease in voltage. A sag typically is caused by simultaneous high power demand of many electrical devices such as motors, compressors and so on. The effect of a sag is to starve electronic equipment of power causing unexpected crashes and lost or corrupted data. Sags also reduce the efficiency and life span of equipment such as electric motors.

Noise – a disturbance in the smooth flow of electricity often referred to as electromagnetic interference (EMI) or radio frequency interference (RFI). Noise can be caused by motors and electronic devices in the immediate vicinity or far away. Noise can affect performance of some equipment and introduce glitches and errors into software programs and data files.

Outage – also called a blackout, is a total loss of power for some period of time. Outages are caused by excessive demands on the power system, lightning strikes and accidental damage to power lines. In addition to shutting down all types of electrical equipment, outages cause unexpected data loss.

Protecting the equipment

Although healthcare providers are not likely able to control the quality and reliability of the electrical power coming into their clinical unit or able to improve the electrical wiring and grounding in their facilities, there are several portable devices that they can use to protect the medical equipment from faulty electricity, prevent interruption of patient care, and reduce risks to the patients:

[repairing a defective backup generator](#)

Repairing a defective backup generator

Voltage Stabilizers- also known as automatic voltage regulators, automatically maintain a constant voltage level and protect equipment against voltage surges, voltage swells, and voltage sags. They regulate fluctuating input power voltage and output a constant voltage such as 220V.

[Voltage Stabilizer](#)

Surge suppressors – reduce or eliminate potentially damaging shortduration power spikes or surges and electrical “noise.” Plugin surge suppressors are used at each individual piece of equipment or can be integrated into a surge suppressing power strip. Most

power strip surge suppressors sold at retail electronics stores offer very limited protection against disturbances. Many inexpensive power strips can be damaged after one voltage spike and fail to protect equipment after the first incident often leaving the user unaware that their equipment is unprotected. Users should look for power strips that offer a test circuit and a diagnostic light that indicates if the unit is working properly. Surge suppressors are rated according to the size of voltage spike that they can handle, so only units with a high enough “Joules” rating to protect the equipment should be used.

Power conditioners – provide protection against surges in power, just as a surge protectors do, but also can filter out electrical noise. The more sophisticated and expensive types of power conditioners can also feed a continuous voltage (automatic voltage regulation) to the equipment during a brownout. Users should be aware that the typical power conditioners used in homes and offices for computer systems do not commonly include voltage regulation.

Uninterruptible power supply (UPS) – a battery-powered device that senses when the incoming AC voltage drops to an unacceptable level and temporarily provides power until it is restored. UPSs generally also provide power conditioning to protect against other disturbances such as spikes and noise. More sophisticated and expensive types of UPSs can also provide automatic voltage regulation during brownouts and will only go into battery backup mode in the event of a power outage.

If you have any further questions regarding this issue, please contact service@gradianhealth.org.

Coming soon, we will be posting a follow up to this blog about electrical safety practices in hospitals.