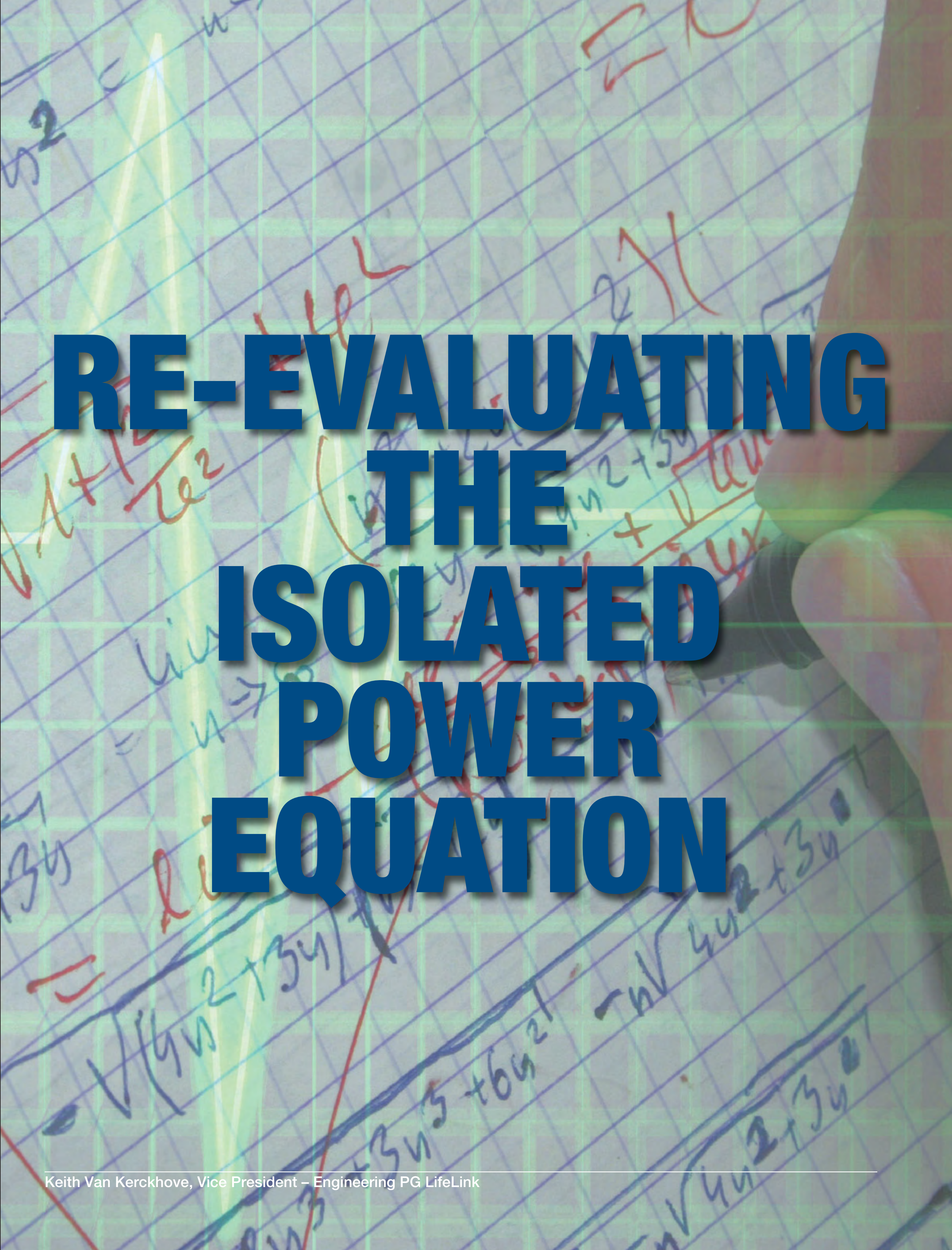

RE-EVALUATING THE ISOLATED POWER EQUATION

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When you think about environments that require advanced power safety techniques, healthcare facilities quickly rise to the top of the list. From large 1,000 bed hospital campuses to small outpatient surgery clinics, the need for safe and reliable power is essential. Patients and their families place their trust in the skilled hands of physicians and nurses on a daily basis and rely on them to provide the best possible medical care. In turn, the owners, designers, and builders of these facilities have an obligation to provide them with the safest possible environment in which to operate.

In many ways, the healthcare construction industry has been a driving force in advancing the areas of power quality, as well as power safety over the years. Nevertheless, budget concerns and "value engineering" often lead to compromise and attempts to diminish this effort to a simple financial equation. A prominent example of this is the dialogue surrounding the use of special protection against electric shocks in operating rooms and other critical care areas.

Utilized in patient areas dating as far back as the 1940's, isolated power systems are one form of electrical shock protection. The original rationale for their use was to protect against ignition sources in highly combustible operating room environments where flammable gases were used as anesthetizing agents. As a greater variety of electro-medical devices were introduced into the operating room, the ability of isolated power systems to protect patients and staff against the occurrence of ground faults took on an even greater significance. However, in the 1970's, flammable anesthetic gases were eliminated from the operating room. With this event, the debate about isolated power began. Raising the ultimate question, do we still need isolated power systems in our operating rooms? Many recent events, including fires in critical areas of healthcare facilities, serious injuries, burns and loss of life make this a question that needs serious reconsideration.

The need to provide this high level of protection on healthcare power systems came into question because of the inherent safety features designed into modern electro-medical devices. Medical device standards require stringent design criteria and regular testing to be employed throughout the life of the device. Then again, no device is perfect. Equipment can be damaged at any time. This damage can go unnoticed until the next scheduled leakage test. Every time a damaged piece of equipment is used it creates a potentially dangerous situation.

Effective application of risk management principals utilizes multiple layers of protection to mitigate potential hazards. Proper wiring and bonding techniques, stringent equipment testing requirements and redundant sources of supply, provide a strong base level of reliability to healthcare facility distribution systems. Ground fault circuit interrupter (GFCI) devices can add an additional layer of protection in the form of ground fault safety. GFCIs are devices intended to protect individuals against electric shock in areas that may become subject to wet conditions.

The 2008 edition of the NEC Code Article 517 Section 20 requires the use of Isolated Power Systems in patient care areas identified as "wet procedure locations" when the interruption of power under fault conditions cannot be tolerated.

However, GFCIs have one major drawback; they react to a fault current by breaking the power circuit and de-energizing downstream equipment. Any upstream power redundancy measures are rendered useless until the cause of the fault is cleared. Depending on the complexity of the system and the nature of the fault, this could take several hours to accomplish. Obviously, this is unacceptable when the same circuit is powering a surgical instrument or some form of life support equipment. For this reason, GFCI devices are typically discouraged from use in critical patient care areas

such as operating rooms and ICUs. In contrast, isolated power systems provide a GFCI equivalent level of fault protection, as well as simultaneously maintaining continuity of power to the branch circuit. In addition, a line isolation monitor (LIM) continuously monitors all critical circuits and equipment for potential first fault occurrences. When the LIM determines that potentially dangerous conditions exist, it will initiate an audible and visual alarm. This notification serves as an early warning of a potential problem to operating room personnel. They may complete their procedure in a safe environment and notify maintenance staff in a timely fashion. With the possible life-threatening condition avoided, the maintenance department can address the situation and make necessary repairs before the next procedure is scheduled.

In addition to the characteristics listed above, there are a number of other benefits associated with the use of isolated power systems. The natural line regula-

tion, common mode noise rejection and ground loop filtering features provide an effective power conditioning system. Isolated power provides clean, stable voltages for sensitive diagnostic equipment. Furthermore, by tracking the degradation of the electrical insulation system over time, the line isolation monitor is a valuable tool for preventative maintenance.

The 2008 edition of the NEC Code Article 517 Section 20 requires the use of Isolated Power Systems in patient care areas identified as "wet procedure locations" when the interruption of power under fault conditions cannot be tolerated. The decision of determining wet location areas becomes the responsibility of the owners and administrators of the hospitals. However, in most instances this decision is entrusted to a consulting engineer who must carefully study the intended use of each space, including potential future expansion. In this analysis, what should be considered?

First, note that a number of fluids, including blood, saline, and urine are present during even routine surgeries and emergency procedures. Physicians rely on an increasing number of electro-medical devices to diagnose and treat patients. Anywhere that liquid and electrical equipment meet, the risk of electric shock exists. Moreover, patients are at an even greater risk for this fatal consequence. Medical procedures often lower, or even circumvent, the natural electrical resistance of the skin and tissue of the patient. This situation raises the risk of serious harm or even death from relatively small fault currents. Clearly, the highly specialized and sensitive nature of surgery, intensive care, emergency, cardiac catheterization, delivery and dialysis areas warrant the use of "special protection" from electric shock hazards.

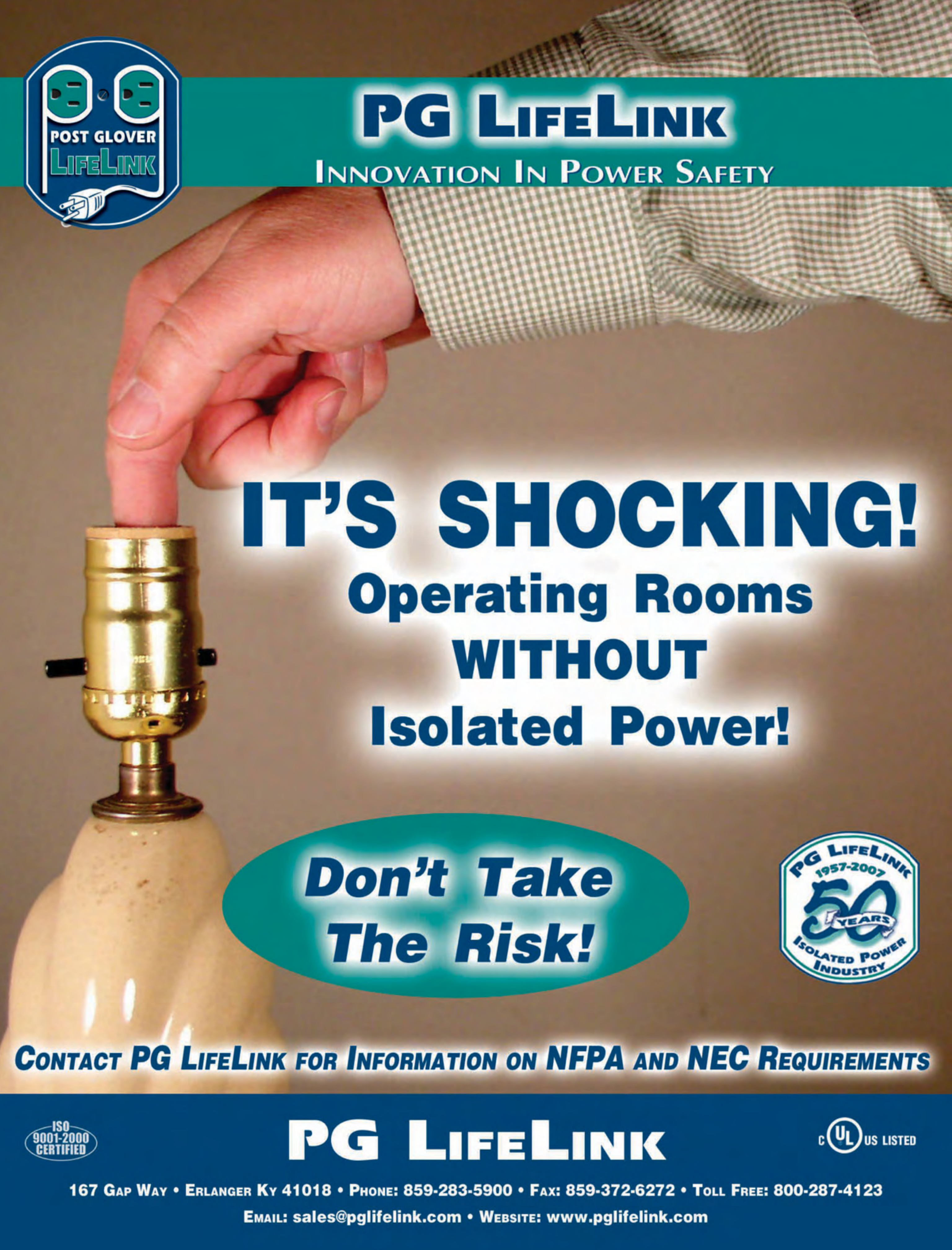
Secondly, the analysis must pose the question, "can the interruption of power, under fault conditions, be tolerated in these significant healthcare areas?" Critical branch power requires a redundant source of supply to ensure that vital equipment is maintained in the event of a power failure. Even for a few moments, loss of supply during time critical procedures or when using life support equipment can prove fatal. Obviously, the risk of interruption in a critical branch circuit is very serious.

Vocal advocates of isolated power, surgeons, anesthesiologists and nurses benefit from its protection as well. Not only does it ensure a safer working environment, it shows a commitment to safety that can potentially reduce liability claims. Many prominent hospitals are using the installation of isolated power as a way to attract top-level physicians to their staff.

The one time initial cost of installing isolated power panels represents a small percentage of the total electrical distribution equipment package installed in a newly constructed hospital. However, the incremental cost over similar grounded distribution equipment is only a few thousand dollars per operating room. This amount is small in comparison to the hundreds of thousands of dollars worth of other materials and equipment required to build and outfit a modern operating room. Furthermore, today's microprocessor based line isolation monitors reduce the amount of time required for maintenance and testing. Newer units call for annual testing versus the monthly testing requirements of older monitoring units.

The installation of isolated power in healthcare facilities is still a choice, albeit one that should be taken very seriously. In the US, some states exceed the NEC by mandating the use of isolated power in all operating rooms. Countries in Europe, Africa, and Asia, which have accepted the International Electric Code, require the use of ungrounded power with continuous monitoring in all Group 2 patient areas including operating theaters, catheterization labs, emergency rooms and intensive care units (IEC 60364-7-710).

In re-evaluating the isolated power equation, based on this logical analysis, the benefits of an isolated power system easily outweigh the incremental costs associated with its installation. Isolated power provides a safer overall system than grounded power. Isolated power systems should be standard equipment for critical areas of any healthcare facility. ❑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