

# Recognizing the Additional Benefits

*Isolated Power Systems Increase the Life of Medical Devices*

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**M**any of us who provide electrical products to the healthcare industry are aware of the benefits associated with Isolated Power Systems (IPS) in hospital operating rooms, critical care, and intensive care areas, for their ability to provide continuous power in the event of one line to ground fault while eliminating the danger of electrical shock. These systems were first introduced into the hospital environment over fifty years ago as a way to reduce the risk of explosions in operating rooms and other areas where flammable anesthesia agents were used. Today, these types of flammable gases are no longer in use and some feel the added cost of IPS is therefore not justified, resulting in ongoing debates involving their safety benefits versus their cost.

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more cardiac operations are performed every year, in many of which the patient's life depends on artificial circulation of the blood; in those and other operations, life is often sustained by means of electric impulses applied directly to the heart muscle to stimulate and regulate its action. Many large hospitals have over 10,000 pieces of equipment, many of which cost tens of thousands of dollars each and often more. Should one of these instruments fail or be damaged for any reason, including poor power quality, not only would the resulting repairs be costly, but more importantly, such a failure could jeopardize the life of the patient.

This increased use of sensitive electronic systems in the hospital environment has created a growing need for a "clean" supply of power, free of noise and transients. Data storage and monitoring equipment is often extremely sensitive to line transients and noise frequently present on power lines. The IPS contains a high quality shielded isolation transformer which provides a convenient and effective means of greatly reducing or even eliminating line-to-line and line-to-ground noise on power feeders. Many manufacturers of noise-sensitive equipment have recognized the problem created by transients and noise on their equipment's input line and have provided a measure of protection as an integral part of their equipment. This protection, however, may not be adequate for frequent or serious disturbances. Although the primary reason for IPS design and installation was not to achieve this noise reduction, but to provide a low leakage secondary power system for safety reasons, we must recognize this

other “built-in” but less obvious advantage of IPS when comparing it against conventional grounded systems.

There are two types of noise that affect medical devices typically found in hospital critical care areas: common mode noise, the most prevalent type, and transverse mode noise. Common mode noise refers to electrical interference existing in common on all current-carrying conductors and measurable as a ground referenced signal. In typical hospital environments, large quantities of this type of noise can be generated by high-power equipment using phase-control techniques, including variable speed motor drives, elevator soft-start controls, and lighting dimmers, as well as other types. In these applications, power savings or other desired effects are accomplished by using only a portion of each cycle of the AC waveform. At the instant during the waveform cycle when the device switches “on”, a large transient current flow can be created in the “neutral” conductor, which can impress a high transient voltage on all conductors of the power line feeder proportional to the impedance of the neutral conductor’s path to ground.

The IPS acts as a filter to safeguard medical electronics by blocking common mode noise and harmonics from reaching equipment connected through it. An IPS consists of the following key components: an isolation transformer, a line isolation monitor, and a circuit breaker panel with ground bus. The isolation transformer is the component responsible for blocking noise while providing surge suppression. This transformer has separate primary and secondary windings and generally a shield between them. Its main purpose is to allow re-referencing of output connections and to reduce conducted electrical noise. An isolation transformer transfers to its secondary only those voltages that differ between legs of its primary, and therefore blocks common-mode noise and transients from its input circuit to its output windings. This attenuation, or reduction in amplitude, could be as high as one million to one.<sup>1</sup>

A study conducted by IBM estimates a power surge of 100 to 1,000 volts occurs at least once per day in every electrical environment, possibly leading to system lock-ups, lost productivity and

even catastrophic equipment damage or data loss. Surges can also degrade lighting, HVAC and elevator controls as well as chiller systems - each potentially leading to life-threatening problems quite apart from dedicated medical devices. Surge related issues result in nearly \$80 billion in losses for the U.S. economy, according to the Worldwatch Institute. These equipment-damaging electrical pulses are also a factor in patient care and the filling of landfills with harmful electronic waste due to equipment failure.

In an article written August 5th, 2009 on Dotmed.com, William Goldbach, a senior life member of the Institute of Electrical and Electronics Engineers (IEEE), wrote, “Microprocessors read in-

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formation through current pulses as binary code (zeros and ones). As equipment is turned on and off, voltage and current pulses, known as transients, are generated. These pulses of energy are distributed throughout every piece of equipment in the system. Depending upon the size and frequency of these pulses,” he says, “the results will vary. As microprocessors try to function, these transient pulses of energy can cause lock-ups, or data can become lost or corrupted. In addition,” Goldbach says, “larger pulses will cause catastrophic failure while smaller pulses degrade the life of these systems and controls.”<sup>2</sup>

As stated above, the cost associated with installing and maintaining these systems is still a large concern. PG LifeLink

has been a leader in this field for over 50 years and continues to develop new technologies and advantages to increase the value and lower the total cost of ownership for these systems. The onetime cost of installing isolated power typically represents 6-8% of the total electrical distribution equipment installed in a newly constructed hospital. The long term savings associated with these systems far outweigh the costs of implementing them into your hospital system. PG LifeLink works with engineers, contractors and specifiers to assist in making a project as economical as possible.

### Conclusion

Many areas of modern healthcare facilities represent the confluence of electrically powered devices. Although the main reason for isolated power in hospital critical care areas is to reduce the potential of electrical shock, isolated power systems provide additional benefits beyond an added safety layer for the patient and staff. As identified in this article, hospitals are able to increase the reliability and possibly even extend the life of expensive medical equipment. Although there are other costly methods available to reduce common mode noise, isolated power inherently includes this beneficial attribute, adding value by being included as part of electrical distribution systems. Because IPS provide a solution to common mode noise found in electrical distribution systems throughout hospitals and also provide additional safety, it is our judgment, based on the facts presented in this paper, that the benefits of IPS easily outweigh the incremental costs. Isolated Power Systems provide both a safer overall system than grounded power and a less hostile electrical environment for critical electronic life-support equipment, and should be considered standard equipment for critical care areas. □

### References

- <sup>1</sup>Energy Technologies, Inc. <http://www.powersource.net/glossary-g.htm#ii> June 8, 2010.
- <sup>2</sup>Dotmed.com, Preventing Power Surge is Key to Medical Device Operation, Rabia Paracha, August 5, 2009.