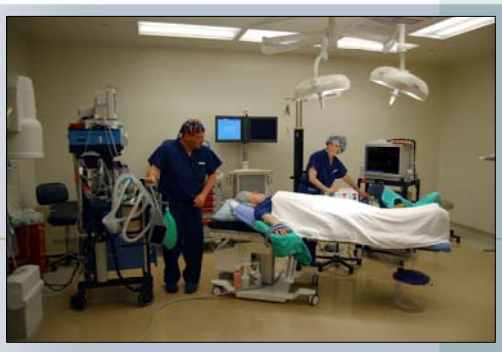
BENDER
ISOTROL Products



Grounded vs. Isolated Power
Which is safer for operating rooms?

In locations involving the use of conductive fluids such as saline solutions, there is an added risk of exposure to electric shock for patients and medical staff. Most experts will agree that determining if critical care areas are wet locations involves performing a risk assessment study. Auditors tasked with responsible risk assessment should be independent and objective; have knowledge of the facility, its systems and processes; and possess skills in risk management, documentation, evaluation and assessment.

The table below illustrates the major differences between grounded power and isolated power systems.

	GROUNDED POWER		ISOLATED POWER	
Power Interruption	GFCIs save lives; however, we must contend with unexpected trippings and loss of power.	UNSAFE	Protection level same as GFCIs; however, there is no power interruption even with a solid ground fault.	SAFE
Selective Coordination	Difficult to achieve for all levels of overcurrent protection.	UNSAFE	Easily accomplished at all levels of electrical distribution.	SAFE
Electrical Hazard for Patient and Staff	The ground fault current from insulation faults within ME equipment may be insufficiently high to trip the overcurrent protection device; portable devices are especially vulnerable.	UNSAFE	There is no direct path back to the supply as a result of insulation fault within a piece of ME equipment.	SAFE
Faulty Electrical Systems and ME Equipmaent	No advance information prior to a circuit breaker tripping and interrupting power.	UNSAFE	The LIM alerts the medical staff without power interruption. It provides an early warning of ME equipment malfunctions, e.g., such as open ground and insulation breakdown.	SAFE
Fire Protection	Various national and international standards set the threshold for fire risk at 500 mA; a 20 A circuit breaker will not trip for a ground fault current less than its rating.	UNSAFE	An isolated power supply limits the ground fault current well below this limit; also, the LIM provides a visual indication as this limit is approached.	SAFE
Electrical Noise Reduction	Not applicable		The shielded isolation transformer provides a 50 to 60 db attenuation of common mode noise and transient voltage disturbances	BONUS
Predictive Maintenance	At best, preventive maintenance procedures, unless rigorously followed, will not be effective in preventing unexpected outages.	UNSAFE	The entire installation, including plugged-in ME equipment, is continuously monitored. There is an early warning of insulation degradation as indicated by the THC reading displayed on the LIM.	SAFE
Installation Costs	As a minimum, several large step-down transformers are required to deliver voltages of 120 and 208 V in the OR. Selective coordination at the 120 V level is difficult; a fused lighting panelboard may be required to meet NEC requirements.		The built-in shielded isolation transformer provides the necessary voltage in the OR. The primary voltage can be fed directly from the switchboard panel on the load side of the transfer switch. Selective coordination is readily achieved.	
	Based on 12 ORs in a real world facility, the additional cost per OR is less than $3,000; all costs are included including equipment, wiring material, and labor costs.. Not included is the additional square footage required to accommodate the equipment for grounded power.			
Test & Maintenance Costs	Sources such as CPSC (Consumer Safety Foundation International), the DOE (Department of Energy), and GFCI manufacturers recommend that GFCIs be tested at least monthly to ensure they operate as designed		As stated in NFPA 99 the maintenance and testing requirements, as they apply to isolated power, are straightforward and minimal. The LIM circuit need be tested at intervals from 1 month to 12 months depending on whether or not it has automated self-test/calibration capabilities.	
	There is no valid data to backup the argument that IPS systems have high maintenance costs. In fact, a facility that complies with the recordkeeping requirements as well as the recommendations for periodic testing of GFCIs will be faced with substantially higher testing and maintenance costs.			
Risk Factors: - Availability of supply - Basic insulation failure - Open ground - Open neutral	- Interruption at first fault - Potentially high and lethal touch currents - Touch currents as high as 500 µA - Touch currents as high as 200 µA under normal conditions	UNSAFE	- No power interruption at first fault - Low touch current at a µA level in the teens or less - Low touch current at a µA level in the teens or less - Low touch current at a µA level in the teens or less	SAFE
National & International Standards	NFPA 99, ***Standard for Health Care Facilities*** dictates that isolated power or GFCIs, if a power loss can be tolerated, be used in a wet location. The provisions in NFPA 70, ***National Electrical Code*** apply to electrical construction and installation criteria. Per healthcare interpretation of IEC Guidance Note 7 and IEC 60364-7-710, ***Electrical Installations in Medical Locations*** "The use of isolating transformers creates a safer environment for the patient and staff by minimizing hazards from touch voltages and ensuring continuity of supply under single fault conditions. Isolation transformers alone are not intended to protect against microshock".			

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