

Code References re. Isolated Power Systems (IPS) in Operating Rooms

NFPA 99 (Health Care Facilities Code) – Design, Performance, Testing, & Record Keeping

- **Ch. 3** Definitions of all terms used: Isolated Power System, Hazard Current, LIM, Wet Procedure Location, Patient Care Vicinity, Receptacle, and many others
- **Ch. 6** Electrical Systems
- **6.3.2.2.6.2 (C)** Minimum 36 receptacles required in ORs
- **6.3.2.2.7.2 (B)** Isolated ground receptacles forbidden (also NFPA 70 517.16)
- **6.3.2.2.8** Wet procedure locations required to have ground-fault protection; IPS preferred over GFCI when power interruption cannot be tolerated (also NFPA 70 517.20); see also 6.3.2.1.1
- **6.3.2.2.8.4** All ORs are wet locations unless a formal risk assessment is done to prove otherwise
- **6.3.2.2.8.8** Every GFCI device, where used, must be individual: no daisy-chaining
- **6.3.2.6** Isolated Power Systems
- **6.3.2.6.2.1** 200,000 ohms minimum leakage impedance required (~600 μ A / 0.6 mA max measured leakage current at 120 V); measurement methods and conditions
- **6.3.3.1** Grounding
- **6.3.3.1.1.2 & .3** Some surfaces “not likely to become energized” exempt from grounding requirements. Architect job specs often call for grounding such things anyway
- **6.3.3.1.2** Ground reference point: IPS ground bus, grounded object such as cold-water pipe, ground terminal of receptacle fed from some other system
- **6.3.3.1.5** Test instruments must be tested periodically, but at least annually, for proper performance
- **6.3.3.1.6** Touch voltage and ground impedance limits: 0.1 ohms and 20 mV max
- **6.3.3.2** Receptacle testing: 10% min. for 6.3.3.1.6 parameters; 100% for polarity, grounding, etc.
- **6.3.3.3.2** LIM must go into alarm when presented with a 5.00 mA calculated fault resistance, calculated as ohms = measured line V \times 200; approx. 24,000 ohms @ 120 VAC
- **6.3.4.1.4** LIM periodic testing requirements: monthly, or annually for LIMs w/ auto self-cal. LIM Test switch to be activated, LIM must go into alarm
- **6.3.4.1.5** LIM must be tested per 6.3.3.3.2 “after any repair or renovation” to the IPS
- **6.3.4.2** Permanent record must be kept of required IPS test results
- **A.6.3.2.2.4.1** Breaker coordination encouraged
- **A.6.3.2.2.6.1** All receptacles should be of only one type, standard hospital-grade preferred
- **A.6.3.3.1** Exhaustive discussion on purpose and importance of grounding

NFPA 70 (National Electric Code) – Construction Specifications, LIM Definition

- **517** Health Care Facilities
- **517.11** Informational note describing purpose – shock prevention, grounding, etc.
- **517.13** All circuits must be in metal conduit and include a ground wire. Boxes must be grounded.
- **517.14** Bond multiple panels serving a patient area with unbroken #10 AWG copper wire
- **517.19** General specifications for electrical systems in patient care areas
- **517.20 (B)** IPS must be listed (e.g. UL) as IPS: no “custom” or ad-hoc
- **517.30 (C) (2)** IPS cannot share feeder with any other load. Receptacle ID required.
- **517.160 (A) (1)** Over-current protection required in all conductors (2-pole breakers). IPS wiring cannot share conduit with anything else.
- **517.160 (A) (4)** An isolation transformer can only serve one OR except high voltage e.g. laser
- **517.160 (A) (5)** Wire colors orange & brown w/ tracer. Orange wired to neutral at receptacles.
- **517.160 (A) (6)** No pulling compounds. Dielectric constant of wire insulation < 3.5 (XHHW-2).
- **517.160 (B)** Line Isolation Monitor characteristics and performance requirements

UL 1047 (Isolated Power Equipment) – Listing Specification

- **21** Isolation Transformers – construction & performance: electrostatic shield, leakage, regulation
- **23.5** Maximum circuits per system: 16
- **29** Maximum allowable temperature rise of various components
- **30** Maximum allowable leakage of transformers and complete systems
- **38.2** Maximum allowable kVA rating: 25 kVA

References taken from NFPA 70 2011 Edition, NFPA 99 2015 Edition, and UL Standard 1047 dated 7 Oct 2010