Isolation Level and EMC Considerations for Medical Power Supplies

Delta Electronics is a global leader in power and thermal management solutions, well-known for its innovative technologies and commitment to sustainability. With decades of expertise, Delta has established itself as a trusted provider of high-performance medical power supplies that meet the stringent requirements of healthcare environments. Their products, which include AC adapters, open frame, enclosed, and configurable models, are acclaimed for their reliability, safety, and exceptional EMI (Electromagnetic Interference) performance. Delta's medical-grade power supplies are engineered to meet IEC 60601-1 standards, offering solutions that ensure both patient safety and the efficient operation of medical equipment.

The healthcare equipment market has grown significantly in recent years owing in part to the global ageing population, increased early-stage detection and screening with advanced diagnostic systems and technical advances in medical devices (for example imaging systems and, surgical robots). Medical power supplies approved to IEC60601 play a crucial role in safely powering critical medical equipment.

Regulatory bodies, such as the US Food and Drug Administration (FDA) and the International Electrotechnical Commission (IEC), have established rigorous guidelines for the design, manufacturing, and testing of medical power supplies. IEC 60601 is a widely accepted series of standards for the basic safety and essential performance of medical electrical equipment and systems. The U.S., Europe and Asia require medical devices to comply to this standard before manufacturers can place their products onto the market.

The 3rd Edition of the general standard IEC 60601-1 was first introduced in 2005 with Amendment A1 in 2012 and Amendment A2 in 2020.It is commonly known as IEC60601-1 (Edition 3.2) and represented a shift in philosophy from the 2nd Edition, including a greater emphasis on risk management and essential performance. Compliance with ISO14971:2019 ‘Application of risk management to medical devices’ is required. The standard defines two levels of Means of Protection from electrical hazards: MOOP (means of operator protection) and the more stringent MOPP (means of patient protection). Compliance with MOOP is sufficient for equipment that is

operated away from the patient vicinity, but 2xMOPP is essential for equipment in contact with or in close proximity to patients who, otherwise, may be more vulnerable to electric shock.

The IEC60601-1 third edition isolation voltages were increased from the second edition. MOPP levels are shown in figure 1 below.

Type	I/P to O/P	I/P to PE	O/P to PE
B rated	4000Vac (2xMOPP)	1500Vac (1xMOPP)	500Vac
BF/CF rated	4000Vac (2xMOPP)	1500Vac (1xMOPP)	1500Vac (1xMOPP)

Figure 1: MOPP Isolation level limits. Power supplies are divided into three categories, namely: Body (B), Body Floating (BF) and Cardiac Floating (CF). I/P is input. O/P is output.PE is protective earth (Source: Delta Electronics)

The safest choice to use with patients is a certified medical power supply that meets the 2xMOPP standard. Using a power supply rated to 1xMOPP plus an isolation transformer is feasible, however, transformers can be bulky and add expense. Using a power supply rated to 2xMOPP is a smaller, lower cost solution.

For medical products and equipment intended for use in a household environment (which includes nursing homes in EU) a related collateral standard IEC60601-1-11:2015 applies.

Also relevant to medical power supplies is an additional collateral standard IEC 60601-1-2:2014 4th Edition which addresses electromagnetic compatibility (EMC) requirements. The growing deployment of medical equipment outside of a relatively controlled hospital environment e.g. home /care home and the presence of mobile communication devices e.g. phones /tablets means that medical devices can be exposed to electromagnetic interference (EMI) from another electronic device and to electrostatic discharge (ESD) from humans or objects potentially causing malfunctions. This poses a risk to patients relying on medical devices keeping them alive or monitoring vital signs. Medical power supplies need to demonstrate compliance with strict limits of emissions and immunity.

In summary, to ensure patient and operator safety, medical power supplies are required to comply with the stringent isolation and electromagnetic disturbance levels detailed in IEC60601.

Delta Electronics Medical-Grade Power Supplies

Known for lower leakage currents, superior EMI performance and exceptional reliability, Delta's medical power supply solutions set the industry standard. Features such as low acoustic noise, high power density, reinforced isolation with two means of patient protection (2 x MOPP), and low leakage highlight Delta's commitment to adaptable and patient-safe technology. The portfolio includes power supplies with capacities exceeding 1000 W and lower capacities for small and portable devices, engineered to ensure medical equipment operates with efficiency and safety.

Delta's medical power supplies are IEC 60601-1 certified and offer solutions that reduce design time, simplify end-user certification, and provide fast time to market. The range includes AC adapters, open frame, enclosed, and configurable models,

The MEP-600A24J BRA is an example of Delta's open frame medical power supplies.in the MEP series. The compact model, with a 3" x 5" footprint (7.62 x 12.7 cm), delivers up to 600 W with fan cooling or up to 450 W with natural convection cooling. Leveraging Gallium Nitride (GaN) technology, the MEP-600A24J BRA has higher power with reduced size, achieving up to 26.67 W/inch³ power density. In addition, GaN adoption allows it to reach higher efficiency and improved thermal performance, making it well-suited for medical applications such as ultrasound, anesthesia ventilators, endoscopes, and in vitro diagnostics (IVD). It also has additional features, including a 5V / 2A standby output, built-in remote on/off, current sharing, and up to 80°C operating temperature, ensuring stable and safe performance.

Figure 2: The GaN based technology MEP-600A supports up to 600 W output power in a wide operating temperature range (Source: Delta Electronics)

The GaN based technology MEP-600A offers high power density in a 3” x 5” footprint. It supports up to 600 W output power in a wide operating temperature ranging from -20°C to +80°C. With 5V/2A standby power and electric shock protection (complying with 2 x MOPP) it ensures protection against electrical shock even in patient-contact applications. The MEP-600A offers reliable power supply for type BF medical equipment (body floating, a classification for medical equipment that has electrical contact with a patient, but not near the heart).

In addition, the MEP-600A24J BRA is certified to the IEC/EN/UL safety standards for medical, IT, and household use as well as EN 55032 Class B standard for minimal electromagnetic interference.

For local purchase and service of industrial and medical power supplies, please contact our authorized distributors https://deltapsu.com/en/contact/find-a-distributor