One of the fastest growing markets for power supplies is medical. Globally, sales of all types of power supplies are expected to reach nearly $900M in the next two to three years, with a CAGR (Compounded Average Growth Rate) in excess of 6%. This includes various products, from desktop adapters, open frame, enclosed and configurable.

With an aging population in North America and Europe, and Asia within five years, private and government funded health programs are struggling to address costs. The quality of care is indeed rising, and with a rise in the number of people having chronic diseases, there is a growing trend to treat the patients at home.
This not only avoids the cost of lengthy hospital stays, but reduces the stress to the sick by caring for them in a more familiar environment.

Some chronic illnesses, like kidney dialysis, are more suited for home care where the treatment can be performed over a longer duration. Toxins can be removed from the blood over a longer time period, which is kinder to the body and more effective. Benefits also include healthier arteries and a reduction in heart disease.

"... there is a growing trend to treat the patients at home."

Some medical devices used in home healthcare include infusion pumps, oxygen concentrators (to avoid the use of oxygen tanks), nebulizers for the treatment of asthma and other breathing disorders, positive airway pressure (PAP) devices for respiratory ventilation and a host of monitoring equipment. The latter allows the hospital to check on a patient remotely.

From a medical equipment viewpoint, home healthcare has some challenges. The medical device is no longer situated in a hospital, where the AC power is better controlled and the environment sterile. In North America and Europe, approximately 50% of the homes do not have a reliable ground connection. For permanently installed equipment, a licensed electrician can ensure that the product is correctly wired.

Medical equipment for home use is now required to meet IEC 60601-1-11 (2010) standards, implemented in 2013 for the U.S. and 2012 for Europe. This mandates that a ground connection is not needed for safe operation, meaning that products have to be designated Class II. Many consumer products already are, having just a
2 pin plug, including cell phone chargers, TVs and hair dryers. Double or reinforced insulation is used to protect the user from electric shock from live parts.

Traditionally power supplies rely on an earth ground connection for “Y” capacitors to reduce electrical noise from interfering with other pieces of equipment. Additional filtering internally to the power supply or the use of soft-switching circuitry has to be used to enable the end equipment to still meet class B EMI (ElectroMagnetic Interference) standards.

Power supplies used in home healthcare medical equipment also have to meet the IEC 60601 1 safety standards. This involves ensuring that the design will withstand 4 kVac input to output isolation and for the 3rd edition, 2 × MOPPs (Means of Patient Protection). MOPPs allows the equipment designer to not have to safety certify any applied part that may have contact with the patient.

In a hospital or clinical environment, cleanliness is a high priority. But, medical equipment in a home setting needs to operate in potentially dusty or unclean conditions. Designers can combat by either not using fans for cooling and/or by using a sealed enclosure or box. However, this raises some concern about the temperature rise in the power supply, particularly when many products on the market require forced air for operation. Fans also produce acoustical noise that can disturb or irritate a resting patient during a procedure.

"A capacitor’s life degrades by 50% for every 10 °C rise in ambient temperature, sometimes resulting in a field lifetime as short as 4 months."

European directives and U.S. energy related initiatives are also affecting medical power supply design in the same way as Energy Star, CEC (California Energy Commission) and other regulatory bodies. Although primarily aimed at external power supplies, many manufacturers are incorporating these standards into their
equipment to show a green initiative. High average efficiency levels are requested, along with an off-load power draw of less than 0.5 W.

For a power supply, having high efficiency ratings reduces waste heat and will lead to the components running cooler. When properly packaged, this allows the manufacturer to state conservative convection cooled ratings, in addition to a higher forced air cooled rating for other applications.

Long-term reliability is also very important. In a hospital or clinic, if a piece of equipment fails, there are usually replacements available. For a product used in a home, this can become an issue, particularly when the patient lives in a remote area. A procedure may have to be stopped for 24 hours until a replacement can be shipped out or delivered.

With TDK-Lambda’s new ZMS100 open frame medical power supply, particular care was taken in regard to electrolytic capacitor life expectancy. A capacitor’s life degrades by 50% for every 10 °C rise in ambient temperature, sometimes resulting in a field lifetime as short as 4 months. Where possible, for example in the capacitor used for power supply start-up, the electrolytic was replaced by a ceramic capacitor. Such failure modes would not become apparent until the equipment was moved or after a power outage. Targets were set in TDK-Lambda’s ZMS100 design stage to achieve capacitor lifetimes of up to 10 years.

Power supply manufacturers are now upgrading their ISO processes and procedures to include ISO 13485. This medical-based certification is recognition for the highest level of traceability and quality control through the product development schedule and the product’s lifetime in the field. The aspects are far ranging throughout the organization and include the design, manufacturing,
procurement, sales, distribution, product support and service of power supplies for medical applications.

For more information on TDK-Lambda's latest power supplies, click here (/axiom/tdk-lambda-power-supplies-providing-long-field-life/).

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