

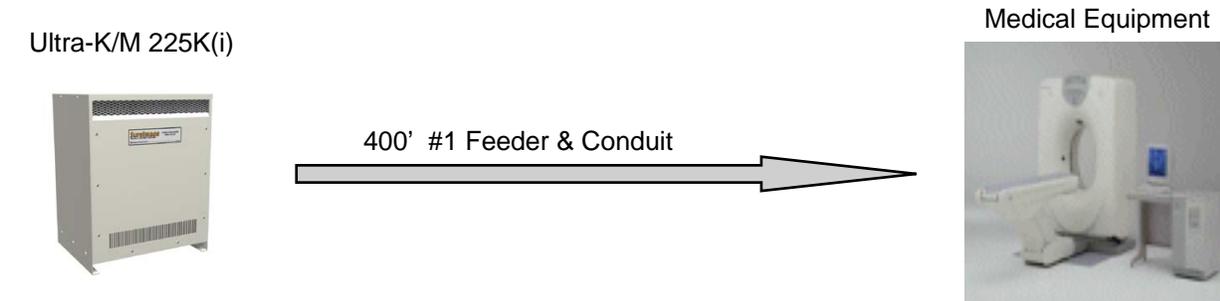
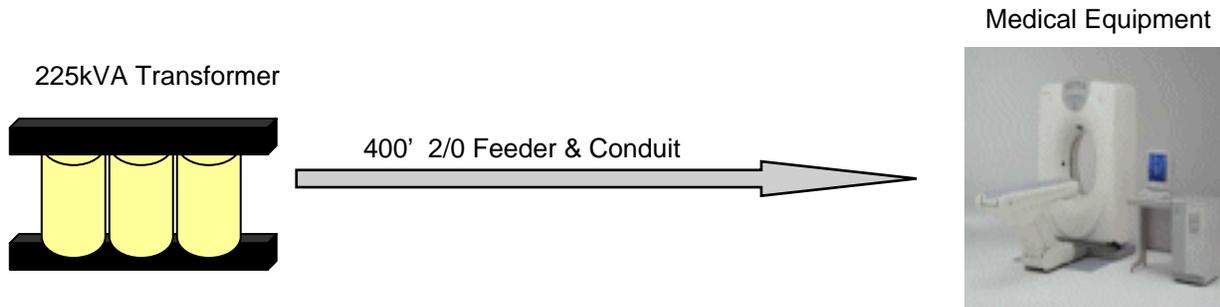
Load Voltage Regulation

General

Load voltage regulation is defined by the drop in voltage when going from a no load to full load condition on a power source. In more practical terms, it is often measured when going from a typical steady state load to a maximum load condition, realized under normal operating conditions. Load voltage regulation is used to evaluate the performance of an isolation transformer and distribution system under heavy step load changes. In the application of medical

imaging and treatment equipment, load voltage regulation is critical. The term "total load regulation" is typically used and takes into account the sum of the voltage drops when stepping from the equipment's stand-by mode to a scan or treatment mode of operation. The kVA capacity of the facility transformer and properly sized feeder cables help to ensure acceptable load voltage regulation. Medical imaging and treatment systems have a

unique power profile. These systems typically utilize a relatively small continuous kVA, and intermittently require a much more significant level of kVA in short bursts. With that power profile in mind, the medical imaging / treatment equipment manufacturers require that the total load regulation, measured at the input of their equipment, not exceed 6% (modality dependant).



Requirements for Medical Imaging and Treatment Equipment

Medical imaging and treatment equipment represent a challenging load profile to source transformers and distribution systems. As mentioned under the General section of this document, they utilize a relatively small continuous kVA in a stand-by mode, and intermittently require a much more significant level of kVA in short bursts when scanning or treating a patient. This step load change creates a drop in the voltage source feeding the equipment. This drop, defined as “total load regulation” must not exceed the limit set by the OEM, which is typically 6% or less, measured at the input of their equipment. That being

said, the objective is to keep the voltage drop at an absolute minimum. Without question, the source impedance dictates this performance. The source impedance is primarily made up of the distribution transformer feeding the load, but other factors include feeder cable sizing and length of the cable run. Even loose or bad electrical connections cause voltage drops and contribute to poor load voltage regulation. In imaging and treatment applications, two approaches can be used to achieve the required load voltage regulation.

1) Install an over-sized isolation transformer, with a

continuous KVA rating and feeder cables to match the momentary power demand of the medical equipment.

2) Install a dedicated K(i) rated isolation transformer, with an output impedance of approximately 2%, close to the medical equipment itself. Doing this and using appropriately sized conductors will ensure that the medical OEM's specified total load regulation requirements are met.

Note: K(i) rated power conditioning transformers are discussed in *SureImage* Application Note # 01.

The Controlled Power Company Solution

While both approaches (1 and 2 above) will meet the total load regulation requirements set forth by the Medical Imaging / Treatment OEM for dedicated distribution transformers, the K(i) rated *SureImage* Model Ultra-K/M product offers much greater design value. The *SureImage* Ultra-K/M is designed with an ultra-low output impedance of 2%

typical, sized properly for the continuous load rating and K(i) surge rated to meet the momentary power demand of medical imaging and treatment modalities. In addition, the Ultra-K/M's high efficiency rating of 98% typical translates into big energy savings. Installation costs can be reduced as well, due to smaller feeder wires and circuit breakers. In

addition, the *SureImage* Model Ultra-K/M features a triple shielded transformer, category B-3 transient voltage surge suppression and a high frequency filter. Not only is excellent load voltage regulation achieved, but clean, conditioned, spike-free power is provided to improve system accuracy and reliability!