Vlet-thruappnotes
17 June 2009

# Voltage Let-Through

## General

Voltage let-through can be a confusing subject, especially since different manufacturers of power treatment devices vary their rating techniques. Voltage let-through refers to the amount of transient voltage passed through a power conditioning device to the load.

A transient is a high amplitude, short duration spike or surge superimposed on the normal waveform. It is often caused by switching electrical loads, switch-mode power supplies or lightning effects. As the use of microelectronic circuits has increased, problems related to transients have also increased tremendously. Surges up to 6,000 volts can appear at the power outlets inside medical facilities. These surges may cause medical equipment to malfunction and often cause component damage.

Energy is a function of voltage and current over a period of time. The ability of a transient to cause disruption or damage depends on the energy contained in the transient.

There are many devices that are designed to suppress transients to safe values. One well known device is the transient voltage surge suppressor (TVSS) or surge protection device (SPD). Other devices, such as power conditioners and shielded isolation transformers, provide a significant amount of transient suppression and are often used in conjunction with TVSS or a SPD, thus providing a more complete power conditioning solution.

## ANSI/IEEE C62.41 and UL 1449

The Institute of Electrical and Electronics Engineers (IEEE) C62.41 standard indicates that “6,000 volts is the largest transient that the interior of a commercial building would experience, and that it’s harshest interior surge environment is one that would experience 100 surges of 6,000 volts, 3,000 amps in one year’s time”. Medical facilities certainly fall into this category. Given the magnitude of the problem, a standard on how to test surge suppressors was put into place. The American National Standards Institute (ANSI) C62.41 standard lists the different waveforms with which to test a surge suppressor. There are three categories (A, B, and C), each having three sub-categories (1, 2, and 3). Underwriters Laboratories (UL) 1449 is the listing a surge suppressor receives when it is tested with the ANSI/IEEE C62.41 waveforms, and it refers to the “let-through voltage”. The ratings range from 330 volts to 6,000 volts.

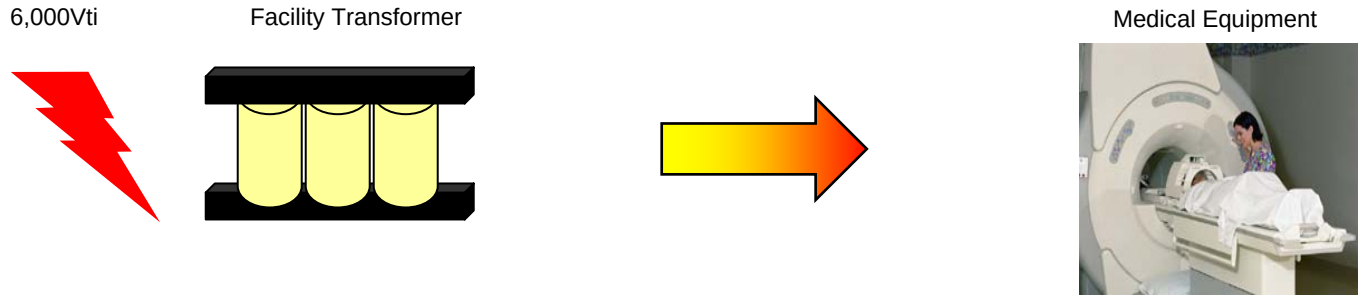
Extreme care must be given when comparing the let-through voltages of different suppressors. A suppressor that has a let-through voltage of 330 volts when tested with a category A3 waveform may not be any better than a suppressor that has a let through voltage of 400 volts when tested with a category B3 waveform. This is because the category B3 waveform has a current value 2 ½ times larger than the category A3 waveform. When the voltage and/or current are increased on the testing waveform, the let-through voltage also increases.

## Transient Voltage Protection for Medical Imaging & Treatment

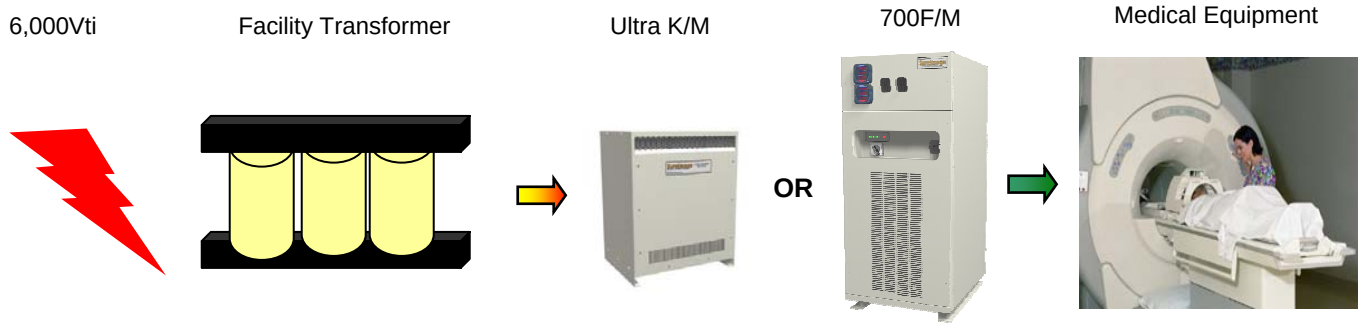
Typical medical OEM equipment specifications limit the maximum transient voltage allowed to 1,500 volts peak. Transient voltages must be kept below this level to avoid damaging OEM equipment. While it is important not to exceed this limit, it is also important to address surge voltages and transients that range from nominal to the clip point of 1,500 volts. To create an optimal power quality environment, transient let-through voltages should be limited even lower. As stated earlier, power conditioners and shielded isolation transformers are often used with TVSS to provide a more complete solution. The TVSS clips the top part of the transient voltage and the shielded transformer

attenuates the remaining part of the transient close to nominal source voltage. This virtually eliminates the concern of surge voltages and transient damaging or disrupting critical imaging and treatment equipment.

## Harsh Environment = 100 Surges of 6,000 Volt & 3,000 Amp per Year




***Does Not Ensure*** surge levels stay < 1,500Vp, a defined requirement by medical equipment manufacturers.




***Ensures Maximum*** let through voltage of 330Vp (on 208V) when exposed to a 6,000V / 3,000A waveform

## The Controlled Power Company Solution

Some surge suppression manufacturers claim their device protects equipment from surges of up to 6,000 volts as described in ANSI/IEEE C62.41, but they do not tell you the voltage waveform and current with which their device was tested, or its let-through voltage. Likewise, specifications may indicate that a device meets or exceeds ANSI/IEEE C62.41, but this claim has no relative meaning to the amount of spike attenuation it provides. The ANSI/IEEE 62.41 standard is a guideline for testing and does not mandate results.

In sharp contrast, the *SureImage* Ultra-K/M Power Conditioning Transformer and Model 700F/M Voltage Regulator with Power Conditioning attenuate a category B3 waveform (6,000 volts / 3,000 amps) to a let-through voltage of less than 330 volts. Attenuation is achieved via the integral triple-shielded isolation transformer and output filter with TVSS. This approach virtually eliminates the concern of surge voltages and transient damaging or disrupting critical imaging and treatment equipment.

When using the *SureImage* product for electrical noise attenuation, you can be assured that your critical medical equipment will be protected from dangerous voltage spikes, and meet the medical OEM's maximum transient voltage limits.