UNDERSTANDING SURGE SUPPRESSION
Demystifying Joules vs. Let-Through Voltage Ratings
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Continuous Uptime: The Rule, Not the Exception

What do hospitals, laboratories, hospitality, manufacturing facilities, emergency call centers all have in common?

The answer: They depend on the continuous uptime of their mission-critical electronic equipment. For context:

Each minute of point-of-sale downtime can cost a retailer up to $4,700\(^1\).

A power failure in manufacturing averages at $260,000 per hour\(^2\).

Anomalous glitches in power quality to analytical lab instruments can generate extraneous data and erroneous or imprecise test results.

Performance degradation of medical diagnostic instruments can threaten patient well-being.

All of these are undesirable outcomes for obvious reasons.

\(^1\) The Standish Group
\(^2\) The Aberdeen Group
Continuous Uptime: The Rule, Not the Exception

The role of surge suppression, then, is more than protecting electronics; it’s to **protect the organizations** and the people who rely on those instruments to:

- **Study disease** and environmental conditions
- Ensure **food and drug safety**
- **Diagnose or treat patients**
- Support **manufacturing** operations
- **Sell food, hospitality services** and other daily living staples

Understanding how alternating current (AC) surge suppression works – and specifically **how joule and let-through ratings influence performance** – is crucial to protecting the integrity, uptime and longevity of your most important equipment.
Back To Basics: What is a Surge?

A voltage surge, or transient voltage, is a sudden high frequency, short duration spike in the voltage delivered through an outlet into an electrical load. Surges can instantly destroy circuitry or degrade components that can shorten equipment’s useful life.

In addition to lightning, power surges can originate from:

- **Utility power grid switching**
- **High-powered electronics** as they draw in large energy quantities
- **Overloaded circuits** or outlets
- **Damaged wiring**
- **Devices that induce high levels of electrical noise**, such as lighting systems, HVAC controls and electrical motors
How Surge Suppression Works

Surge suppression devices work by blocking or shorting to ground any transient voltages above a certain threshold. A commonly used component in most surge suppressors is a metal oxide varistor (MOV), which work like two Zener diodes connected back to back.

The MOV exhibits significant resistance at normal voltages so that little current passes through. But when actual voltage exceeds the rated threshold voltage (such as in a surge), the MOVs internal diodes break down, and resistance drops to zero via events called “electron tunneling” and “avalanche breakdown.”

Consequently, the surge is diverted from the AC line to either AC neutral or ground. The timing of where on the sine wave the spike occurs is also important to keep in mind.
MOV surge suppression has two **fundamental drawbacks:**

1. **MOVs sometimes fail when exposed to a surge greater than the max voltage rating.** As a result, excess voltage may still enter equipment during a **particularly strong surge.**

2. **Even minor surges** create MOV **internal heat** that causes the device to deteriorate over time. This means suppression gradually weakens, allowing gradually increasing quantities of transient voltage to pass into electronics and stress their circuits, **shorten their lifespans or cause performance issues.**
Another Common Caveat:
Joule Ratings Don’t Tell the Whole Story

Surge suppressors, and most UPS manufacturers with integrated surge suppressors, are typically rated by joules. A joule is a unit measurement of electrical energy in watt-seconds.

The joule rating refers only to the amount of energy the MOV can absorb.

This is not the same as the amount of protection the surge suppressor provides a device. In fact, the joule rating has little bearing on how much transient voltage the surge suppressor will allow to pass into your equipment.

In this sense, a joule rating should not be treated as the most important factor when rating a surge suppressor.

Example: A 100-watt light bulb on for 10 seconds consumes 1000 joules of energy.
Let-through Rating: The Most Important Metric in Surge Suppression

Let-through rating determines how much transient voltage will be allowed to reach the electrical load. This is a far more important distinction as it pertains to the performance, safety and longevity of your equipment.

An MOV with a high joule rating typically has a higher let-through voltage. So, what seems on the surface to be a more protective surge suppressor, may in fact be causing harm or damage to your mission-critical equipment.

The key industry standards for let-through limits of surge suppression and power conditioning devices are IEEE 62.41 and UL1449. They define the type of surge and the clamping voltage rating of the surge suppressors. The best effective clamping rating of an MOV is 330V as noted in UL1449.

More simply, these are the standards that matter, not the joule rating.
Know Your Metrics. Powervar Offers the Best Protection Available.

MOV-based surge suppressors are not designed for, nor capable of, delivering proper transient voltage protection for sensitive electronics. Manufacturers that rate their surge suppressors in joules mask the let-through voltage, which is the true indication of system protection.

At Powervar, we design to achieve the very best performance. Our power conditioning technology—with let-through voltage ratings at 10V AC (normal mode) and 0.5 V (common mode)—delivers the lowest industry ratings for surge voltage let-through, ensuring you the best possible protection.

Remember, it’s not just your equipment that’s at risk from surges. **It’s also the people and processes that rely on its performance.**

To make power-induced downtime and equipment degradation problems of the past:

Visit powervar.com or call: 800.369.7179
Contact Powervar today to learn more about how our power quality solutions protect your high-performance equipment.