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Surge Protective Devices – Keeping it Real

Recall not long ago when the Surge Protection industry was in its infancy, many manufacturers were tasked with trying to demonstrate their product's performance and effectiveness with little or few standards to go by. This was the start of a "wild west" effort that had manufacturer's demonstrating superior performance using elaborate tests that rarely reflected the "real world" environment.

Single Impulse testing: Most manufacturers rate the Peak Surge Current Capacity of their SPD by adding all of the Individual MOV component ratings of a single phase. This definition gives an indication of the construction of the device as well as an overall durability gauge. This "capacity" does not mean that an SPD rated at 100kA, can survive a single 100kA strike (for many design reasons). Even if it did survive, the performance would more than likely be poor at best. In most cases, there is no need to have single impulse survivability beyond 10kA because it's not a real-world event. In the white paper by Marztloff/Crouch (Lightning Protection of Residential AC Wiring), they demonstrate that arcing/flashover and distribution occurs in lighting events at 100kA and above, the SPD would only see 30kA or 10kA/phase from a utility down drop. In addition, this event would only occur every 8000 years at a specific location.

It would then make sense for SPD's to have high performance in the "real-world" 10kA environment proposed by Martzloff/Crouch. This has been the focus of manufacturers in recent years along with the supporting SPD agencies including IEEE, NEMA, UL, CSA and IEC.

Repetitive Impulse Testing: There are still a few manufacturers that are clinging onto the concept called "Repetitive Impulse Testing". Back in the day, these tests were created, with no real standards, knowing that if they let the MOV cool between hits (this is key) that the MOV could survive beyond 10,000 hits/mode. Although somewhat impressive at first glance, it actually predates the UL 1449 Nominal Discharge Current test (I_n) that is currently in use today. With the collaboration of many SPD manufacturers, this new durability test (I_n) simulates a "real world" environment with an elaborate array of repetitive hits (up to 20kA), while injecting maximum operating voltage between these hits. The end goal is to heat up and over-exercise the MOV to the brink of failure. This "real world" test **does not allow for the MOV to cool** which is typically why they fail.

Temporary Overvoltage Protection: Ask many or most SPD manufacturer's "what is their product's primary reason for failure?" and if they are forthright they will tell you TOV events - Temporary Over Voltages. This is not an uncommon response, since most, if not all SPD manufacturers are using Metal Oxide Varistors (MOVs) as the primary workhorse in their products. Remember, MOV's are designed to help mitigate high speed transients that typically last no longer than a few milliseconds and cannot handle long term energy. TOV's are slow 60hz events that typically last beyond a ½ cycle, and up to many seconds or minutes. In general terms, TOV's are a product of the utility grid itself via switching operations or faults and represent a real-world problem, not only for downstream equipment but for SPD's as well. Fortunately, there are a few SPD manufacturers that implemented circuits onto their products that recognize the slower 60hz TOV event. These "smart" SPD's do not try and mitigate the TOV event, Instead they focus on what they were intended for - mitigating high speed transients. Let us not forget, the purpose of an SPD is to increase reliability of "mission critical systems" therefore the SPD itself must be exponentially more reliable than the system it is trying to protect!

In Summary:

Single Impulse testing and Repetitive Impulse testing were the original "wild west" concepts invented by manufacturers that had little to no real-world gauge on SPD performance or need. Since then we are relying on several oversight agencies that are fully committed to the safety and performance of SPDs. On the other hand, Temporary Overvoltage Problems (TOVs), which have been an issue since the advent of SPDs, are now being addressed by new smarter technologies. This has brought forth a new generation of higher performing, more reliable SPDs for today's very sensitive loads.