



kA Ratings – What size SPD/TVSS do I need?

The answer is subjective. Reasons for selecting larger kA ratings are one of the most misunderstood concepts in surge suppression.

- I have a 100A panel – what size SPD do I need?
- My customer has a 4000A Main – what size SPD does he need?

Conventional wisdom suggests that larger panels need larger SPDs. However, surges are indifferent to panel size. For example, a lightning strike or utility surge does not know if it's entering a 100A panel or a 4000A switchboard. Consequently, surge protection should be the same – or should it?

Over the years, SPDs have become available in ever increasing ratings; sometime *very* large. However, the surge environment has not changed. Lightning intensity has not increased over the last hundred years. IEEE C62.41 Standards detail why 10kA is the largest realistic surge that can enter building wiring. Like a fire hose shot through a soda straw, only part of a lightning strike will go through wire. For this reason, IEEE Standards specify roughly the same test impulses over three Standard revisions and 25+ year's experience. This has not stopped surge manufacturers from building ever larger suppressors; some with over a million amp ratings.

Larger kA ratings are for redundancy & longer life. An assumption implied by marketing is that a 500kA SPD will protect electronics against a 500kA lightning strike. This is where industry folklore and scare tactics come to play. For example, a sales rep might say, *'lightning can be 200kA, and you probably want two or three times margin of capacity, so how about a 400-600kA SPD?'* Per IEEE, a 500kA lightning strike could not traverse building wiring. Even if it could, actual protection would be questionable. Fortunately, such events do not exist. However, factions of the industry prey on emotions & fear to promote higher kA ratings.

Most SPDs include MOV suppression elements. If an MOV rated 10kA handled a 10kA surge, it would use 100% of its capacity. The MOV would degrade a little bit, thus reducing its life expectancy. Suppose there were two 10kA MOVs in parallel; i.e., 20kA of capacity. Both MOVs would share surge current. Theoretically, each MOV would take 5kA. This is 50% of their rating. In turn, this degrades the MOVs less, and improves clamping performance. Thus longevity and performance are improved by increasing kA ratings. At some point, more is simply more and not adding substantial benefit. That part is subjective.

An analogy with bugs & bug spray: Assume a bug on a baseboard. One or two squirts of bug spray will kill it. A husband might use 3-4 squirts. A wife might use 10-15 squirts. The amount of bug spray becomes subjective. And pouring a quart or gallon of bug spray won't kill the bug any deader.

How does that apply to SPDs/TVSS? Suppose IEEE's 10kA surge. A 10kA SPD will kill the surge, but it makes sense to have some redundancy. That amount is subjective. A 600kA SPD won't kill a 10kA surge any deader either. Like wasted bug spray, it just wastes kA & costs more.

The notion that larger panels equate to larger SPDs is partially unfounded. Panel location within the electrical system is more important than the panel's size. But larger panels tend to be at service entrances or closer to them, suggesting higher surge risk and a need for higher kA ratings.

There is also a partially unfounded premise that larger panels equate to deeper pockets. For example, a larger panel suggests that there could be more loads that are sensitive, expensive or worth protecting. Thus an end user might be willing to purchase a larger SPD. Maybe. However, it depends on the load, its value, and the owner's willingness to protect it.

What is the scientific surge environment? IEEE C62.41.2-2002 does an outstanding job outlining different surge environments based on location within the facility. To recap:

- Category C Service Entrance, more severe environment: 10kV, 10kA surge
- Category B Downstream, $\geq 30'$ from Cat C, less severe environment: 6kV, 3kA surge
- Category A Further downstream, $\geq 60'$ from Cat C, least severe environment: 6kV, 0.5kA surge

These different categories suggest different kA ratings based on location.

What kA ratings have you had good luck with before? It is hard to argue with success, and many specifiers will not change when they find something that works. This is evident at APT SPD/TVSS seminars taught for Florida PE PDHs over the years. It is common for several Florida Engineers to be seated with other Engineers from around the country. Many Florida Engineers used SPDs 15-20 years ago, when kA ratings were more modest. They know that 100-150kA SPD work great – even in lightning prone Central Florida. Engineers from other regions might use 400-500kA SPDs because that has been a regional practice in the more recent 5-10 years. Interestingly, each group shakes their head in disbelief at the other.

Summary:

Selecting SPD kA ratings should include qualified judgment involving IEEE Category, level of desired redundancy, experience, cost, and avoided expenses. There are rarely 'wrong' sizes. However, there are usually many 'right' sizes. Keep in mind that a lower clamping lower kA SPD provides better surge suppression than a higher kA, but higher clamping SPD.

APT guidelines:

- Category C 300kA per phase in Gulf of Mexico rim and Southeast states. 200kA elsewhere.
- Category B 150-100kA per phase
- Category A 100-50kA per phase

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