



Novaris

Lightning and Surge
Protection

Commercial and Industrial LV Power Protection

Surge protection in
Australia

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Introduction

Selecting appropriate surge protection devices is essential for implementing a robust and reliable surge protection solution. The surge protection system must be able to deal with large surge current while also providing a very low let through voltage during these events. This application note will be following the standards outlines in AS1768:2007 Australian Lightning Protection Standard which can be used to find more information including site risk assessments and structural protection application.

What is a Surge?

A surge is a temporary overvoltage that can cause damage to electrical equipment. Surges have a very short duration with most of the energy dissipated within 1 millisecond. These over voltages can occur as a result of lightning discharges, electrical system switching or electrostatic discharge. Other terms often used to describe a surge are ‘spike’, ‘transient overvoltage’, or ‘lightning impulse’.

A surge can come from 4 main sources.

- **Direct strikes** occur when cables or equipment are struck directly by the surge
- **Earth Potential rise** occurs when lightning hits the ground in the local area causing a large voltage gradient through the ground
- **Induced surges** are picked up by long cable runs due to the energy of the strike
- **Switching spikes** are caused by large loads in the local grid turning on and off

Surge Protection Device

The surge protection device (SPD) is designed to limit the surge exposure of electrical and electronic equipment. The purpose of the SPD is to provide an alternate, low impedance path for the surge current. This protects equipment from overcurrent degradation and dramatically reduces the voltage exposure.

Surge Protection Categories

AS1768:2007 breaks up the surge protection types into three categories based on their surge exposure.

Category C

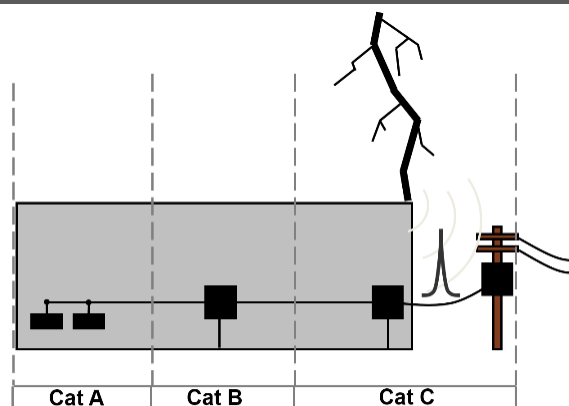
Indicates the point of entry to the premises. This point has the highest exposure to surges originating from the grid or earth potential rises in the local area.

Category B

Category B is the second level of protection. This is designed for a lower surge current but provides a lower let through voltage and redundancy if the first protection stage fails.

Category A

Category A is the final level of protection for long final sub-circuits or supply outlets. This protection stage is used for sensitive or mission critical equipment.



Source data: AS1768

Figure 1 - Surge Protection Categories

Multi-Stage Protection

The performance of a surge protection scheme for a site is greatly enhanced when multiple layers of surge protection are used. Novaris recommends at least 2 layers of protection.

The first benefit of multiple surge protection layers is SPD coordination. When the high voltage of the surge is applied to the surge protection device it changes from a high impedance state to a low impedance state. The residual impedance combined with the current passing through the device, or the spark over voltage, determine the surge protector's residual voltage. The point of entry device passes the majority of the surge current due to the impedance of the wire separating each layer of SPDs. Because the secondary SPD passes less current, the residual voltage is less.

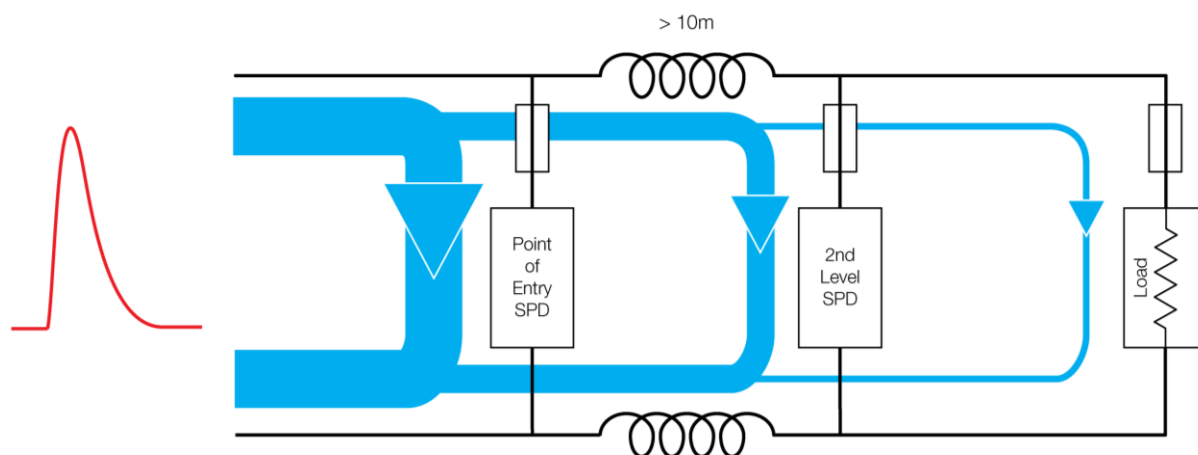


Figure 2 - Surge protection Co-ordination

The other benefit of multiple layers of protection is redundancy. If the point of entry protection device fails, the secondary protection device will keep the circuit protected. This means the equipment is not exposed while the primary protection is replaced.

Surge Protection Ratings

AS1768:2007 provides recommendations for the surge protection ratings dependant on the site where the surge protection is applied. These values are selected to prevent a majority of lightning surge events. In extreme areas of lightning activity such as the northern regions of Australia, Novaris recommends an I_{max} rating of 150kA. This higher rating also greatly extends the lifespan of the device and increases the systems resilience to direct strikes to overhead lines.

SPD location	I_{max} rating kA
Category A – Long final subcircuits and electricity supply outlets	3 - 10
Category B – Major submains, short final subcircuits and load centres	10 – 40
Category C1 – Service entrances, other than below	40
Category C2 – Building fed by long overhead service lines or large industrial or commercial premises	40 - 100
Category C3 – Building in a high lightning area, or fitted with a LPS	100

Source data: AS1768

Point of Entry – Category C

Category C3 - Buildings in a high lightning area or fitted with a lightning protection system

A site with a structural lightning protection system increases the likelihood of surge activity appearing in the area due to the low resistance path to ground provided, causing effects such as earth potential rise.

For sites that fall into the C3 category rating, the point of entry protection recommended is the SD1 MULTIMOV protection unit with 150kA of multi-segmented protection.

This Line to Neutral protection device is specifically designed for locations that utilise the MEN earthing system.



Figure 3 - SD1-150-275

Category C2 – Building fed by long overhead lines or large industrial or commercial premises

Long overhead lines are more likely to be affected by direct strike activity and therefore sites utilising these feeds require a high level of protection.

Sites with high current feeds also require a high level of protection due to the current rating of the power feeding the premises. A low resistance high current cable is going to feed more surge energy into the site than a low current cable.

For sites that fall into the C2 category rating, the point of entry protection recommended is the SD1 MULTIMOV protection unit with 100kA of multi-segmented protection.

This Line to Neutral protection device is specifically designed for locations that utilise the MEN earthing system.



Figure 4 - SD1-100-275

Category C3 – Service entrances other than below (above)

Category C3 covers the rest of use cases such as small industrial installations with less than 250A current draw per phase. These sites are not exposed to levels of surge activity as high as the previous examples and the higher resistance of the site will also reduce the maximum surge energy.

Redundancy is still important even for these smaller sites. Therefore Novaris recommends the SDN series of MULTIMOV protection units for point of entry protection.



Figure 5 - SDN3-100-275

Secondary Protection – Category B

Category B – Major submains, short final subcircuits and load centres

The secondary level protection unit provides the much lower let through voltage and redundancy needed for a commercial or industrial site.

There are two potential product recommendations for the secondary protection devices.



Figure 6 - SDD surge diverter



Figure 7 - SSP series surge protector

The SDD DIN profile series of protection units provide excellent protection whilst using minimum space in the switchboard. To achieve an even better performance the SSP series surge protectors provide guaranteed performance that is not installation quality dependant for loads up to 63A. The 50kA variant of these devices can provide ample protection for these secondary circuits.

Tertiary Protection – Category A

Category A – Long final subcircuits and electrical supply outlets

The final protection stage is for equipment located more than 20m from a distribution board, sensitive or mission critical equipment on the site.

The Novaris Series Surge protectors can guarantee a low let through voltage for final sub circuits.



Figure 8 - SSP Series surge protector



Figure 9 - SFD Surge Filter

For sensitive equipment racks the SFD DIN mount surge filter provides premium protection. By utilising a 3 stage protection system including a low pass LC filter, the SFD provide the best protection available in a DIN mount form factor.

The PP10 surge filter uses the same technology used in the SFD in pluggable form for supply outlets.



Figure 10 - PP10 plug-in surge filter

Conclusion

An effective surge protection system must have be designed to prevent excessive overvoltages from reaching equipment on site whilst providing redundancy in case of failure. The extensive range of Novaris protection units are designed to achieve this goal.

For more information visit www.novaris.com.au