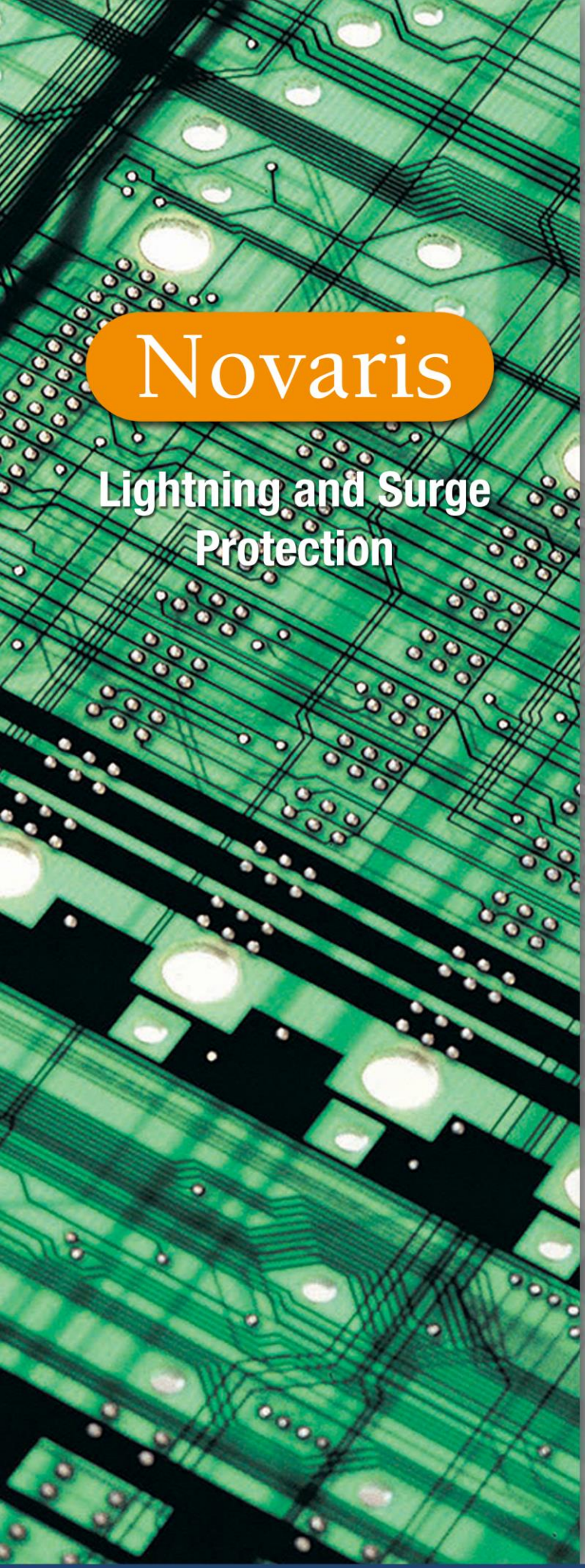


Remote telecom site protection

Robust high energy protection approach

Tristan King

Introduction

Novais is well known for developing surge protection solutions for specific customer applications around the world. To achieve this we rely on a solid understanding of the environment and requirements for each project. This feeds from our consultative approach to surge protection.

A recent example of this was a custom solution developed for a telecoms company in Sri Lanka. The remote mobile sites were exposed to a large amount of surge activity combined with grid instability.

Some of the key factors that were taken into consideration were:

- Providing a multilayered protection approach for redundancy and performance
- Ensure minimal residual voltage during a surge event
- Allowing for temporary overvoltages (TOV) without surge protection failure
- Protect against line to earth failures
- Provide all of the above without having to resort to a large scale site filter

Hybrid Spark Gap

To achieve these goals a new set of products was developed. These were a 3 phase version of our hybrid spark gap protectors with variants of 50kA and 100kA of protection per phase. These units were also designed with customisable N-E protection depending on their intended location.

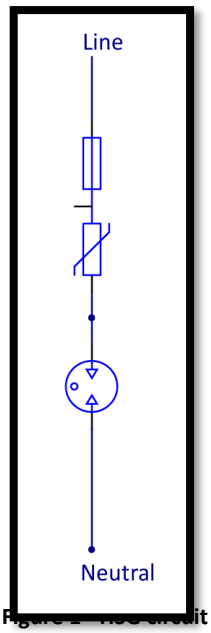


Figure 2 – HSG circuit diagram

The hybrid spark gap inherits the best characteristics from both spark gap and MOV based protection approaches. The spark gap is able to ignore voltages up to 475VAC during normal operation allowing the circuit to selectively ignore these TOV situations.

NOTE: all modern power supplies are designed to handle TOV for a duration.

The disadvantage of spark gap solutions is that they have follow on current. Follow on current is where a spark gap continues to pass AC current after a surge. This can draw up to the short circuit current of the switchboard, causing the site feeder fuses to trip.

The advantage of the MOV in series is that it instantaneously reacts to the drop in voltage after the surge changing from a low impedance to a high impedance state. This effectively blocks the follow on current.

This series combination creates a highly robust and effective protection approach.

600V N-PE Protection

The HSG based SDN diverters used for this project utilise 600V spark gaps between neutral and earth. These components are designed to fire before insulation breakdown occurs within earthed equipment. The 600V voltage was selected to ensure a phase to earth fault would not inject phase voltage onto the neutral, causing large overvoltages across single phase equipment.

Multi-Stage Protection

The performance of a surge protection scheme for a site is greatly enhanced when multiple layers of surge protection devices (SPDs) 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.

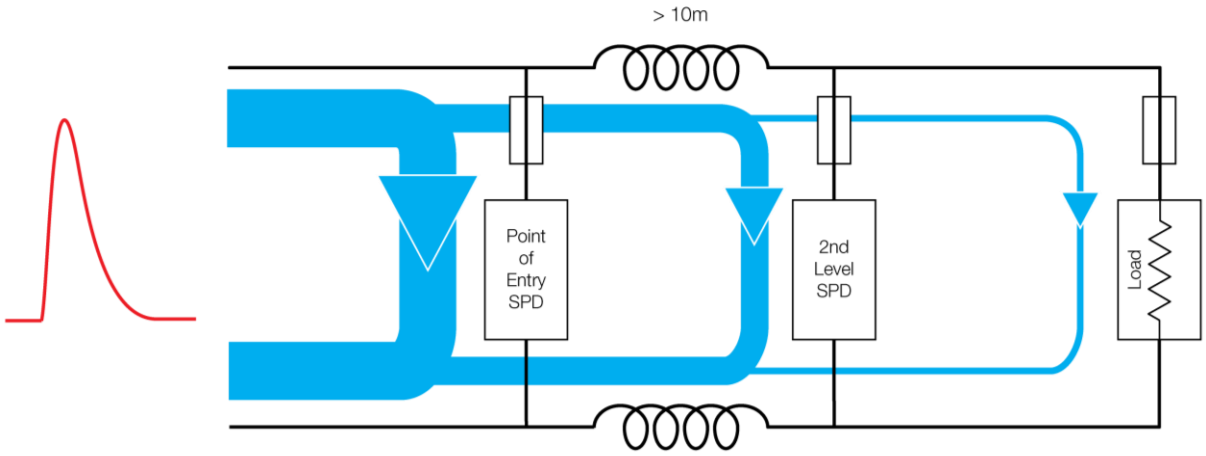


Figure 2 - Surge protection Co-ordination

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.

Protection Implementation

The following test report was conducted on site at the Novaris High Voltage Test Facility witnessed by delegates from the Telecommunications company based in Sri Lanka. The results will show the performance of the multistage HSG based SDN implementation.

Simulation of a multistage surge protection system proposed for lightning intense environments

Description

This report outlines testing carried out to simulate the multistage surge protection system proposed for lightning intense environments. The result gives a real world performance summary by including simulation loads and in line cable impedance.

Scope

The scope of the testing outlined in this report is to determine the let through voltage of the surge protection system when a 6kV (1.2/50µs) 3kA (8/20µs) combination waveform as defined in the Australian Standard AS 1931.1:1996 section 6.

The surge protective devices used for testing were produced at the Novaris Australia factory in Kingston, Tasmania and were randomly selected from Novaris stock at the time of testing. It is of the current design and made using current construction techniques at the time of testing.

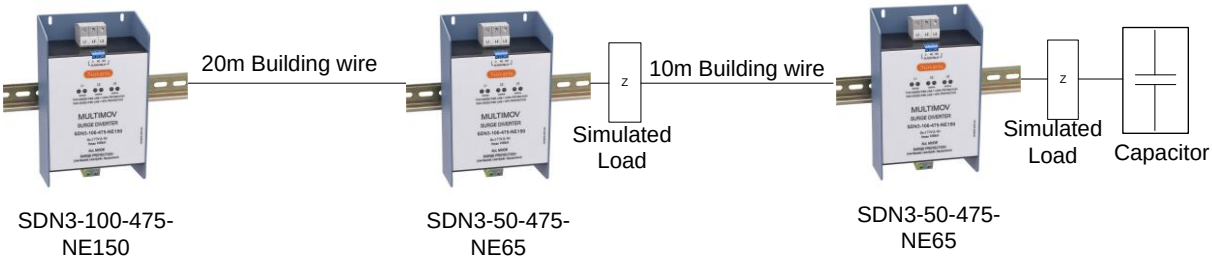
The desired outcome of the testing is to produce a numerical value for the let through voltage of the proposed surge protective system. This includes three stages of protection and associated sample loads.

Testing Procedure

The proposed surge protection system consists of a SDN3-100-475-NE150 surge diverter as the primary protection. There is then to be a 20m cable run to a distribution board where a SND3-50-475-NE65 is to be installed. Finally, there is proposed a 10m cable run to a capacitor and another SDN3-50-475-NE65. This is the scenario to be simulated by the testing.

To simulate this, a SDN3-100-475-NE150 was connected to one end of 20m of building wire, the other end connected to a SDN3-50-475-NE65, an impedance to simulate a load, and one end of another 10m of cable. At the other end of the 10m of cable has a 680nF capacitor, a SDN3-50-475-NE65 surge diverter and an impedance to simulate the final connected load.

The test set up was as follows:



A surge was applied to the terminals of the SDN3-100-475-NE150, and the let through voltage was measured at the terminals of the final SDN3-50-475-NE65 surge diverter. From the results, the let through voltages are measured.

The test set up used the following equipment for testing and measuring the let through voltage of the system:

- KeyTek EMCPro surge generator
- Tektronix TDS3012 digital oscilloscope
- Tektronix P5100 100x 2.5kV probe
- Test leads as necessary

Test Parameters

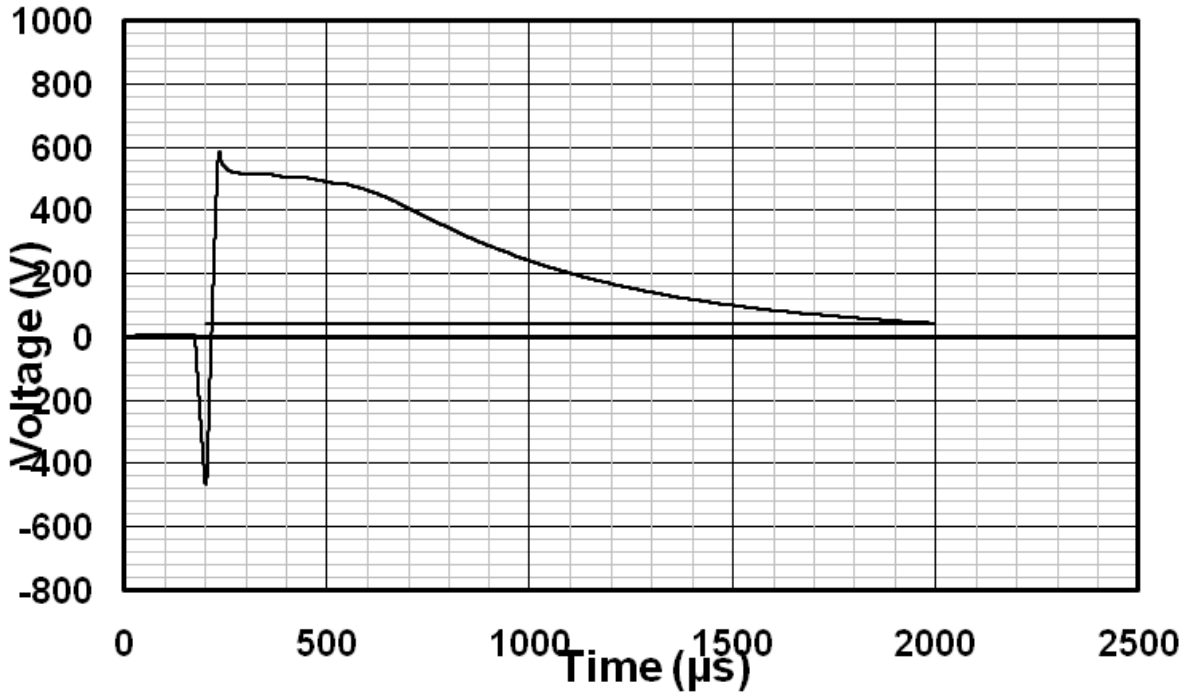
Date of testing: 15th of October, 2009
SPD model tested: Building simulation
Serial number: N/A
Location of testing: Novaris HV test laboratory, Kingston, Australia
Testing officer:

Nick Johnston

Novaris Specification Test Engineer
24th of August, 2009

Results

The following graph depicts the waveform when the test described previously was carried out:



From the above chart, the let through voltage of the surge protection system proposed is under 600V.

Discussion

The selected surge protection system has many advantages for installation in a high lightning environment, and also an environment with an unstable grid supply. One weakness of surge protection devices is their susceptibility to temporary over voltages which cause the unit to fail. By increasing the voltage of the protection device with the Hybrid Spark Gap, we remove the susceptibility as they will not start clamping till over 475V.

The disadvantage of this is the increase in sparkover voltage also increases the let through voltage, reducing the protection that the unit can offer. This has been overcome by implementing a multi

stage protection system that reduces the surge at multiple points from the original source of the surge to the final loads, achieving a much better let-through than a standard diverter and removing the TOV susceptibility.

The front stage protection has the added benefit of a higher kA Imax rating for direct strike protection between Line and Neutral, and Neutral and Earth.

Conclusion

The protection system detailed in the test report has been implemented throughout Sri Lanka for the past 5 years. The feedback from the company has been excellent. There have been no device failures due to overvoltage and the sites have been protected effectively from surge activity originating from the power feed to the site.