



LIGHTNING PROTECTION

Lightning protection up to date has been a science of statistics where the risk of strikes and consequent damage has been weighed against the cost of partial protection. The Ultimate 1 team has sourced a product that will eliminate the risk factor from Lightning strike.

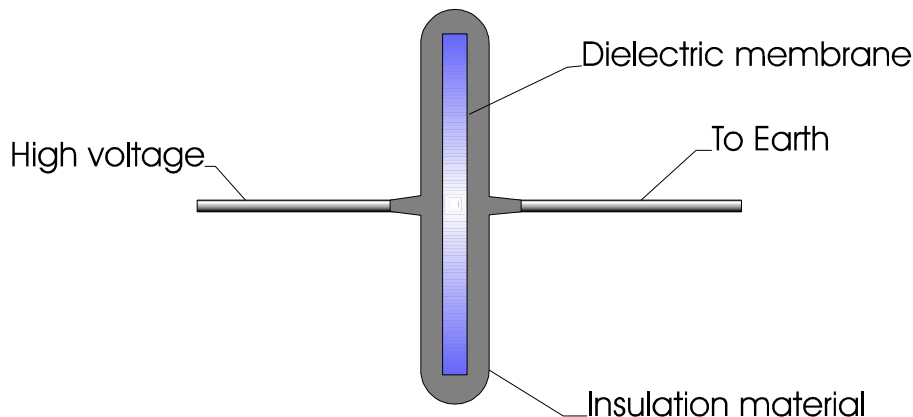
THEORY

Lightning strikes occur in an extremely short time and dissipate very large amounts of energy: typically between 10 and 100 micro seconds and release energy that can cause currents of 300,000 amps and more.

To dissipate this energy without causing permanent damage to electrical components requires releasing the lightning energy to ground the same way a pressure release valve blows off excess pressure to atmosphere in a pipeline.

To date Metal oxide varistors have been used to allow this release to earth but the inherent problems with this type of protection is:

- There is a fixed life from the dielectric material
- If the surge exceeds the capacity of the Varistor then the system will blow up.
- If the temperature rise within the dielectric membrane exceeds specifications then the material breaks down.



These units are good for medium protection where small currents are to be controlled with relatively fast reaction times. They will regularly fail where the current exceed the varistor rating. They also breakdown over a period of time and are therefor a replaceable item. Some varistors will not indicate if the units are still functional and need to be tested with a multi-meter regularly.

CURRENT SOLUTIONS

The current solutions available on the market attempt to dissipate the excess energy from the mains supply directly to earth and therefore bypass the electronic componentry within the switchboard.

As the size of the current to be diverted cannot be determined in advance the current systems assume that the maximum current to be bypassed is less than 30,000amps. The actual current can be significantly more than this so the systems are really providing a statistical protection.

This means that whilst lightning protection is installed it is certainly no guarantee that damage will not occur in case of a lightning strike.

The lightning protection device is installed between the mains supply and earth so that when a voltage rise is detected the surge protector will close contact and dump the excess voltage and residual current to earth. It is imperative that all three phases and the Neutral is protected to prevent and back surging from the earth and MEN points.

Techsys Corporation recommends a minimum of 25mm sq cable to run to the main earth from the surge diverter.

Typical protection device- 40,000 amp 4 pole

Data

frequency: 50...60 Hz

Uc: 275 V

Operating indication via mechanical indicator:

white: normal operation

red: surge arrester must be replaced

Disconnection of short-circuited surge arrester to be conducted using a circuit-breaker minimum 63amk "C" curve

permissible internal short-circuit current STD: 10 kA

permissible internal short-circuit current STM 3P+N: 25 kA

The PRD65r surge arrester is recommended for a very high risk level (highly exposed site).

The PRD40r surge arrester for a high risk level.

Due to its multiple effects, lightning can lead to disturbances in equipment and production means in industrial installations. Their breakdown can lead to serious risks for the personnel and their surroundings.

Lightning can notably produce voltage surges that, just like industrial voltage surges (switching, resonance, etc.) constitute harsh conditions for installations and in particular electrical equipment (energy, electronic, computer, remote information, etc.).

A rise in the voltage of earth connections

Lightning current has very steep rise fronts, impedances of the connection circuit to the earth connector and of the earth connector itself become dominant. Rise in voltages result in arcing with neighbouring metal objects that are not directly linked to this circuit (thus the risk of fire), or the destruction of electrical or electronic equipment that is incorrectly connected to the earth.

Induced effects

Induced currents may appear in conductors that are parallel to those that run off the lightning current. These currents will themselves generate rises in voltage that lead to the same type of inconveniences as those described above.



Selection Criterion

Today, there are ways to protect the electric installations in Buildings, the production and transportation of Energy, the equipment in Infrastructures and Industrial sites against the direct or indirect effects of lightning. The need to even better satisfy customer expectations and the recent evolution of standards, has led Schneider Electric to develop a new range of surge arrestors. This modular offer is suitably designed for the protection needs in the residential, commercial and industrial sectors. It is in compliance with the international IEC 61 643-1 class 2 test standard.

Risk evaluation of each installation is essential for the effective protection of electric equipment as well as to ensure the best possible continuity of supply. For this, just choose a surge arrestor in function of the criteria linked to both the loads to be protected as well as the site's characteristics.

Low Voltage modular surge arrestors can be installed in electric enclosures, switchboards or cabinets.

They are intended for the protection of single-phase or three-phase electrical installations against transient atmospheric voltage surges.

| pulse withstand voltage category | category I reduced | category II normal | category III high | category IV very high |
|---|---|---|--|--|
| load type | devices with electronic circuits | household electric appliances | industrial devices | industrial devices |
| U_{imp} impulse withstand voltage | 1.5 kV | 2.5 kV | 4 kV | 6 kV |
| load examples | television, VCR, decoder, home cinema, Hi-Fi equipment, telephone, fax, modem, microwave, computer equipment, alarm system, fire detection. | dishwasher, oven, electric stovetop, washer, dryer, freezer, refrigerator, portable appliances, portable tools, CCTV, electric gate, heating adjustment system, Automatic sprinkler system, Swimming pool motor, submerged pump | switchboard, industrial motor, air compressor, fan, air-conditioner, outlet, battery charger, UPS system, Generator set, industrial PLCs | electric meter, measurement transformer, remote measurement device |

Some general installation guidelines recommended by AS 4070-1992:

The total length of the active and earth connections should not exceed 1m. For optimal protection, the total length should not exceed 300mm

Such connections should be 25mm² copper conductors and be as straight as practicable.

The connection between neutral and earth should be as short as possible, and for optimal protection, should not exceed 150mm may be connected between the neutral link and the supply side of the main switch or circuit breaker.

The surge arrestors may be connected to the load side of the main switch or circuit breaker but this may increase the likelihood of unwanted tripping of devices such as RCDs.

To protect an installation, the surge arrestor should be connected as close as possible to the point of connection, that is, in the main switchboard)

In this case, the installation is protected from common mode voltage surges (between phases and earth). Therefore, for a three-phase installation, only a 3P surge arrestor is required, or for a single-phase installation, only a 1P surge arrestor is required. However, downstream of the MEN link, 1P+N and 3P+N surge arrestors should be installed when cascading with incoming surge arrestors.

