SURGE PROTECTIVE DEVICES

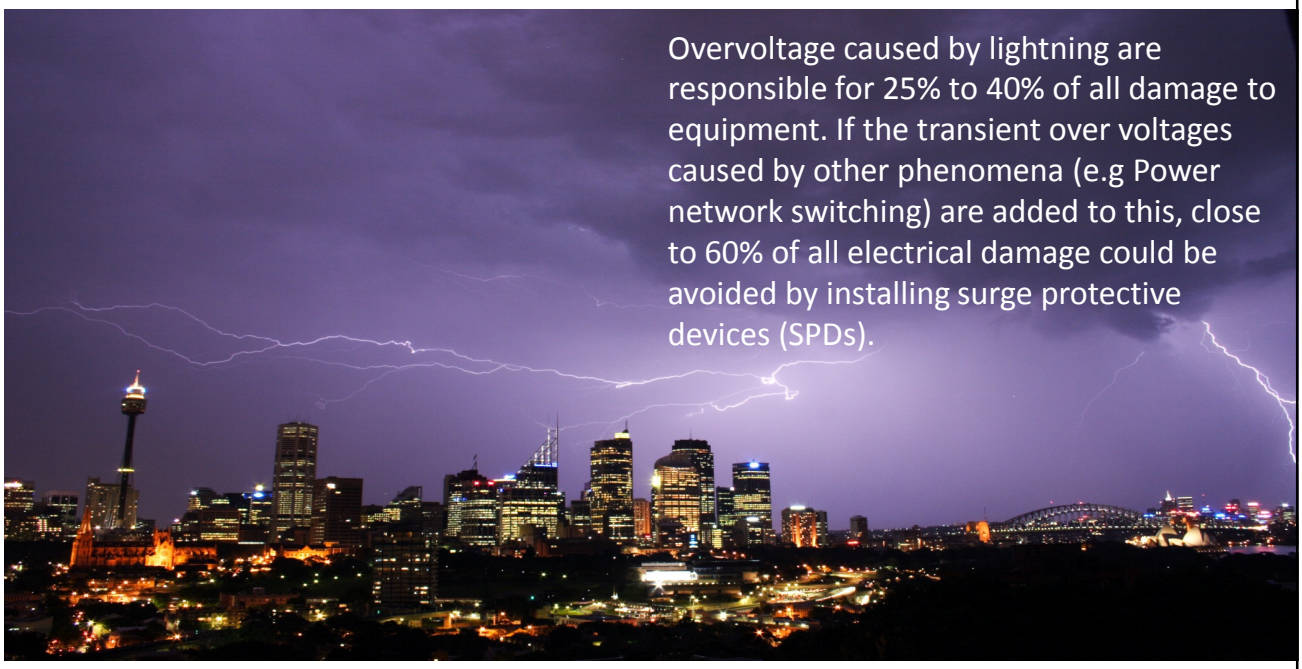
CONTENT:

- Introduction
- Theory and principles
- Installation rules
- Legrand offer

INTRODUCTION

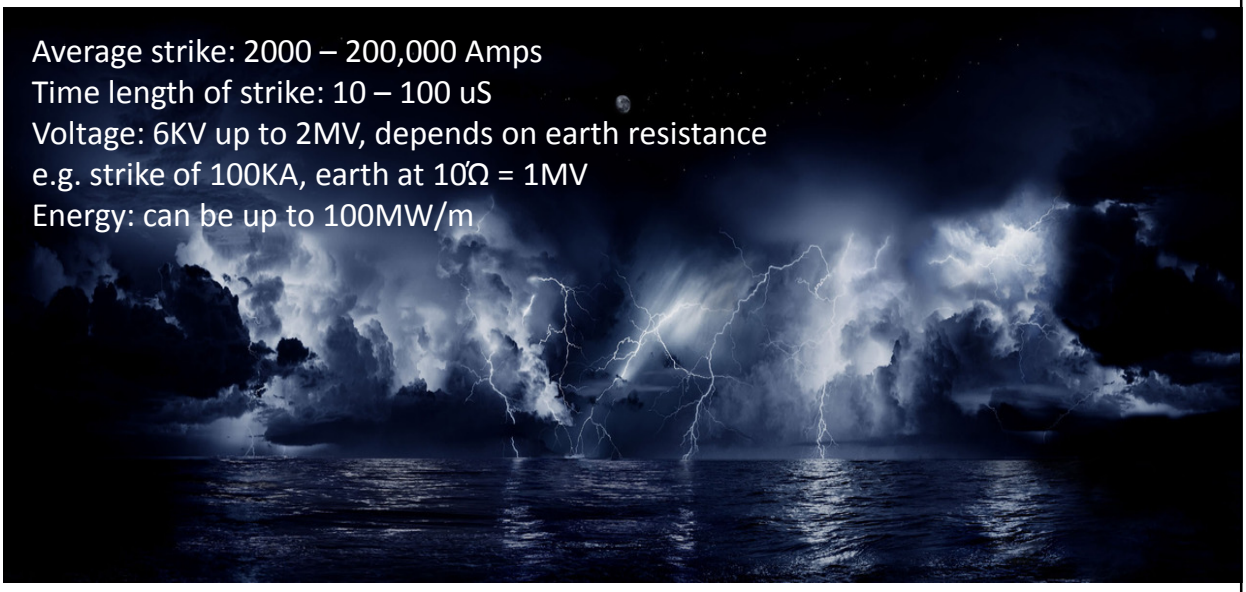
- Lightning facts
- Average annual thunder-day and lightning flash density
- Electrical overvoltage, characteristics
- Origin of transient overvoltage
- Damage caused by lightning

INTRODUCTION



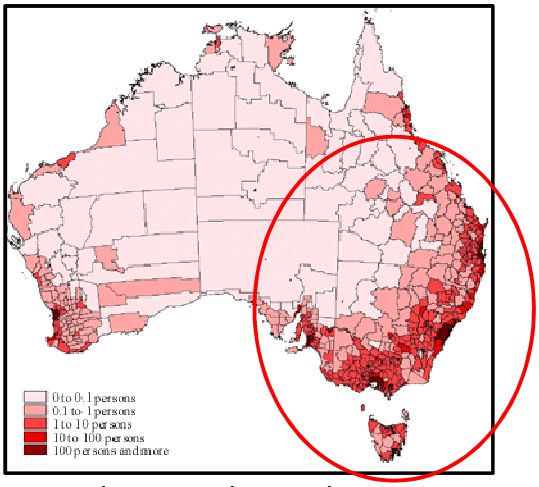
Overvoltage caused by lightning are responsible for 25% to 40% of all damage to equipment. If the transient over voltages caused by other phenomena (e.g Power network switching) are added to this, close to 60% of all electrical damage could be avoided by installing surge protective devices (SPDs).

LIGHTNING FACTS

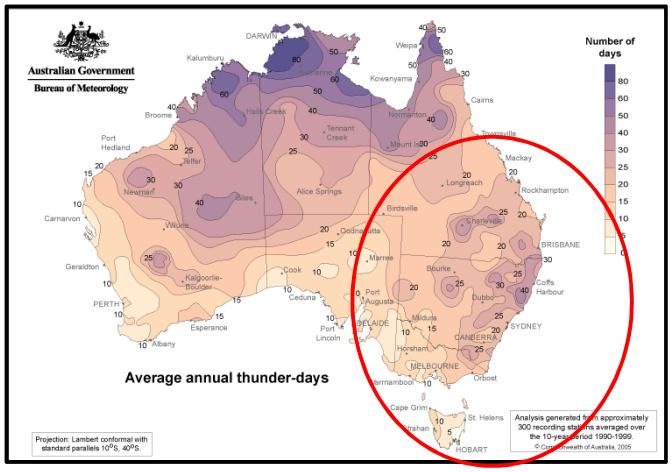


Lightning is caused by electrical charges in the atmosphere that are unbalanced with regards to the earth
Around one quarter of lightning is from cloud to ground
The average temperature of lightning is around 20000 °C

AVERAGE ANNUAL THUNDER-DAY AND LIGHTNING FLASH DENSITY



Australian population density



The average annual number of thunder-days using data over a ten year period

The majority (80-90%)of lightning strikes in Australia are Negative and less than 30kA. However the remaining strikes are generally positive and may be as large as 400kA

ELECTRICAL TRANSIENT OVERVOLTAGE, CHARACTERISTICS

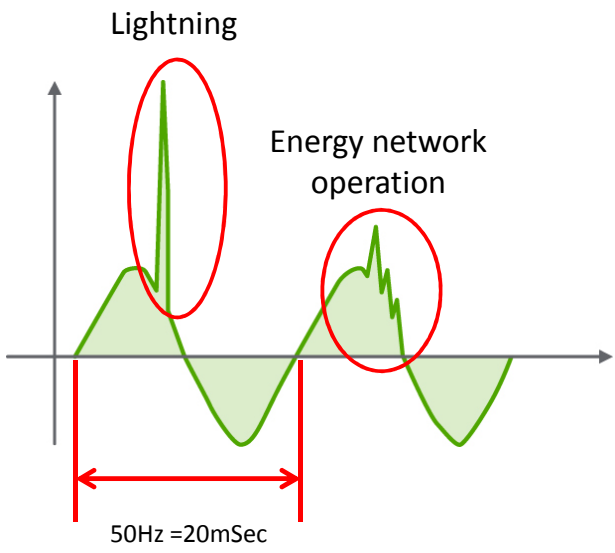
Sources:

Transient over voltage generated by Lightning

- Ultra-rapid transient phenomenon. Unit of measurement = kV/ μs
- Highly destructive energy.

Transient overvoltage generated by operations or incidents on the network.

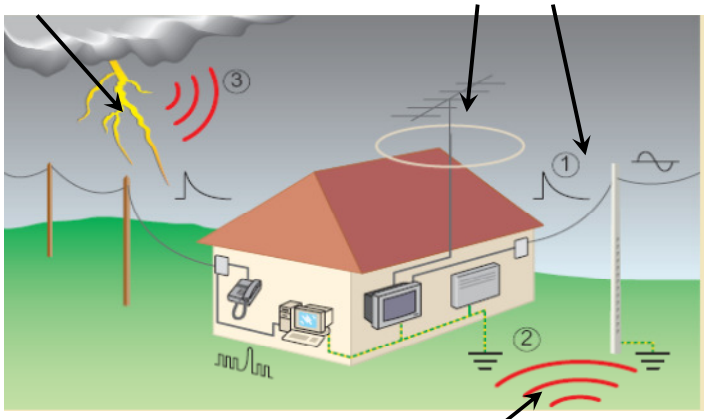
- Repetitive phenomenon leading to premature aging of user appliances.
- Energy network malfunction which may even result in permanent damage of user assets.



THE ORIGINS OF TRANSIENT OVERVOLTAGE

Strikes close to the lines, trees
Electromagnetic coupling
(induced overvoltage)

Direct strikes on
LPS, buildings (fires, explosions, etc.)
power and telephone lines



Statistically : more risks of surges coming from the power lines !

Strikes nearby buildings (trees, ...)
"earth feedback" (raising of the earth potential)
(induced overvoltage)

DAMAGE CAUSED BY TRANSIENT OVERVOLTAGE

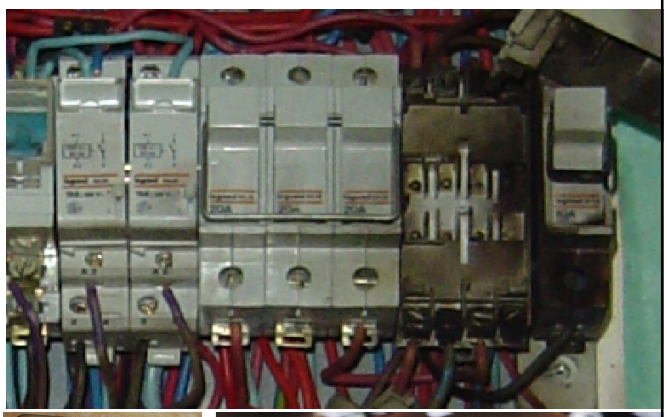
The main effect of lightning is **electrical overvoltage** which exposes the electrical installations to **a serious risk of:**

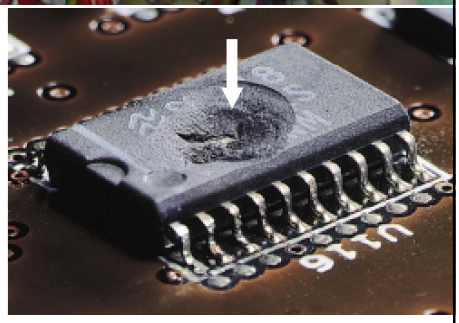
- Malfunction,
- Destruction of equipment
- Lost of production

Home appliances at risk of transient over voltage:

Bedroom: computer, hi-fi, telephone
Living-room: TV, home cinema, rolling shutters, air-conditioning, ADSL modem
Laundry: washing machine, dryer, alarm
Kitchen: microwave oven, oven, fridge, dishwasher

THE EFFECTS OF TRANSIENT OVERVOLTAGE





Multiple consequences

- Interruption of electric/communication networks (internal/external)
- Loss of data
- Equipment damaged or destroyed
- Untimely loss of critical networks (supervision, installations at risk for environment...)

Costs

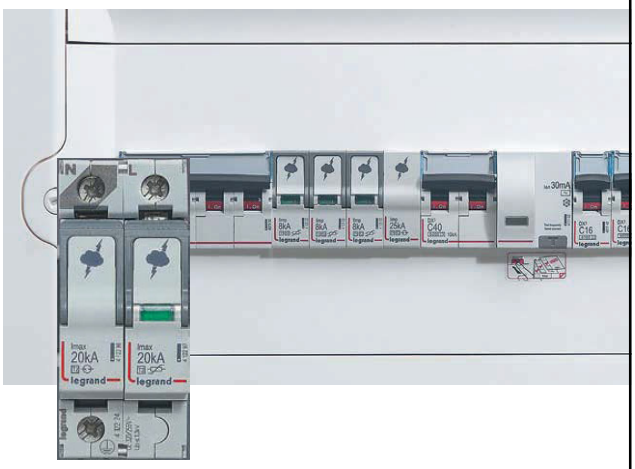
- Replacement of equipment
- Production losses

THEORY AND PRINCIPLES

- Surge Protection Devices
- SPD operating principle
- Where to Install (AS/Nzs3000:2007)
- Terminology
- Protect against transient over voltages
- Standards

SURGE PROTECTION DEVICES
SPD

The Surge Protection Device (SPD) is a component of the electrical installation protection system.
This device is connected in parallel on the power supply circuit of the loads that it has to protect.
It can also be used at all levels of the power supply network wwhich is the most commonly used and most efficient type of overvoltage protection.



SPDs do not provide protection against long term overvoltage or power outages.
(AS/NZ 3000)

SURGE PROTECTION DEVICES

SPD

Principle

SPD is designed to limit transient over voltages of atmospheric origin or generated by operation switching and divert current waves to earth, so as to limit the amplitude of this overvoltage to a value that is not hazardous for the electrical installation and electric switchgear and control gear.

* Usual protection devices (fuses, circuit-breakers, …) are too slow to provide any protection against overvoltage

Main applications

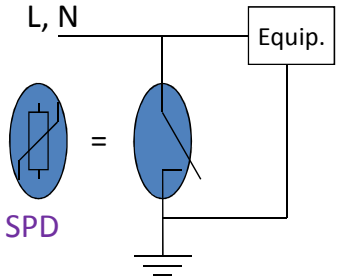
Low Voltage SPD

Low voltage SPDs are modular to be easily installed inside LV switchboards.

SPD OPERATING PRINCIPLE

SPDs for 230/400V~ installations (SPDs for “power networks” or “mains”)

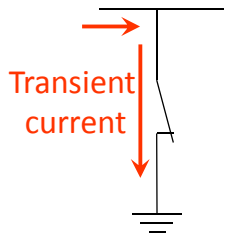
Normal operation



SPD =
“open circuit-breaker”

SPD 100% transparent

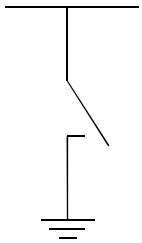
During the overvoltage



SPD =
“closed circuit-breaker”

SPD equivalent to short-circuit

After the overvoltage



SPD =
“open circuit-breaker”

SPD 100% transparent

WHERE TO INSTALL

AS/NZ 3000:2007

- Where lightning is prevalent.
- Where power disturbances are frequent, e.g. in industrial areas.
- Where the site is at the end of long overhead power lines.
- Where the site is exposed, e.g. on a hill.
- Where dwellings may be many hundreds or more metres apart, e.g. in outer suburban or rural areas.
- Where the dwelling contains sensitive electronic equipment, e.g. a home office, home theatre, computer network, etc.

TERMINOLOGY

Type 1
SPD which can discharge partial lightning current with a typical waveform 10/350 µs.

Type 2
SPD which can prevent the spread of over voltages in the electrical installations and protects equipment connected to it and is characterized by an 8/20 µs current wave.

Type 3
These SPDs have a low discharge capacity. They must therefore only be installed as a supplement to Type 2 SPD and in the vicinity of sensitive loads and are characterised by a combination of voltage waves (1.2/50 µs) and current waves (8/20 µs).

TERMINOLOGY

Iimp

Peak current with 10/350 µs waveform which the protection device can withstand without reaching end of life. Type 1

Imax

Maximum discharge current at peak with 8/20 µs waveform which the protection device can withstand without reaching end of life. Type 2

In

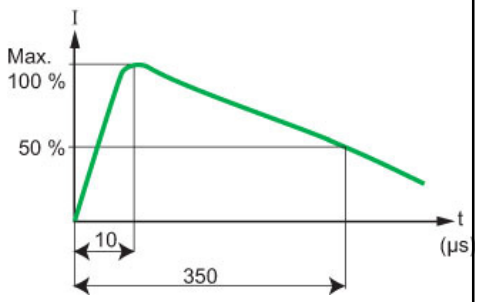
Peak current in 8/20 µs waveform the protection device can withstand 20 times without reaching end of life.

Up

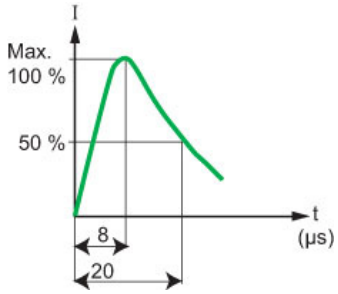
Maximum residual voltage between the terminals of the protection device during the application of a peak current.

Uc

Maximum effective voltage that can be applied permanently to the terminals of the protection device.



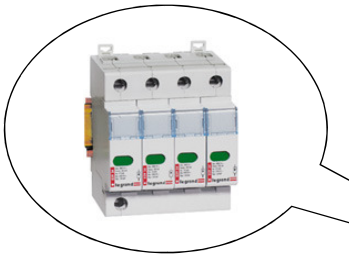
10/350 µs current wave



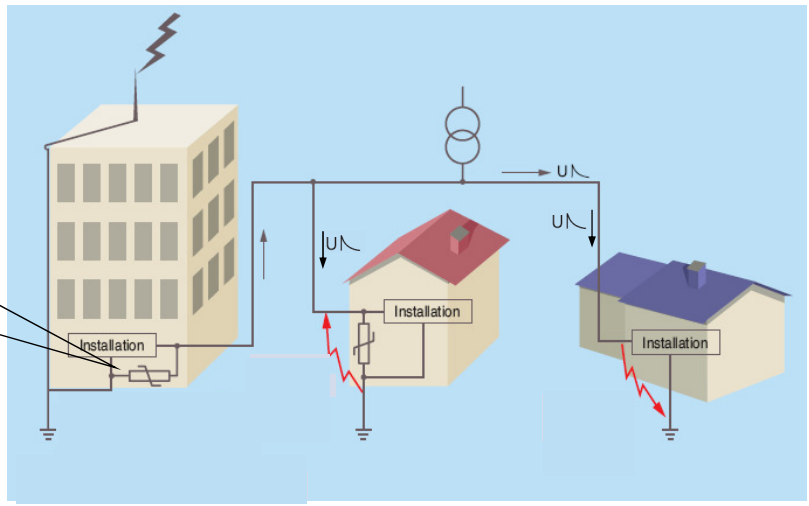
8/20 µs current wave

PROTECTION AGAINST TRANSIENT OVERVOLTAGE. SURGE PROTECTIVE DEVICES (SPDS)

The building requires a dedicated path to direct the rush current to the earth.
Also we need to Limit the overvoltage to the level that equipment (power lines, communication lines, etc.) can withstand.



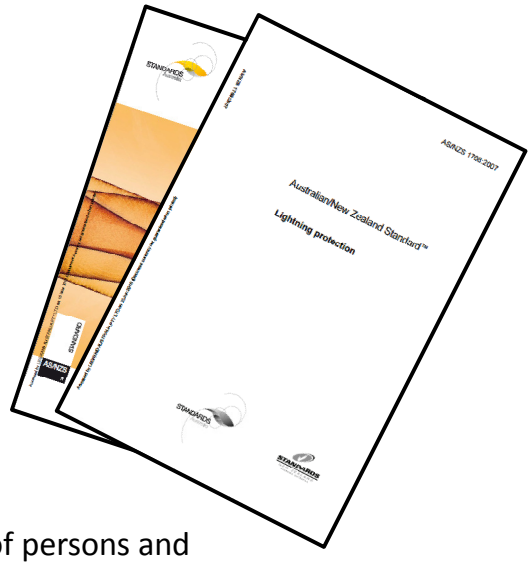
INTERNAL PROTECTION (SPDS)



STANDARDS

AS/NZS 3000:2007

Clause 2.7.3 and Appendix F provide guidance on overvoltage (surge) protection.



AS/NZS 1768

This Standard sets out guidelines for the protection of persons and property from hazards arising from exposure to lightning. The recommendations specifically cover the following applications:

- The protection of persons, both outdoors, and indoors
- The protection of a variety of buildings or structures
- The protection of sensitive electronic equipment

INSTALLATION RULES

- Design rules
- Cascaded protection
- Installation
- Cabling rules

DESIGN RULES

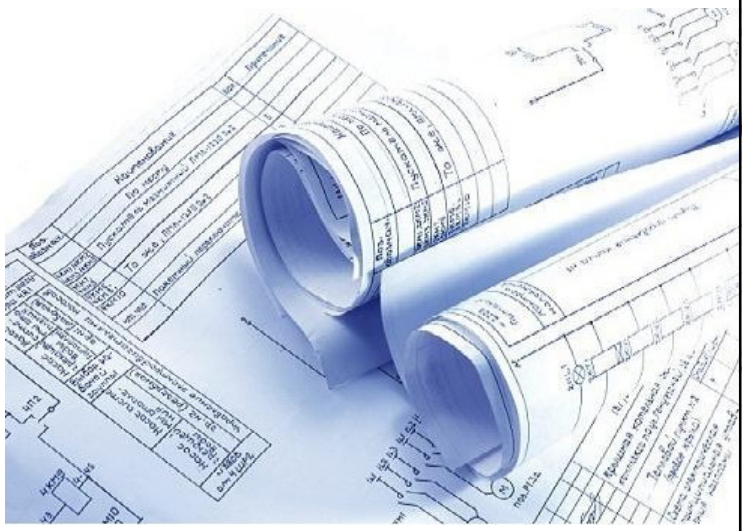
For a distribution system, the main characteristics used to define and select a SPD to protect an electrical installation in a building are:

SPD

- Quantity of SPD;
- Type;
- Level of exposure to define the SPD's

Short circuit protection device

- Short-circuit current (Isc)at the point of installation.

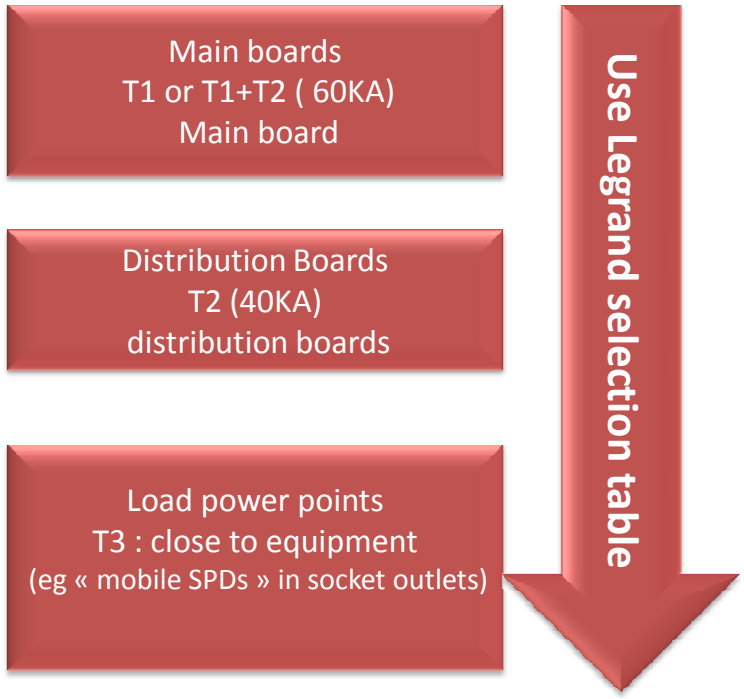


DESIGN RULES

Other characteristics for selection of a SPD are predefined for an electrical installation.

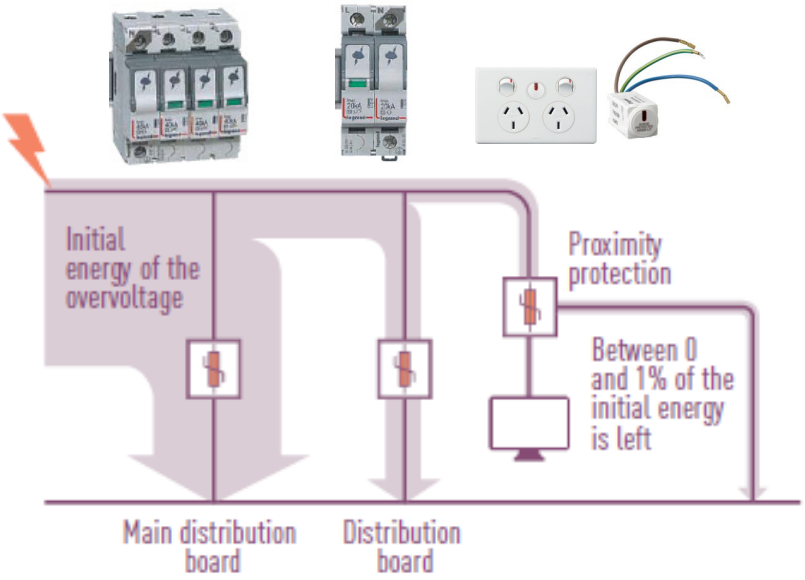
- Number of poles in SPD;
- Voltage protection level Up;
- Operating voltage Uc.

To protect an electrical installation in a building at main boards, simple rules apply for the choice of a SPD(s) and its protection system.



CASCADED PROTECTION

Protection of low-voltage circuits from the effects of Lightning and over-voltages is best achieved in a step by step approach as no single device can totally protect an installation from a very high surge.



The only way to discharge all the initial energy is to install SPDs at every level of the installation.

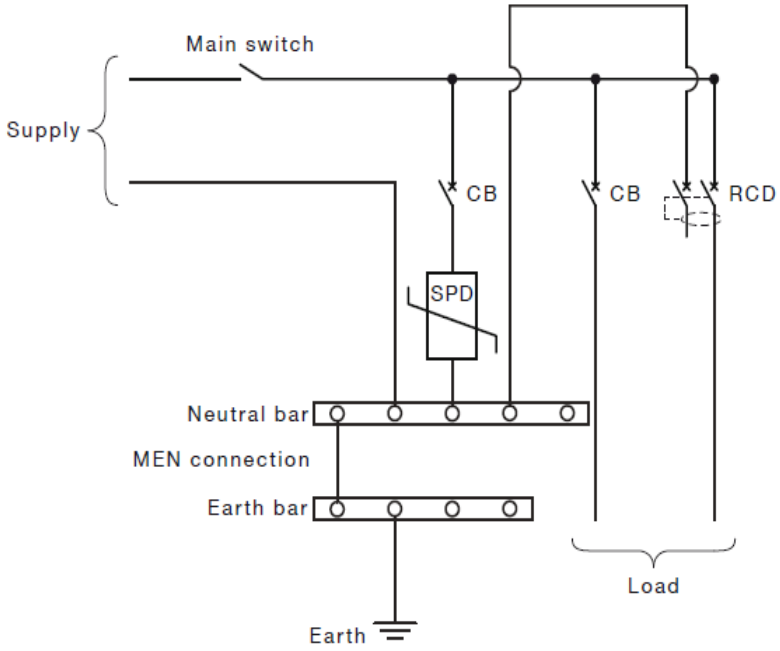
INSTALLATION

PRIMARY SPD ON MAIN SWITCHBOARD (AS/NZ 3000)

Primary SPDs are installed near the origin of the electrical installation or in the main switchboard. Secondary SPDs are installed in switchboards remote from the main switchboard.

SPDs should be

- Installed after the main switch or isolation switch but prior to any RCD devices
- Protected by an appropriate fuse or circuit breaker separate from the SPD
- Connected at the main switchboard from each phase to neutral



Note :-Sometimes referred to as “Common Mode”

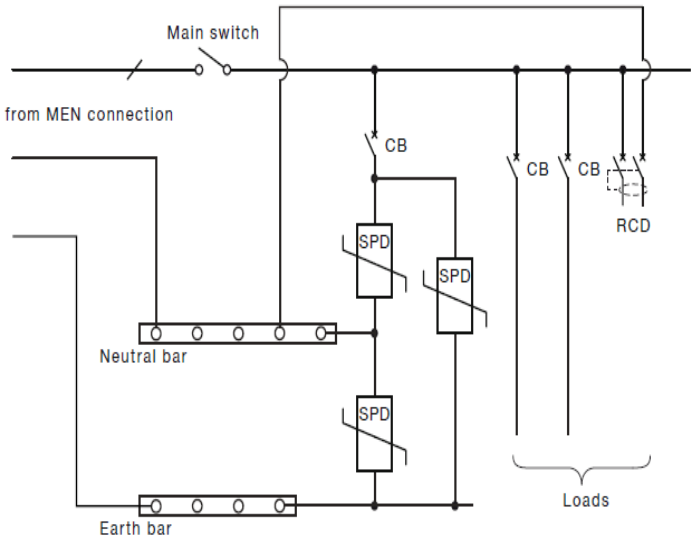
INSTALLATION

SECONDARY SPD ON MAIN SWITCHBOARD (AS/NZ 3000)

Secondary SPDs
should be coordinated with the primary SPDs in accordance with the manufacturer's instructions.

Where premises contain sensitive electronic equipment, secondary protection in the form of plug-in surge Protection usually needed.

For most domestic single-phase supplies in urban environments,
a surge rating at secondary distribution board of Imax = 40 kA per phase for an 8/20 µs impulse and a minimum working voltage of 275 V a.c. is suitable.

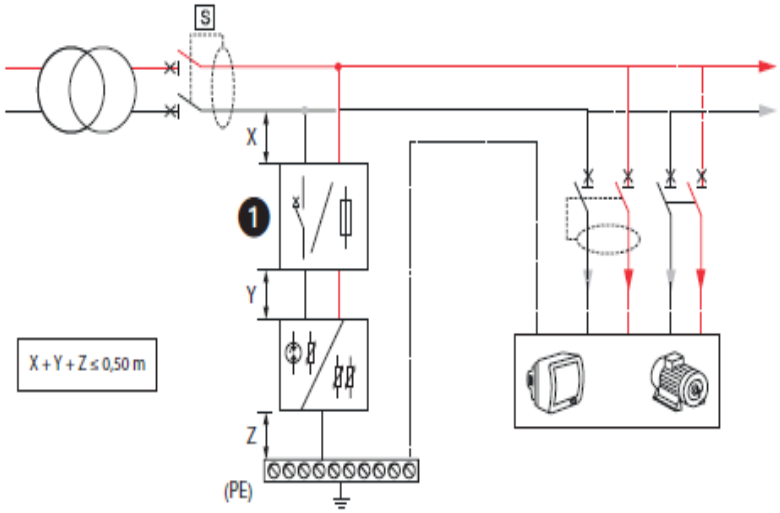


Note :-Sometimes referred to as "All or Differential Mode"

CABLING RULE

The first rule ,
to is that the length of the SPD connections between the network (via the external SCPD) and the earthing terminal block should not exceed 50 cm.
X+Y+Z < 50cm

The conductors of protected outgoing feeders:
• Should be connected to the terminals of the external the SPD;
• Should be separated physically from the polluted incoming conductors.



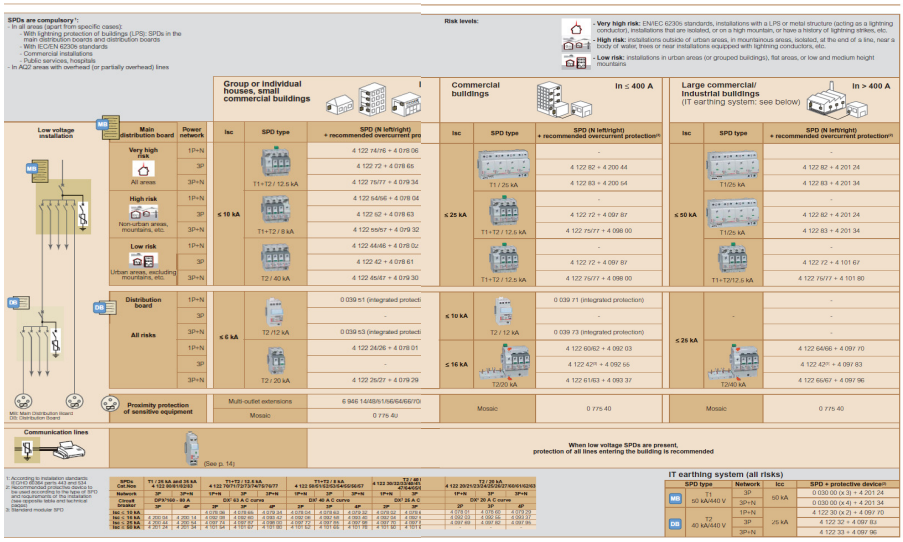
LEGRAND OFFER

- Legrand selection table
- Legrand offer
- Benefit of using Legrand

Legrand selection table

How to define a risk level and chose best SPD for Distribution boards at different level

Use Legrand selection table to chose the best SPD for different risk levels at different application as well as associated protection.



Protection against Short circuit currents cannot be ensured by the SPD itself.
Legrand selection table propose best protection device to be associated with SPD's

LEGRAND OFFER

For high risk level installations
T1
Iimp 50 kA/pole
Up: 2.5 kV - Uc: 440 V±
Recommended MCCB: DPX3160 - 80 A

For general protection of big installations and protection of small installations with external lightning protection (LPS).
T1+T2
Iimp 12,5 kA/pole
Imax: 60 kA/pole
Uc: 320 V± - Up: 1.5 kV
Recommended MCB: DX3 63 A

LEGRAND OFFER

SPDs recommended for secondary distribution board
T2
Imax 40 kA/pole
Up: 1.7 kV - In: 20 kA/pole - Uc: 320 V±
Recommended MCB: DX3 25 A

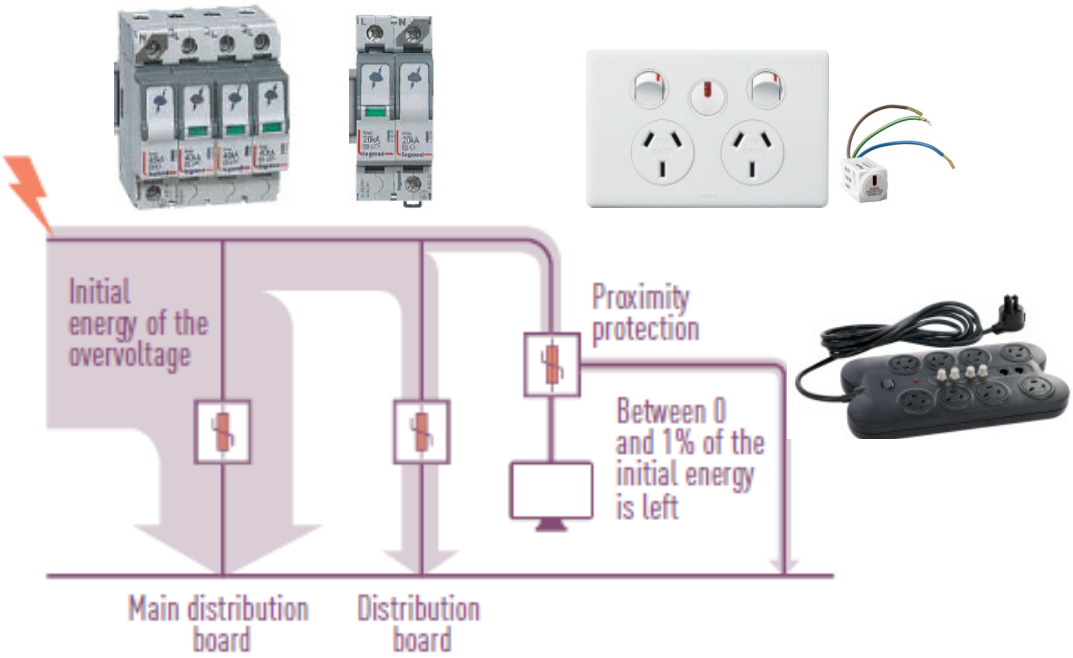
SPDs recommended for small installations
T2
Imax 20 kA/pole
Up: 1.2 kV - In: 5 kA/pole - Uc: 320 V±
Recommended MCB: DX3 20 A

Benefits of using Legrand SPD's

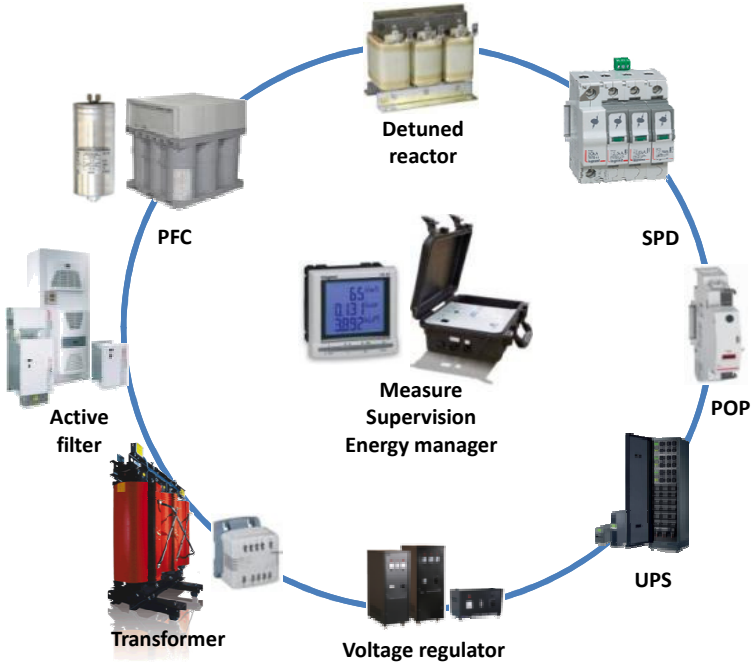
All applications are covered with a full range of compatible devices.
Protection for high rise towers; commercial buildings with essential computer data and expensive office machinery; domestic dwellings with entertainment and computer systems.
• Advanced warning that the device needs replacing.
Remote indication option means an remote control can warn the user that the cartridge needs replacing.

- **Remote indication option can warn the user that the cartridge needs replacing**
- **Reinforced neutral protection**
- **Extraction handle for easy replacing the module**

A complete offer for complete surge protection



A complete offer for Energy quality by Legrand



Questions.
Thanks for your time

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