How to protect a secondary school against the effects of lightning?

Customer needs

This secondary school has several buildings including:

- 2 "day school" and "boarding school" 2-storey buildings with lift
- 1 gymnasium: dressing rooms and sports field
- 1 half-board building: restaurant and kitchen
- 1 technical workshop and gas boiler room
- 1 administrative building and housing for employees.

This site must comply with the regulations for protection against fire, it has a safety system and fire alarm like all school establishments or holiday camps which have sleeping areas.

It is recommended to monitor the continuity of supply of automatic detection devices and fire alarms for all circumstances including atmospheric voltage surges.

Environment

- Located in the suburbs of a large city, this establishment may be subjected to atmospheric voltage surges from near or far lightning strokes (high trees around)
- The local lightning density is moderate (0.5 < Ng < 1.6)
- It has a TN-S earthing system
- The equipment to be protected is moderately expensive, however the establishment does not have a large budget to cover for risks (and thus replacement), sensitive devices must therefore be well-protected: electron microscopes, measurement devices, electronic and computer equipment
- A great number of teaching devices and equipment have a reduced impulse withstand voltage (U choc ≤ 1.5 kV) in particular for lab workshops: biology, chemistry, electronics and computer rooms require suitable protection against lightning as near as possible to loads.

The same is true for alarm and fire detection devices.

The building, traditional construction, does not have any special earthing device, however is in compliance with the standards in force.

- The secondary school is supplied by a low voltage three-phase + neutral underground line that is supplied by the local utility.

The other supply networks: gas, telecommunications and water are underground as well.
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Proposed solution

The main LV distribution board MSB1 installed in the technical room in the day school building, has a Type 1+2 surge protection device for the protection against lightning (LV withdrawable surge arrester iPRF1 12.5r associated with a 100 A disconnection circuit-breaker).

The main LV distribution cabinet MSB2 installed in the technical room for external premises, has a Type 2 device for the protection against lightning (LV withdrawal surge arrester iPRD40 associated with a 40 A disconnection circuit-breaker).

Secondary distribution enclosures on each floor of the other buildings are protected by 8 kA LV surge arresters (surge arrester iPRD8 associated with a 10 A disconnection circuit-breaker).

Telecommunication, monitoring and fire alarm devices are protected by communication surge arresters of the type:
• iPRC, for analogue telephone networks,
• iPRI 12/48 V for digital telephone and PLC networks.

Customer benefits

• **Incoming surge arresters:** run lightning current off to the ground and limit voltage surges on equipment located in the vicinity (within a distance of 10 m max.),
• **Secondary surge arresters:** located near sensitive loads reduce the voltage between P-E and N-E so that the rated impulse withstand voltage remains lower than 1500 V,
• **In compliance with regulations.**

Recommendations

• Make sure that building frames and earths are equipotentially bonded,
• Reduce loop surfaces.
• Make sure that surge arrester incoming cables are at a distance from the installations outgoing cables,
• Always associate a disconnection circuit-breaker with the surge arrester,
• If the building is fitted out with a lightning conductor, both MSB1 and MSB2 should have Type 1+2 surge arrester PRD1 25r with a high run off capacity (Iimp = 25 kA; Imax = 40 kA) with associated disconnector Compact NSX 100B, 100 A.

The role of the surge arrester disconnector

• Isolate the surge arrester from the rest of the installation in case the surge arrester’s run off capacity Imax is exceeded, following a particularly intense lightning stroke.
If the disconnector has been activated, loads are no longer protected against atmospheric voltage surges.
Replacement of the surge arrester is thus recommended.
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- transformer: 400 kVA
- guard house
- boiler room
- workshop
- stock room
- heating
- admin
- housing
- kitchen
- light
- oven
- cash registers
- gym
- heating
- hot water
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Standards

- International installation standard IEC 60364-4-443 and 5-443 (09/2015)
- Electrical installation of buildings NF C 15 100 of 2002
- SPD are mandatory:
  - in case of overheadlines and if lightning density is \( Ng \geq 2.5 \)
  - in case of presence of lightning rod (risk of direct impact).

Products used

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<tr>
<th>Product</th>
<th>Description</th>
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Note: number of poles of MCB should be the same as SPD.

More information:

For information concerning the protection of your electrical installation against lightning, please check our website or contact your local Schneider Electric office.