Coordination of Surge protection devices

Design guide
Surge arresters for commercial and industrial buildings
Coordination between the surge protective device and its disconnect circuit breaker

An external disconnecting device must be coordinated with a surge protective device in order to achieve:
- continuity of service:
- do not trip due to surge current,
- do not increase (Up) voltage protection level.
- effective protection against all types of overcurrents:
- overload due to SPD aging,
- short circuit of low intensity (impedant) due to temporary overvoltages,
- short circuit of high intensity due to SPD degradation.

The disconnecting device must be coordinated with the surge protective device. It is designed to meet the following two constraints:

**Resistance to lightning current**
The resistance to lightning current is an essential characteristic of the surge protective device’s external disconnecting device. The device must be capable of passing the following standardized tests: not trip upon 15 successive impulse currents at In.

**Resistance to short-circuit current**
The breaking capacity is determined by the installation rules (IEC 60364 standard):
- the external disconnecting device must have a breaking capacity equal to or greater than the presumed short-circuit current Isc at the point of installation.
- when this device is integrated into the surge protective device, conformity with product standard IEC 61643-11 naturally ensures protection.
Main reasons why the disconnecting device recommended by the manufacturer should be used:
- if the disconnecting device’s rating is lower than the recommended rating: risk of the disconnecting device opening in normal operation.
- If the disconnecting device’s rating is higher than the recommended rating: risk of non-disconnection during a temporary voltage surge.
Coordination between the surge protective device and its disconnect circuit breaker in the event of a short circuit

This table shows: the rating, curve and short circuit current level of the disconnector coordinated with the surge protective device.

**Disconnector**

<table>
<thead>
<tr>
<th>Type 1</th>
<th>Type 2</th>
<th>Low risk</th>
<th>Medium risk</th>
<th>High risk</th>
<th>Maximum risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.5 kA</td>
<td>25 kA</td>
<td>5 kA</td>
<td>20 kA</td>
<td>65 kA</td>
<td>12.5 kA</td>
</tr>
<tr>
<td>20 kA</td>
<td>50 kA</td>
<td>5 kA</td>
<td>20 kA</td>
<td>50 kA</td>
<td>20 kA</td>
</tr>
<tr>
<td>25 kA</td>
<td>50 kA</td>
<td>5 kA</td>
<td>20 kA</td>
<td>50 kA</td>
<td>20 kA</td>
</tr>
<tr>
<td>50 kA</td>
<td>70 kA</td>
<td>5 kA</td>
<td>20 kA</td>
<td>50 kA</td>
<td>20 kA</td>
</tr>
<tr>
<td>70 kA</td>
<td>100 kA</td>
<td>5 kA</td>
<td>20 kA</td>
<td>50 kA</td>
<td>20 kA</td>
</tr>
</tbody>
</table>

**Surge protective device**

- **Type 1**: Protection rating range from 12.5 kA to 70 kA.
- **Type 2**: Protection rating range from 20 kA to 100 kA.
- **Low risk**: Protection rating range from 2.5 kA to 20 kA.
- **Medium risk**: Protection rating range from 5 kA to 65 kA.
- **High risk**: Protection rating range from 20 kA to 50 kA.
- **Maximum risk**: Protection rating range from 50 kA to 100 kA.

**Notes**

1. Equivalence table Compact NSXm - Compact NSX100 / NSX160
2. For lightning impulse current withstand use NSXm E TM80D range
3. For lightning impulse current withstand use NSXm B TM80D range
Protection
Load protection
Surge protective device coordination (cont.)

Coordination between the surge protective device and its disconnect fuse in the event of a short circuit

Note:
(1): for Type 2 application with Isc > 50 kA, please contact Schneider Electric.
(2): GSC and GSD are fuse switch disconnectors for DIN and NFC fuse. You can use BS fuse inside GSB fuse switch disconnector (cf catalog LVPED216031EN)
When two surge protective devices are installed in an electrical installation, coordination is needed according to IEC 61643-12 to obtain an acceptable stress distribution between the two surge protective devices according to their permissible energy "E".

For coordination between two surge protective devices, a minimum cable length between these 2 surge protective devices is needed to ensure that:

- \( I_2 < I_{\text{max SPD2}} \).
- \( U_{\text{p2}} < U_{\text{w}} \).
- \( E_2 < E_{\text{max SPD2}} \).
Minimum distance between two surge protective devices, upstream/downstream

For a cable section of 16 mm² and an impulse current equal to the maximum discharge current (Imax) of the upstream surge protective device.

**Example**

If iPRD65r is installed in the incoming panelboard, the second SPD iPRD8r must be installed at a cable length of 8 meters from the first one.

### Upstream surge protective device

<table>
<thead>
<tr>
<th>Type 2</th>
<th>Type 1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>iQuick PRD 20r</strong></td>
<td><strong>iQuick PRD 40r</strong></td>
</tr>
<tr>
<td>0 m</td>
<td>10 m</td>
</tr>
<tr>
<td>0 m</td>
<td>2 m</td>
</tr>
<tr>
<td>0 m</td>
<td>0 m</td>
</tr>
<tr>
<td>3 m</td>
<td>7 m</td>
</tr>
<tr>
<td>2 m</td>
<td>6 m</td>
</tr>
</tbody>
</table>

(*) Forbidden configuration
Cascading in the event of a short circuit between the surge protective device disconnector and the upstream circuit breaker

What is cascading?

Cascading means using the circuit breakers' limiting power, which allows circuit breakers of lower performance to be installed downstream.

The upstream circuit breakers then act as a barrier for major short-circuit currents. They thus enable circuit breakers of breaking capacity lower than the presumed short-circuit current (at their point of installation) to be loaded in their normal breaking conditions.

Since current limiting takes place all along the circuit controlled by the upstream current-limiting circuit breaker, cascading concerns all the devices located downstream of that circuit breaker.

It is not restricted to two consecutive devices.

Case 1

Disconnect circuit breaker not integrated into the surge protective device.

For this type of study, refer to the existing coordination tables.

> see 548E4205 catalogue module.
Case 2
Disconnect circuit breaker integrated into the surge protective device.

MCCB = Molded-case circuit breaker.
MCB = Modular circuit breaker.
SPD = Surge protective device.

(1) Uoc: 10 kV.
(2) rating up to 80 A is validated.