

Risks of Electrical Surges

Surge protective devices (SPD) assist in the protection of valuable electrical and electronic equipment against transients, originating from lightning and also from switching sources.

These transients can cause damage ranging from the premature ageing of equipment, logic failures and down time, to the complete destruction of equipment within the entire electrical installation. Products such as LCD screens, data servers and industrial equipment such PLC's are critical to business activity. Protecting this equipment may now be a necessity.

The Hager SPD range of solutions may offer protection to prevent damage to this sensitive equipment by diverting the damaging transient over-voltages. In the majority of cases this will eliminate equipment failures and reduce downtime.

The choice of a surge protective device depends upon:

- The exposure of the building to lightning transients
- The sensitivity and value of the equipment that requires protection (it is recommended that the contractor should discuss the installations requirements with the customer)
- The location and therefore the exposure level of the installation
- The equipment used within the installation and whether this equipment could generate switching transients

BS 7671 and the AQ criteria method

Lightning discharges could contain currents of 200,000A which if struck at or near power transmission lines would generate a significant voltage transient. This voltage transient could cause significant damage to both domestic and commercial electronic equipment.

The UK regional map illustrates the likely lightning activity caused by the number of thunderstorm days across the country.

Protection against over-voltages is the subject of section 443 of BS 7671. Here the AQ criteria method is introduced which is based on the likelihood of the equipment being subjected to over-voltages caused by lightning strikes, taking account

of the probable number of lightning strikes per year.

For electrical installations in the UK, the map shows that the probable number of thunderstorm days per year in any given location is less than 25, and therefore condition AQ1 applies.

Where this is the case and for installations being supplied by overhead lines, Regulation 443.2.2 indicates that provided the impulse withstand voltage of the equipment is not less than the values given in Table 44.3 (see Table 1 for installations rated at 230 V to Earth), no additional protection by a SPD is required. However, where higher levels of equipment reliability or higher risks (e.g. fire) are expected, additional protection by an SPD against over-voltage may be required.

Similarly, for an installation having overhead lines, no additional protection against over-voltages is required if the equipment meets the minimum voltage withstand values in table 44.3.

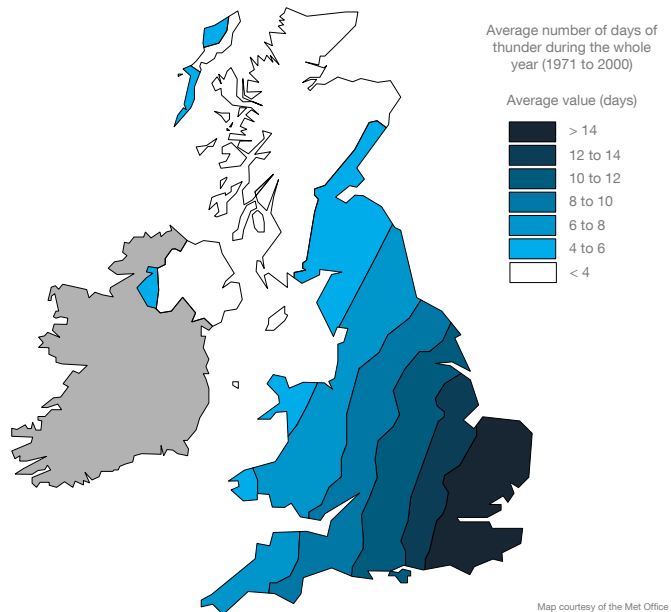
There are some words of caution in the notes to this section where it is recognised that transient over-voltages transmitted by the supply distribution system are not significantly attenuated. So an induced voltage some distance away could easily manifest itself at the electrical installation and cause potential harm to the equipment within. It is also worth considering that the AQ data is for thunderstorm days NOT lightning strikes. One storm will usually contain many lightning flashes which could lead to an over-voltage on the installation causing damage to equipment.

Cascading

Cascading is the term used to describe the method of combining several levels of surge protection devices into the one installation.

This takes advantage of the best features of each device to improve the protection level for the equipment. Hager recommends using a high surge current capacity device to divert the bulk of the transient over-voltage at the origin of the installation.

In the case of a Class 1 & 2 device this would be either the spark gap arrester or a high current capacity MOV. Should finer protection be required, the next step is to install a Class 3 device SP202N near the terminal equipment.



Cascading increases the current diverting capacity of the SPD system whilst maintaining a low voltage (Up) to ensure the best protection for valuable equipment.

Selecting SPD of the same manufacturer or make will ensure correct co-ordination between devices.

SPD Quick Selection Guide

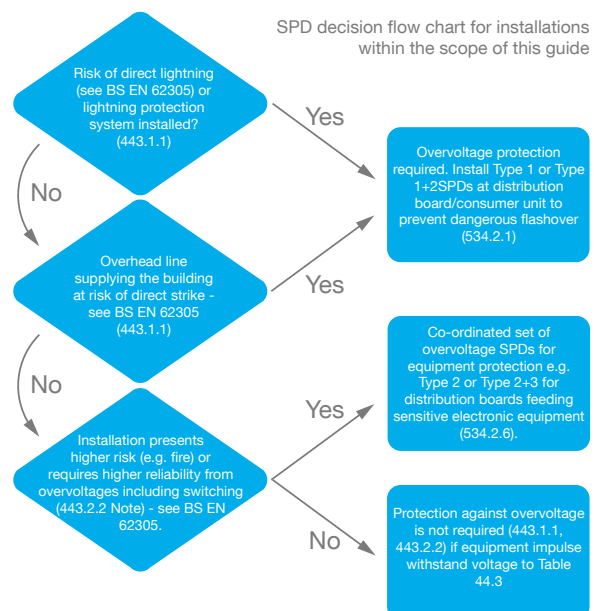
The following is a quick selection guide which may assist in choosing whether SPD's are required and the correct type of device

- Does the installation contain a lightning protection system?
- Is the installation adjacent to any tall structure, tall trees or near a hill top in a lightning prone area?

- Does the installation contain equipment where higher reliability from overvoltages is required

If the answer is YES in the above to the first two questions, it is recommended to install a Type 1+2 device. This will provide protection against surges caused by direct lightning strikes and provide protection against transient over-voltages caused by indirect lightning strikes or by switching events.

If the answer is YES to the third question then it is recommended to install Type 2 devices to provide protection against transient over-voltages caused by indirect lightning strikes or by switching events.



Note: For larger installations beyond the scope of this guide, a risk assessment method used to evaluate the need for SPDs is given in Section 443 of BS 7671:2008(2011)

SPD's protect electrical and electronic equipment against transients, originating from lightning, switching of transformers, lighting and motors

These transients can cause premature ageing of equipment, downtime, or complete destruction of electronic components and materials.

SPDs are strongly recommended on installations that are exposed to transients, to protect sensitive and expensive electrical equipment such as TV, video, washing machines, Hi-Fi, PC, alarm etc.

The choice of SPD depends on a number of criteria such as:

- The risk of lightning strikes
- The exposure of the building to transients.
- The sensitivity and value of the electrical equipment that requires protection.
- Earthing system
- Level of protection

The range of SPDs is separated into 3 types of protection:

1. Main protection - class 1
SPDs with higher discharge current (I_{max} 10/350), to evacuate as much of the transient overvoltages associated with lightning strikes
2. Main protection - class 2
With a discharge current (I_{max} 8/20), to evacuate as much of the transient overvoltage to earth as possible protection level ($U_p \leq 1000V$).

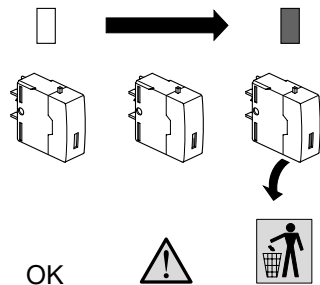
3. Main protection - class 3
To cut-down the transient surge as low as possible to protect very sensitive equipment.

Technical Data
Complies with IEC61643-1

Reserve Status Indicator
(R versions)



End of Life Indicator
(D versions)



OK
Auxiliary contact for remote signalling (R versions only)



230V~ 1A
12V ... 10mA

Installation and Connection
The main protection SPDs are installed directly after the main incoming switch or RCCB (type S).

SPDs can be used in any supply system e.g TNCS, TNS, TT.

Options: Replacement cartridges.

Connected in parallel to the equipment to be protected.

Protection is assured in both common and differential modes.

SPDs with Low Let Through Voltage Levels Type 3
To protect very sensitive electronic equipment. This fine protection complements the main protection and can protect 1 or many electronic devices.

Optimal coordination is obtained when cascaded with a main protection device.

Discharge current
 I_{max} 8kA (8/20 wave)
a green LED on the front face indicates the status of the SPD SP202N, connected in series with the equipment that needs to be protected (with a maximum line current of 25A). Protection is assured in both common and differential modes

Connection Capacity
Terminal blocks L, N & E
• Rigid conductor: 10mm²
• Flexible conductor: 6mm²

Replacement Cartridges
The cartridges replace the cartridge in the main SPN* devices.

They allow simple replacement without the need to cut-off the

power supply.
Cartridges are available for all discharge currents (40kA and 15kA) with and without condition indication.

A keying system exists to prevent a line cartridge being interchanged by mistake with a neutral one and visa versa neutral cartridges have a discharge current of 65kA

For technical details see page 4.55 - 4.59.

	TNS	TNC-S	TT
SPA201	✓	✓	✓
SPA401	✓	✓	✓
SPN801	✓	✓	x
SPN802	x	x	✓
SPN215D	✓	✓	✓
SPN415D	✓	✓	✓
SPN440D	✓	✓	✓
SP202N	✓	✓	✓



SPN801R



SPN080

Class 1 + 2 (Class 1 + 2 + 3 if less than 5m) (with lifetime indicator)

Poles	I_{imp} kA L-N	I_{imp} kA N-PE	I_n L-N	I_n N-PE	U_p kV	Single or Three Phase	Width (mm)	Cat. ref.	Cat. ref. with remote contact
2	12.5	25	-	-	≤ 1.5	Single	35	SPA201	-
4	12.5	50	-	-	≤ 1.5	Three	70	SPA401	-
4	25	100	-	-	≤ 1.5	Three	140	SPN801	SPN801R
4	25	100	-	-	≤ 1.5	Three	140	SPN802	SPN802R

Replacement Cartridges (SPN8* range)

Dimensions	Cat. ref.
Phase replacement for SPN800, SPN800R, SPN801, SPN801R, SPN802 & SPN802R	SPN080
Neutral replacement for SPN801, SPN801R, SPN802, SPN802R	SPN080N



SPN415D



SPN040D



SP202N



SPV325

Class 2 (with lifetime indicator)

Poles	I_{imp} L-N	I_{imp} N-PE	I_n kA L-N	I_n kA N-PE	U_p kV	Single or Three Phase	Width (mm)	Cat. ref.	Cat. ref. with remote contact
1	-	-	5	15	≤ 1.2	Single	17.5	SPN115D	SPN115R
1	-	-	5	40	≤ 1.2	Single	17.5	SPN140D	SPN140R
2	-	-	5	15	≤ 1.2	Single	35	SPN215D	SPN215R
2	-	-	15	40	≤ 1.2	Single	35	SPN240D	SPN240R
4	-	-	5	15	≤ 1.5	Three	70	SPN415D	SPN415R
4	-	-	15	40	≤ 1.5	Three	70	SPN440D	SPN440R

Replacement Cartridges

Dimensions	Cat. ref.
Phase replacement for SPN215D & SPN415D	SPN015D
Phase replacement for SPN215R & SPN 415R	SPN015R
Phase replacement for SPN140D, SPN240D & SPN440D	SPN040D
Phase replacement for SPN240R & SPN44R	SPN040R
Neutral replacement for SPN215D, SPN415D, SPN215R & SPN415R	SPN040N

Class 3 (fine protection) (with lifetime indicator)

Poles	I_{imp} L-N	I_{imp} N-PE	I_n kA L-N	I_n kA N-PE	U_p kV	Single or Three Phase	Width (mm)	Cat. ref.	Cat. ref. with remote contact
2	-	-	3	-	≤ 1.5	Single	35	SP202N	-

PV Applications (DC side) (with lifetime indicator)

Poles	I_{imp} L-N	I_{imp} N-PE	I_n kA L-N	I_n kA N-PE	U_p kV	Single or Three Phase	Width (mm)	Cat. ref.	Cat. ref. with remote contact
3	-	-	12.5	25	≤ 4	-	52.5	SPV325	-

Consumer Unit Kit Type 2 SPD with SPN215D (with lifetime indicator)

Consists of: Neutral terminal bar, 3x 20mm neutral link bar 370mm, 300mm & 200mm lengths, 4mm² neutral, live & earth cables, 2 connector busbar, 4 way terminal bar, terminal bar clip, 1x Double Pole SPD's, 32A MCB

Poles	I_{imp} L-N	I_{imp} N-PE	I_n kA L-N	I_n kA N-PE	U_p kV	Single or Three Phase	Width (mm)	Cat. ref.	Cat. ref. with remote contact
2	-	-	5	15	≤ 1.2	Single	35	VA02SPD	-