Perfect protection for industrial buildings

The right backup fuse for surge protective devices

Protection against overvoltages is important and has also become mandatory in most countries. Just as important, however, is the fuse protection for the installed protective devices. This info paper explains what you have to take into consideration when selecting the backup fuse for particular surge protective devices.

Selecting the appropriate backup fuse

As is the case for all electrical equipment, a surge protective device (SPD) and its connecting cables must be protected against the effects of overcurrents. To achieve this, a suitably dimensioned overcurrent protective device must be installed. The manufacturer of the SPD provides information on the maximum permissible nominal value of the overcurrent protective device in its technical documentation. This information normally relates to an NH fuse with gG characteristic. The nominal fuse value is significantly higher with branch wiring than with V through-wiring, because in this case there is no protection in the event of an overload, but only in the event of a short circuit. With V through-wiring, however, protection in the event of overload also has to be taken into consideration because the operating current flows across the SPD connection terminal blocks.

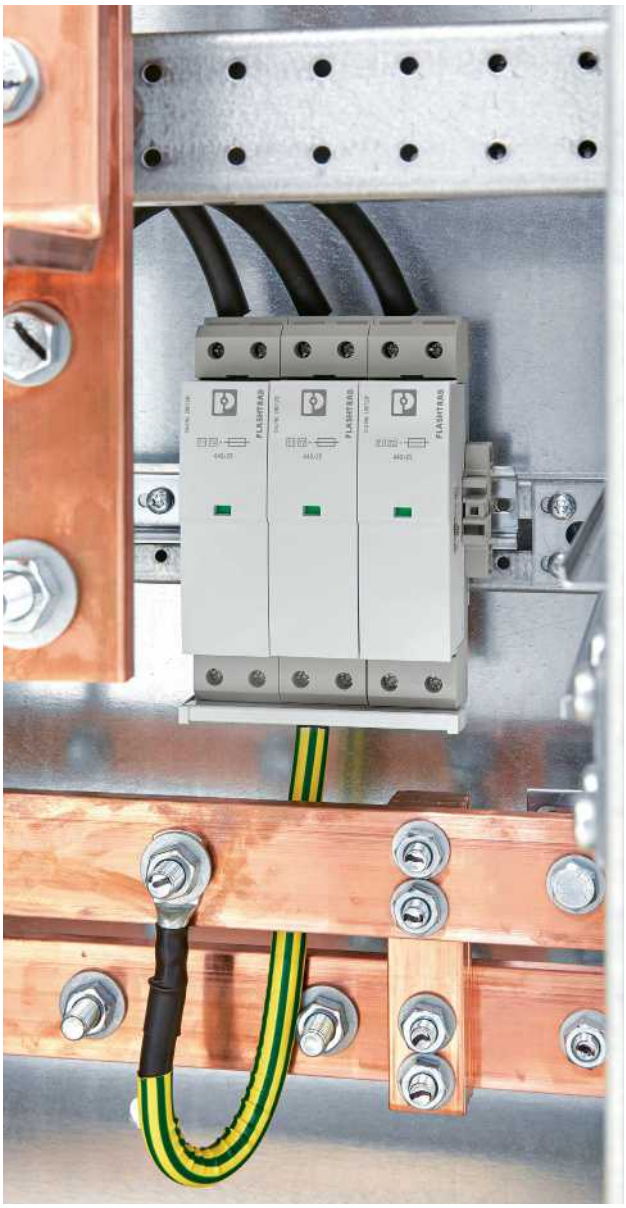
For a type 1 SPD, a maximum backup fuse of 315 A gG is common for branch wiring, and 125 A gG for V through-wiring.

For a type 2 SPD, on the other hand, a maximum backup fuse of 125 A gG is usual for branch wiring, and 80 A gG for V through-wiring.

The compact VALVETRAB-SEC-T2 is extraordinary. With an overall width of just 12 mm, it provides maximum performance and a high short-circuit current rating. Up to a nominal main fuse value of 315 A gG, the VALVETRAB SEC can be installed in branch wiring without an additional fuse in the branch line.

If branch wiring is selected and the nominal value of the system-side fuse F1 is greater than the maximum value specified by the manufacturer, an additional fuse F2 must be planned for the branch in all cases. To make sure that the fuse does not trip or even become destroyed during a discharge process, both the selectivity criteria (F2:F1 ≤ 1:1.6) and the impulse durability have to be taken into consideration during dimensioning.

If the nominal value of F1 is lower or the same as the maximum permissible backup fuse, two arguments have to be weighed up against each other: On the one hand, the permissible forgoing of the separate fuse F2 could lead to an (extremely unlikely) short circuit in the surge protective device shutting the entire system down, because in this case the main fuse F1 would be tripped. On the other hand, an insufficiently impulse-durable fuse F2 could, under certain circumstances, lead to this tripping at surge currents below the rating of the SPD, meaning that there is no longer any system protection. And without fuse monitoring, this error would remain unnoticed.



Type 1+2 combined lightning current and surge arrester with integrated fuse
FLT-SEC-H-T1-3C-264/25-FM
Order No. 2905871

Fuse dimensioning for a type 1 SPD

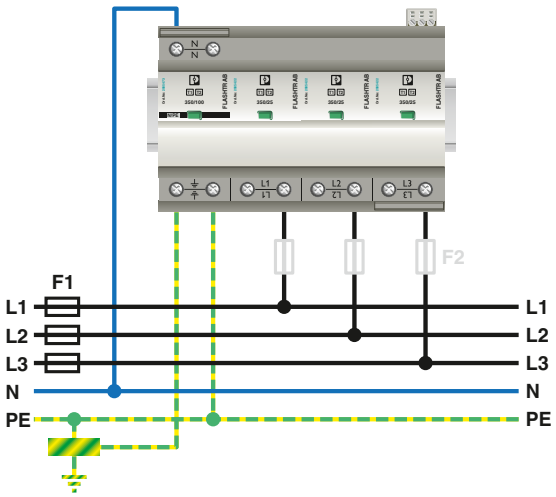
The fuse dimensioning for a type 1 SPD with a discharge capacity of 25 kA (10/350 µs) per path is outlined below as an example. According to the manufacturer, the maximum permissible backup fuse for the SPD is 315 A gG.

In the first case, the type 1 SPD is intended for a system with a fuse F1 = 500 A gG. Therefore, a branch-wiring fuse F2 is necessary. Due to the selectivity criterion F2:F1 ≤ 1:1.6, the maximum permissible nominal value of 315 A gG could be utilized for F2. And because a 315 A gG NH fuse can also discharge a 25 kA lightning surge current several times without destruction, this would be the optimum solution from a normative perspective.

In the second case, the type 1 SPD is intended for a system with a fuse F1 = 315 A gG. A separate branch-wiring fuse F2 is not necessary. If a backup fuse F2 is nevertheless to be installed, then this fuse must be selected to be as large as possible while complying with the selectivity criterion; that is to say, 200 A gG. Such a fuse, however, cannot reliably discharge the 25 kA lightning surge.

Furthermore, an additional fuse F2 always requires more space and results in longer connecting cables.

An SPD with integrated impulse-durable fuse is a good alternative. In this case, it is assured that even multiple lightning surge currents with 25 kA per pole will be discharged by the integrated fuse. Additional advantages of such a solution include the significantly lower space requirement compared to a conventional size 2 external fuse and the ability to optimize the length of the connecting cables in favor of a better voltage protection level.



Type 1+2 combined lightning current and surge arrester F
LT-SEC-P-T1-3S-350/25-FM
Order No. 2905421

Fuse dimensioning for a type 2 SPD

For a type 2 SPD, a maximum backup fuse of 125 A gG is common for branch wiring. The VAL-SEC, however, can be installed in the branch line without an additional backup fuse F2 up to 315 A gG. Therefore, an additional backup fuse F2 would be superfluous in almost all cases.

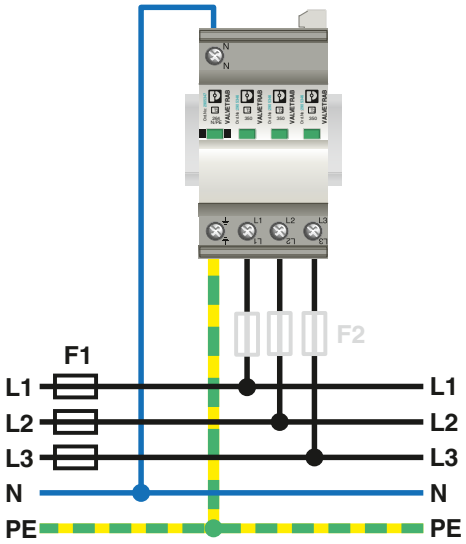
If, nevertheless, a branch-wiring fuse F2 is demanded or desired, it has to be dimensioned to be sufficiently large. A 125 A gG NH fuse can reliably discharge the maximum surge current of 40 kA without destruction. F2 = 125 A gG is therefore the optimum backup fuse and can be installed with a system fuse F1 ≥ 200 A.

F2 backup fuses smaller than 80 A gG should not, however, be selected. The impulse durability of an 80 A gG fuse is the same as the nominal discharge current of a typical type 2 SPD of 20 kA (8/20 µs) per pole. Among other things, there is a risk of the branch-wiring fuse F2 being tripped without this being noticed. In this case, system surge protection is no longer assured.

And here, as well, an additional fuse F2 always requires more space and results in longer connecting cables.

An SPD with integrated fuse is a space-saving alternative in this case as well. The ability to discharge the maximum surge currents is proven via tests in the laboratory.

Additional advantages of such a solution include the ability to optimize the length of the connecting cables in favor of a better voltage protection level as well as the fuse monitoring integrated into the SPD.



Type 2 surge protective device with integrated backup fuse
VAL-CP-MCB-3S-350/40/FM
Order No. 2882750

Impulse durability of fuses

Fuses are supposed to ensure short-circuit and overload protection for the electrical system. In the event of a short circuit, the fuse must trip as quickly as possible. In the event of an overload, a latency is desired depending on the demand.

NH fuses are slow-blow fuses. However, NH fuses can also be tripped by very brief surge currents. The crucial factor here is the energy converted in the fuse. This energy is defined via the I^2t value. For fuses, this value represents what is referred to as the melting integral.

Typical values for the impulse durability of fuses

Typical fuse nominal currents	Melting integral I^2t A^2s	Calculated 8/20 kA	According to test 8/20 kA	Melting integral I^2t A^2s	Calculated 10/350 kA	According to test 10/350 kA
25 A	800	7.6	5			
32 A	1300	9.6	7			
40 A	2500	13.4	10			
50 A	4200	17.3	15			
63 A	7500	23.1	17			
80 A	14500	32.2	25			
100 A	24000	41.4	30	20000	8.8	5
125 A	40000	53.4	40	33000	11.3	7
160 A				60000	15.3	10
200 A				100000	19.75	15
250 A				200000	27.93	20
315 A				300000	34.21	25

Maintaining and checking surge protective devices

A surge protective device does not need to be maintained or operated. Checking the status indicator is sufficient for regular checking. If the indicator is green, the surge protective device is ready for operation. This status can also be evaluated via the remote indication contact. It will immediately recognize an SPD failure.

With an SPD with integrated impulse-durable fuse, the fuse is also monitored and a failure is displayed via the status indicator or reported via the remote indication contact. Therefore, you always have your system surge protection under control.

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Find out more

Further information on the distinction between a classic combined lightning current and surge arrester and our special combined lightning current and surge arrester is available in our info paper at **phoe.co/spd-industry**

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