

# BETA Protecting SITOR Semiconductor Fuses

## Application information

### Overview

#### Characteristics

SITOR fuse links protect converter equipment against short circuits.

The power semiconductors used in these devices (diodes, thyristors, GTOs and others) require high-speed elements for protection due to their low thermal capacity. SITOR fuse links (super quick fuse links for semiconductor protection) are ideal for this type of application.

The following types of short-circuit faults can occur:

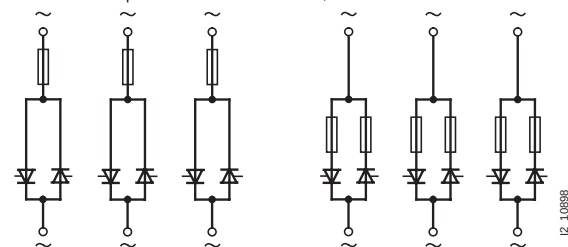
- Internal short circuit:  
A faulty semiconductor device causes a short circuit within the power converter.
- External short circuit:  
A fault in the load causes a short circuit on the output side of the power converter.
- Shoot-throughs:  
In the event of a failure of the chassis converter control system during inverter operation (commutation failure), the converter connection forms a short-circuit type connection between the DC and AC power supply system.

Fuse links can be arranged in a number of ways within the converter connection. A distinction is made between phase fuses in three-phase current incoming feeders and, if applicable, DC fuses and arm fuses in the arms of the converter connections (see adjacent graphs). In the case of center tap connections, fuse links can only be arranged as phase fuses in three-phase current incoming feeders.

When using SITOR fuse links of operational class aR, the overload protection of converter equipment, up to approx. 3.5 times the rated current of the fuse link, is taken from conventional protective devices (for example, thermal-delayed overload relays) or, in the case of controlled power converters, from the current limiter (exception: full range fuses).

As semiconductor protection, SITOR fuse links of the 3NE1 ...-0 series with gS operational class are also suitable for the overload and short-circuit protection of cables, lines and busbars. All other dual-function fuses of the SITOR series have a gR characteristic. Overload protection is ensured as long as the rated current of the SITOR fuse links of the series 3NE1 ...-0 is selected as  $I_n \leq I_z$  (DIN VDE 0100 Part 430).

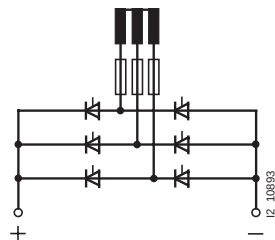
The rules of DIN VDE 0100 Part 430 must be applied when rating short-circuit protection for cables, lines and busbars.



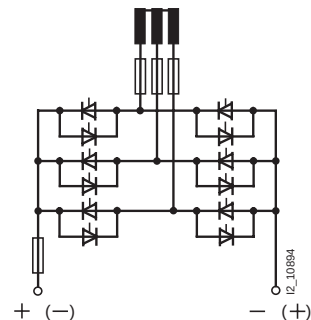
Three-phase bidirectional connection W3  
with phase fuses

with arm fuses

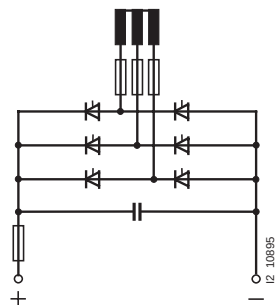
#### Configuration options



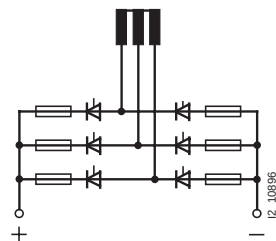
Six-pulse bridge circuit B6  
with phase fuses



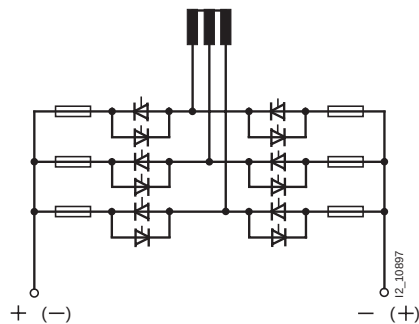
Six-pulse bridge circuit B6  
with phase fuses and DC fuse  
(reversible connection)



Six-pulse bridge circuit B6  
with phase fuses and DC fuse  
(switching for converter)



Six-pulse bridge circuit B6  
with arm fuses



Six-pulse bridge circuit B6 with arm fuses  
(reversible connection)

### ***Use in switch disconnectors***

When using SITOR semiconductor fuses in 3KL and 3KM switch disconnectors with fuses and 3NP fuse switch disconnectors, the rated current of the fuse must sometimes be reduced due to the higher power loss compared to LV HRC fuses for line protection. Sometimes when using SITOR semiconductor fuses in switch disconnectors, the currents designated can be higher than the rated currents of the switches. These higher currents only apply when using SITOR switch disconnectors with semiconductor fuses and cannot be used when using switch disconnectors with standard LV HRC fuses. You will find further details in the following selection table.

When using SITOR semiconductor fuses of the 3NC24, 3NC84, 3NE33 and 3NE43 series, the standard switching capacity of the fuse must not be used as the blades of these fuses (in contrast to LV HRC fuses) are slit. Occasional switching of currents up to the rated current of the fuses is permissible.

Due to the mechanical strain on the comparatively long fuse blade, SITOR semiconductor fuses of the 3NE41 series may only be occasionally switched, and only without load. If only switching without load is permissible, this must be clearly stated on the switch itself.

The use of SITOR semiconductor fuses > 63 A for overload protection is not permitted - even if gR fuses are used (exception: 3NE1).

The operational voltage is limited by the rated voltage of the switch disconnector or the fuse. If switching without load, the limit value is the rated insulation voltage of the switch disconnector.

The 3NE1 "double protection fuses" can be used as full range fuses (gS) for semiconductor and line protection.

For further information on the assignment of SITOR fuses to the fuse bases and safety switching devices, please refer to the "Selection and ordering data".