Use of semi-conductor fuses

Use of semi-conductor fuses in Rittal RiLine NH disconnectors/ fuse-switch disconnectors and bus-mounting fuse bases

The overload and short-circuit protection of semi-conductor components places very high demands on fuse inserts. Because semi-conductor components have a low thermal capacity, the integral disconnect value (I^2t-value) of the semi-conductor fuse inserts type aR, gR or gRL must match the integral limit value of the semi-conductor cell being protected. Consequently, the tripping characteristic of the fuse inserts must be very fast, and overvoltage during the disconnection process (switching or arc voltage) must be as minimal as possible. Compared with fuse inserts for cable and line protection and transformer protection, the particular features of semi-conductor fuse inserts produce a comparatively high heat loss.

The high heat loss is dissipated to the environment in the form of thermal energy. Because NH switchgear only has a limited capacity to dissipate thermal energy to the environment, the maximum heat loss ($P_{v\,max.}$/fuse insert) is listed in the technical specifications of the NH switchgear. If the values exceed the heat loss specified by the manufacturer, the rated current should be reduced in accordance with the table opposite, or the minimum connection cross-section increased accordingly to encourage heat dissipation.
These technical properties also apply to semi-conductor fuses based on standards IEC 60 269-3 and 60 269-4. These fuses are equivalent to the Neozed and Diazed fuses commonly available on the market, and may be physically inserted into the Rittal bus-mounting fuse bases.
Care should be taken to ensure that the heat loss of the comparable fuse with gL or gG characteristic is not exceeded. If necessary, allowance should be made for reduction factors.

Reduction factors for fuse inserts to DIN EN/IEC 60 269-2 for NH disconnectors

With due regard for the reduction factors listed in the following tables and minimum connection cross-sections, all overtemperature limits prescribed by IEC/EN 60 947-3 are met. The values were calculated on the basis of the IEC/EN standard assembly. Siemens Sitor fuses to IEC 60 269-2 were used for sample testing.

NH disconnectors, size 00

Sitor fuse insert				Min. connection cross-section (Cu)	Reduction factor	Max. operating current¹⁾
Model No.	Size	In A	Operating category	mm²		A
3NE8 017	00	50	gR	10	0.9	45
3NE8 018	00	63	gR	16	0.9	60
3NE8 020	00	80	aR	25	0.85	70
3NE8 021	00	100	aR	35	0.85	85
3NE8 022	00	125	aR	50	0.80	100
3NE8 024	00	160	aR	70	0.75	120
3NE1 021-2	00	100	gR	35	1.0	100
3NE1 022-2	00	125	gR	50	0.95	120
3NE1 022-0	00	125	gS	50	1.0	125

1) Maximum operating current figures have been rounded to the nearest 5 A.

NH disconnectors. size 1

Sitor fuse insert				Min. connection cross-section (Cu)	Reduction factor	Max. operating current[1]
Model No.	Size	In A	Operating category	mm²		A
3NE3 221	1[2]	100	aR	35	0.95	95
3NE3 222	1[2]	125	aR	50	0.9	110
3NE3 224	1[2]	160	aR	70	0.9	150
3NE3 225	1[2]	200	aR	95	0.85	170
3NE3 227	1[2]	250	aR	120	0.8	200
3NE3 230-0B	1[2]	315	aR	185	0.75	240
3NE1 225-2	1	200	gR	95	1.0	200
3NE1 227-2	1	250	gR	120	0.95	240
3NE1 230-2	1	315	gR	185	0.9	285
3NE1 230-0	1	315	gS	185	0.95	300

1) Maximum operating current figures have been rounded to the nearest 5 A.
2) Fuse design with slotted contact blades corresponding to IEC 60 269-4. Devices must only be switched while off-load.

NH disconnectors, size 2

Sitor fuse insert				Min. connection cross-section (Cu)	Reduction factor	Max. operating current[1]
Model No.	Size	In A	Operating category	mm²		A
3NE1 331-2	2	350	gR	2 x 95	1.0	350
3NE1 333-2	2	450	gR	2 x 120	0.95	425
3NE1 334-2	2	500	gR	2 x 120	0.9	450
3NE1 334-0	2	500	gS	2 x 120	1.0	500
3NE3 332-0B	2[2]	400	aR	240	0.85	340
3NE3 333	2[2]	450	aR	2 x 150	0.8	360

[1] Maximum operating current figures have been rounded to the nearest 5 A.
[2] Fuse design with slotted contact blades in accordance with IEC 60 269-4. Devices must only be switched while off-load.

NH disconnectors, size 3

Sitor fuse insert				Min. connection cross-section (Cu)	Reduction factor	Max. operating current[1]
Model No.	Size	In A	Operating category	mm²		A
3NE1 435-2	3	560	gR	2 x 185	1.0	560
3NE1 436-2	3	630	gR	2 x 40 x 5	1.0	630
3NE1 447-2	3	670	gR	2 x 40 x 5	0.95	650
3NE1 437-2	3	710	gR	2 x 40 x 5	0.9	650
3NE1 437-0	3	710	gS	2 x 40 x 5	0.95	675

[1] Maximum operating current figures have been rounded to the nearest 5 A.

Note:
Where possible, we recommend using the next-largest conductor cross-section in order to ensure superior heat dissipation. When using several NH devices close together, the rated load factor pursuant to IEC 60 439, Table 1 must be observed. For configuration of the busbar system, we recommend the following design, depending on the size of the NH disconnector:

NH disconnector size	Busbar system
NH 00	At least 30 x 5 mm
NH 1 – 2	At least 30 x 10 mm
NH 3	PLS 1600

Heat loss of fuse inserts for bus-mounting fuse bases

The following table shows the maximum power output per fuse insert for Rittal D 02/D II and D III fusible elements. These values are based on DIN VDE 0636-3 and HD 60 269-3 “Low-voltage fuses Part 3: Supplementary requirements for use by unskilled persons”, Table 101. For other heat losses, it is necessary to calculate application-dependent reduction factors for the rated current. This primarily concerns applications with fuse characteristics aR or gR (semi-conductor fuses), which may have considerably greater heat losses by virtue of their design.

Rated current I_n A	Maximum power output W	
	D 01/D 02	D II/D III
2	2.5	3.3
4	1.8	2.3
6	1.8	2.3
10	2.0	2.6
13	2.2	2.8
16	2.5	3.2
20	3.0	3.5
25	3.5	4.5
35	4.0	5.2
50	5.0	6.5
63	5.5	7.0