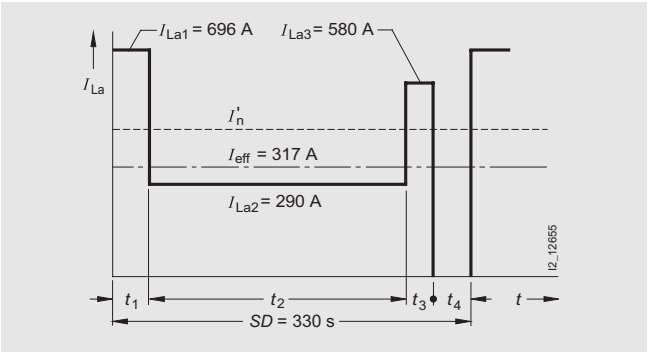
Notes on Dimensioning

Specifying the rated current

Varying load with known load cycle



Direct current:
I_{d1} = 1200 A t_1 = 20 s
I_{d2} = 500 A t_2 = 240 s
I_{d3} = 1000 A t_3 = 10 s
I_{d4} = 0 A t_4 = 60 s

Fuse current:
I_{La1} = 1200 x 0.58 = 696 A
I_{La2} = 500 x 0.58 = 290 A
I_{La3} = 1000 x 0.58 = 580 A

R.m.s. value of load current

$$I_{eff} = \sqrt{\frac{696^2 \times 20 + 290^2 \times 240 + 580^2 \times 10}{330}} = 317\,A$$

Selected:
3NE3 333 SITOR fuse link
(450 A/1000 V), WL = 1
breaking I^2t value I^2t_A = 175 x 10^3 x 0.53 = 93 x 10^3 A^2s
test cross-section to page 2/78: 320 mm^2

The following correction factors are to be applied:

k_u = 1.02 (ϑ_u = +35 °C)

k_q = 0.94 (conductor cross-section, double-ended, 50 % of test cross-section)

k_λ = 1.0 (conduction angle λ = 120°)

k_l = 1.0 (no forced-air cooling)

1. Required rated current I_n of the SITOR fuse link:

$$I_n \geq I_{eff} \times \frac{1}{k_u \times k_q \times k_\lambda \times k_l \times WL} =$$

$$317\ A \times \frac{1}{1,02 \times 0,94 \times 1,0 \times 1,0 \times 1,0} = 331\,A$$

Permissible load current I_n' of the selected fuse link:

$I_n' = k_u$ x k_q x k_λ x k_l x WL x I_n = 1.02 x 0.94 x 1.0 x 1.0 x 1.0 x 450 = 431 A

2. Checking the permissible overload duration of current blocks exceeding the permissible fuse load current I_n'.

Previous load ratio:

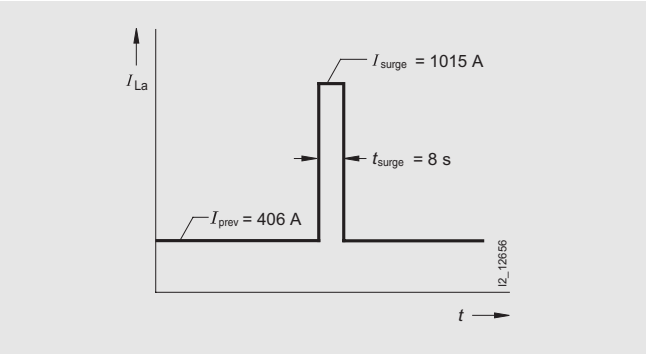
$$V = \frac{I_{eff}}{I_n'} = \frac{317}{431} = 0,74$$

Residual value factor *RW*: for V = *0.74 of curve a (*characteristic curve page 2/82, frequent surge/load cycle currents) *RW* = 0.2

Current block I_{La1}: melting time t_{vs}: 230 s (from time/current characteristic curve for 3NE3 333) t_{vs} x *RW* = 230 s x 0.2 = 46 s > t_1

Current block I_{La3}: melting time t_{vs}: 1200 s from time/current characteristic curve for 3NE3 333) t_{vs} x *RW* = 1200 s x 0.2 = 240 s > t_3

Occasional surge load from preloading with unknown surge outcome



Direct current:
I_{dprev} = 700 A
I_{dsurge} = 500 A t_{surge} = 8 s

Fuse current:
I_{prev} = I_{dprev} x 0.58 = 406 A
I_{surge} = I_{dsurge} x 0.58 = 1015 A

Conditions:
$t_{interval} \geq 3\ t_{surge}$ and $t_{interval} \geq 5$ min must be fulfilled.

Selected:
3NE3 333 SITOR fuse link
(560 A/1000 V), WL = 1
breaking I^2t value I^2t_A = 360 x 10^3 x 0.53 = 191 x 10^3 A^2s
test cross-section to page 2/78: 400 mm^2

The following correction factors are to be applied:

k_u = 1.02 (ϑ_u = +35 °C)

k_q = 0.91 (conductor cross-section, double-ended, 40 % of test cross-section)

k_λ = 1.0 (conduction angle λ = 120°)

k_l = 1.0 (no forced-air cooling)

1. Required rated current I_n of the SITOR fuse link:

$$I_n \geq I_{prev} \times \frac{1}{k_u \times k_q \times k_\lambda \times k_l \times WL} =$$

$$406\ A \times \frac{1}{1,02 \times 0,91 \times 1,0 \times 1,0 \times 1,0} = 437\,A$$

Permissible load current I_n' of the selected fuse link:

$I_n' = k_u$ x k_q x k_λ x k_l x WL x I_n =
1.02 x 0.91 x 1.0 x 1.0 x 1.0 x 560 = 520 A

2. Checking the permissible overload duration of the surge current I_{surge}

Previous load ratio:

$$V = \frac{I_{prev}}{I_n'} = \frac{406}{520} = 0,78$$

Residual value factor *RW*: for V = *0.78 of curve a (*characteristic curve page 2/82, frequent surge/load cycle currents) *RW* = 0.18

Surge current I_{surge}: melting time t_{vs}: 110 s (from time/current characteristic curve for 3NE3 333) t_{vs} x *RW* = 110 s x 0.18 = 19.8 s > t_{surge}

Correction factors can be found on page 2/78 and page 2/79.