

# Battery Fuse

## Applications:

- ✓ in battery storage systems
- ✓ in UPS systems
- ✓ in e-mobility

**BATTERY FUSE**

**BECAUSE EVERY SECOND COUNTS**



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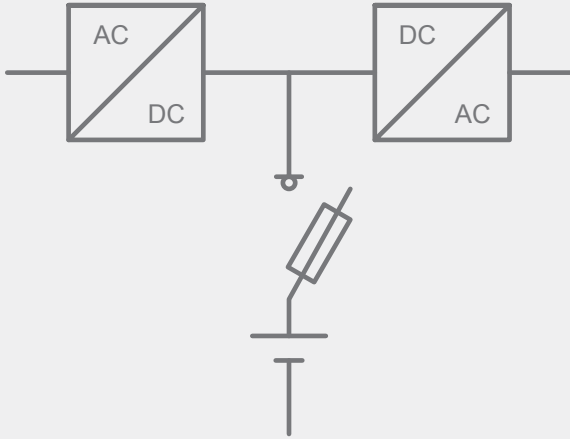
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# Battery Protection Fuses

## Battery storage fuse selection



### Short circuit current

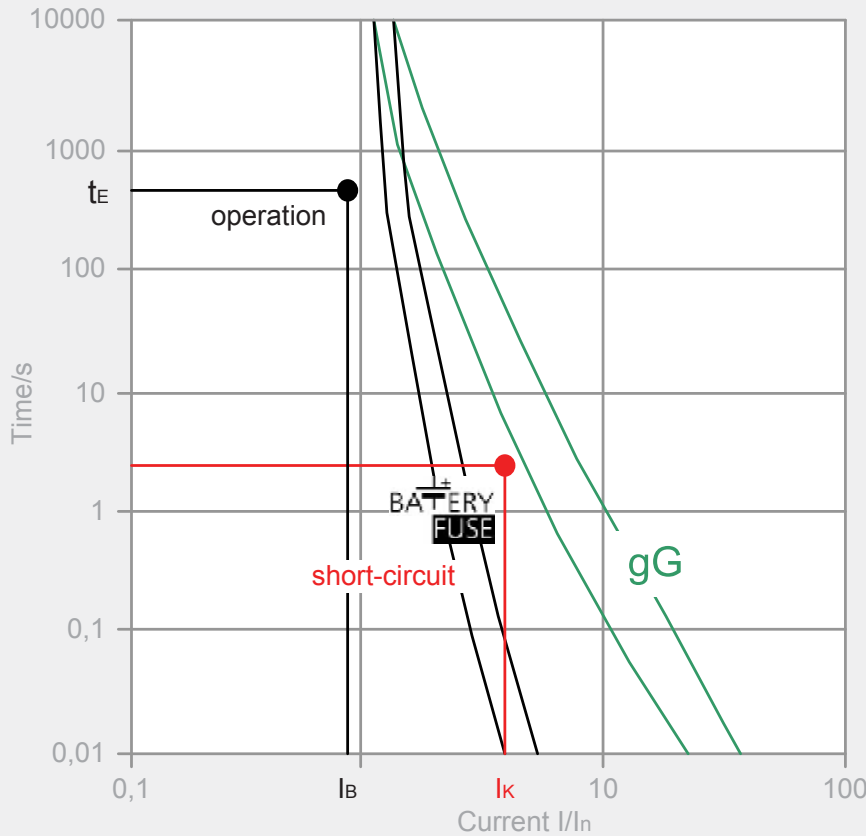
- Short circuit current depending on battery model, type and capacity, low compared to operating current
- Short circuit current has to be interrupted in <5 seconds

**Required steep characteristics: protection with Battery fuse link required!**

### Operating current

- Operating current depends on battery storage specification
- Battery operation: voltage of DC link circuit decreases to the final discharge voltage

**Consider maximum current at final discharge voltage for fuse link selection**



**In accordance with IEC SC 32B standardisation work.**

### Short circuit point ( $I_k$ )

- Short circuit current depending on battery model and type
- Manufacturer datasheets to include short circuit current according to IEC896
- Operating point has to be in adequate distance below the curve
- Short-circuit point has to be above the range of tolerance of the curve

### Operating point ( $t_E/I_B$ )

- maximum operating current  $I_B$  has to be calculated from battery storage true power and final discharge voltage  $U_E$ :  $I_B = P_w / U_E$
- $t_E$  is the back-up time of battery storage system

**When choosing fuse switch disconnector consider fuse link power dissipation!**

$$P_d(I_B) < P_y$$

Power dissipation of fuse link at maximal operating current ( $I_B$ ):

$$P_d(I_B) = (I_B / I_n)^2 \times P_d(I_n)$$

$I_B$  - maximal operating current

$P_d(I_B)$  - power dissipation of fuse link at maximal operating current

$P_d(I_n)$  - power dissipation of fuse link at nominal current

$P_y$  - maximal permissible fuse link power dissipation mounted in fuse switch disconnector

# Applications



# CH 10x38 BATTERY Fuse link 550V d.c.

General characteristics	
Rated voltage	550V d.c. (L/R=10ms)
Breaking capacity	30kA d.c.
Standard	IEC 60269
Application	Battery protection

CH BATTERY fuse link									
Size	$I_n$ [A]	Code No. "standard contacts" 550V DC 30kA	Code No. "type SU contacts" 550V DC 30kA	Pre-arcing Joule integral L/R=10ms [A <sup>2</sup> s]	Operating Joule integral L/R=10ms [A <sup>2</sup> s]	Power dissipation [0,7 x $I_n$ ] $P_d$ [W]	Power dissipation [1x $I_n$ ] $P_d$ [W]	Weight [g]	Pack. [pcs]
10x38	2	002626002	002626102	1,1	1,8	0,47	1,12	10/12	10/500 SU: 10/380
	4	002626004	002626104	3,0	7,8	0,52	1,25		
	6	002626006	002626106	14,1	27,3	0,73	1,75		
	8	002626008	002626108	25,1	53,4	0,8	1,9		
	10	002626010	002626110	8,0	18,8	0,97	2,4		
	12	002626012	002626112	18,5	41,5	0,8	1,9		
	16	002626016	002626116	42	88	1,1	2,6		
	20	002626020	002626120	86	166	1,3	3,2		
	25	002626025	002626125	140	270	1,65	4,1		



Note:  
CH Battery fuse links are used in combination  
with fuse disconnecter EFH 10 DC

## CH 10x38 BATTERY Fuse link 800V d.c.

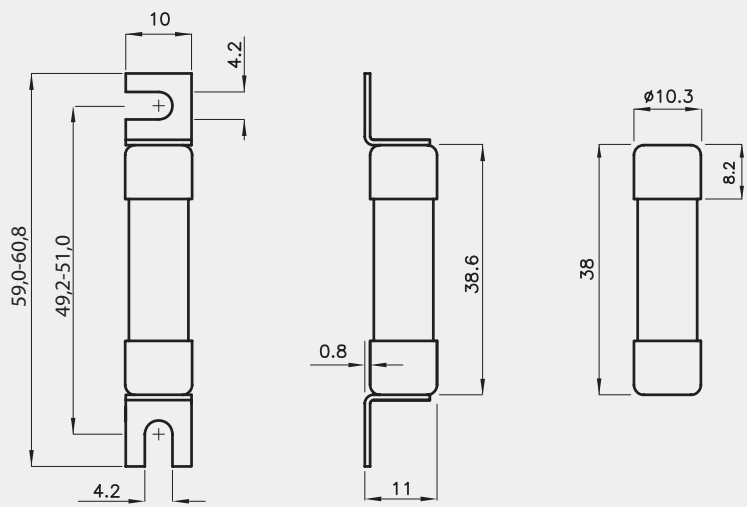
General characteristics	
Rated voltage	800V d.c. (L/R=10ms)
Breaking capacity	30kA d.c.
Standard	IEC 60269
Application	Battery protection

CH BATTERY fuse link									
Size	$I_n$	Code No. "standard contacts" 800V DC	Code No. "type SU contacts" 800V DC	Pre-arcing Joule integral L/R=10ms	Operating Joule integral L/R=10ms	Power dissipation [0,7 x $I_n$ ] $P_d$	Power dissipation [1x $I_n$ ] $P_d$	Weight	Pack.
	[A]	30kA	30kA	[A <sup>2</sup> s]	[A <sup>2</sup> s]	[W]	[W]	[g]	[pcs]
10x38	2	002626030	002626130	1,2	1,6	0,47	1,12	10/12	10/500 SU: 10/380
	4	002626032	002626132	3,6	8,9	0,52	1,25		
	6	002626034	002626134	9,5	27,2	0,73	1,75		
	8	002626036	002626136	27,3	65,8	0,8	1,9		
	10	002626038	002626138	8,2	26,6	0,97	2,4		
	12	002626040	002626140	20,6	54,6	0,8	1,9		
	16	002626042	002626142	44,4	109,3	1,1	2,6		

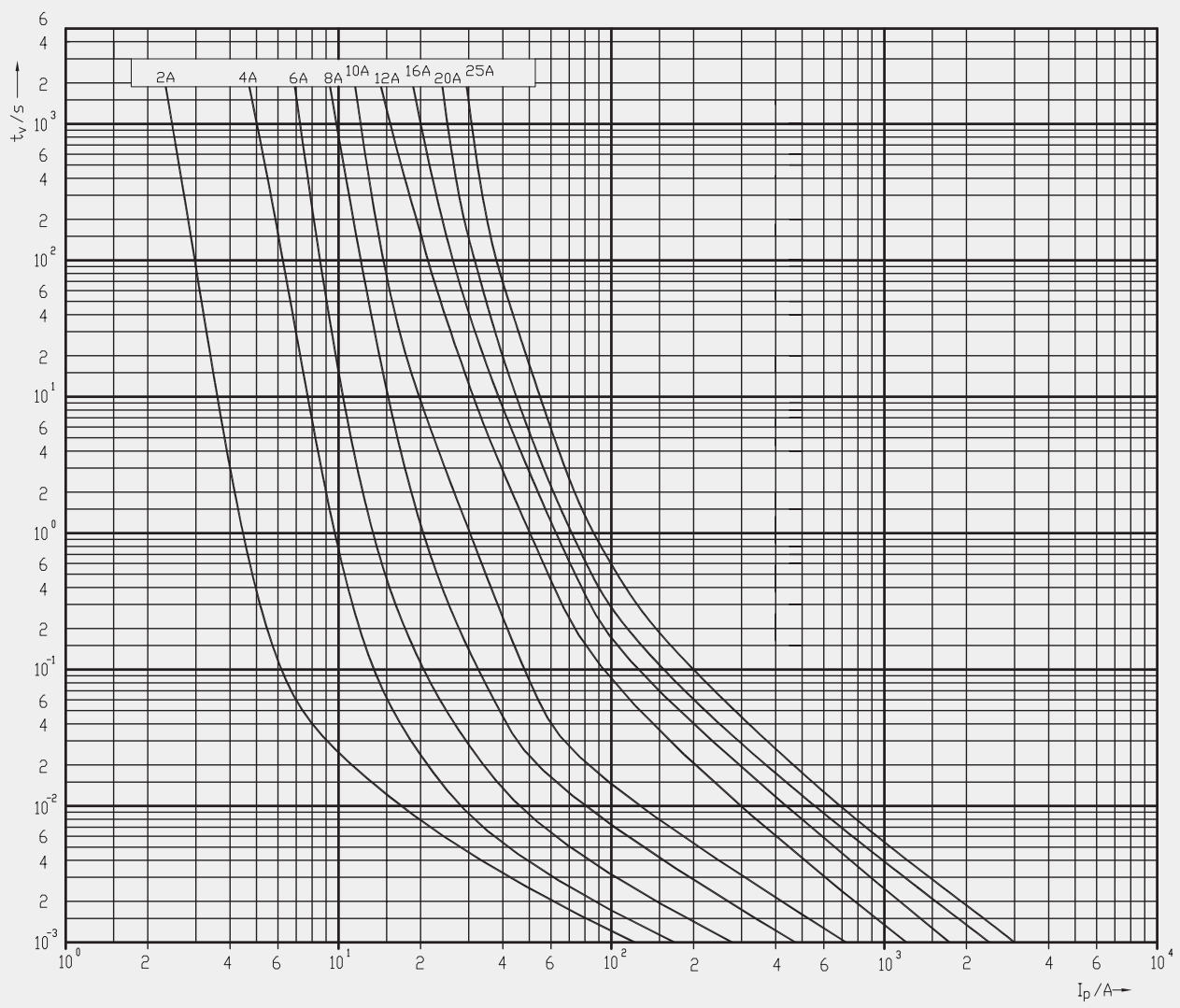


Note:  
CH Battery fuse links are used in combination  
with fuse disconnecter EFH 10 DC

### Dimensions for CH 10x38 Battery fuses



### I/t characteristics for CH 10x38 Battery fuses



## CH 14x51 BATTERY Fuse link 800V d.c.

General characteristics	
Rated voltage	800V d.c. (L/R=10ms)
Breaking capacity	30kA d.c.
Standard	IEC 60269
Application	Battery protection

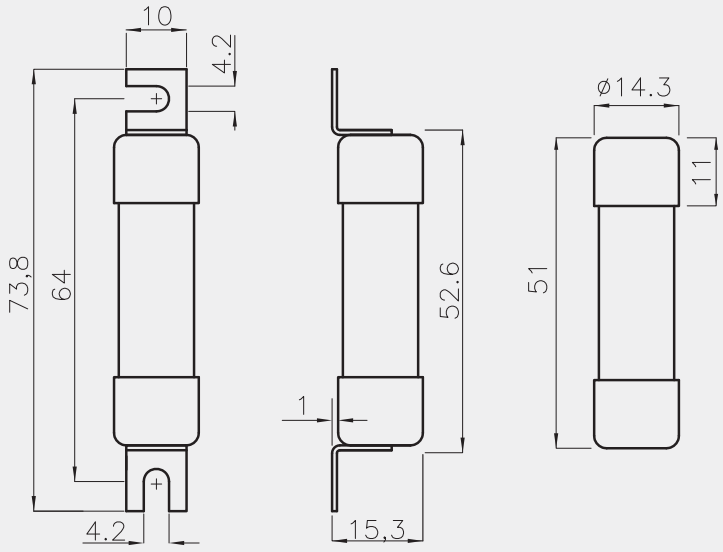
CH BATTERY fuse link									
Size	$I_n$	Code No. "standard contacts" 800V DC	Code No. "type SU contacts" 800V DC	Pre-arcing Joule integral L/R=10ms	Operating Joule integral L/R=10ms	Power dissipation [0,7 x $I_n$ ] $P_d$	Power dissipation [1x $I_n$ ] $P_d$	Weight	Pack.
	[A]	30kA	30kA	[A <sup>2</sup> s]	[A <sup>2</sup> s]	[W]	[W]	[g]	[pcs]
14x51	16	002637405	002637505	37	136	1,4	3,1	19/21	10/200 SU: 10/260
	20	002637407	002637507	80	284	1,5	3,2		
	25	002637409	002637509	128	438	2	4		
	32	002637411	002637511	296	1050	2,1	5,1		
	36	002637412	002637512	370	1160	2,3	5,6		



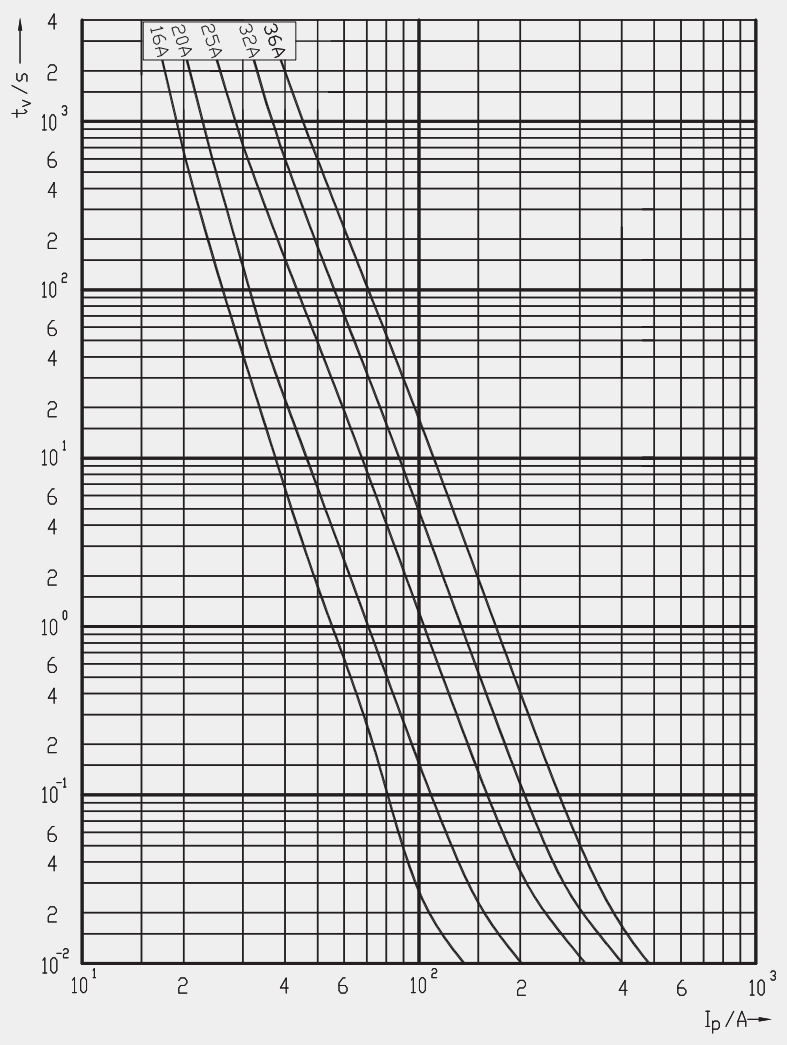
Note:

CH Battery fuse links are used in combination  
with fuse disconnecter EFH 14 DC

### Dimensions for CH 14x51 Battery fuses



### I/t characteristics for CH 14x51 Battery fuses





## CH fuse holder for DC applications

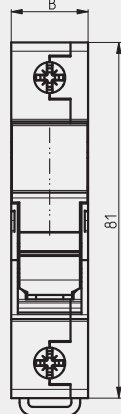
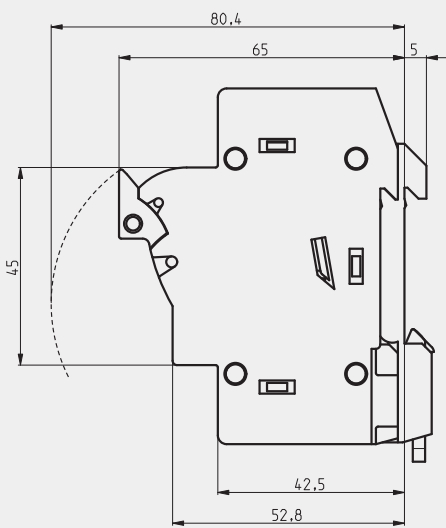
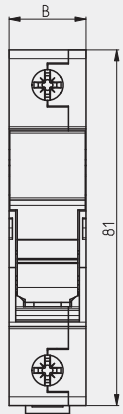
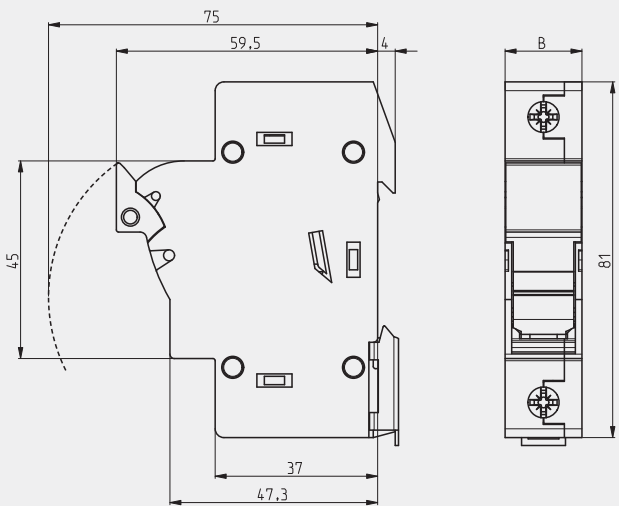
Technical data				
Fuse type	EFH 10 DC		EFH 14 DC	
	CH 10x38 DC		CH 14x51 DC	
	IEC	UL	IEC	UL
Versions	Without indicator, LED indicator			
Number of poles	1p, 2p, 2p+N+S			
Rated operational voltage Ue	1000V d.c.			
Rated operational current Ie	25A		50A	
Rated conditional short-circuit current	30kA	10kA	30kA	10kA
Rated insulation voltage Ui	1000V		1000V	
Rated imp. withstand voltage Uimp	8kV		8kV	
Required insulation temperature rating		60°C		60°C
Max power dissipation of the fuse-link	3W		5W	
Derating factor of current I <sub>n</sub> for different ambient temperatures	20°	1		
	30°	0,95		
	40°	0,9		
	50°	0,8		
	60°	0,7		
	70°	0,5		
Derating factor of current I <sub>n</sub> for side by side mounting fuse holders (nr. of poles)	1-4	1		
	5-6	0,8		
	7-9	0,7		
	≥10	0,6		
LED indicator operating range	80V - 1000V d.c.			
Utilization category	Do not operate under load			
Operational performance (cycles with current)	0		0	
Operational performance (cycles without current)	2000		2000	
Inclined Plane Tracking (IPT)		60min / 1kV		60min / 1kV
Humidity	90% / 20°C		90% / 20°C	
Operating ambient temperature	-5°C ... +40°C		-5°C ... +40°C	
Store ambient temperature	-25°C ... +55°C		-25°C ... +55°C	
Degree of protection (IEC 60529)	IP 20		IP 20	
Terminal capacity	1-25mm <sup>2</sup>	AWG 18-8, solid&stranded, Cu only	1,5-35mm <sup>2</sup>	AWG 16-6, solid&stranded, Cu only
Screw	PZ M5	PZ M5	PZ M5	PZ M5
Torque	2Nm	2Nm, 17,7 lb-in	2,5-3Nm	2Nm, 17,7 lb-in
Mounting on EN 60715 rail	35mm rail			
Sealing possibility	ON and OFF			
Standards - fuse links	IEC/EN 60269-2, IEC/EN 60269-6, UL 284-4	IEC/EN 60269-2, IEC/EN 60269-6, UL 284-4	IEC/EN 60269-2, IEC/EN 60269-6, UL 284-4	UL 248-4, IEC/EN 60269-2
Standards - fuse holders	IEC 60947-1, IEC 60947-3	UL 4248-1*, UL 4248-18*, UL 486E*, CSA C22.2 No.65*	IEC 60947-1, IEC 60947-3	UL 4248-1*, UL 4248-18*, UL 486E*
Test reports	Int	UL	Int	UL
Certificates		UL Listed		UL Listed

\*Not for 2p+N+S

# EFH 10 DC - Fuse holder

EFH 10 DC							
Number of poles	$U_e/U_i$ [V]	$I_{max.}$ [A]	Code No.	Indicator	Adapter	Weight [g]	Pack. [pcs]
1p	1000V d.c.	25	002540201	-	-	63	12/108
			002540211	LED	-	64	
			002540501	-	✓	68	
			002540511	LED	✓	69	
2p			002540203	-	-	124	6/54
			002540213	LED	-	125	
			002540503	-	✓	134	
			002540513	LED	✓	135	
2p+N+S*			002540204	-	-	257	3/27

\*Only IEC certified



Version with adapter

	B
1p	17,5
2p	35
2p+N+S	70

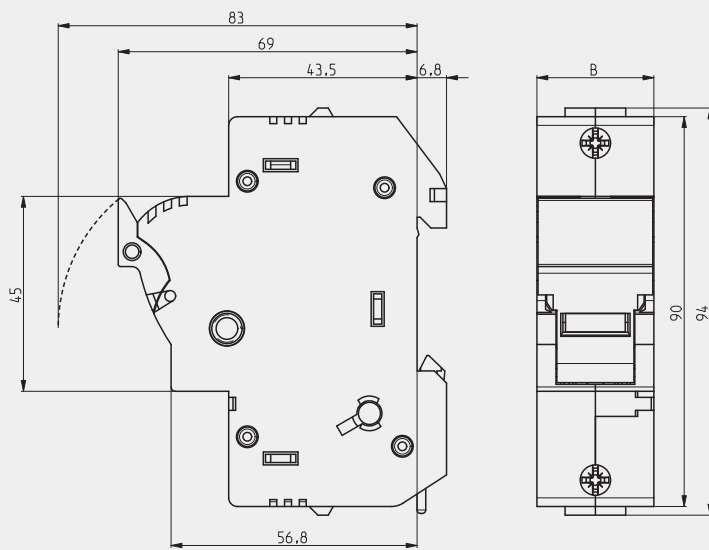


# EFH 14 DC - Fuse holder

EFH 14 DC						
Number of poles	$U_e/U_i$ [V]	$I_{max.}$ [A]	Code No.	Indicator	Weight [g]	Pack. [pcs]
1p	1000V d.c.	50	002560201	-	102	12/96
			002560211	LED	103	
2p			002560203	-	206	6/48
			002560213	LED	208	
2p+N+S*			002560205	-	452	3/24

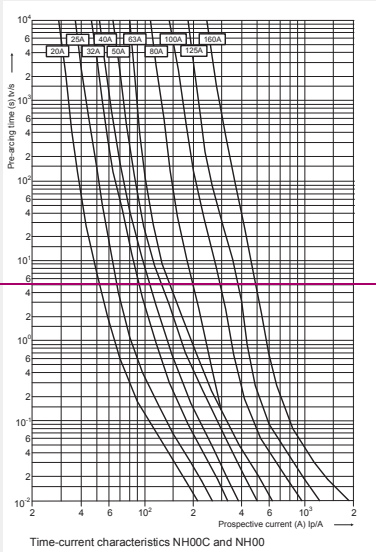
\*Only IEC certified

	B
1p	27
2p	54
2p+N+S	108



# NH BATTERY fuse link 80V d.c.

Low power dissipation and fast characteristic in time range of 5s!

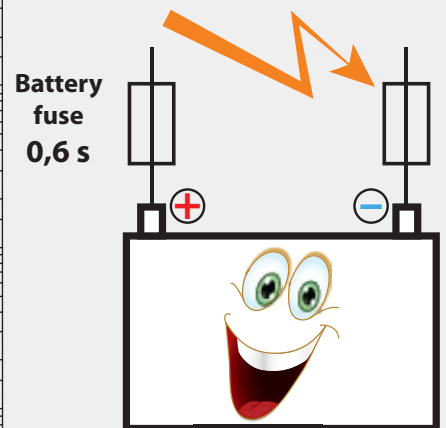
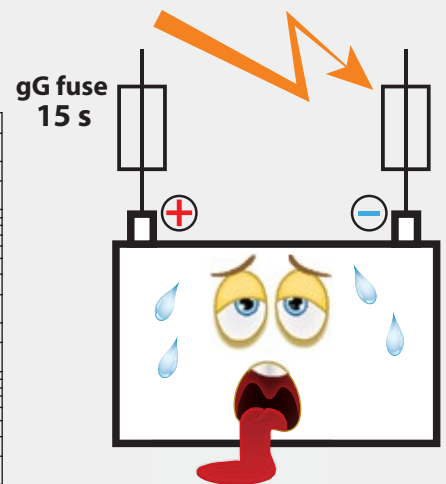
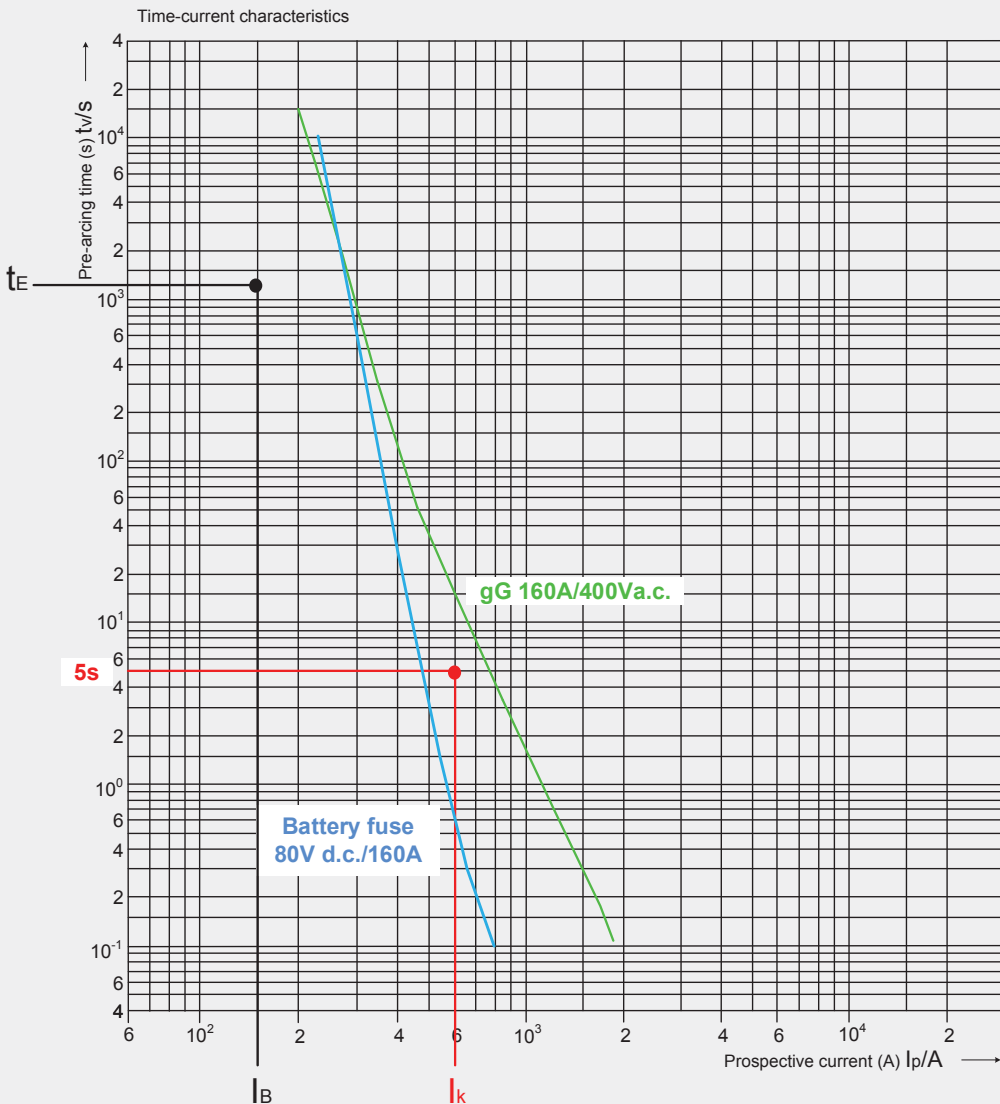


5s

$I_k$

Discharge	-20~60°C
Charge	-10~60°C
Storage	-20~60°C
Max. Discharge Current 77°F(25°C)	1000A(5s)
Short Circuit Current	3300A
Charge Methods: Constant Voltage Charge 77°F(25°C)	
Cycle use	14.4-14.7V
Maximum charging current	60A
Temperature compensation	-30mV/°C

Better protection of battery cells on overheating in case of short circuit comparable to standard gG characteristic

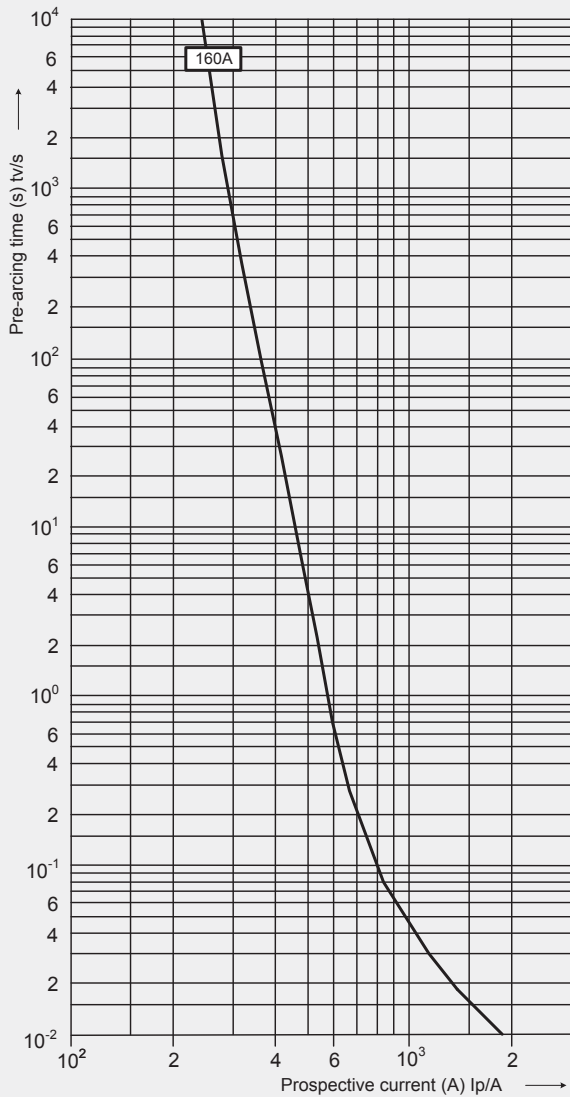


### General characteristics

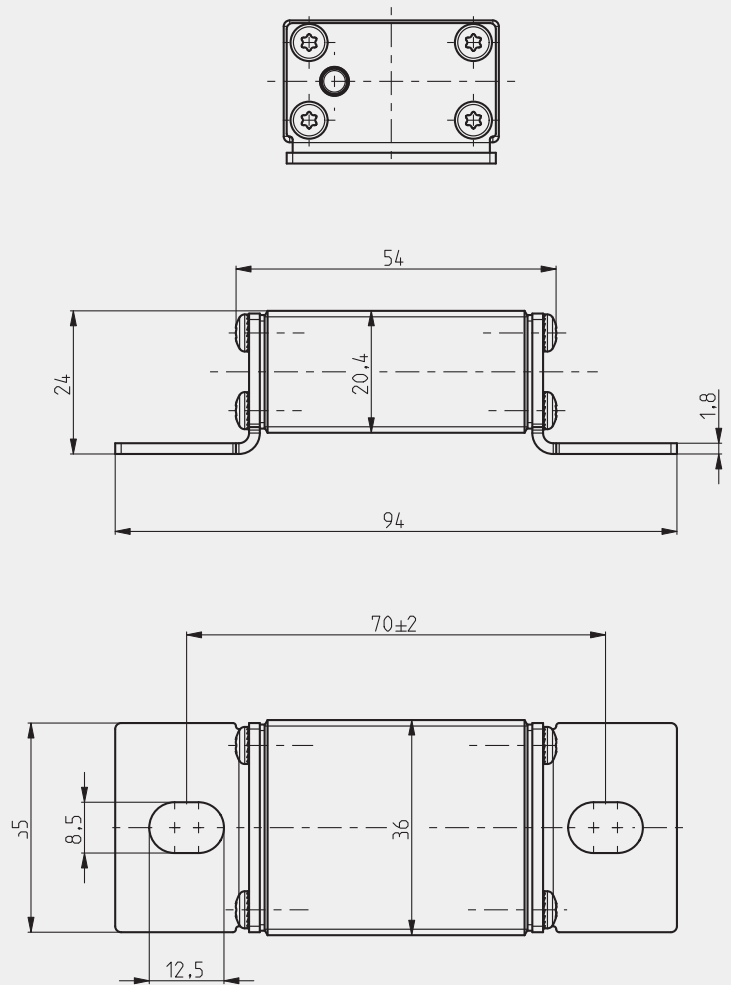
Rated voltage	80V d.c., L/R=10ms
Breaking capacity	30kA d.c..
Standard	IEC 60269
Application	Battery protection

### NH 000L Battery fuse link 80V d.c.

Size	$I_n$ [A]	Code No.	Power dissipation [W]	Pre-arcing Joule integral [A <sup>2</sup> s]	Operat- ing Joule integral [A <sup>2</sup> s]	Weight [g]	Pack. [pcs]
000L	160	004110070	15,5	27.000	30.000	125	3/120



Time-current characteristics NH000L

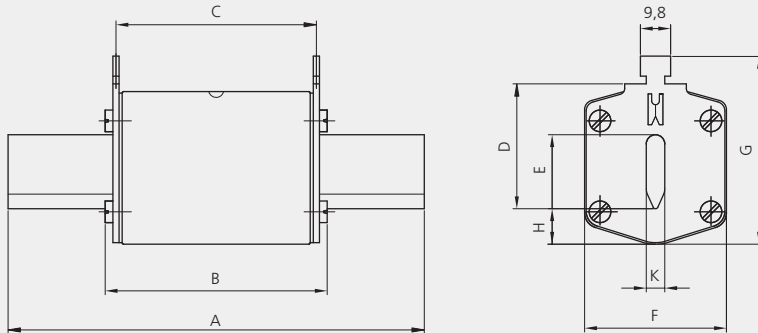


General characteristics	
Rated voltage	80V d.c., L/R=10ms
Breaking capacity	50kA d.c..
Standard	IEC 60269
Application	Battery protection

NH BATTERY fuse link 80V d.c.								
Size	$I_n$	Standard indicator	Power dissipation	Power dissipation $0,7 \times I_n$	Pre-arcing Joule integral	Operating Joule integral	Weight	Pack.
	[A]	pic. 1	[W]	[W]	[A <sup>2</sup> s]	[A <sup>2</sup> s]	[g]	[pcs]
00C	20	004110075	4,6	2	360	414	125	3/120
	25	004110076	5,8	2,6	710	817		
	32	004110077	6,6	3	920	1.058		
	40	004110078	9,4	4,2	1.440	1.656		
	50	004110079	11,1	5	2.820	3.243		
00	63	004110080	11,7	5,2	4.160	4.784	173	3/90
	80	004110081	10,4	4,7	4.670	5.371		
	100	004110082	11,1	5	9.360	10.764		
	125	004110083	13,4	6	14.750	16.963		
	160	004110084	15,5	7	27.880	32.062		
1C	20	004110085	6,3	2,8	360	414	233	3/45
	25	004110086	7,3	3,3	710	817		
	32	004110087	9	4	920	1.058		
	40	004110088	11,2	5	1.440	1.656		
	50	004110089	14,5	6,5	2.820	3.243		
	63	004110090	16,8	7,5	4.160	4.784		
	80	004110091	11,4	5,1	4.670	5.371		
	100	004110092	12	5,4	9.360	10.764		
1	125	004110093	14,8	6,6	14.750	16.963	430	3/24
	160	004110094	17,6	7,9	27.880	32.062		
	200	004110095	26,6	11,9	41.990	48.289		
	250	004110096	31	13,9	81.000	93.150		

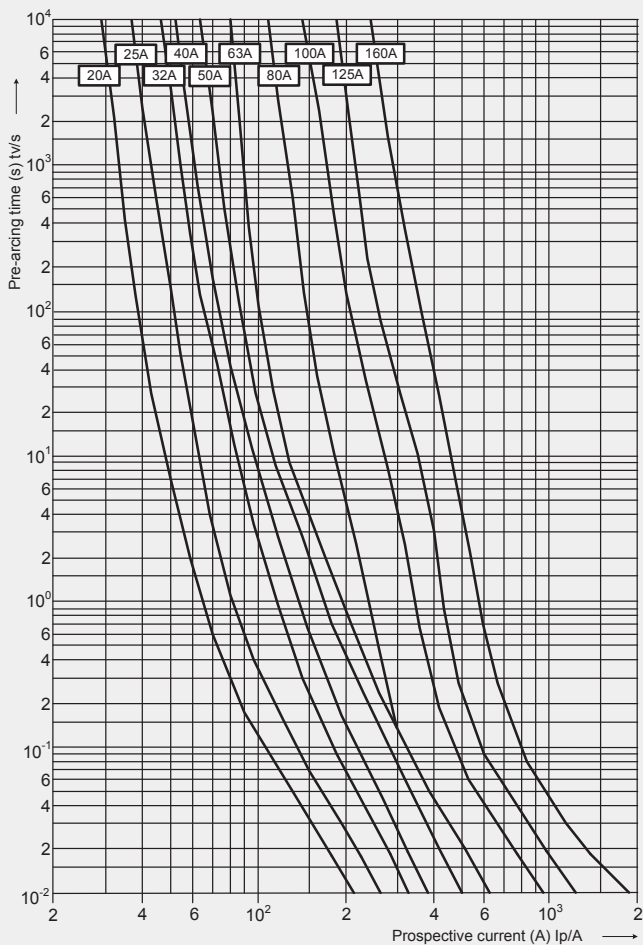


## Dimensions

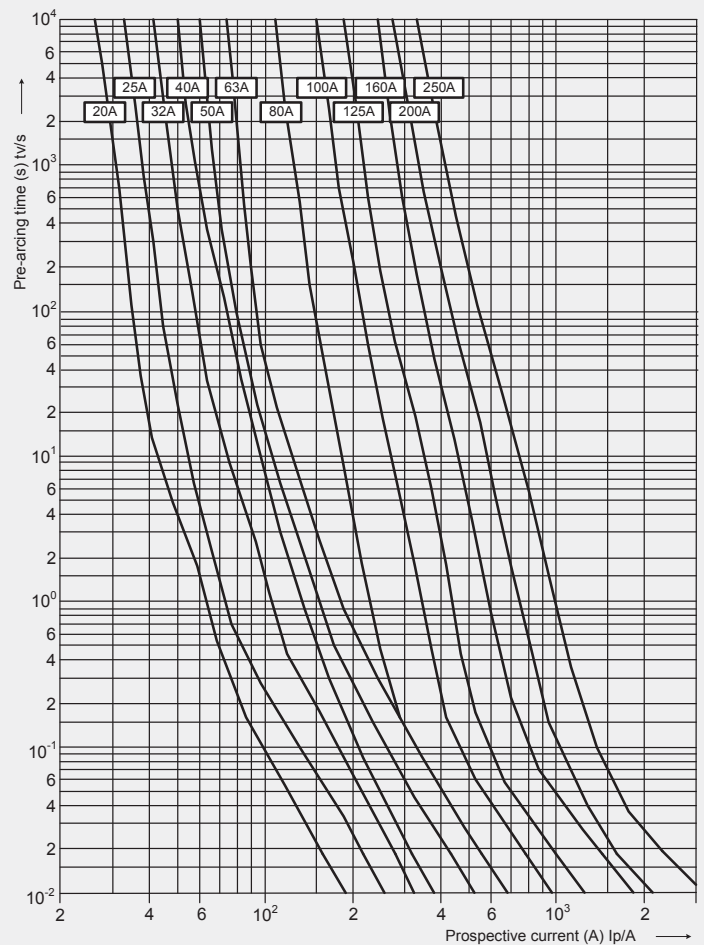


	A	B	C	D	E	F	G	H	K
00 C	79	53	47	35	15	21	52	7,5	6
00	79	53	47	35	15	28	56	12	6
1 C	135	68	65	40	15	28	61	12	6
1	135	72	65	40	20	46	65	14	6

## I/t characteristics for NH Battery fuses



Time-current characteristics NH00C and NH00

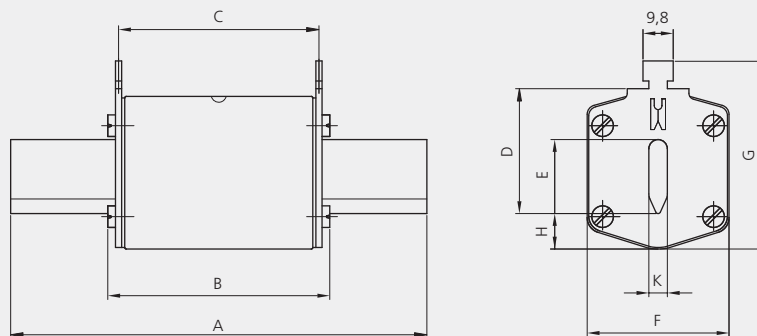


Time-current characteristics NH1C and NH1

# NH BATTERY fuse link 440V d.c.

General characteristics	
Rated voltage	440V d.c., L/R=10ms
Breaking capacity	30kA d.c.
Standard	IEC 60269
Application	Battery protection

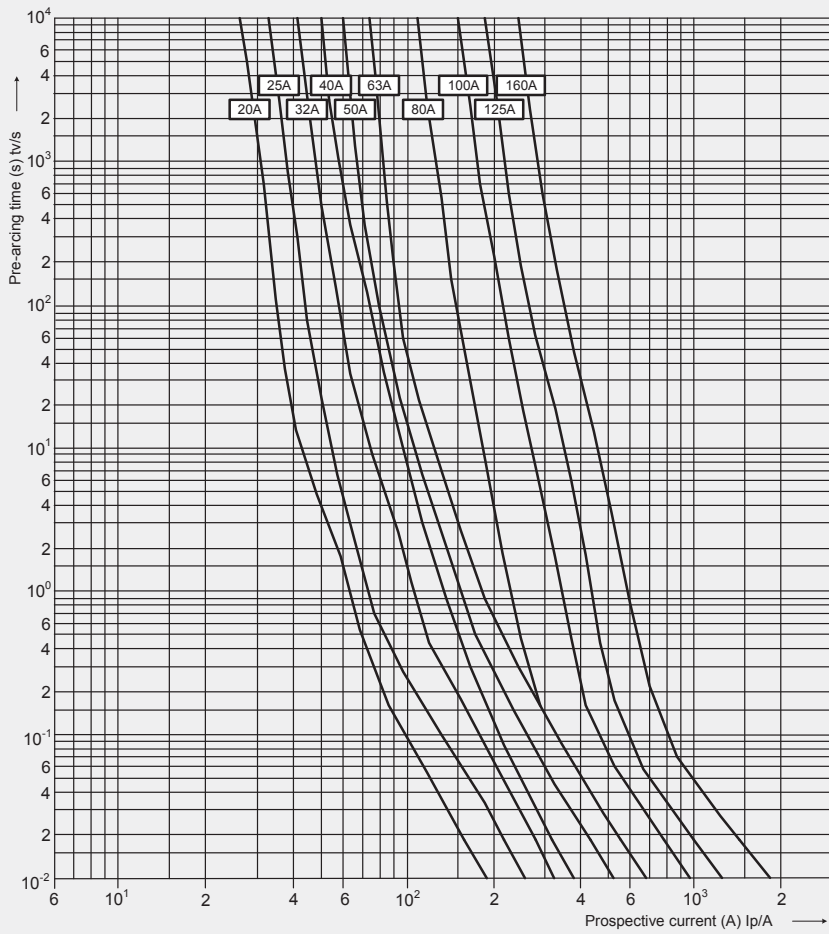
NH BATTERY fuse link 440 V d.c.								
Size	$I_n$	Standard indicator	Power dissipation	Power dissipation $0,7 \times I_n$	Pre-arcing Joule integral L/R=10ms	Operating Joule integral L/R=10ms	Weight	Pack.
	[A]		[W]	[W]	[A <sup>2</sup> s]	[A <sup>2</sup> s]	[g]	[pcs]
00	32	004110209	6,6	3	920	1.656	173	3/90
	40	004110219	9,4	4,2	1.440	2.592		
	50	004110218	11,1	5	2.820	5.076		
	63	004110217	11,7	5,2	4.160	7.488		
	80	004110216	10,4	4,7	4.670	8.406		
	100	004110215	11,1	5	9.360	16.848		
1C	20	004723103	6,3	2,8	360	648	233	3/45
	25	004723104	7,3	3,3	710	1.278		
	32	004723105	9	4	920	1.656		
	40	004723106	11,2	5	1.440	2.592		
	50	004723107	14,5	6,5	2.820	5.076		
	63	004723108	16,8	7,5	4.160	7.488		
	80	004723109	11,4	5,1	4.670	8.406		
	100	004723110	12	5,4	9.360	16.848		
	125	004723111	14,8	6,6	14.750	26.550		
	160	004723112	17,6	7,9	27.880	50.184		



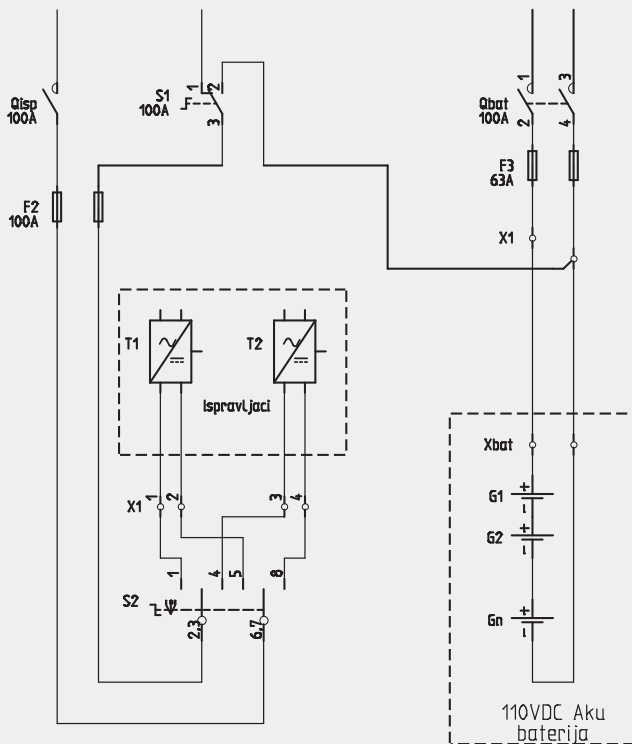
	A	B	C	D	E	F	G	H	K
00	79	53	47	35	15	28	56	12	6
1C	135	68	65	40	15	28	61	12	6



## I/t characteristics



## Application



# NH BATTERY fuse link 550V d.c.



General characteristics	
Rated voltage	550V d.c. (L/R=10ms)
Breaking capacity	30kA d.c.
Standard	IEC 60269
Application	Battery protection

## NH BATTERY fuse link 550 V d.c.

Size	$I_n$	Standard indicator	Striker indicator	Standard indicator S110mm	Power dissipation	Power dissipation $0,7 \times I_n$	Preclearing Joule integral L/R=10ms	Operating Joule integral L/R=10ms	Weight	Pack.
	[A]	pic. 1	pic. 1	pic. 2	[W]	[W]	[A <sup>2</sup> s]	[A <sup>2</sup> s]	[g]	[pcs]
1	40	004723259	004723279	004723269	6	2,7	250	833	420	3/24
	50	004723260	004723280	004723270	7	3,1	449	1.495		
	63	004723261	004723281	004723271	9	4	700	2.331		
	80	004723262	004723282	004723272	12	5,4	1.200	3.996		
	100	004723263	004723283	004723273	15	6,7	1.650	5.495		
	125	004723264	004723284	004723274	20	9	2.200	7.326		
	160	004723265	004723285	004723275	26	11,7	4.300	14.319		
	200	004723266	004723286	004723276	32	14,4	8.500	28.305		
	224	004723267	004723287	004723277	37	16,6	10.000	33.300		
	250	004723268	004723288	004723278	43	19,3	15.000	50.000		
2	125	004724260	004724280	004724270	20	9	2.200	10.296	660	3/24
	160	004724261	004724281	004724271	26	11,7	4.300	20.124		
	200	004724262	004724282	004724272	32	14,4	8.500	39.780		
	224	004724263	004724283	004724273	37	16,6	10.000	46.800		
	250	004724264	004724284	004724274	43	19,3	15.000	70.200		
	315	004724265	004724285	004724275	57	26,6	20.000	93.600		
	350	004724266	004724286	004724276	67	30	28.000	131.040		
3	400	004724267	004724287	004724277	76	34,2	32.000	150.000	870	3/24
	250	004725260	004725280	004725270	43	19,3	15.000	65.550		
	315	004725261	004725281	004725271	57	26,6	20.000	87.400		
	350	004725262	004725282	004725272	67	30	28.000	122.360		
	400	004725263	004725283	004725273	76	34,2	32.000	139.840		
	425	004725264	004725284	004725274	84	37,8	40.000	174.800		
	500	004725265	004725285	004725275	110	49,5	44.000	192.280		
	630	004725266	004725286	004725276	160	72	80.000	350.000		

# NH BATTERY fuse link 700V d.c.

General characteristics	
Rated voltage	700V d.c. (L/R=10ms)
Breaking capacity	30kA d.c.
Standard	IEC 60269
Application	Battery protection



NH BATTERY fuse link 700 V d.c.										
Size	$I_n$	Standard indicator	Striker indicator	Standard indicator S110mm	Power dissipation	Power dissipation $0,7 \times I_n$	Pre-arcing Joule integral L/R=10ms	Operating Joule integral L/R=10ms	Weight	Pack.
	[A]	pic. 1	pic. 1	pic. 2	[W]	[W]	[A <sup>2</sup> s]	[A <sup>2</sup> s]	[g]	[pcs]
1	40	004723289	004723309	004723299	6	2,7	250	1.000	420	3/24
	50	004723290	004723310	004723300	7	3,1	449	1.796		
	63	004723291	004723311	004723301	9	4	700	2.800		
	80	004723292	004723312	004723302	12	5,4	1.200	4.800		
	100	004723293	004723313	004723303	15	6,7	1.650	6.600		
	125	004723294	004723314	004723304	20	9	2.200	8.800		
	160	004723295	004723315	004723305	26	11,7	4.300	17.200		
	200	004723296	004723316	004723306	32	14,4	8.500	34.000		
	224	004723297	004723317	004723307	37	16,6	10.000	40.000		
	250	004723298	004723318	004723308	43	19,3	15.000	60.000		
2	125	004724290	004724310	004724300	20	9	2.200	11.682	660	3/24
	160	004724291	004724311	004724301	26	11,7	4.300	22.833		
	200	004724292	004724312	004724302	32	14,4	8.500	45.135		
	224	004724293	004724313	004724303	37	16,6	10.000	53.100		
	250	004724294	004724314	004724304	43	19,3	15.000	79.650		
	315	004724295	004724315	004724305	57	26,6	20.000	106.200		
	350	004724296	004724316	004724306	67	30	28.000	148.680		
3	400	004724297	004724317	004724307	76	34,2	32.000	170.000	870	3/24
	250	004725290	004725304	004725297	43	19,3	15.000	75.000		
	315	004725291	004725305	004725298	57	26,6	20.000	100.000		
	350	004725292	004725306	004725299	67	30	28.000	140.000		
	400	004725293	004725307	004725300	76	34,2	32.000	160.000		
	425	004725294	004725308	004725301	84	37,8	40.000	200.000		
	500	004725295	004725309	004725302	110	49,5	44.000	220.000		
	630	004725296	004725310	004725303	160	72	80.000	400.000		

# NH BATTERY fuse link 800V d.c.

General characteristics	
Rated voltage	800V d.c. (L/R=10ms)
Breaking capacity	30kA d.c.
Standard	IEC 60269
Application	Battery protection

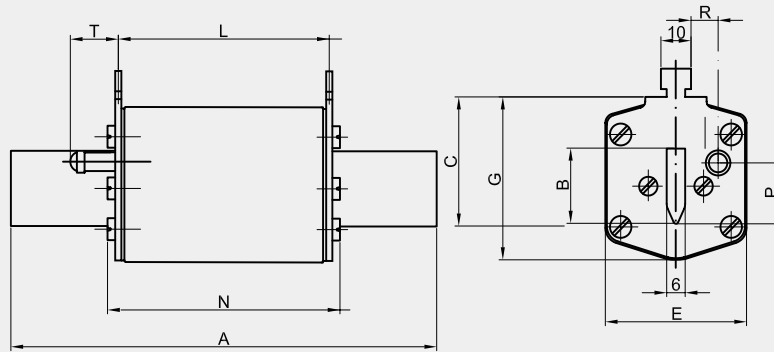


NH BATTERY fuse link 800 V d.c.										
Size	$I_n$	Standard indicator	Striker indicator	Standard indicator S110mm	Power dissipation	Power dissipation $0,7 \times I_n$	Pre-arcing Joule integral L/R=10ms	Operating Joule integral L/R=10ms	Weight	Pack.
	[A]	pic. 1	pic. 1	pic. 2	[W]	[W]	[A <sup>2</sup> s]	[A <sup>2</sup> s]	[g]	[pcs]
1	40	004723320	004723330	004723340	6	2,7	250	1.750	420	3/24
	50	004723321	004723331	004723341	7	3,1	449	3.143		
	63	004723322	004723332	004723342	9	4	700	4.900		
	80	004723323	004723333	004723343	12	5,4	1.200	8.400		
	100	004723324	004723334	004723344	15	6,7	1.650	11.550		
	125	004723325	004723335	004723345	20	9	2.200	15.400		
	200	004723327	004723337	004723347	32	14,4	8.500	60.000		
2	125	004724320	004724330	004724340	20	9	2.200	13.046	660	3/24
	160	004724321	004724331	004724341	26	11,7	4.300	25.499		
	200	004724322	004724332	004724342	32	14,4	8.500	50.405		
	224	004724323	004724333	004724343	37	16,6	10.000	59.300		
	250	004724324	004724334	004724344	43	19,3	15.000	88.950		
	315	004724325	004724335	004724345	57	26,6	20.000	118.600		
	350	004724326	004724336	004724346	67	30	28.000	166.040		
3L*	400	004724327	004724337	004724347	76	34,2	32.000	190.000	1970	1/10
	500	004110350	-	-	112	50	150.000	300.000		

\*Pic 3

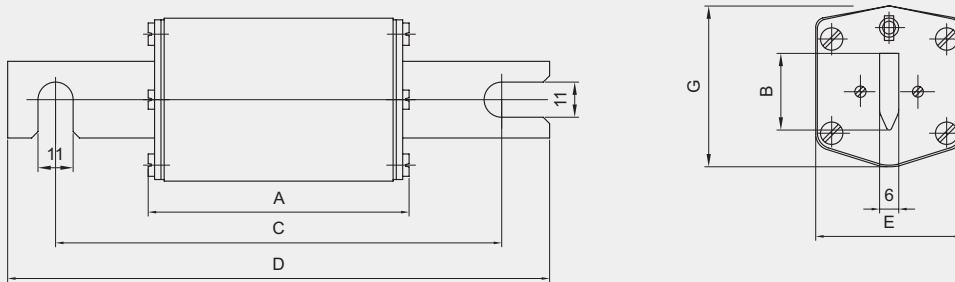
## Dimensions

pic. 1



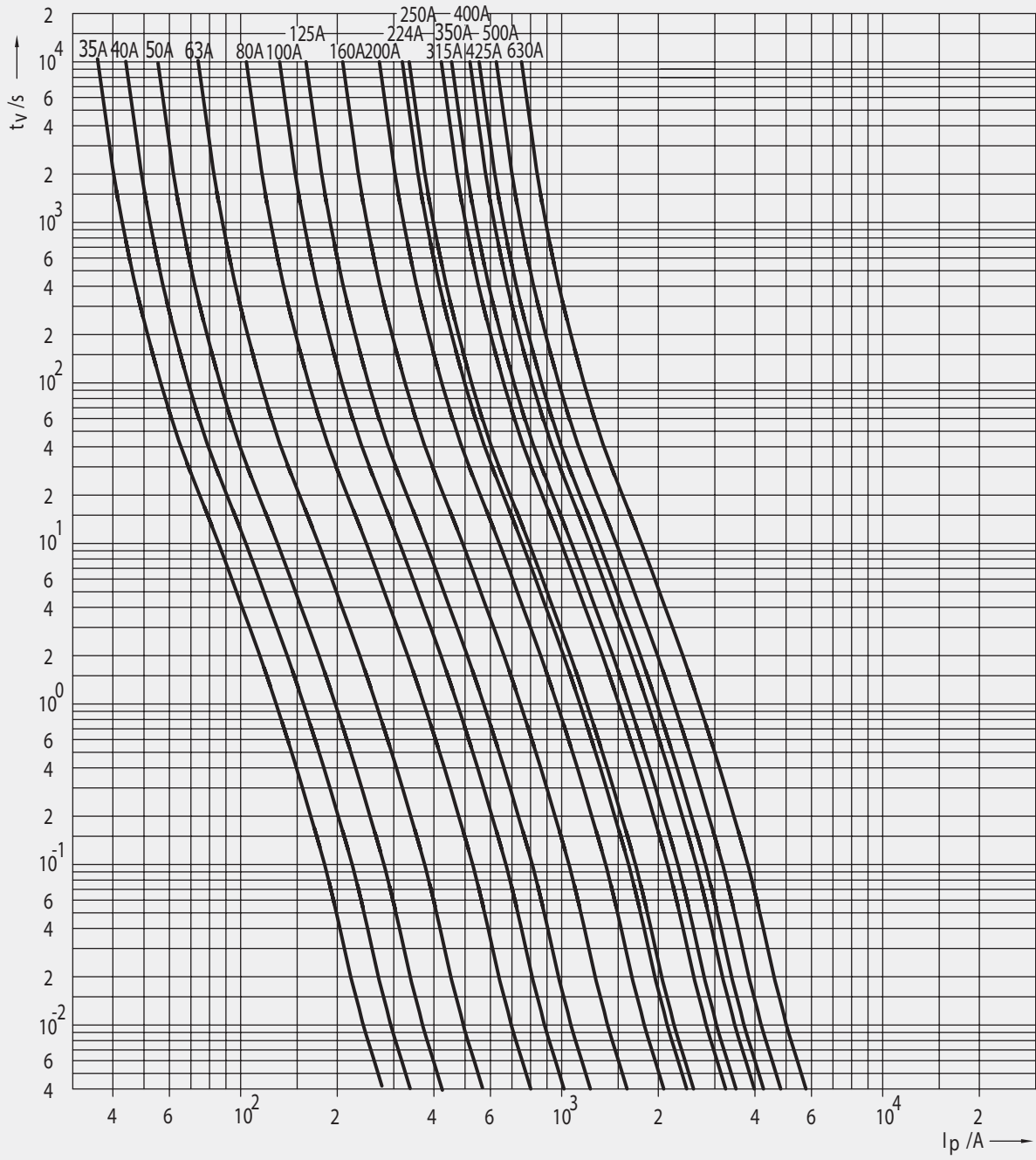
	A	B	C	E	G	S	L	N	P	R	T
1	135	24	40	46	52	6	65	73	20,5	13,7	27,5
2	150	30	48	54	61	6	65	73	27,3	16,2	27,5
3	150	37	60	64	74	6	65	73	35,6	17	27,5

pic. 2

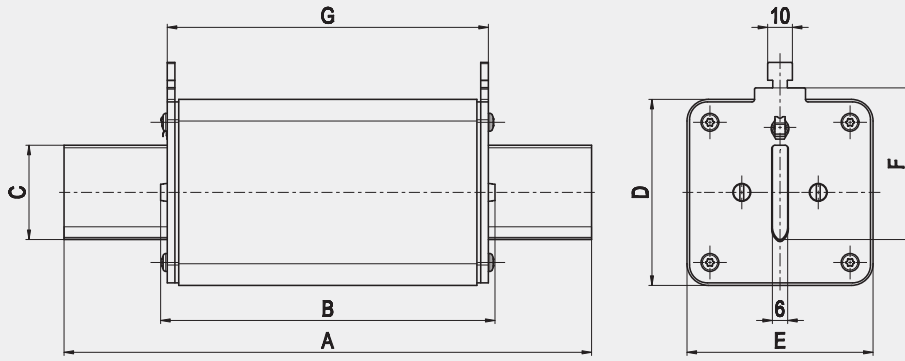


	A	B	C	D	E	G
1	72	24	110	140	46	51
2	72	30	110	140	54	59
3	72	37	110	140	64	70

I/t characteristics for NH Battery fuses sizes 1, 2, 3

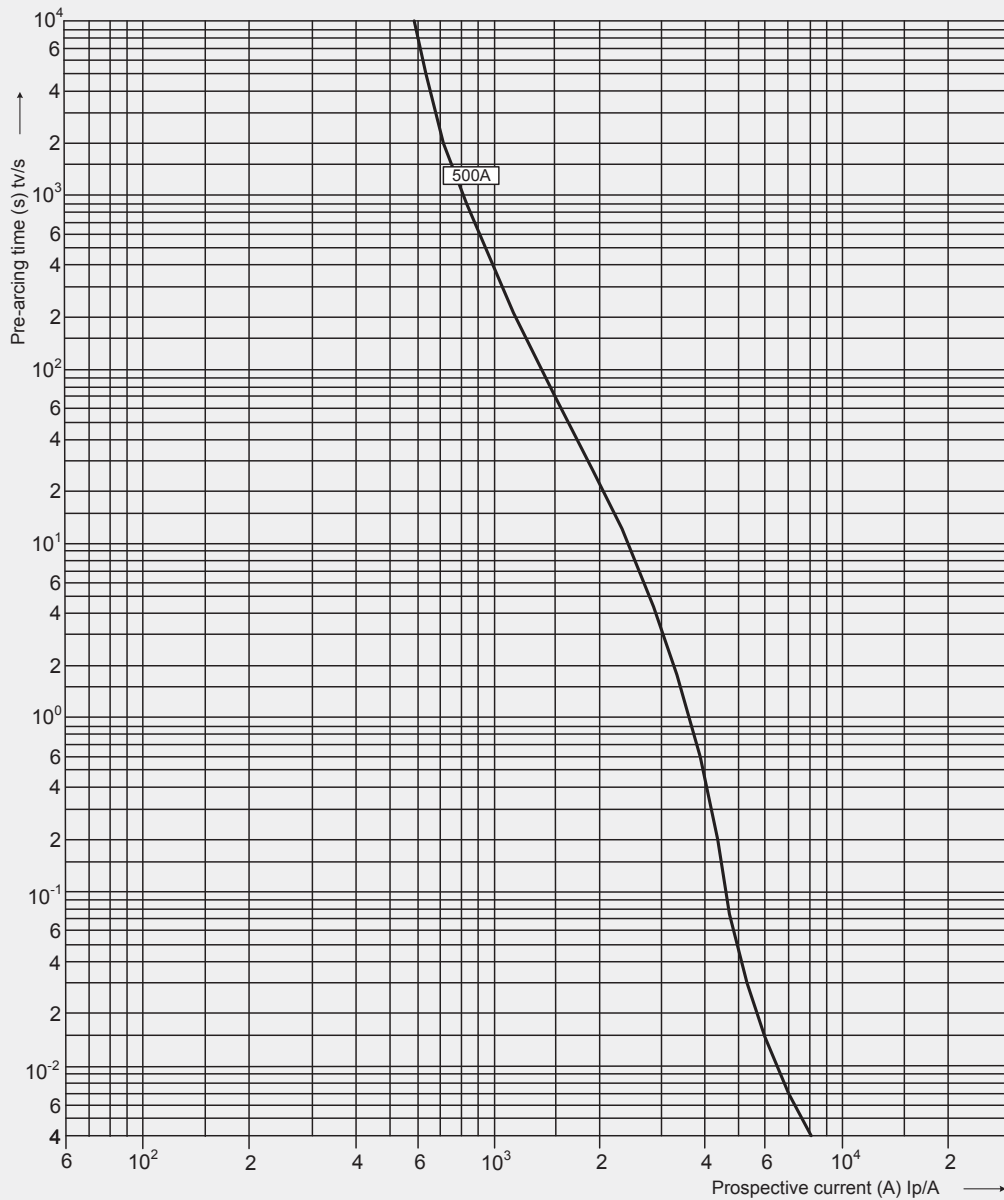


pic.3

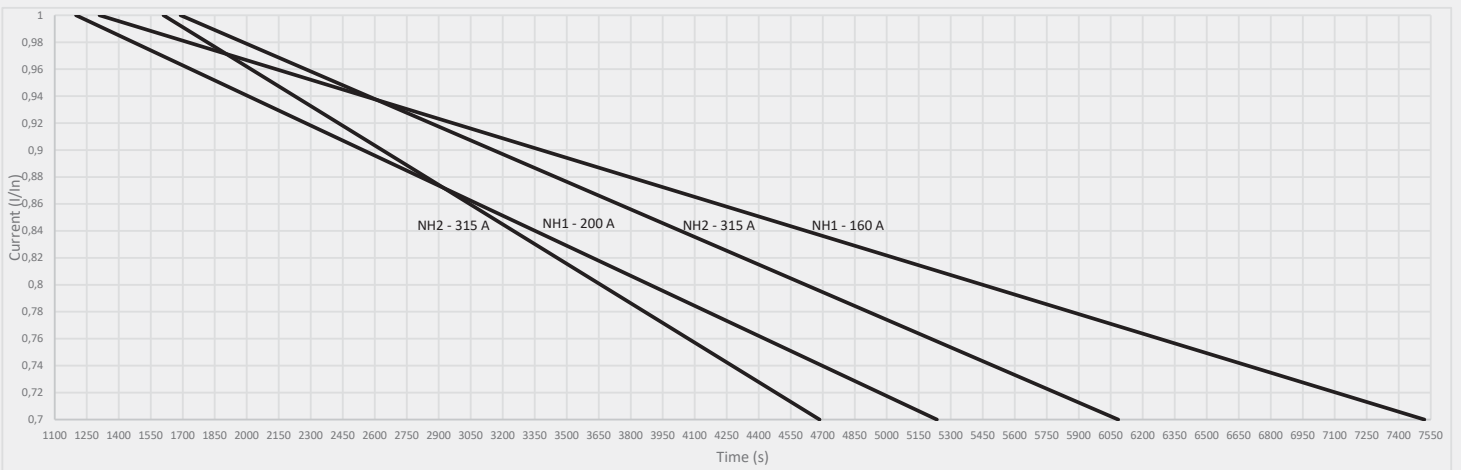
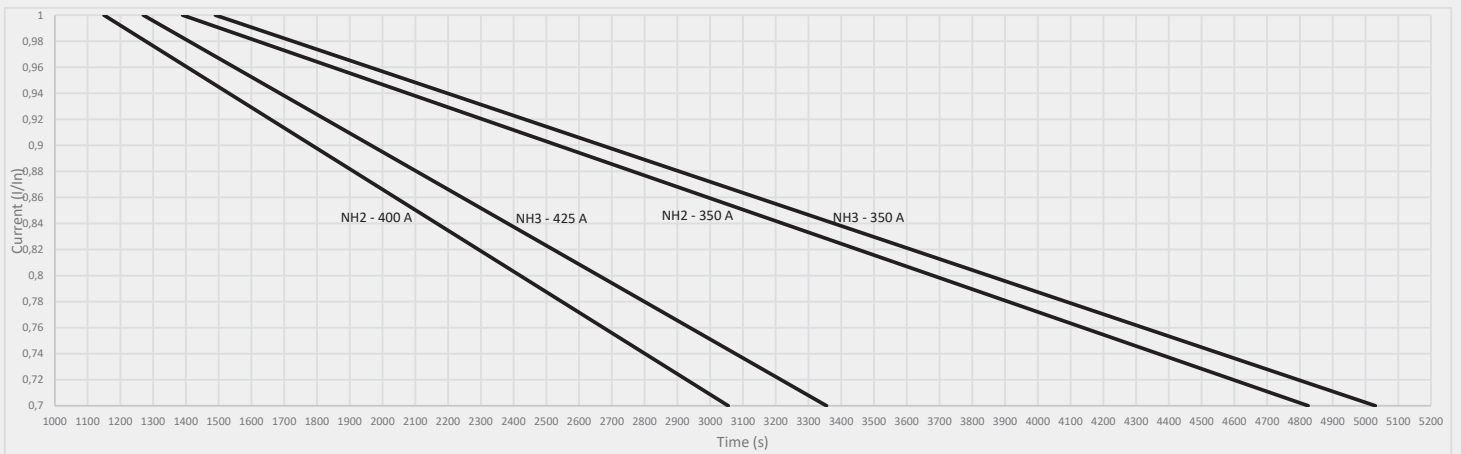
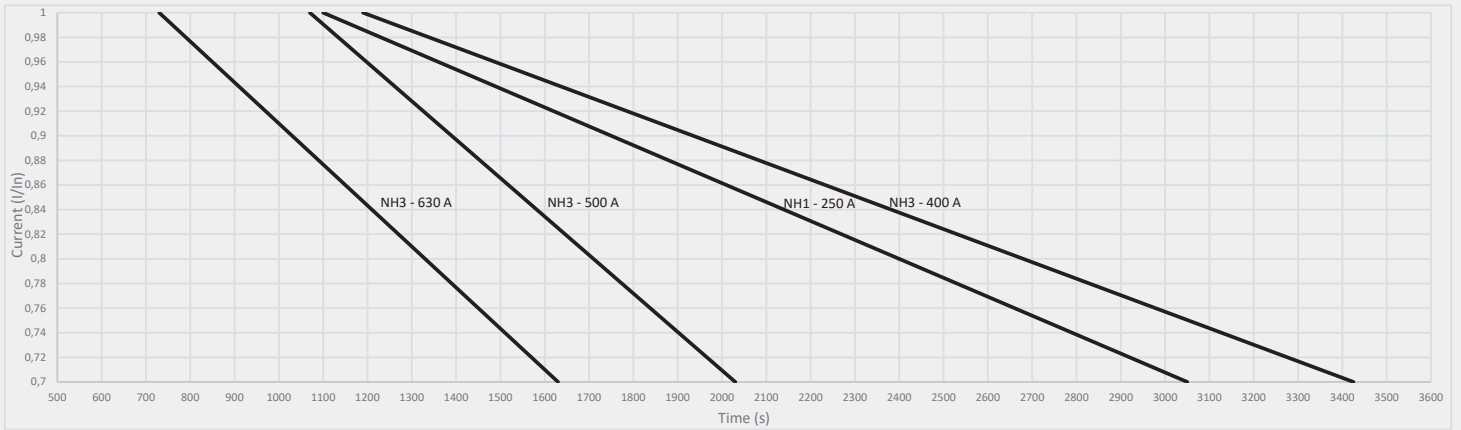


	A	B	C	D	E	F	G	H	J
3L	208	130	37	73	73	60	126	11	13

**I/t characteristics for NH Battery fuses size 3L**



## Battery fuse NH1,2,3 550V, 700V, 800V d.c.-current loading derating factor in disconnecter





# Horizontal fuse-switch disconnecter type KVL for DC applications

## Technical data (in accordance with IEC/EN 60947-3)

Technical specifications			Size 00			Size 1			Size 3		
<b>Technical characteristics</b>											
Rated operational voltage	Ue	V	DC250	DC440	DC1000	DC250	DC440	DC1000	DC220	DC440	DC1000
Rated operational current	Ie	A	160	160	160	250	250	250	630	630	630
Rated insulation voltage	Ui	V	AC1000			AC1000			AC1000		
Total power loss (without fuse)	Pv	W	1P-3W, 3P-9W			1P-5W, 3P-15W			1P-17W, 3P-51W		
Utilisation category	-	-	DC22B	DC21B	DC20B	DC22B	DC21B	DC20B	DC22B	DC22B	DC20B
<b>Fuse links</b>											
Size-DIN43620	-	-	00C/00			1			3		
Max. rated current	In	A	160	160	160	250	250	250	630	630	630
Max. permissible power loss per fuse link	Pa	W	12			23			48		
Screw	-	-	M8			M10			M10/M12		
Torque	Ma	Nm	12-15			30-35			30-35		
Clip terminal, Clamping cross-section	-	mm <sup>2</sup>	Round conductor: 1,5-70 Cu, Strip conductor: 6 x 9 x 0,8 Cu			Round conductor: 2,5-150 Cu, Strip conductor: 6 x 16 x 0,8 Cu			Strip conductor: 11 x 21 x 1 Cu		
Tightening torque	Ma	Nm	2,6			9,5			23		
Prism Clamp, Clamping cross-section		mm <sup>2</sup>	(SP KVL00 P1); 10-70 Al/Cu, 35-95 Al/Cu			(SP KVL1 P1); 10-150 Al/Cu			(SP KVL3 P1); 120-300 Al/Cu		
Tightening torque	Ma	Nm	(SP KVL00 P1); 2,6			(SP KVL1 P1); 4,5			(SP KVL3 P1); 11		
Prism Clamp, Clamping cross-section		mm <sup>2</sup>	/			(SP KVL1 P2); 2 x (10-150) Al/Cu			(SP KVL3 P2); 2 x (120-240) Al/Cu		
Tightening torque	Ma	Nm	/			(SP KVL1 P2); 4,5			(SP KVL3 P2); 11		
Frame clamp, Clamping cross-section		mm <sup>2</sup>	1,5-95 Al/Cu, (Al 95: max. 125A)			35-150 Al/Cu			95-300 Al/Cu		
Torque	Ma	Nm	4,5			12			20		
<b>Protection</b>											
Front cover close	-	-	IP20			IP20			IP20		
Front cover open	-	-	IP10			IP10			IP10		
<b>Operating condition</b>											
Ambient temperature	Tu	°C	-25°C ... +55°C								
Operating condition	-	-	continuous operation								
Mounting	-	-	vertical, horizontal								
Altitude	-	m	≤ 2000								
Pollution degree overvoltage category	-	-	3								

### 1-pole horizontal fuse-switch disconnecter for baseplate mounting

For size	Code No.	Type	Weight [kg]	Packaging [pcs]
00	001690890	KVL-00 1p M8-M8	0,31	2
1	001690891	KVL-1 1p M10-M10	0,93	1
2-3	001690892	KVL-3 1p M10-M10	1,57	1

\* see also table of accessories for KVL



### 2-pole horizontal fuse-switch disconnecter for baseplate mounting

For size	Code No.	Type	Weight [kg]	Packaging [pcs]
00	001690895	KVL-00 2p M8-M8	0,72	1
1	001690896	KVL-1 2p M10-M10	1,88	1
2-3	001690897	KVL-3 2p M10-M10	3,19	1

\* see also table of accessories for KVL

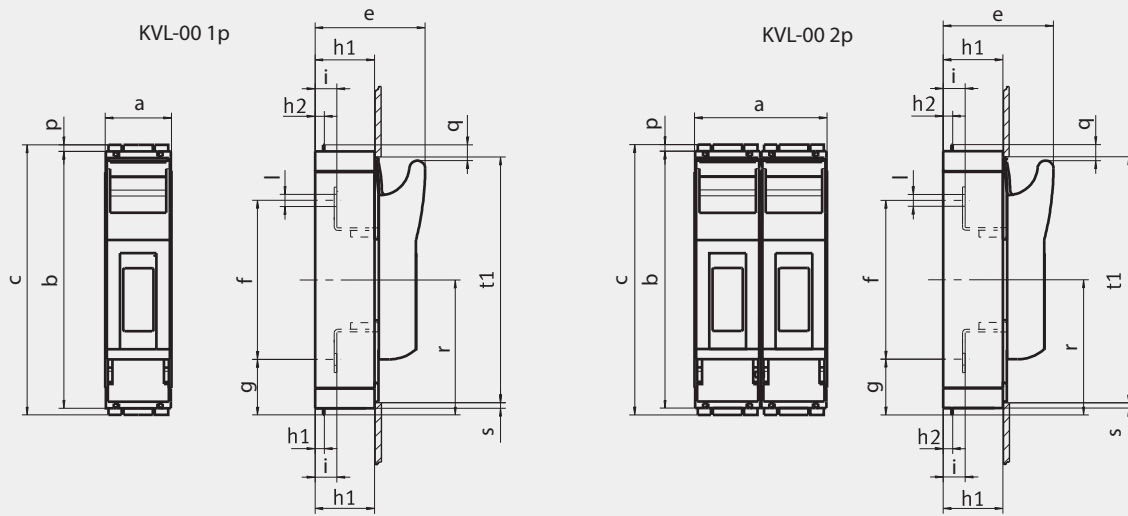


### 3-pole horizontal fuse-switch disconnecter for baseplate mounting

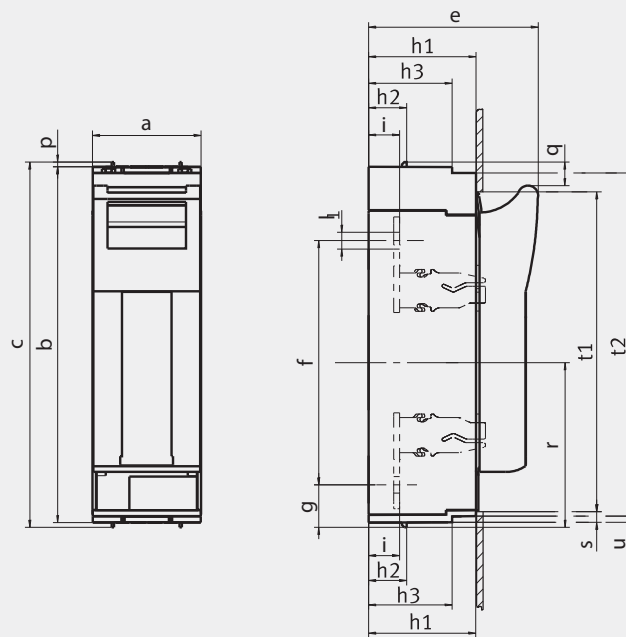
For size	Code No.	Type	Weight [kg]	Packaging [pcs]
00	001690870	KVL-00 3p M8-M8	0,63	1
	001690871	KVL-00 3p BC95-BC95	0,67	1
1	001690872	KVL-1 3p M10-M10	2,03	1
2	001690873	KVL-2 3p M10-M10	3,42	1
3	001690874	KVL-3 3p M10-M10	3,95	1

\* see also table of accessories for KVL

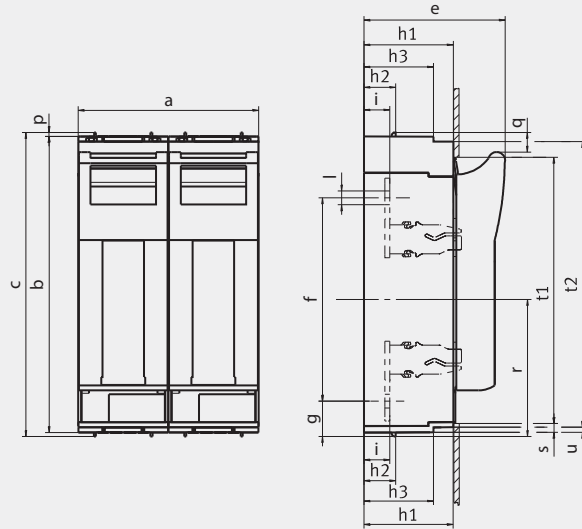




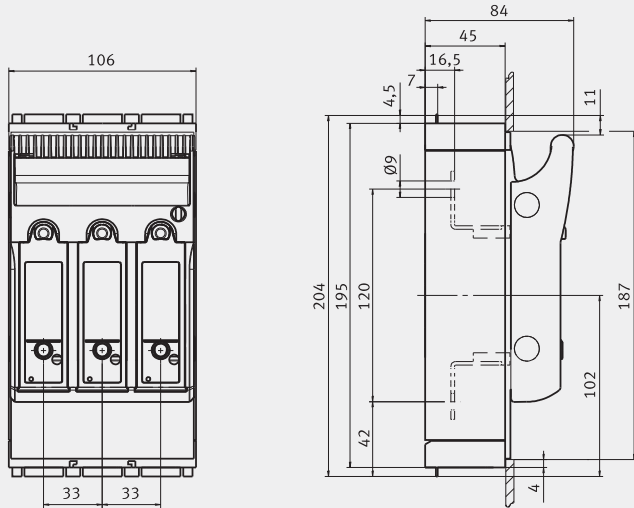
	a	b	c	e	f	g	h1	h2	h3	i	l	p	q	r	s	t1
KVL-00 1p M8-M8	50	195	204	84	120	42	45	7	-	16,5	∅9	4,5	12	102	5	187
KVL-00 2p M8-M8	100	195	204	84	120	42	45	7	-	16,5	∅9	4,5	12	102	5	187



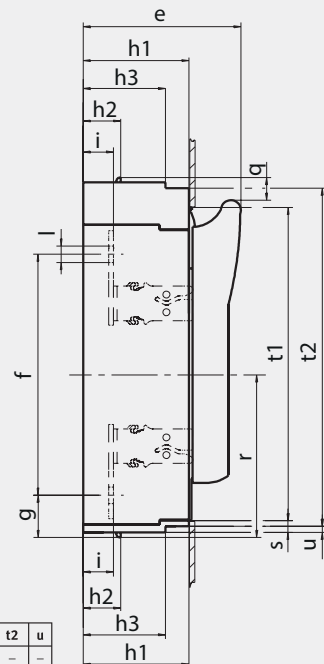
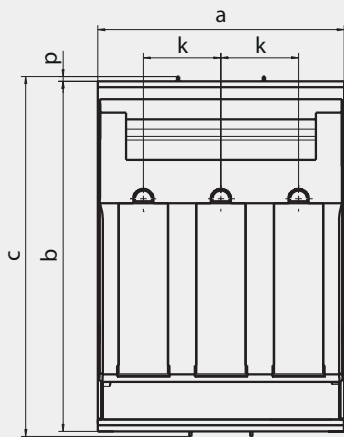
	a	b	c	e	f	g	h1	h2	h3	i	l	p	q	r	s	t1	t2	u
KVL-1 1p M10-M10	69	298	306	117	185	46	70	32	-	25	∅10,5	4	19	138	5	272	-	-
KVL-3 1p M10-M10	91	298	306	143	205	36	90	32	70	26	∅14	4	19	138	10	268	288	5



	a	b	c	e	f	g	h1	h2	h3	i	l	p	q	r	s	t1	t2	u
KVL-1 2p M10-M10	138	298	306	117	185	46	70	32	-	25	Ø10,5	4	19	138	5	272	-	-
KVL-3 2p M10-M10	182	298	306	143	205	36	90	32	70	26	Ø14	4	19	138	10	268	288	5



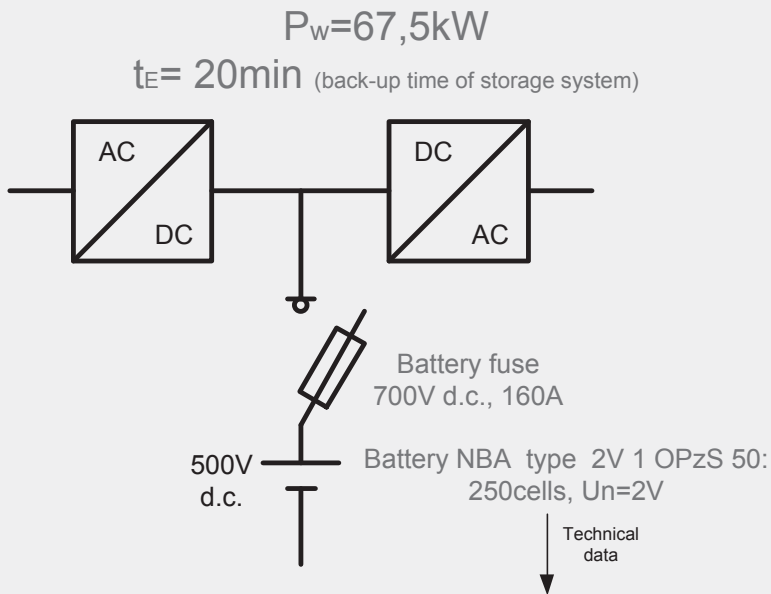
- KVL-00 3p M8-M8
- KVL-00 3p BC95-BC95
- KVL-00 3p M8-M8 LED
- KVL-00 3p BC95-BC95 LED



	a	b	c	e	f	g	h1	h2	h3	i	k	l	p	q	r	s	t1	t2	u
KVL-1 3p M10-M10 (LED)	184	298	306	117	185	46	70	32	-	25	58	Ø10,5	4	19	138	5	272	-	-
KVL-2 3p M10-M10 (LED)	210	298	306	134	205	36	90	32	70	26	66	Ø14	4	19	138	10	268	288	5
KVL-3 3p M10-M10 (LED)	250	298	306	143	205	36	90	32	70	26	82	Ø14	4	19	138	10	268	288	5

Accessories for KVL			
Type	Code No.	Description	Packaging
SP KVL00	001692701	Clip terminal, 1,5 – 70 50mm <sup>2</sup> Cu	set=3
SP KVL1	001692702	Clip terminal, 25– 150 50mm <sup>2</sup> Cu	set=3
SP KVL2	001692703	Clip terminal, 25– 240 50mm <sup>2</sup> Cu	set=3
SP KVL3	001692704	Clip terminal, 11x21 50mm <sup>2</sup> Cu	set=3
SP KVL00 P1	001692760	Prism clamp, 10 – 70 50mm <sup>2</sup> Al/Cu	set=3
SP KVL1 P1	001692761	Prism clamp, 70 – 150 50mm <sup>2</sup> Al/Cu	set=3
SP KVL2 P1	001692762	Prism clamp, 120 – 240 50mm <sup>2</sup> Al/Cu	set=3
SP KVL3 P1	001692763	Prism clamp, 120 – 300 50mm <sup>2</sup> Al/Cu	set=3
SP KVL1 P2	001692764	Prism clamp for 2-conductors connection, 2x70 – 95 50mm <sup>2</sup> Al/Cu	set=3
SP KVL2 P2	001692765	Prism clamp for 2-conductors connection, 2x120 – 150 50mm <sup>2</sup> Al/Cu	set=3
SP KVL3 P2	001692766	Prism clamp for 2-conductors connection, 2x120 – 240 50mm <sup>2</sup> Al/Cu	set=3
SP KVL-1 V	001690940	Frame clamp, 35-150mm <sup>2</sup> Al/Cu	set=3
SP KVL-23 V	001690941	Frame clamp, 95-300mm <sup>2</sup> Al/Cu	set=3
SP KVL-00 FC95	001690942	Feeding clamp, 25-95mm <sup>2</sup> Cu/Al, isolated, terminal M8,*	set=3
IZ2 KVL-00 3p	001690943	Phase busbars, 2 x 3pole KVL-00 50mm <sup>2</sup>	5
IZ3 KVL-00 3p	001690944	Phase busbars, 3 x 3pole KVL-00 50mm <sup>2</sup>	5
IZ4 KVL-00 3p	001690945	Phase busbars, 4 x 3pole KVL-00 50mm <sup>2</sup>	3
IZ5 KVL-00 3p	001690946	Phase busbars, 5 x 3pole KVL-00 50mm <sup>2</sup>	3
MST KVL-00 1p	001690947	Switch position indicator, 1-pole, size 00, **	1
MST KVL-00 3p	001690948	Switch position indicator, 3-pole, size 00, **	1
MST KVL-123 1p/2p/3p	001690949	Switch position indicator, 1/2/3 -pole, size 1, 2, 3, **	1
MFM KVL-00 1p/2p/3p	001690950	Mechanical fuse monitor, size 00, **	3
MFM KVL-123 1p/2p/3p	001690951	Mechanical fuse monitor, size 1, 2, 3, **, ***	3
PRS KVL-00 3p L	001690952	Terminal cover, 3-pole, variable to open, Length 66mm, size 00	2
PRS KVL-00 3p S	001690953	Terminal cover, 3-pole, variable to open, Length 36mm, size 00	2
PRS KVL-1 3p	001690954	Terminal cover, 3-pole, variable to open, Length 42mm, size 1	2
PRS KVL-2 3p	001690955	Terminal cover, 3-pole, variable to open, Length 42mm, size 2	2
PRS KVL-3 3p	001690956	Terminal cover, 3-pole, variable to open, Length 42mm, size 3	2
PRS KVL-00 1p L	001690957	Terminal cover, 1-pole, variable to open, Length 66mm, size 00	2
PRS KVL-00 1p S	001690958	Terminal cover, 1-pole, variable to open, Length 36mm, size 00	2
PRS KVL-1 1p	001690959	Terminal cover, 1-pole, variable to open, Length 42mm, size 1	2
PRS KVL-3 1p	001690960	Terminal cover, 1-pole, variable to open, Length 42mm, size 3	2
DIN KVL-00 100-150	001690964	DIN rail fixing parts, For mounting on DIN rails, size 00	1
DIN KVL-1 100-150	001690965	DIN rail fixing parts, For mounting on DIN rails, size 1	1

# How to choose the correct Battery fuse - example



## 1. Short circuit point ( $I_k$ ):

### 2. Types, capacities, dimensions, mass

Type	C10	C5	C3	C1	Ri 1)	$I_k$ 2)	length	width	height max	mass 3)	mass 4)
	Ah	Ah	Ah	Ah	mΩ	kA	mm	mm	mm	kg	kg
$U_e$ (V/cell)	1,80	1,77	1,75	1,67							
2V 1 OPzS 50	50	45	36	24	3,96	0,58	103	206	426	4,5	7
2V 2 OPzS 100	100	85	66	48	1,98	1,16	103	206	426	7,5	6,5
2V 3 OPzS 150	150	125	102	72	1,27	1,74	103	206	426	10	6
2V 4 OPzS 200	200	170	133	96	1,01	2,06	103	206	426	12	6
2V 5 OPzS 250	250	210	171	120	0,81	2,57	124	206	426	14	7,5
2V 6 OPzS 300	300	250	204	144	0,69	3,14	145	206	426	16	9
6V 3 OPzS 150	150	125	107	75	3,71	0,82	233	224	426	23,5	13,5

1, 2) internal resistance and short - circuit - current according to IEC 696-1      3) dry-charged      4) filled and charged



$I_k = 580A$

## 2. Operating point ( $t_E/I_B$ ):

$t_E = 20min$  (1200s)

$U_E = 250cells \times 1,8V = 450V$  d.c.

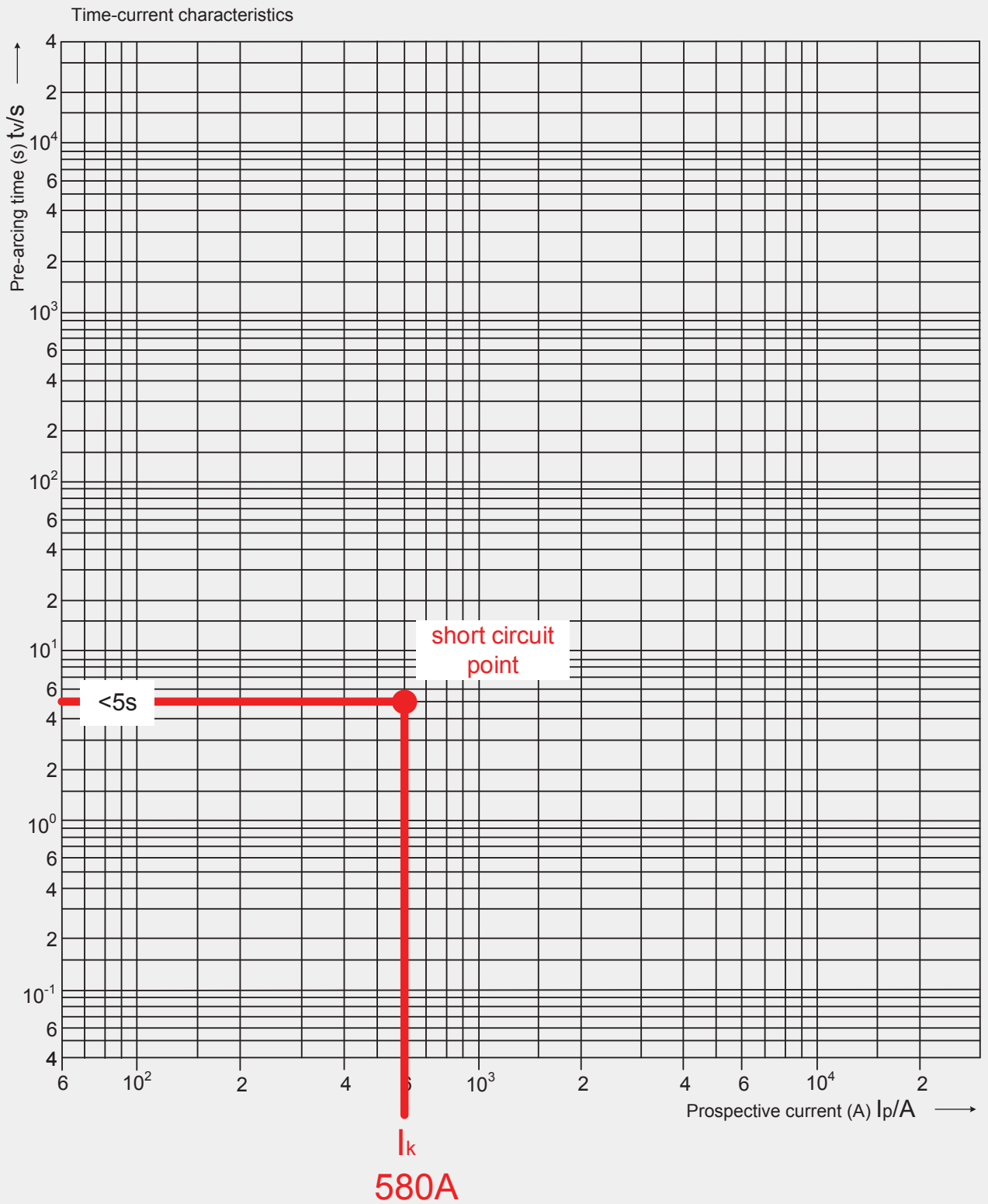
$I_B = P_w / U_E = 67,5kW / 450V = 150A$

## 3. DC rated fuse link:

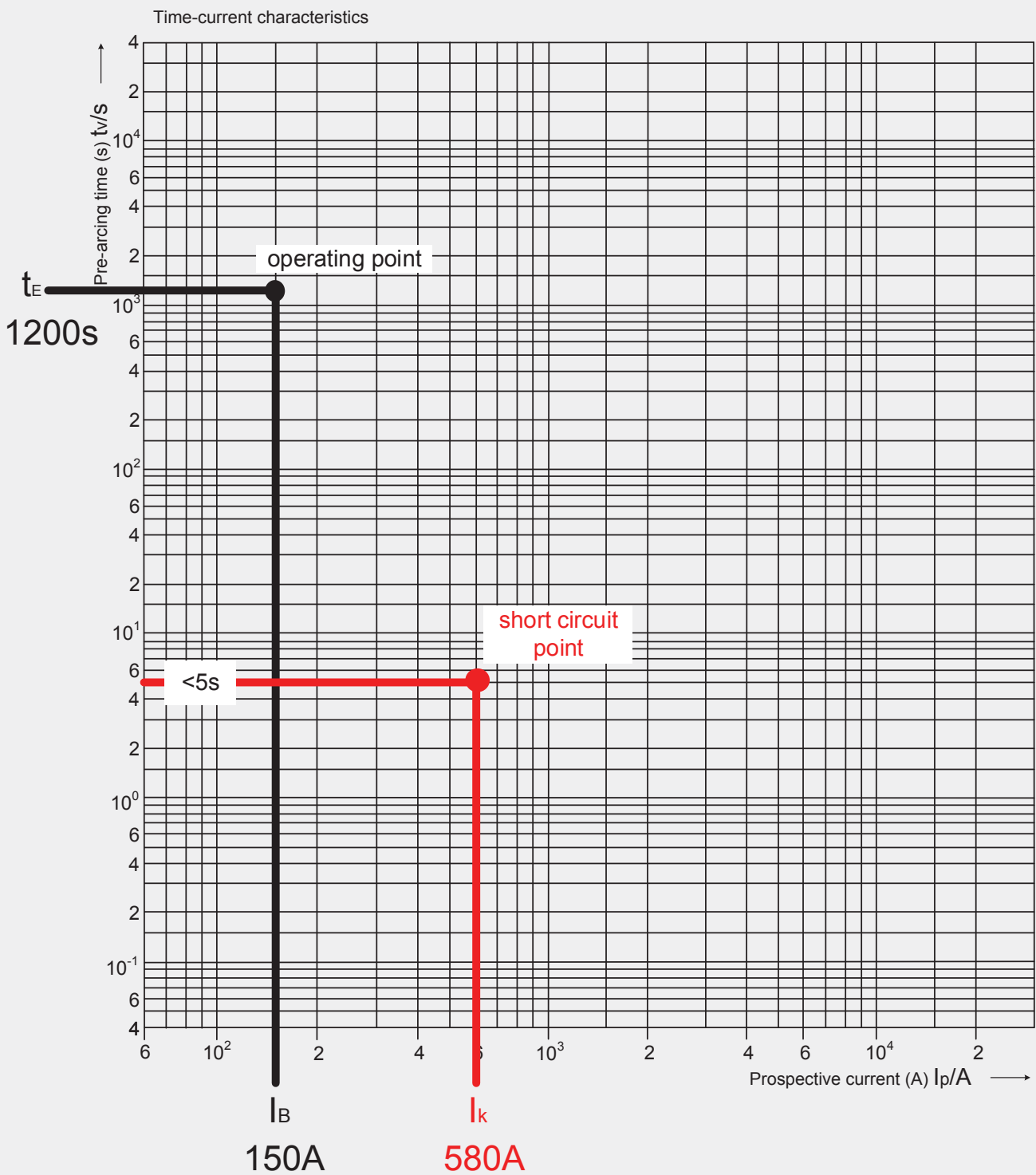
Battery fuse 700V d.c.,  $L/R=10ms$

NH00 gG 160A 690V a.c.....problem DC rating at min. breaking capacity  $\sim 2xI_n$  ???

# 1. Short circuit point ( $I_k$ ):

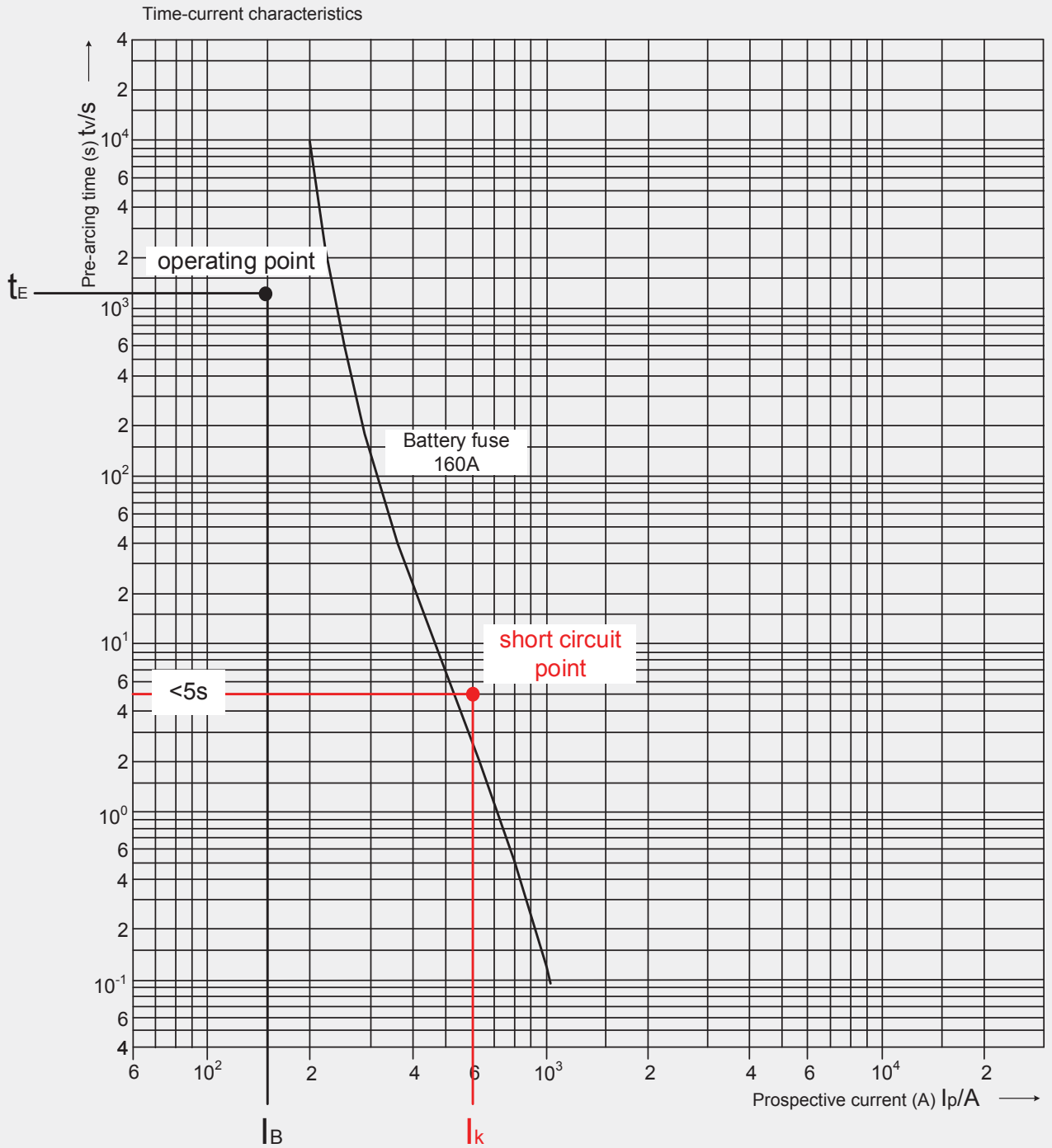


## 2. Operating point ( $t_E/I_B$ ):

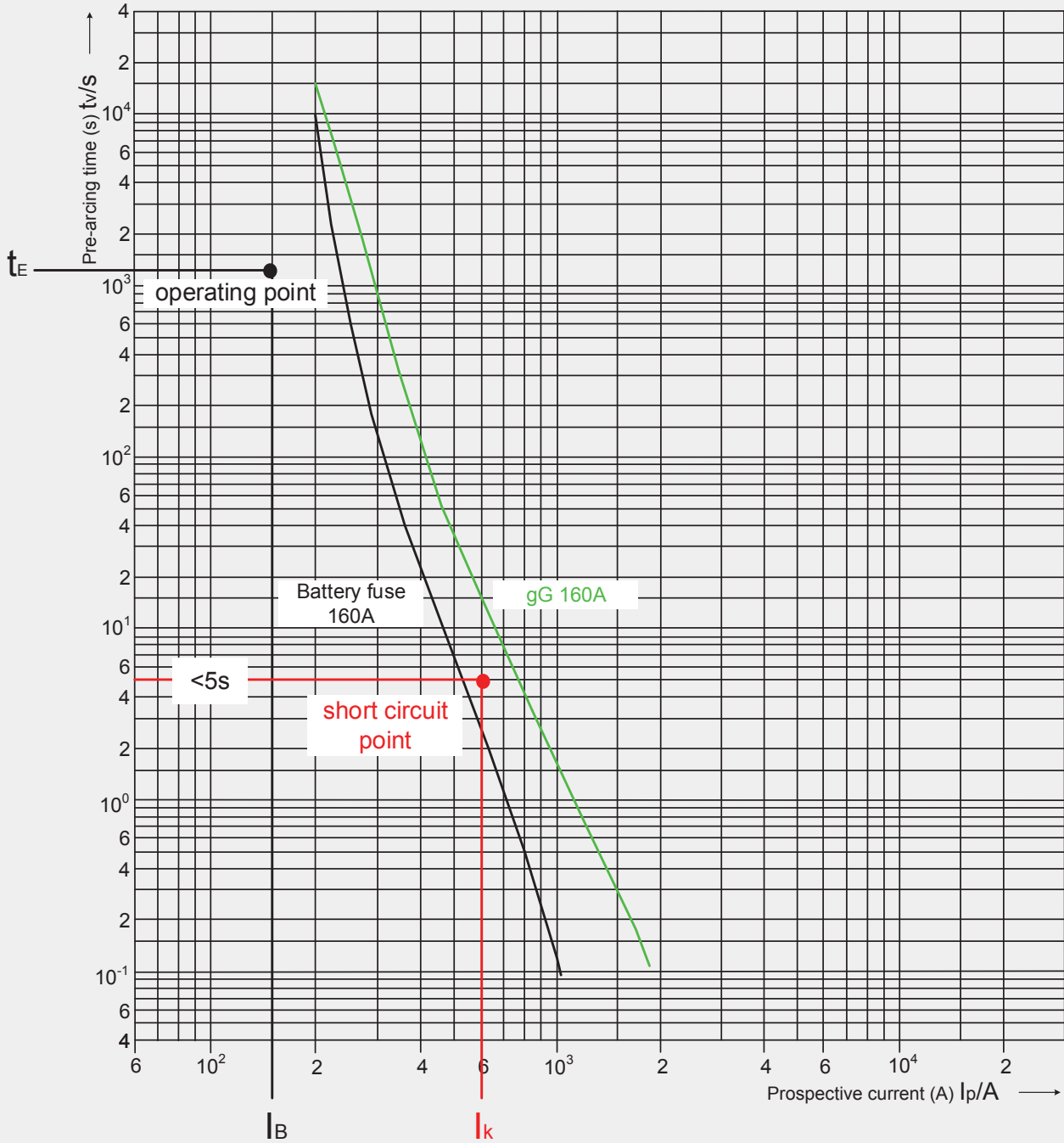




## Battery fuse selection-I/t characteristic



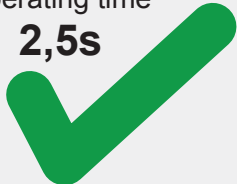
Time-current characteristics



Required operating time

**<5s**

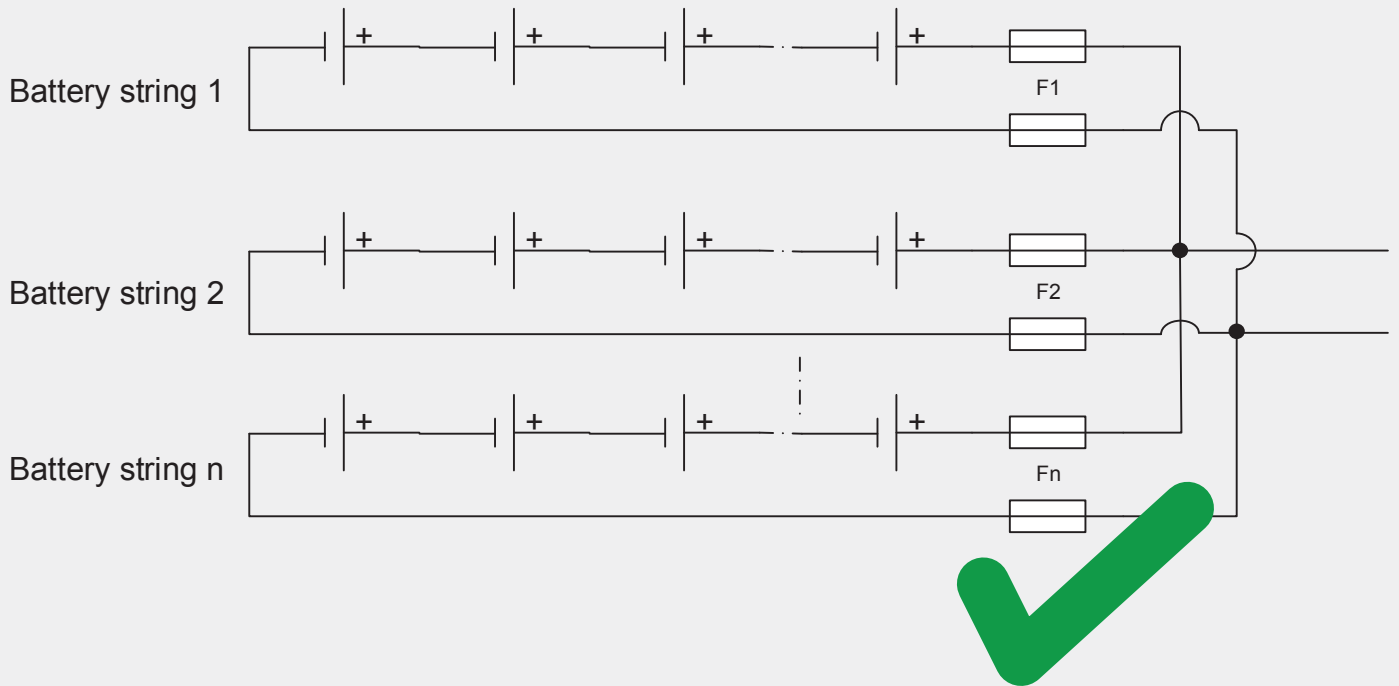
Battery fuse 700V d.c.  
160A  
operating time  
**2,5s**



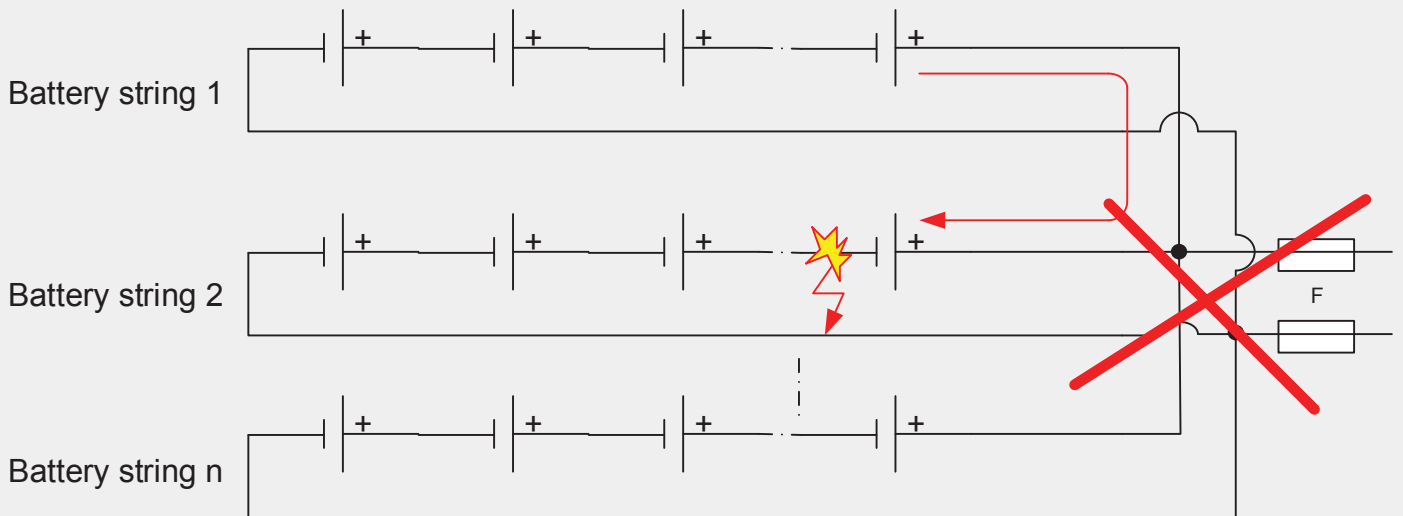
~~gG fuse 160A  
operating time  
**15s**~~

~~MCE 160A  
operating time  
**~30s**~~

Battery array



Battery array



For battery banks with parallel strings, a good practice is to include overcurrent protection for each battery string. This minimizes the potential of the bank backfeeding a single shorted battery, which can lead to fires and property damage.

Battery-string fusing is best accomplished with appropriately sized dc-rated fuses secured in bolt-in fuse holders that are housed in a single enclosure. This arrangement makes it easy to isolate one battery string for testing or maintenance while allowing the system to continue operation. Individual battery-string fuses can provide protection against catastrophic failure in the event of major fault in the main disconnect breaker panel or elsewhere in the battery bank. Series fuses on each battery string also reduce the available shortcircuit current levels, allowing for the use of lower ampere interrupting current rated circuit breakers for the inverter/ charger disconnects. Without the fuses, the amount of current that the circuit breaker has to interrupt during a fault could potentially exceed its rating.

# Ratings for Li-ion batteries

## Burst discharge (pulse) ratings for Li-ion batteries:

The first set of C ratings on a Li-ion tells us how fast the battery can be discharged.

30C/60C

translates to

(maximum constant discharge rate) / (Burst discharge rate)

Burst can last for <5 seconds. To figure out how many amps this rate is, you need to know the capacity of the battery pack. If the pack says that it has 2,3Ah, take that number before the Ah and multiply with 30 to get the number of amps. In this case, it would be 69A. That is rating of 30C for that pack.

The burst rate would then be  $2,3 \times 60 = 138A$  amps for less than 5 seconds.



**Specifications: Hypersonic 2300 6.6V**

<p><b>Product Summary:</b>                  2S1P cell configuration Li Ion                  Deans Ultra output/charge connector                  Balancing connector (Balancing only with Sonic Charge™)</p>	<table border="0" style="width: 100%;"> <tr><td>Voltage:</td><td>6.6V</td></tr> <tr><td>Capacity:</td><td>2300 mAh</td></tr> <tr><td>Max C-rate cont.</td><td>30C</td></tr> <tr><td>Max C-rate pulse</td><td>60C</td></tr> <tr><td>Max Current cont.</td><td>69A (limited by connector)</td></tr> <tr><td>Max Current pulse</td><td>138A</td></tr> <tr><td>Max temperature*</td><td>160F/71°C</td></tr> <tr><td>Size (length x diam)</td><td>135mm x 28mm</td></tr> <tr><td>Weight:</td><td>155g</td></tr> </table>	Voltage:	6.6V	Capacity:	2300 mAh	Max C-rate cont.	30C	Max C-rate pulse	60C	Max Current cont.	69A (limited by connector)	Max Current pulse	138A	Max temperature*	160F/71°C	Size (length x diam)	135mm x 28mm	Weight:	155g
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Weight:	155g																		

### Product Specifications

Type:	Lithium Ion
Capacity:	2300 mAh
Voltage:	6.6V
Connector Type:	Deans Ultra (WSD1300)
Number of Cells:	2
Weight:	155g
Configuration:	2S1P
Length:	5.31 in (135mm)
Width:	1.10 in (28.0mm)
Height:	1.10 in (28.0mm)
Maximum Continuous Discharge :	30C
Maximum Burst Discharge :	60C

## Examples of maximum discharge current for Lead-acid and Li-ion batteries:

Internal Resistance (Fully Charged Battery).....	<12m Ω
<b>Maximum Discharge Current For 5 sec.(A).....</b>	<b>180A</b>

Storage .....	-20~60°C
<b>Max. Discharge Current 77°F(25°C) .....</b>	<b>1000A(5s)</b>
Short Circuit Current .....	3300A
Charge Methods: Constant Voltage Charge 77°F(25°C)	

Capacity	20.0Ah@20m rate
Weight	Approx. 5.9 Kg
<b>Max. Discharge Current</b>	<b>200 A (5 sec)</b>
Internal Resistance	Approx. 12 mΩ
Operating Temperature Range	Discharge: -20°C~#

Continuous discharge current	100 A	100 A
Max discharge impulse current:		
(10 min.)	200 A (temperature controlled)	200 A (temperature controlled)
(5 sec.)	>500 A	>500 A
(uSec.)	>1000 A	>1000 A
Continuous charge current	100 A	100 A

Max. Discharging Rate	<ul style="list-style-type: none"> <li>66A (30.0C), Maximum continuous discharge, Recommended</li> <li>132A (60.0C), Maximum Burst rate &lt; 5 seconds</li> </ul>
Dimensions (LxWxH)	116mm(4.6") x 38mm(1.5") x 40mm(1.6")
Weight	10.8 Oz (300 g)

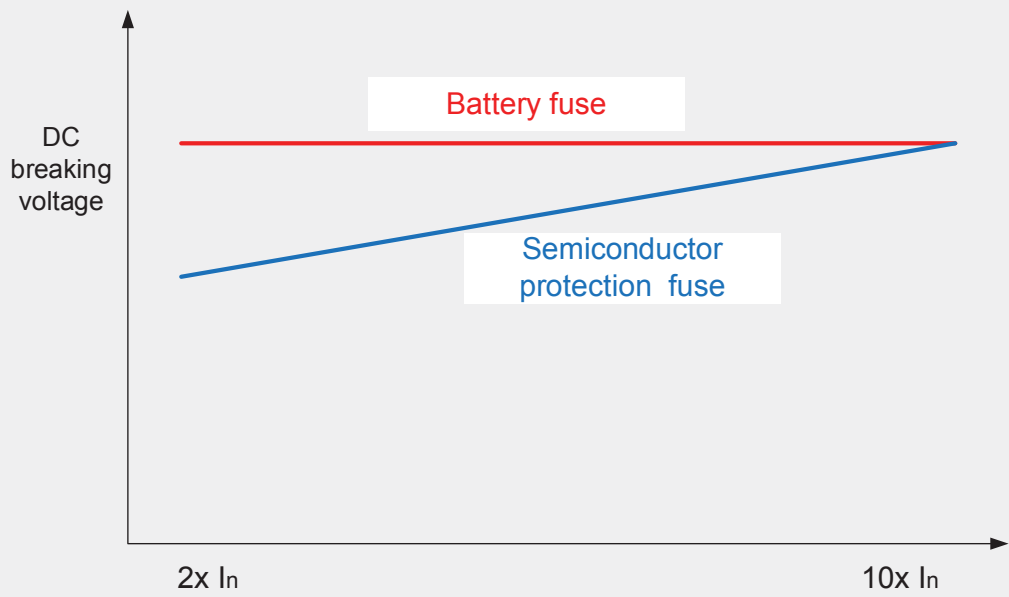
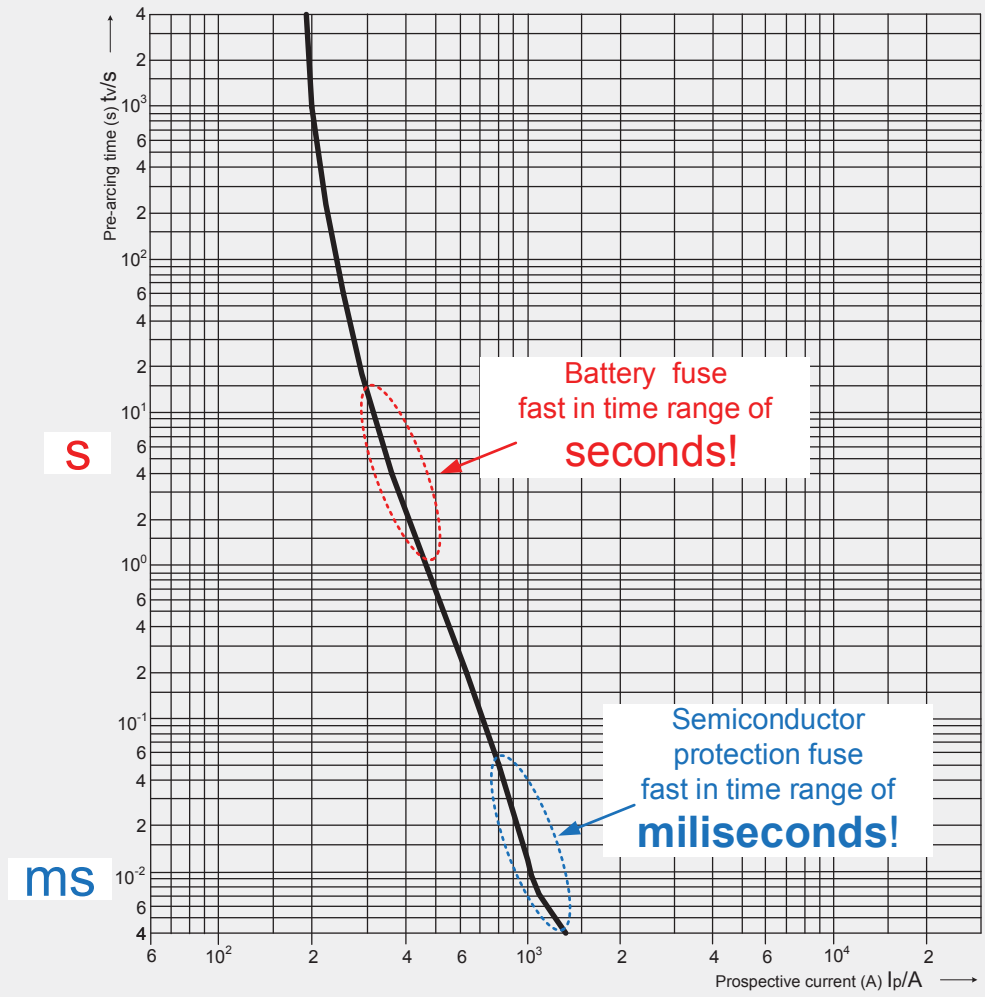
## A few reasons why protection of batteries with simple fuse link is not OK:

- ✓ Flammable hydrogen gas is always present during battery recharging. Hydrogen gas is potentially explosive if allowed to accumulate in a closed area.
- ✓ Prevent open flames, sparks, or **electrical arcs** in the battery charging area to minimize the danger of explosion.
- ✓ Breaking capacity of »fork lift fuse link« is less than 1kA at nominal voltage!



### Comparison characteristics

Battery fuse ← → Semiconductor protection fuse







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ETI d.d. withholds the right to make changes and additions to any information contained herein.