SITOR

Semiconductor Protection Fuses

Selection and
Engineering Documents

Applications and Standards

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1

Applications
Features

SITOR fuse links protect converters against short-circuit.

The power semiconductors used in these devices (diodes, thyristors, GTOs and others) require fast-switching elements to protect them as a result of their low thermal capacity. SITOR fuse links are admirably suited for this type of application (fuse links for semiconductor protection with super-fast characteristics).

The following fault situations involving short-circuits can occur:

- Internal short-circuit:
  A defective semiconductor component causes a short-circuit within the converter
- External short-circuit:
  A fault in the load causes a short-circuit at the output of the converter
- Inverter commutation faults:
  If the converter control fails when in the inverter mode (commutation faults), then the converter circuit forms a short-circuit connection between the DC voltage and AC voltage supply.

Fuse links can be arranged in various ways within the converter circuit. A differentiation is made between the phase fuses in the three-phase feeder cables as well as, if required, DC current fuses and branch fuses in the branches of the converter circuit (diagrams 5-1 to 5-6). For center-tap circuit configurations, fuse links can only be located in the three-phase feeder cables as phase fuses.

When using SITOR fuse links, utilization Category aR, the overload protection of the converters up to approx. 350% of the rated current is handled using conventional protective devices (e.g. thermally delayed overload relays). For closed-loop converters, overload protection is provided by the current limiting (exception: general-purpose fuses).

3NE1...-0 SITOR fuse links, utilization Category gS are, in addition to providing semiconductor protection, also designed for overload and short-circuit protection for cables, conductors and busbars. All of the other double function fuses belonging to the SITOR series have gR characteristics. Overload protection is guaranteed if the rated current of the 3NE1..-0 SITOR fuse link is selected corresponding to $I_n \leq I_z$ (DIN VDE 0100 Part 430).

The rules as laid-down in DIN VDE 0100 Part 430 must be applied when dimensioning the fuse links to provide short-circuit protection for cables, conductors and busbars.

Applications
Possible arrangements

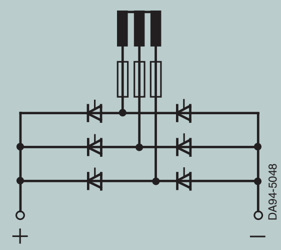


Fig. 5-1 *Six-pulse bridge circuit B6 with branch fuses*

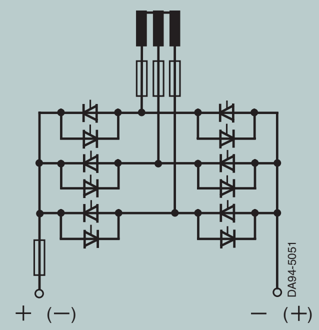


Fig. 5-2 *Six-pulse bridge circuit B6 with phase fuses and DC fuses (reversing connection)*

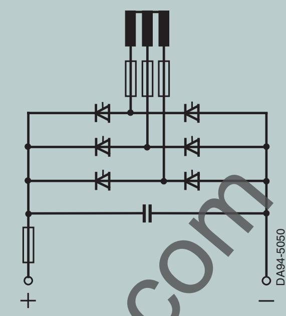


Fig. 5-3 *Six-pulse bridge circuit B6 with phase fuses and DC fuses (converter circuit)*

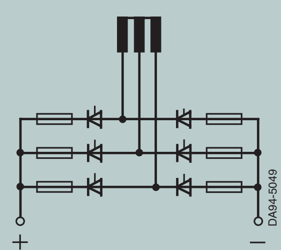


Fig. 5-4 *Six-pulse bridge circuit B6 with branch fuses*

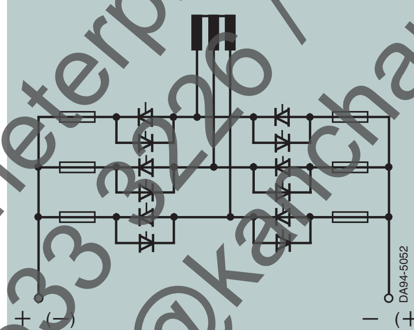


Fig. 5-5 *Six-pulse bridge circuit B6 with branch fuses (reversing connection)*

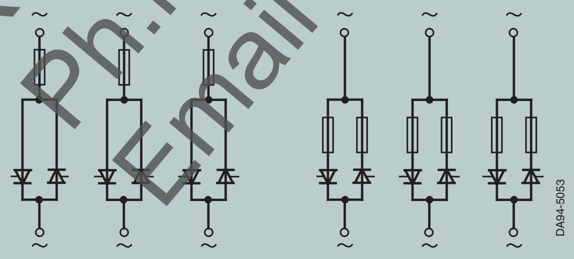


Fig. 5-6 *Three-phase bidirectional circuit W3 with phase fuses* — *with branch fuses*

Important Information

Standards

SITOR fuse links comply with the following Standards and regulations:

- DIN VDE 0636, Part 40
- IEC 60 269-4

When appropriately noted in Sections 2 and 3 '*Ordering and engineering data*' and '*Characteristics and dimension drawings*', SITOR fuse links also fulfill the following Standards and regulations:

- IEC 60 269-2-1
  VDE 0636/201
  (for insertion in l.v.h.b.c. fuse bases according to VDE 0636/201 as well as in fused-switch disconnectors and disconnectors with fuses)
- Ⓤ
  The following Sitor fuse links and l.v.h.b.c. fuse bases are Ⓤ recognized:

Series	Guide number	File number
3NC1 0.. 3NC1 4.. 3NC2 2.. 3NE1 ... 3NE3 2.. 3NE3 3.. 3NE4 1.. 3NE8 0..-1 3NE8 7..-1	JFHR2	E167357
3NC1 1..	JDDZ	E223216
3NC1 038-. 3NC1 09. 3NC1 49. 3NC2 29.	IZLT2	E220063
3NH3 030 3NH3 120 3NH3 230 3NH3 330 3NH3 430	JFHR2	E171267
3NC1 451-1 3NC2 258-1	being processed	being processed

- IEC 60 269-4-1
  VDE 0636/401
  (for bolting to busbars) SITOR fuse links, Sizes 1 to 3 with an inside caliper of 110 mm can also be inserted in l.v.h.b.c. fuse bases according to IEC 60 269-2-1 as well as in fused switch disconnectors and switch disconnectors with fuses.
- CE
  All of the SITOR fuse links with rated voltages $V_n \leq 1000$ V have the CE marking in compliance with the Low-Voltage Directive 73/23/EEC. The CE marking confirms that the products are in compliance with the requirements as laid down in the Directive.

Environmentally-friendly recycling

In 1995, seven German manufacturers of l.v.h.b.c./h.v.h.b.c. fuse links founded a non-profit association.

NH **l.v.h.b.c./ h.v.h.b.c. Recycling** HH

The objective is to practically and sensibly recycle fuse links and to define an acceptable disposal concept which fulfills all of the requirements of today's environmental protection legislation.

The used fused links are collected, sorted and then recycled without the packaging; materials which have been melted and recovered are then recycled.

According to the rules and regulations of the association, excess funds from the recycling process are donated to a university to promote research in the area of fuse links.

More detailed information is available under:

http://www.nh-hh-recycling.de

Liability exclusion

The products described here were developed as part of a complete system or machine to assume safety-related functions. Generally, a complete safety-related system includes sensors, evaluation units, signaling devices and concepts for safe shutdown. It is the responsibility of the manufacturer of a plant or machine to ensure that his complete plant or machine functions correctly. Siemens AG, its regional offices and associated companies (known in the following as "Siemens") are able to guarantee all of the properties and characteristics of a complete plant or machine which Siemens itself did not design.

Siemens does not accept any liability for the recommendations which are either provided or implicitly provided in the following document. The information in this document does not represent a new guarantee, warranty or liability claims which extend beyond Siemens general conditions of supply.

Caution

Only fully authorized and trained personnel may install and use fuses.

Ordering and Engineering Data

SITOR fuse links

SITOR fuse links for special applications

Accessories for l.v.h.b.c fuses

Accessories for cylindrical fuses

2

Ordering and Engineering Data

2.1 SITOR fuse links

	Order No.	Weight kg	Rated voltage V_n AC V	DC V	Rated current I_n A	Clearing I^2t value I^2t_A at 1.0 x V_n A^2s
	**3NC2 423** 3)	0.95	500	–	150	33000
	3NC2 425 3)	0.95	500	–	200	64000
	3NC2 427 3)	0.95	500	–	250	99000
	3NC2 428 3)	0.95	500	–	300	132000
	3NC2 431 3)	0.95	500	–	350	249000
	3NC2 432 3)	0.95	500	–	400	390000
	3NC2 423-3	0.95	500	–	150	33000
	3NC2 425-3	0.95	500	–	200	64000
	3NC2 427-3	0.95	500	–	250	99000
	3NC2 428-3	0.95	500	–	300	132000
	3NC2 431-3	0.95	500	–	350	249000
	3NC2 432-3	0.95	500	–	400	390000
	3NC8 423 3)	0.95	660	–	150	17600
	3NC8 425 3)	0.95	660	–	200	38400
	3NC8 427 3)	0.95	660	–	250	70400
	3NC8 431 3)	0.95	660	–	350	176000
	3NC8 434 3)	0.95	660	–	500	448000
	3NC8 423-3	0.95	660	–	150	17600
	3NC8 425-3	0.95	660	–	200	38400
	3NC8 427-3	0.95	660	–	250	70400
	3NC8 431-3	0.95	660	–	350	176000
	3NC8 434-3	0.95	660	–	500	448000
	3NC8 444-3	0.95	600	–	1000	2480000
	**3NE3 221** 2)	0.55	1000	–	100	4800
	3NE3 222 2)	0.55	1000	–	125	7200
	3NE3 224 2)	0.55	1000	–	160	13000
	3NE3 225 2)	0.55	1000	–	200	30000
	3NE3 227 2)	0.55	1000	–	250	48000
	3NE3 230-0B 2)	0.55	1000	–	315	80000
	3NE3 231 2)	0.55	1000	–	350	100000
	3NE3 232-0B 2)	0.55	1000	–	400	135000
	3NE3 233 2)	0.55	1000	–	450	175000

Table 10-1

1) Envelope dimension and pullers correspond to IEC 60269-2-1; however, contact blades are slotted according to IEC 60269-4-1
2) ® recognized (UR), for Guide Nos. and File Nos. of the Approval, refer to Section 1 *'Applications and Standards'*
3) Special version with 2 longitudinal slots (not shown in the diagram)

Pre-arcing I^2t value A^2s	Power loss W	Utilization category	Cyclic load factor *WL*	Size according to IEC/EN 60 269-2-1 or VDE 0636/201 (or DIN 43 620)	Inside caliper according to IEC/EN 60 269-4-1 or VDE 0636/401 (or DIN 43 653) mm	Characteristics and dimension drawings Section
7000	35	gR	0.85	3	–	3.1.1
13600	40	gR	0.85	3	–	3.1.1
21000	50	gR	0.85	3	–	3.1.1
28000	65	gR	0.85	3	–	3.1.1
53000	60	aR	0.85	3	–	3.1.1
83000	50	aR	0.85	3	–	3.1.1
7000	35	gR	0.85	3 [1)]	110	3.1.1
13600	40	gR	0.85	3 [1)]	110	3.1.1
21000	50	gR	0.85	3 [1)]	110	3.1.1
28000	65	gR	0.85	3 [1)]	110	3.1.1
53000	60	aR	0.85	3 [1)]	110	3.1.1
83000	50	aR	0.85	3 [1)]	110	3.1.1
1100	40	gR	0.85	3	–	3.1.4
2400	50	gR	0.85	3	–	3.1.4
4400	72	gR	0.85	3	–	3.1.4
11000	95	gR	0.85	3	–	3.1.4
28000	130	gR	0.85	3	–	3.1.4
1100	40	gR	0.85	3 [1)]	110	3.1.4
2400	50	gR	0.85	3 [1)]	110	3.1.4
4400	72	gR	0.85	3 [1)]	110	3.1.4
11000	95	gR	0.85	3 [1)]	110	3.1.4
28000	130	gR	0.85	3 [1)]	110	3.1.4
400000	140	aR	0.9	3 [1)]	110	3.1.4
665	28	aR	0.95	1 [1)]	110	3.1.14
1040	36	aR	0.95	1 [1)]	110	3.1.14
1850	42	aR	1	1 [1)]	110	3.1.14
4150	42	aR	1	1 [1)]	110	3.1.14
6650	50	aR	1	1 [1)]	110	3.1.14
13400	65	aR	0.95	1 [1)]	110	3.1.15
16600	75	aR	0.9	1 [1)]	110	3.1.15
22600	85	aR	0.9	1 [1)]	110	3.1.15
29500	95	aR	0.9	1 [1)]	110	3.1.15

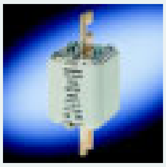
	Order No.	Weight kg	Rated voltage V_n AC V	DC V	Rated current I_n A	Clearing I^2t value I^2t_A at 1.0 x V_n A^2s
	**3NE3 332-0B** 2)	0.7	1000	–	400	135000
	3NE3 333 2)	0.7	1000	–	450	175000
	3NE3 334-0B 2)	0.7	1000	–	500	260000
	3NE3 335 2)	0.7	1000	–	560	360000
	3NE3 336 2)	0.7	1000	–	630	600000
	3NE3 337-8 2)	0.7	900	–	710	800000
	3NE3 338-8 2)	0.7	800	–	800	850000
	3NE3 340-8 2)	0.7	690	–	900	1300000
	**3NE3 421**	1.15	1000	–	100	13500
	3NE3 430	1.15	1000	–	315	218000
	3NE3 432	1.15	1000	–	400	364000
	3NE3 434	1.15	1000	–	500	870000
	3NE3 626	1.15	1000	–	224	54000
	3NE3 635	1.15	1000	–	450	488000
	3NE3 635-6 4)	1.15	1000	–	450	488000
	3NE3 636	1.15	1000	–	630	1280000
	3NE3 637	1.15	1000	–	710	1950000
	3NE3 637-1	1.15	1000	–	710	1950000
	**3NE4 101** 2)	0.27	1000	–	32	280
	3NE4 102 2)	0.27	1000	–	40	500
	3NE4 117 2)	0.27	1000	–	50	800
	3NE4 118 2)	0.27	1000	–	63	1500
	3NE4 120 2)	0.27	1000	–	80	3000
	3NE4 121 2)	0.27	1000	–	100	6000
	3NE4 122 2)	0.27	1000	–	125	14000
	3NE4 124 2)	0.27	1000	–	160	29000
	**3NE4 327-0B**	0.7	800	–	250	29700
	3NE4 330-0B	0.7	800	–	315	60700
	3NE4 333-0B	0.7	800	–	450	191000
	3NE4 334-0B	0.7	800	–	500	276000
	3NE4 337	0.7	800	–	710	923000

Table 12-2

1) Envelope dimension and pullers correspond to IEC 60269-2-1; however, contact blades are slotted according to IEC 60269-4-1
2) Ⓡ recognized (UL), for Guide Nos. and File Nos. of the Approval, refer to Section 1 *'Applications and Standards'*
3) M12
4) Diagram, refer to Section 4.2, 3NE6 4.., 3NE9 4..

Pre-arcing I^2t value A^2s	Power loss W	Utilization category	Cyclic load factor *WL*	Size according to IEC/EN 60 269-2-1 or VDE 0636/201 (or DIN 43 620)	Inside caliper according to IEC/EN 60 269-4-1 or VDE 0636/401 (or DIN 43 653) mm	Characteristics and dimension drawings Section
22600	85	aR	1	2 [1]	110	3.1.16
29500	90	aR	1	2 [1]	110	3.1.16
46100	90	aR	1	2 [1]	110	3.1.16
66400	95	aR	1	2 [1]	110	3.1.16
104000	100	aR	1	2 [1]	110	3.1.16
149000	105	aR	1	2 [1]	110	3.1.16
184000	130	aR	0.95	2 [1]	110	3.1.16
223000	165	aR	0.95	2 [1]	110	3.1.16
1800	25	aR	1	3	130	3.1.17
29000	80	aR	1	3	130	3.1.17
48500	110	aR	1	3	130	3.1.17
116000	95	aR	1	3	130	3.1.17
7200	85	aR	1	3	130	3.1.17
65000	110	aR	1	3	130	3.1.17
65000	110	aR	1	3	139	3.1.17
170000	132	aR	1	3	130	3.1.17
260000	145	aR	1	3	130	3.1.17
260000	145	aR	1	3	140 [3]	3.1.17
40	12	gR	0.9	0	–	3.1.13
75	13	gR	0.9	0	–	3.1.13
120	16	gR	0.9	0	–	3.1.13
230	20	aR	0.9	0	–	3.1.13
450	22	aR	0.9	0	–	3.1.13
900	24	aR	0.9	0	–	3.1.13
1800	30	aR	0.9	0	–	3.1.13
3600	35	aR	0.9	0	–	3.1.13
3600	105	aR	0.85	2 [1]	110	3.1.12
7400	120	aR	0.85	2 [1]	110	3.1.12
29400	140	aR	0.85	2 [1]	110	3.1.12
42500	155	aR	0.85	2 [1]	110	3.1.12
142000	155	aR	0.95	2 [1]	110	3.1.12

	Order No.	Weight kg	Rated voltage V_n AC V	Rated voltage V_n DC V	Rated current I_n A	Clearing I^2t value I^2t_A at 1.0 x V_n A^2s
	**3NE5 424**	1.95	1 500	–	160	54 000
	3NE5 426	1.95	1 500	–	224	138 000
	3NE5 430	1.95	1 500	–	315	311 000
	3NE5 431	1.95	1 500	–	350	428 000
	3NE5 433	1.95	1 500	–	450	870 000
	3NE5 433-1	1.95	1 500	–	450	870 000
	**3NE5 627**	1.6	1 500	–	250	84 000
	3NE5 633	1.6	1 500	–	450	590 000
	3NE5 643	1.6	1 500	–	600	1 950 000
	**3NE1 813-0** 1)	0.13	690	–	16	200
	3NE1 814-0 1)	0.13	690	–	20	430
	3NE1 815-0 1)	0.13	690	–	25	780
	3NE1 803-0 1)	0.13	690	–	35	1 700
	3NE1 802-0 1)	0.13	690	–	40	3 000
	3NE1 817-0 1)	0.13	690	–	50	4 400
	3NE1 818-0 1)	0.13	690	–	63	9 000
	3NE1 820-0 1)	0.13	690	–	80	18 000
	**3NE1 021-0** 1)	0.2	690	–	100	33 000
	3NE1 022-0 1)	0.2	690	–	125	63 000
	3NE1 022-2 1)	0.2	690	–	125	23 000
	**3NE1 224-0** 1)	0.55	690	–	160	60 000
	3NE1 225-0 1)	0.55	690	–	200	100 000
	3NE1 227-0 1)	0.55	690	–	250	200 000
	3NE1 230-0 1)	0.55	690	–	315	310 000
	3NE1 224-2 1)	0.55	690	–	160	15 840
	3NE1 225-2 1)	0.55	690	–	200	44 000
	3NE1 227-2 1)	0.55	690	–	250	68 800
	3NE1 230-2 1)	0.55	690	–	315	135 500

Table 14-3

1) ® recognized (UL), for Guide Nos. and File Nos. of the Approval, refer to Section 1 *'Applications and Standards'*

Pre-arcing I^2t value A²s	Power loss W	Utilization category	Cyclic load factor *WL*	Size according to IEC/EN 60 269-2-1 or VDE 0636/201 (or DIN 43 620)	Inside caliper according to IEC/EN 60 269-4-1 or VDE 0636/401 (or DIN 43 653) mm	Characteristics and dimension drawings Section
7200	56	aR	1	3	210	3.1.18
18400	80	aR	1	3	210	3.1.18
41500	115	aR	1	3	210	3.1.18
57000	135	aR	1	3	210	3.1.18
116000	145	aR	0.95	3	210	3.1.18
116000	145	aR	0.95	3	210	3.1.18
11200	130	aR	1	3	170	3.1.19
78500	160	aR	1	3	170	3.1.19
260000	145	aR	1	3	170	3.1.19
18	3	gR/gS	1	000	–	3.1.5
41	3.5	gR/gS	1	000	–	3.1.5
74	4	gR/gS	1	000	–	3.1.5
166	5	gR/gS	1	000	–	3.1.5
295	5	gR/gS	1	000	–	3.1.5
461	6	gR/gS	1	000	–	3.1.5
903	7	gR/gS	1	000	–	3.1.5
1843	8	gR/gS	1	000	–	3.1.5
3100	10	gR/gS	1	00	–	3.1.6
6000	11	gR/gS	1	00	–	3.1.6
3115	13.5	gR	1	00	–	3.1.9
7400	24	gR/gS	1	1	–	3.1.6
14500	27	gR/gS	1	1	–	3.1.6
29500	30	gR/gS	1	1	–	3.1.6
46100	38	gR/gS	1	1	–	3.1.6
2650	30	gR	1	1	–	3.1.9
5645	28	gR	1	1	–	3.1.9
11520	35	gR	1	1	–	3.1.9
22580	42	gR	1	1	–	3.1.9

	Order No.	Weight kg	Rated voltage V_n AC V	 DC V	Rated current I_n A	Clearing I^2t value I^2t_A at 1.0 x V_n A^2s
	**3NE1 331-0** 2)	0.7	690	–	350	430000
	3NE1 332-0 2)	0.7	690	–	400	590000
	3NE1 333-0 2)	0.7	690	–	450	750000
	3NE1 334-0 2)	0.7	690	–	500	950000
	3NE1 331-2 2)	0.7	690	–	350	177000
	3NE1 333-2 2)	0.7	690	–	450	276000
	3NE1 334-2 2)	0.7	690	–	500	398000
	**3NE1 435-0** 2)	0.95	690	–	560	1700000
	3NE1 436-0 2)	0.95	690	–	630	2350000
	3NE1 437-0 2)	0.95	690	–	710	3400000
	3NE1 438-0 2)	0.95	690	–	800	5000000
	3NE1 437-1 2)	0.95	600	–	710	2460000
	3NE1 438-1 2)	0.95	600	–	800	3350000
	3NE1 435-2 2)	1	690	–	560	845000
	3NE1 436-2 2)	1	690	–	630	1320000
	3NE1 447-2 2)	1	690	–	670	1557000
	3NE1 437-2 2)	1	690	–	710	1725000
	3NE1 438-2 2)	1	690	–	800	2348000
	3NE1 448-2 2)	1	690	–	850	3381000
	**3NE7 425**	1.95	2000	–	200	138000
	3NE7 427	1.95	2000	–	250	218000
	3NE7 431	1.95	2000	–	350	555000
	3NE7 432	1.95	2000	–	400	870000
	3NE7 633	1.95	2000	–	450	960000
	3NE7 633-1	1.95	2000	–	450	960000
	3NE7 648-1	1.95	2000	–	525	1120000
	3NE7 636	1.95	2000	–	630	1950000
	3NE7 636-1	1.95	2000	–	630	1950000
	3NE7 637-1	1.95	2000	–	710	3110000
	**3NE9 632-1**	2.5	2500	–	400	620000
	3NE9 634-1	2.5	2500	–	500	1270000
	3NE9 636-1A	2.5	2500	–	630	2800000

Table 16-4

1) M12
2) ® recognized (UR), for Guide Nos. and File Nos. of the Approval, refer to Section 1 *'Applications and Standards'*

Pre-arcing I^2t value A²s	Power loss W	Utilization category	Cyclic load factor *WL*	Size according to IEC/EN 60 269-2-1 or VDE 0636/201 (or DIN 43 620)	Inside caliper according to IEC/EN 60 269-4-1 or VDE 0636/401 (or DIN 43 653) mm	Characteristics and dimension drawings Section
58000	42	gR/gS	1	2	–	3.1.7
84000	45	gR/gS	1	2	–	3.1.7
104000	53	gR/gS	1	2	–	3.1.7
149000	56	gR/gS	1	2	–	3.1.7
29500	44	gR	1	2	–	3.1.9
46100	62	gR	1	2	–	3.1.9
66400	65	gR	1	2	–	3.1.9
215000	50	gR/gS	1	3	–	3.1.7
293000	55	gR/gS	1	3	–	3.1.7
437000	60	gR/gS	1	3	–	3.1.7
723000	59	gR/gS	1	3	–	3.1.7
321000	65	gR	1	3	–	3.1.8
437000	72	gR	1	3	–	3.1.8
130100	60	gR	1	3	–	3.1.10
203000	62	gR	1	3	–	3.1.10
240000	65	gR	1	3	–	3.1.10
265000	72	gR	1	3	–	3.1.10
361000	82	gR	1	3	–	3.1.10
520000	76	gR	1	3	–	3.1.10
18400	75	aR	1	3	210	3.1.20
29000	110	aR	1	3	210	3.1.20
74000	120	aR	1	3	210	3.1.20
116000	150	aR	1	3	210	3.1.20
128000	160	aR	1	3	210	3.1.20
128000	160	aR	1	3	210 [1)]	3.1.20
149000	210	aR	1	3	210 [1)]	3.1.20
260000	220	aR	1	3	210	3.1.20
260000	220	aR	1	3	210 [1)]	3.1.20
415000	275	aR	1	3	210 [1)]	3.1.20
81000	205	aR	1	3	260 [1)]	3.1.21
170000	235	aR	1	3	260 [1)]	3.1.21
385000	275	aR	1	3	260 [1)]	3.1.21

	Order No.	Weight kg	Rated voltage V_n		Rated current	Clearing I^2t value
			AC	DC	I_n	I^2t_A at 1.0 x V_n
			V	V	A	A^2s
	**3NE8 015-1** [1)]	0.2	690	–	25	180
	3NE8 003-1 [1)]	0.2	690	–	35	400
	3NE8 017-1 [1)]	0.2	690	–	50	700
	3NE8 018-1 [1)]	0.2	690	–	63	1400
	3NE8 020-1 [1)]	0.2	690	–	80	2400
	3NE8 021-1 [1)]	0.2	690	–	100	4200
	3NE8 022-1 [1)]	0.2	690	–	125	6500
	3NE8 024-1 [1)]	0.2	690	–	160	13000
	**3NE8 714-1**	0.13	690	700 [1)]	20	83
	3NE8 715-1	0.13	690	700 [1)]	25	140
	3NE8 701-1	0.13	690	700 [1)]	32	285
	3NE8 702-1	0.13	690	700 [1)]	40	490
	3NE8 717-1	0.13	690	700 [1)]	50	815
	3NE8 718-1	0.13	690	700 [1)]	63	1550
	3NE8 720-1	0.13	690	700 [1)]	80	2700
	3NE8 721-1	0.13	690	700 [1)]	100	4950
	3NE8 722-1	0.13	690	700 [1)]	125	9100
	3NE8 724-1	0.13	690	700 [1)]	160	17000
	3NE8 725-1	0.13	690	700 [1)]	200	30000
	3NE8 727-1	0.13	690	700 [1)]	250	55000
	3NE8 731-1	0.13	690	700 [1)]	315	85500
	**3NC1 003**	0.01	600	400	3	8
	3NC1 006	0.01	600	400	6	30
	3NC1 008	0.01	600	400	8	50
	3NC1 010	0.01	600	400	10	70
	3NC1 012	0.01	600	400	12	120
	3NC1 016	0.01	600	400	16	150
	3NC1 020	0.01	600	400	20	260
	3NC1 025	0.01	600	400	25	390
	3NC1 032	0.01	600	400	32	600
	3NC1 103	0.01	600	–	3	–
	3NC1 105	0.01	600	–	5	–

Table 18-5

1) ® recognized (UL) for Guide Nos. and File Nos. of the Approval, refer to Section 1 *'Applications and Standards'*
2) CLASS CC

Pre-arcing I^2t value A^2s	Power loss W	Utilization category	Cyclic load factor *WL*	Size according to IEC/EN 60 269-2-1 or VDE 0636/201 (or DIN 43 620)	Inside caliper according to IEC/EN 60 269-4-1 or VDE 0636/401 (or DIN 43 653) mm	Characteris-tics and dimension drawings Section
30	7	gR	0.95	00	–	3.1.11
70	9	gR	0.95	00	–	3.1.11
120	14	gR	0.95	00	–	3.1.11
260	16	gR	0.95	00	–	3.1.11
450	19	aR	0.95	00	–	3.1.11
850	22	aR	0.95	00	–	3.1.11
1400	28	aR	0.95	00	–	3.1.11
2800	38	aR	0.95	00	–	3.1.11
12	7	gR	0.9	000	80	3.1.2
19	9	gR	0.9	000	80	3.1.2
40	10	gR	0.9	000	80	3.1.2
69	12	gR	0.9	000	80	3.1.2
115	15	gR	0.9	000	80	3.1.2
215	16	aR	0.95	000	80	3.1.2
380	19	aR	0.9	000	80	3.1.3
695	24	aR	0.95	000	80	3.1.3
1250	28	aR	0.95	000	80	3.1.3
2350	32	aR	0.9	000	80	3.1.3
4200	37	aR	0.9	000	80	3.1.3
7750	42	aR	0.9	000	80	3.1.3
12000	55	aR	0.85	000	80	3.1.3
3	1.2	aR	–	10 x 38	–	3.1.22
4	1.5	aR	–	10 x 38	–	3.1.22
6	2	aR	–	10 x 38	–	3.1.22
9	2.5	aR	–	10 x 38	–	3.1.22
15	3	aR	–	10 x 38	–	3.1.22
25	3.5	aR	–	10 x 38	–	3.1.22
34	4.8	aR	–	10 x 38	–	3.1.22
60	6	aR	–	10 x 38	–	3.1.22
95	7.5	aR	–	10 x 38	–	3.1.22
–	2.5	[2]	–	10 x 38	–	3.1.23
–	2	[2]	–	10 x 38	–	3.1.23

Order No.	Weight kg	Rated voltage V_n AC V	Rated voltage V_n DC V	Rated current I_n A	Clearing I^2t value I^2t_A at 1.0 x V_n A^2s
3NC1 401	0.02	660	700 1)	1	–
3NC1 402	0.02	660	700 1)	2	–
3NC1 403	0.02	660	700 1)	3	–
3NC1 404	0.02	660	700 1)	4	–
3NC1 405	0.02	690	700 1)	5	11
3NC1 406	0.02	690	700 1)	6	–
3NC1 410	0.02	690	700 1)	10	22
3NC1 415	0.02	690	700 1)	15	22
3NC1 420	0.02	690	700 1)	20	60
3NC1 425	0.02	690	700 1)	25	130
3NC1 430	0.02	690	700 1)	30	150
3NC1 432	0.02	690	700 1)	32	800
3NC1 440	0.02	690	700 1)	40	980
3NC1 450	0.02	690	700 1)	50	1800
3NC1 504	0.02	690		4	–
3NC1 506	0.02	690		6	–
3NC1 516	0.02	690		16	–
3NC2 220	0.06	690	700 1)	20	370
3NC2 225	0.06	690	700 1)	25	560
3NC2 232	0.06	690	700 1)	32	850
3NC2 240	0.06	690	700 1)	40	1350
3NC2 250	0.06	690	700 1)	50	1120
3NC2 263	0.06	690	700 1)	63	2700
3NC2 280	0.06	690	700 1)	80	5100
3NC2 200	0.06	600	700 1)	100	10000

Table 20-6

1) ® Recognized (UL), for Guide Nos. and File Nos. of the Approval, refer to Section 1 *'Applications and Standards'*

Pre-arcing I^2t value A²s	Power loss W	Utilization category	Cyclic load factor *WL*	Size according to IEC/EN 60 269-2-1 or VDE 0636/201 (or DIN 43 620)	Inside caliper according to IEC/EN 60 269-4-1 or VDE 0636/401 (or DIN 43 653) mm	Characteristics and dimension drawings Section
–	5	aR	–	14 x 51	–	3.1.24
–	3	aR	–	14 x 51	–	3.1.24
–	2.5	aR	–	14 x 51	–	3.1.24
–	–	aR	–	14 x 51	–	3.1.24
1.6	1.5	aR	–	14 x 51	–	3.1.24
–	1.5	aR	–	14 x 51	–	3.1.24
3.6	4	aR	–	14 x 51	–	3.1.24
10	5.5	aR	–	14 x 51	–	3.1.25
26	6	aR	–	14 x 51	–	3.1.25
44	7	aR	–	14 x 51	–	3.1.25
58	9	aR	–	14 x 51	–	3.1.25
95	7.6	aR	–	14 x 51	–	3.1.25
110	8	aR	–	14 x 51	–	3.1.25
220	9	aR	–	14 x 51	–	3.1.25
–	–	gG	–	14 x 51	–	3.1.26
–	–	gG	–	14 x 51	–	3.1.26
–	–	gG	–	14 x 51	–	3.1.26
34	4.6	aR	–	22 x 58	–	3.1.27
60	5.6	aR	–	22 x 58	–	3.1.27
95	7	aR	–	22 x 58	–	3.1.27
185	8.5	aR	–	22 x 58	–	3.1.27
155	9.5	aR	–	22 x 58	–	3.1.27
310	11	aR	–	22 x 58	–	3.1.27
620	13.5	aR	–	22 x 58	–	3.1.27
1250	16	aR	–	22 x 58	–	3.1.27

2.2 SITOR fuse links for special applications

	Order No.	Weight kg	Rated voltage V_n AC V	 DC V	Rated current I_n A	Clearing I^2t value I^2t_A at 1.0 x V_n A^2s
	**3NC5 531** 1) **3NC5 838** 1) **3NC5 840** 1) **3NC5 841** 1)	0.67 1.2 1.4 1.2	800 1000 1000 800		350 800 600 630	260000 1728000 888000 888000
	3NC7 327-2 2) **3NC7 331-2** 2)	0.7 0.7	680 680	– –	250 350	635000 1430000
	3NE3 525-5 3) **3NE3 535-5** 3)	0.7 0.7	1000 1000	–	200 450	44000 395000
	**3NE4 117-5** 4) **3NE4 121-5** 4) **3NE4 146-5** 4)	0.28 0.28 0.28	1000 1000 800	– – –	50 100 170	1100 7400 60500

Table 22-7

1) For rectifiers in electrolysis systems (these are screwed onto water-cooled busbars)
2) For traction feeder rectifiers
3) For SITOR thyristor sets 6QG10
4) For SITOR thyristor sets 6QG11

Pre-arcing I^2t value A²s	Power loss W	Utilization category	Cyclic load factor *WL*	Size according to IEC/EN 60 269-2-1 or VDE 0636/201 (or DIN 43 620)	Inside caliper according to IEC/EN 60 269-4-1 or VDE 0636/401 (or DIN 43 653) mm	Characteristics and dimension drawings Section
66000	80	aR	0.9	–	–	3.2.3
360000	170	aR	0.9	–	–	3.2.3
185000	150	aR	0.9	–	–	3.2.3
185000	145	aR	0.9	–	–	3.2.3
244000	25	aR	0.9	–	–	3.2.5
550000	32	aR	0.9	–	–	3.2.5
7150	50	aR	0.85	–	–	3.2.1
64500	90	aR	0.85	–	–	3.2.1
135	20	gR	0.85	–	–	3.2.1
900	35	aR	0.85	–	–	3.2.1
7370	43	aR	0.85	–	–	3.2.1

	Order No.	Weight kg	Rated voltage V_n AC	Rated voltage V_n DC	Rated current I_n	Clearing I^2t value I^2t_A at 1.0 x V_n
			V	V	A	A^2s
	**3NE4 327-6B** 1)	0.65	800	–	250	29700
	3NE4 330-6B 1)	0.65	800	–	315	60700
	3NE4 333-6B 1)	0.65	800	–	450	191000
	3NE4 334-6B 1)	0.65	800	–	500	276000
	3NE4 337-6 1)	0.65	800	–	710	923000
	**3NE6 437** 2)	1.0	900	–	710	620000
	3NE6 444 2)	1.1	900	–	900	1920000
	3NE9 440-6 2)	1.0	600	–	850	2480000
	3NE9 450 2)	1.0	600	–	1250	2480000
	**3NE6 437-7** 3)	1.0	900	–	710	620000
	3NE9 450-7 3)	1.0	600	–	1250	2480000

Table 24-8

1) For SITOR thyristor sets 6QG12
2) For air-cooled rectifiers in electrolysis systems
3) For rectifiers in electrolysis systems (these are screwed onto water-cooled busbars)

Pre-arcing I^2t value A^2s	Power loss W	Utilization category	Cyclic load factor *WL*	Size according to IEC/EN 60 269-2-1 or VDE 0636/201 (or DIN 43 620)	Inside caliper according to IEC/EN 60 269-4-1 or VDE 0636/401 (or DIN 43 653) mm	Characteristics and dimension drawings Section
3600	105	aR	0.85	–	–	3.2.2
7400	120	aR	0.85	–	–	3.2.2
29400	140	aR	0.85	–	–	3.2.2
42500	155	aR	0.85	–	–	3.2.2
142000	155	aR	0.95	–	–	3.2.2
100000	150	gR	0.9	–	–	3.2.4
400000	170	aR	0.9	–	–	3.2.4
400000	85	gR	1	–	–	3.2.4
400000	210	aR	0.9	–	–	3.2.4
100000	150	aR	0.9	–	–	3.2.4
400000	210	aR	0.9	–	–	3.2.4

2.3 Accessories for l.v.h.b.c fuses

Permissible loading and required connection cross-sections when used in l.v.h.b.c fuse bases and switch disconnectors

SITOR fuse link	Rated current	Required cross-section of cables/busbars	l.v.h.b.c. fuse base		Suitable puller	Fuse switch disconnector		Switch disconnector with fuses	
	I_n			max. current			max. current		max. current
Order No.	A	mm² Cu	Order No.	A	Order No.	Order No.	A	Order No.	A
3NC2 423/-3	150	70	**3NH3 430** [2) 3)]	150	**3NX1 011**	**3NP5 4**	145	**3KL61 30**	145
3NC2 425/-3	200	95		190			180		180
3NC2 427/-3	250	120		240			225		225
3NC2 428/-3	300	185		285			255		255
3NC2 431/-3	350	240		330			330		330
3NC2 432/-3	400	240		400			400		400
3NC8 423/-3	150	70		135			135		135
3NC8 425/-3	200	95		180			180		180
3NC8 427/-3	250	120		250			225		225
3NC8 431/-3	350	240		315			300		300
3NC8 434/-3	500	2 x 150		450			425		425

Table 26-9

1) When maintaining pollution degree 2 according to DIN VDE 0660 Part 100, the rated insulation voltage of 3KL, 3KM and 3NP switch disconnectors (designed for degree of pollution 3) is 1000 V
2) The maximum currents are valid for natural air cooling. With forced cooling $v \geq 1$ m/s the fuses can be used with rated current I_n.
3) UR recognized (UL), for Guide Nos. and File Nos. of the Approval, refer to Section 1 *'Applications and Standards'*

Permissible loading and required connection cross-sections when used in l.v.h.b.c fuse bases and switch disconnectors

SITOR fuse link	Rated current	Required cross-section of cables/busbars	l.v.h.b.c. fuse base		Suitable puller	Fuse switch disconnector		Switch disconnector with fuses	
	I_n			max. current			max. current		max. current
Order No.	A	mm^2 Cu	Order No.	A	Order No.	Order No.	A	Order No.	A
3NE1 813-0	16	1.5	**3NH3 030[1]/ 3NH4 030**	16	**3NX1 011**	**3NP4 0/ 3NP5 0**	16	**3KL50 30/ 3KM50 30**	16
3NE1 814-0	20	2.5		20			20		20
3NE1 815-0	25	4		25			25		25
3NE1 803-0	35	6		35			35		35
3NE1 802-0	40	10		40			40		40
3NE1 817-0	50	10		50			50		50
3NE1 818-0	63	16		63			63		63
3NE1 820-0	80	25		80			80	**3KL52 30/ 3KM52 30**	80
3NE1 021-0	100	35		100		**3NP4 0/ 3NP5 0**	100		100
3NE1 022-0	125	50		125			125		125
3NE1 224-0	160	70	**3NH3 230[1]/ 3NH4 230**	160		**3NP4 2/ 3NP5 2**	160	**3KL55 30/ 3KM55 30**	160
3NE1 225-0	200	95		200			200		200
3NE1 227-0	250	120		250			250		250
3NE1 230-0	315	2 x 70	**3NH3 330[1]**	315		**3NP5 3**	315	**3KL57 30/ 3KM57 30**	315
3NE1 331-0	350	2 x 95		350			350		350
3NE1 332-0	400	2 x 95		400			400		400
3NE1 333-0	450	2 x 120	**3NH3 430[1]**	450		**3NP5 4**	450	**3KL61 30**	450
3NE1 334-0	500	2 x 120		500			500		500
3NE1 435-0	560	2 x 150		560			560		560
3NE1 436-0	630	2 x 185		630			630		630
3NE1 437-0	710	2 x (50 x 5)		710			710	**3KL62**	710
3NE1 438-0	800	2 x (50 x 5)		800			800		800
3NE1 437-1	710	2 x (50 x 5)	**3NH3 430**	690		**3NP5 4**	690		710
3NE1 438-1	800	2 x (50 x 5)		750		**3NP5 4**	750		800
3NE1 022-2	125	50	**3NH3 030/ 3NH4 030**	125		**3NP4 0/ 3NP5 0**	125	**3KL52/ 3KM52**	125
3NE1 224-2	160	70	**3NH3 230/ 3NH4 230**	160		**3NP4 2/ 3NP5 2**	160	**3KL55 3KM55**	145
3NE1 225-2	200	95		200			200		180
3NE1 227-2	250	120		250			250		220
3NE1 230-2	315	2 x 70	**3NH3 330**	315		**3NP5 3**	315	**3KL57/ 3KM57**	280
3NE1 331-2	350	2 x 95		350			350		300

1) UL recognized (UL), for Guide Nos. and File Nos. of the Approval, refer to Section 1 *'Applications and Standards'*

Table 27-10

Permissible loading and required connection cross-sections when used in l.v.h.b.c fuse bases and switch disconnectors

SITOR fuse link	Rated current	Required cross-section of cables/busbars	l.v.h.b.c. fuse base		Suitable puller	Fuse switch disconnector		Switch disconnector with fuses	
Order No.	I_n A	mm^2 Cu	Order No.	max. current A	Order No.	Order No.	max. current A	Order No.	max. current A
3NE1 333-2	450	2 x 120	**3NH3 430**	450	**3NX1 011**	**3NP5 4**	450	**3KL61**	450
3NE1 334-2	500	2 x 120		500			500		500
3NE1 435-2	560	2 x 150		560			560		560
3NE1 436-2	630	2 x 185		630		**3NP5 4**	625		615
3NE1 447-2	670	2 x (40 x 5)		670			655	**3KL62**	670
3NE1 437-2	710	2 x (40 x 5)		710		**3NP5 4**	685		700
3NE1 438-2	800	2 x (50 x 5)		800		**3NP5 4**	770		760
3NE1 448-2	850	2 x (30 x 8)		850		**3NP5 4**	820		790
3NE8 015-1	25	4	**3NH3 030**1)**/**	25		**3NP4 0/**	25	**3KL50 30**	25
3NE8 003-1	35	6	**3NH4 030**	35		**3NP5 0**	35	**3KM50 30**	35
3NE8 017-1	50	10		50			45		45
3NE8 018-1	63	16		63			55		55
3NE8 020-1	80	25		80			70	**3KL52 30/**	70
3NE8 021-1	100	35		100			85	**3KM52 30**	85
3NE8 022-1	125	50		125			100		100
3NE8 024-1	160	70		160			130		130
3NE4 327-0B	250	120	**3NH3 330**2)	240		**3NP5 3**	190	**3KL57 30/**	170
3NE4 330-0B	315	240		300			250	**3KM57 30**	225
3NE4 333-0B	450	40 x 8	**3NH3 430**2)	425		**3NP5 4**	420	**3KL61 30**1)	370
3NE4 334-0B	500	40 x 8		475			450		425
3NE4 337	710	50 x 10		630			600	**3KL62**	600
3NE4 101	32	6	**3NH3 120**2)**/**	32		**3NP4 2**1)**/**	32	**3KL55 30/**	32
3NE4 102	40	10	**3NH4 230**	40		**3NP5 2**	40	**3KM55 30**	40
3NE4 117	50	10		50			50		50
3NE4 118	63	16		63			63		63
3NE4 120	80	25		80			80		80
3NE4 121	100	35		100			95		95
3NE4 122	125	50		125			120		120
3NE4 124	160	70		160			150		150

Table 28-11

1) When maintaining pollution degree 2 according to DIN VDE 0660 Part 100, the rated insulation voltage of 3KL, 3KM and 3NP switch disconnectors (designed for degree of pollution 3) is 1000 V

2) ® recognized (UL), for Guide Nos. and File Nos. of the Approval, refer to Section 1 *'Applications and Standards'*

Permissible loading and required connection cross-sections when used in l.v.h.b.c fuse bases and switch disconnectors									
SITOR fuse link	Rated current	Required cross-section of cables/busbars	l.v.h.b.c. fuse base		Suitable puller	Fuse switch disconnector		Switch disconnector with fuses	
Order No.	I_n A	mm^2 Cu	Order No.	max. current A	Order No.	Order No.	max. current A	Order No.	max. current A
3NE3 221	100	35	**3NH3 230** [2]**/**	100	**3NX1 011**	**3NP4 2** [1]**/**	90	**3KL55 30/**	90
3NE3 222	125	50	**3NH4 230**	125		**3NP5 2**	110	**3KM55 30**	110
3NE3 224	160	70		160			140		140
3NE3 225	200	95		200			175		175
3NE3 227	250	120		250			210		210
3NE3 230-0B	315	185	**3NH3 330** [2]	305		**3NP5 3**	285	**3KL57 30/**	240
3NE3 231	350	240		335			310	**3KM57 30**	265
3NE3 232-0B	400	240		380			330		290
3NE3 233	450	2 x 150		425			360		320
3NE3 332-0B	400	240	**3NH3 430** [2]	400		**3NP5 4**	340	**3KL61 30** [1]	340
3NE3 333	450	2 x 150		450			380		380
3NE3 334-0B	500	2 x 150		500			450		440
3NE3 335	560	2 x 185		560			510		500
3NE3 336	630	2 x 185		630			580	**3KL62**	570
3NE3 337-8	710	2 x 200		680			630		640
3NE3 338-8	800	2 x 200		700			630		720
3NE3 340-8	900	2 x 240		750			630		800

Table 29-12

1) When maintaining pollution degree 2 according to DIN VDE 0660 Part 100, the rated insulation voltage of 3KL, 3KM and 3NP switch disconnectors (designed for degree of pollution 3) is 1000 V
2) ® recognized (ЯU), for Guide Nos. and File Nos. of the Approval, refer to Section 1 '*Applications and Standards*'

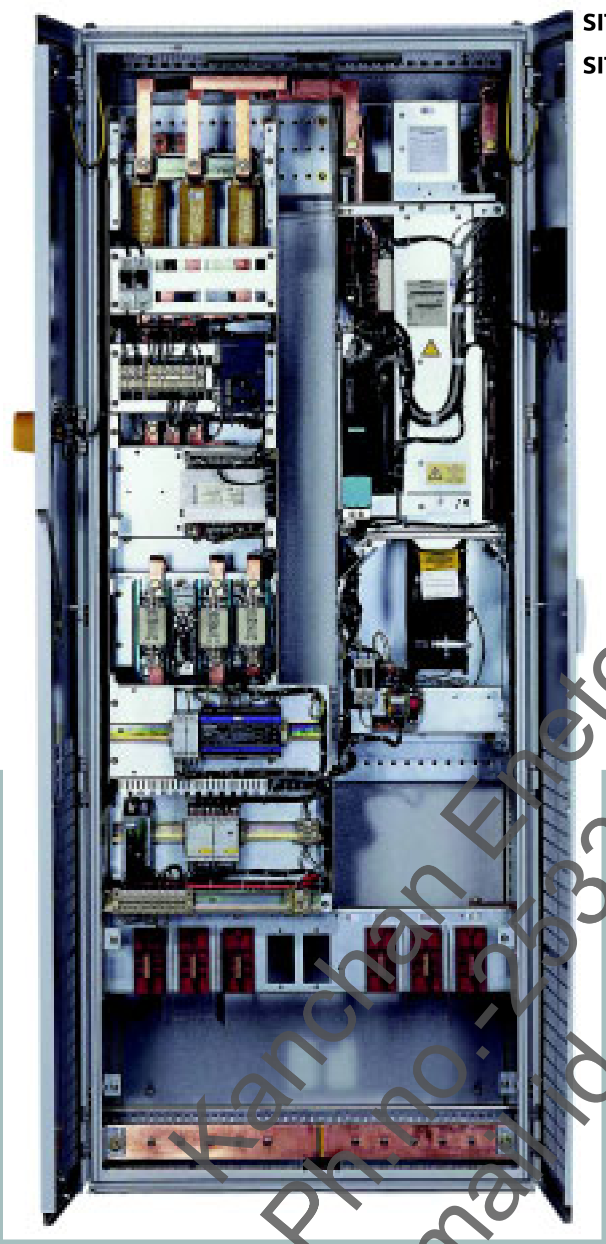
2.4 Accessories for cylindrical fuses

Permissible load and required connection cross-sections when using in cylindrical fuse bases and switch disconnectors

SITOR fuse link Order No.	Rated current I_n A	Required connection cross-section mm² Cu	Cylindrical fuse base 1-phase Order No.	I_{max} A	Cylindrical fuse base 2-phase Order No.	I_{max} A	Cylindrical fuse base 3-phase Order No.	I_{max} A	Fuse puller Order No.	Cylindrical fuse disconnector 1-phase Order No.	I_{max} A	Cylindrical fuse disconnector 2-phase Order No.	I_{max} A	Cylindrical fuse disconnector 3-phase Order No.	I_{max} A
3NC1 003	3	1	**3NC1 038-1**	3	**3NC1 038-2**	3	**3NC1 038-3**	3	**3NC1 000**	**3NC1 091**	3	**3NC1 092**	3	**3NC1 093**	3
3NC1 006	6	1		6		6		6			6		**6**		6
3NC1 008	8	1		8		8		8			8		8		8
3NC1 010	10	1.5		10		10		10			10		10		10
3NC1 012	12	1.5		12		12		12			12		12		12
3NC1 016	16	2.5		16		16		16			16		16		16
3NC1 020	20	2.5		20		20		20			20		20		20
3NC1 025	25	4		25		24		24			25		25		25
3NC1 032	32	6		32		28		28			32		30		29
3NC1 103	3	1		3		3		3			3		3		3
3NC1 105	5	1		5		5		5			5		5		5
3NC1 401	1	1	**3NC1 451-1**	1						**3NC1 491**	1	**3NC1 492**	1	**3NC1 493**	1
3NC1 402	2	1		2							2		2		2
3NC1 403	3	1		3							3		3		3
3NC1 404	4	1		4							4		4		4
3NC1 405	5	1		5							5		5		5
3NC1 406	6	1		6							6		6		6
3NC1 410	10	1.5		10							10		10		10
3NC1 415	15	1.5		15							15		15		15
3NC1 420	20	2.5		20							20		20		20
3NC1 425	25	4		25							25		24		23
3NC1 430	30	6		30							28		27		25
3NC1 432	32	6		32							31		30		30
3NC1 440	40	10		40							38		37		36
3NC1 450	50	10		50							48		46		44
3NC1 504	4	1		4							4		4		4
3NC1 506	6	1		6							6		6		6
3NC1 516	16	2.5		16							16		16		16
3NC2 220	20	2.5	**3NC2 258-1**	20						**3NC2 291**	20	**3NC2 292**	20	**3NC2 293**	20
3NC2 225	25	4		25							25		25		25
3NC2 232	32	6		32							32		32		32
3NC2 240	40	10		40							40		39		38
3NC2 250	50	10		50							50		48		46
3NC2 263	63	16		63							60		58		56
3NC2 280	80	25		80							74		71		69
3NC2 200	100	35		100							95		90		85

Table 30-13

Characteristics and Dimension Drawings



SITOR fuse links

SITOR fuse links for special applications

3

Characteristics

3.1 SITOR fuse links

3.1.1 **3NC2 4..** (IEC 60 269-2-1, Size 3), **3NC2 4..-3** (IEC 60 269-4-1, Size 3/110) [1)]

Order No.		**3NC2 423 3NC2 423-3**	**3NC2 425 3NC2 425-3**	**3NC2 427 3NC2 427-3**	**3NC2 428 3NC2 428-3**	**3NC2 431 3NC2 431-3**	**3NC2 432 3NC2 432-3**
Utilization category (IEC 60 269)		gR	gR	gR	gR	gR	aR
Rated voltage V_n	V	500	500	500	500	500	500
Rated current I_n	A	150 [2)]	200 [2)]	250 [2)]	300 [2)]	350 [2)]	400 [2)]
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	7000	13600	21000	28000	53000	83000
Clearing I^2t value I^2t_A at V_n	A^2s	33000	64000	99000	132000	249000	390000
Temperature rise at I_n (center of the fuse body)	K	26	25	30	40	35	30
Power dissipation at I_n	W	35	40	50	65	60	50
Cyclic load factor *WL*		0.85	0.85	0.85	0.85	0.85	0.85
Weight, approx.	kg	0.95	0.95	0.95	0.95	0.95	0.95
Accessories [3)]							
Fuse base, 1-pole		3NH3 430					
Fuse puller		3NX1 011					
Fused switch disconnector		3NP54					
Switch disconnector with fuses		3KL61 30-1.B0					

Table 34-14

1) Envelope dimension and pullers correspond to IEC 60269-2-1; however, contact blades are slotted according to IEC 60269-4-1
2) Cooling air velocity 1 m/s. For natural air cooling, reduced by 5 %
3) Maximum current and minimum required connection cross-section when using fuse bases and switch disconnectors, refer to Section 2.3

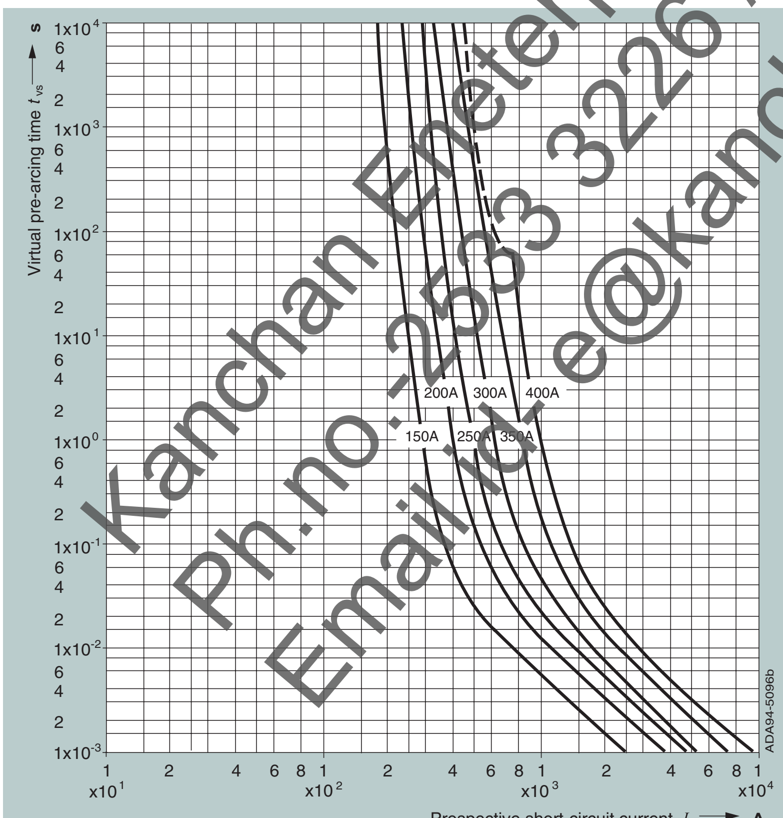


Fig. 34-7 *Time/current characteristics*

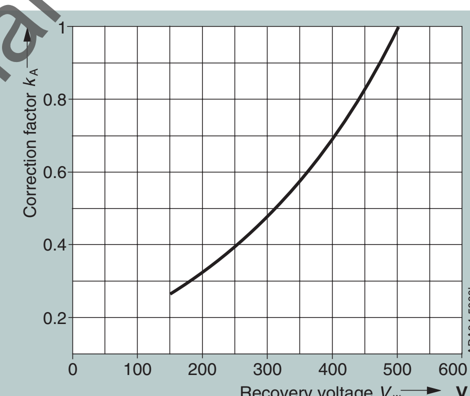


Fig. 34-8 *Correction factor k_A for clearing I^2t value*

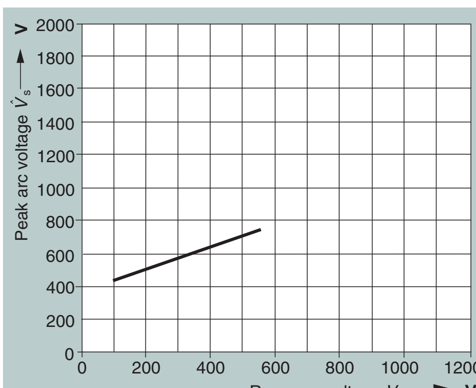


Fig. 34-9 *Arc voltage*

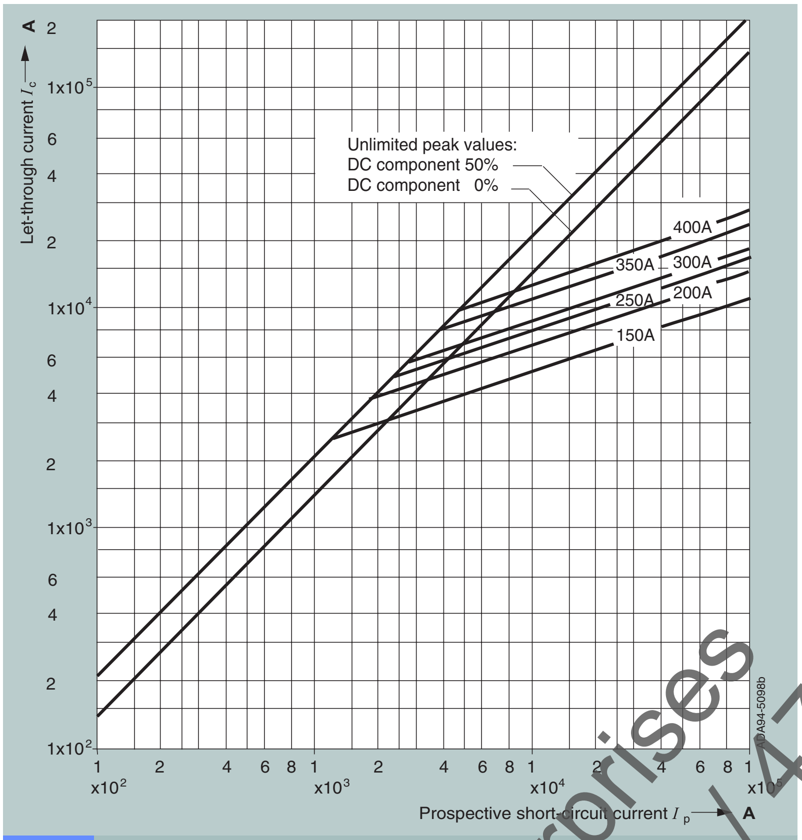


Fig. 35-10 *Let-through characteristics (current limiting at 50 Hz)*

3NC2 4..

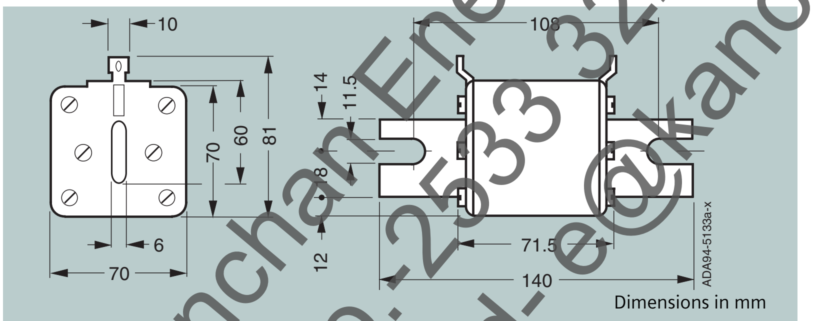


Fig. 35-11

3NC2 4..-3

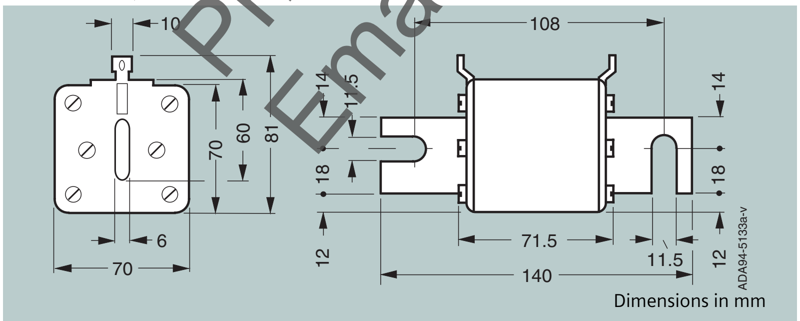


Fig. 35-12

3.1.2 **3NE8 7..-1** (IEC 60 269-4-1, Size 000/80)

Order No.		3NE8 714-1	3NE8 715-1	3NE8 701-1	3NE8 702-1	3NE8 717-1	3NE8 718-1
Utilization category (IEC 60 269)		gR	gR	gR	gR	gR	aR
Rated voltage V_n	V	690	690	690	690	690	690
Rated current I_n	A	20	25	32	40	50	63
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	12	19	40	69	115	215
Clearing I^2t value I^2t_A at V_n	A^2s	83	140	285	490	815	1550
Temperature rise at I_n (center of the fuse body)	K	40	40	45	55	60	70
Power dissipation at I_n	W	7	9	10	12	15	16
Cyclic load factor *WL*		0.9	0.9	0.9	0.9	0.9	0.95
Weight, approx.	kg	0.13	0.13	0.13	0.13	0.13	0.13

Table 36-15

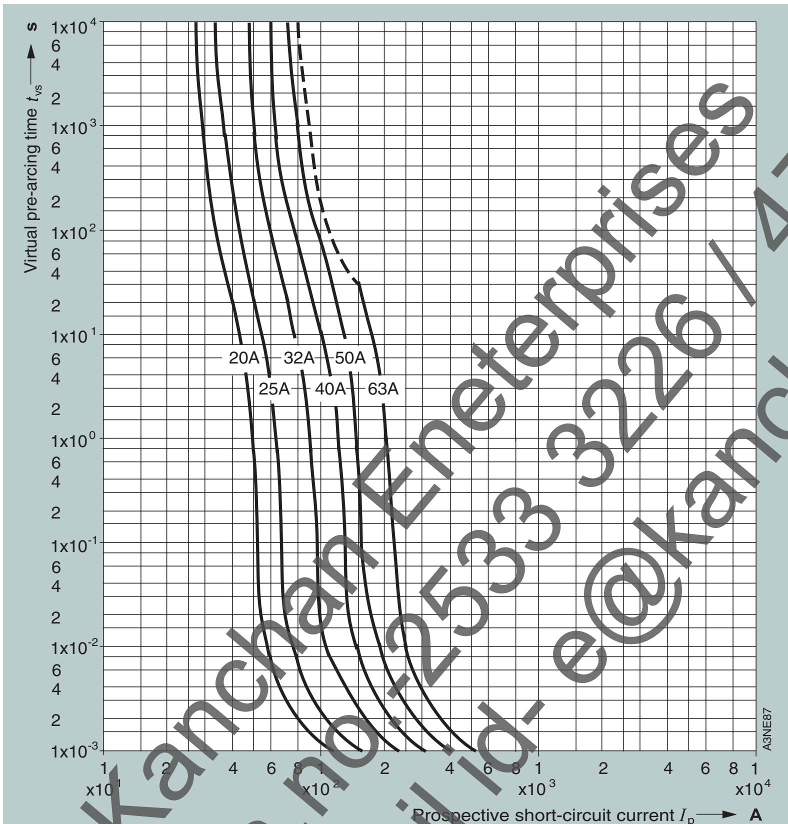


Fig. 36-13 *Time/current characteristics*

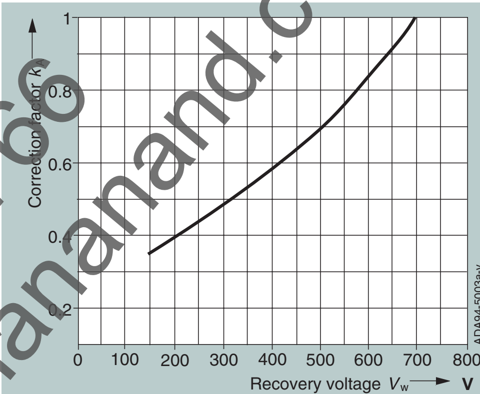


Fig. 36-14 *Correction factor k_A for clearing I^2t value*

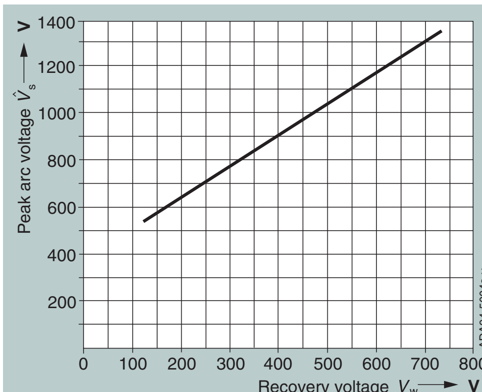


Fig. 36-15 *Arc voltage*

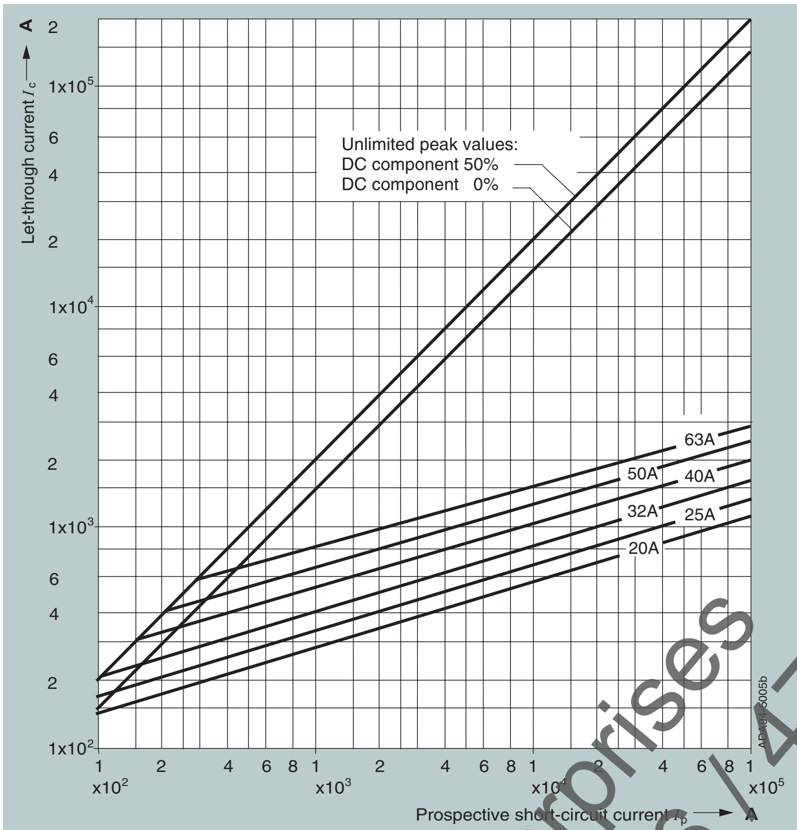


Fig.
37-16

Let-through characteristics (current limiting at 50 Hz)

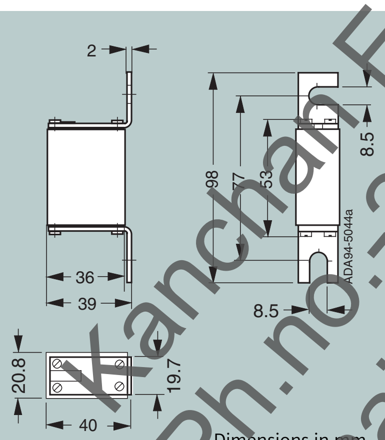


Fig.
37-17

3.1.3 **3NE8 7..-1** (IEC 60 269-4-1, Size 000/80)

Order No.		**3NE8 720-1**	**3NE8 721-1**	**3NE8 722-1**	**3NE8 724-1**	**3NE8 725-1**	**3NE8 727-1**	**3NE8 731-1**
Utilization category (IEC 60 269)		aR	aR	aR	aR	aR	aR	aR
Rated voltage V_n	V	690	690	690	690	690	690	690
Rated current I_n	A	80	100	125	160	200	250	315
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	380	695	1250	2350	4200	7750	12 000
Clearing I^2t value I^2t_A at V_n	A^2s	2700	4950	9100	17000	30000	55000	85 500
Temperature rise at I_n (center of the fuse body)	K	80	75	80	100	120	125	150
Power dissipation at I_n	W	18	19	23	31	36	42	54
Cyclic load factor *WL*		0.9	0.95	0.95	0.9	0.9	0.9	0.85
Weight, approx.	kg	0.13	0.13	0.13	0.13	0.13	0.13	0.13

Table 38-16

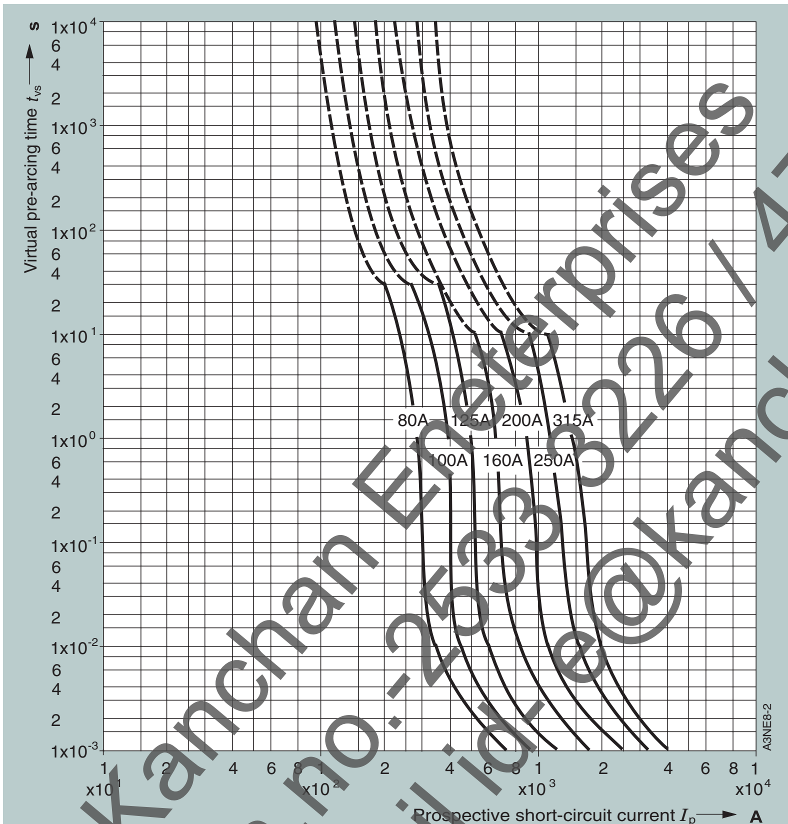


Fig. 38-18 *Time/current characteristics*

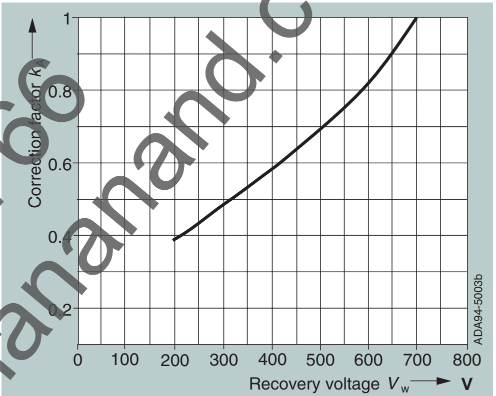


Fig. 38-19 *Correction factor k_A for clearing I^2t value*

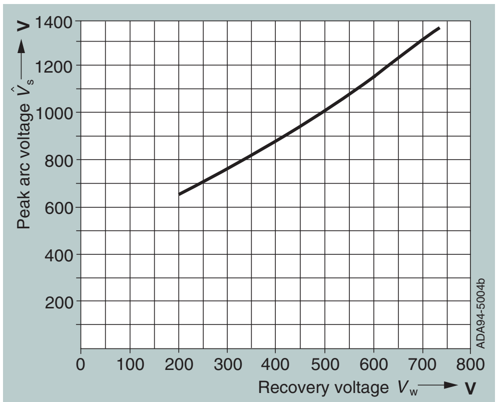


Fig. 38-20 *Arc voltage*

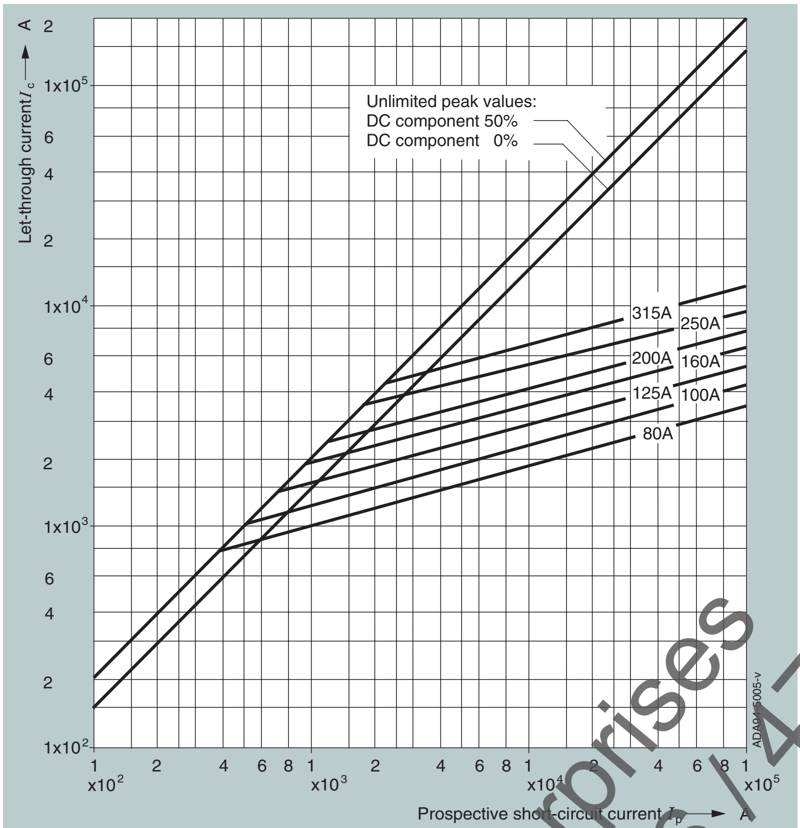


Fig. 39-21 *Let-through characteristics (current limiting at 50 Hz)*

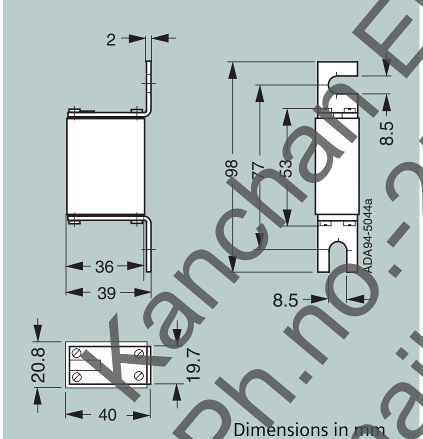


Fig. 39-22

3.1.4 **3NC8 4..** (IEC 60 269-2-1, Size 3), **3NC8 4..-3** (IEC 60 269-4-1, Size 3/110) [1)]

Order No.		3NC8 423 3NC8 423-3	3NC8 425 3NC8 425-3	3NC8 427 3NC8 427-3	3NC8 431 3NC8 431-3	3NC8 434 3NC8 434-3	3NC8 444-3
Utilization category (IEC 60 269)		gR	gR	gR	gR	gR	aR
Rated voltage V_n	V	660	660	660	660	660	600
Rated current I_n	A	150 [2)]	200 [2)]	250	350 [2)]	500 [2)]	1 000
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	1 100	2400	4400	11 000	28 000	400 000
Clearing I^2t value I^2t_A at V_n	A^2s	17 600	38 400	70 400	176 000	448 000	2 480 000
Temperature rise at I_n (center of the fuse body)	K	33	46	95	65	75	110
Power dissipation at I_n	W	40	55	72	95	130	140
Cyclic load factor *WL*		0.85	0.85	0.85	0.85	0.85	0.9
Weight, approx.	kg	0.95	0.95	0.95	0.95	0.95	0.95
Accessories [3)]							
Fuse base, 1-pole		3NH3 430					–
Fuse puller		3NX1 011					3NX1 011
Fused switch disconnector		3NP54					–
Switch disconnector with fuses		3KL61 30-1AB0					–

Table 40-17

1) Envelope dimension and pullers correspond to IEC 60269-2-1; however, contact blades are slotted according to IEC 60269-4-1
2) Cooling air velocity 1 m/s. For natural air cooling, reduced by 10 %
3) Maximum current and minimum required connection cross-section when using fuse bases and switch disconnectors, refer to Section 2.3

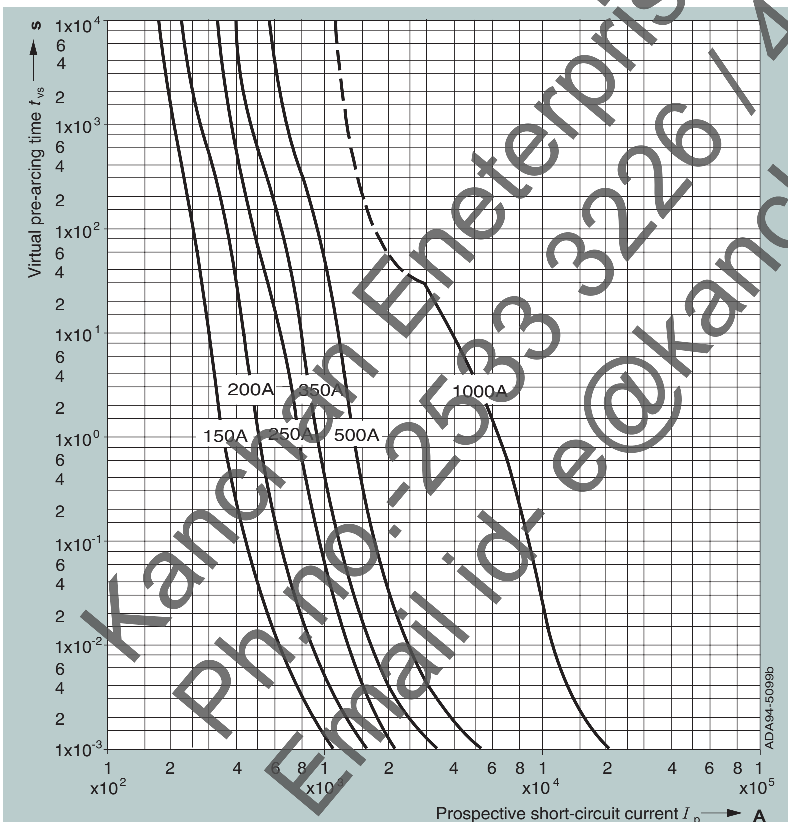


Fig. 40-23 *Time/current characteristics*

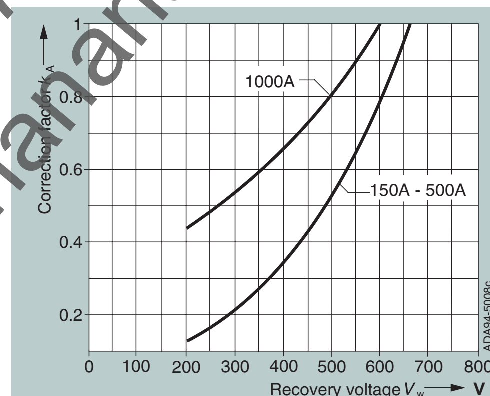


Fig. 40-24 *Correction factor k_A for clearing I^2t value*

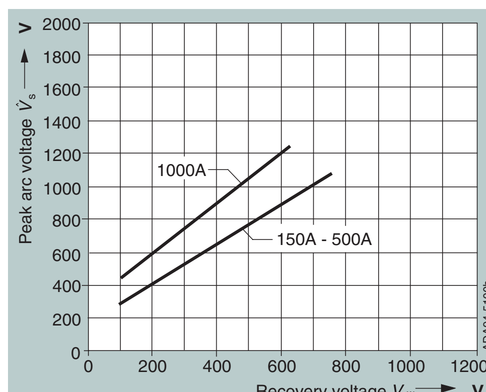


Fig. 40-25 *Arc voltage*

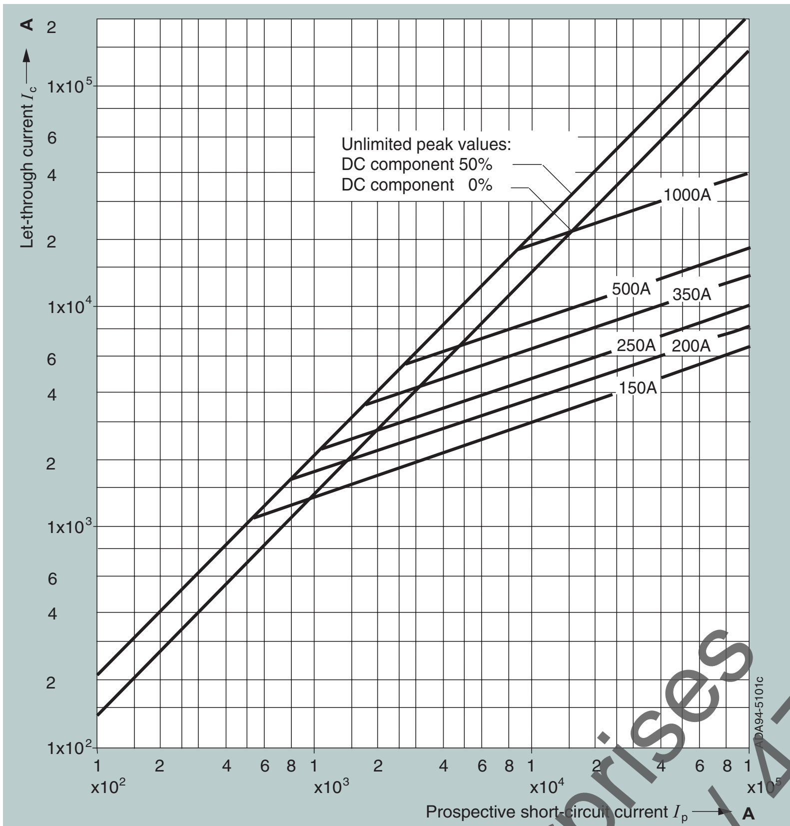


Fig. 41-26 *Let-through characteristics (current limiting at 50 Hz)*

3NC8 4..

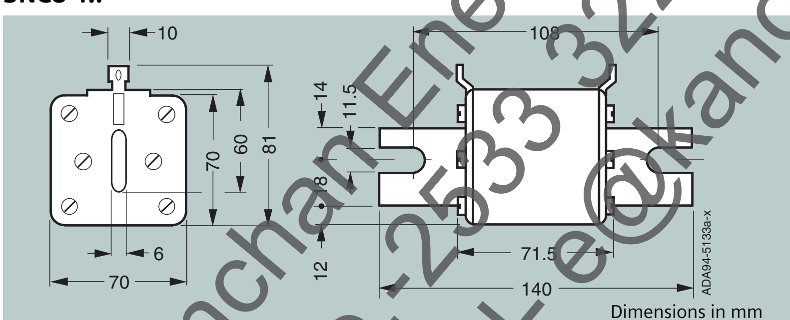


Fig. 41-27

3NC8 4..-3

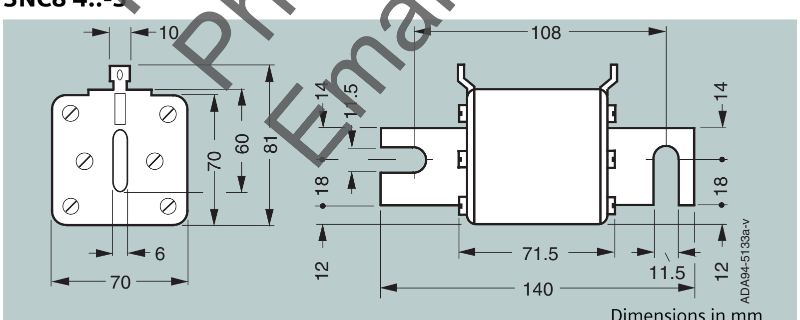


Fig. 41-28

3.1.5 **3NE1 8..-0** (IEC 60 269-2-1, Size 000)

Order No.		3NE1813-0	3NE1814-0	3NE1815-0	3NE1803-0	3NE1802-0	3NE1817-0	3NE1818-0	3NE1820-0
Utilization category (IEC 60 269)		gR/gS	gR/gS	gR/gS	gR/gS	gR/gS	gR/gS	gR/gS	gR/gS
Rated voltage V_n	V	690	690	690	690	690	690	690	690
Rated current I_n	A	16	20	25	35	40	50	63	80
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	18	41	74	166	295	461	903	1843
Clearing I^2t value I^2t_A at V_n	A^2s	200	430	780	1700	3000	4400	9000	18000
Temperature rise at I_n (center of the fuse body) 1)	K	25	25	30	35	30	35	40	40
Power dissipation at I_n 1)	W	3.0	3.5	4.0	5.0	5.0	6.0	7.0	8.0
Cyclic load factor *WL*		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Weight, approx.	kg	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Accessories 2)									
Fuse base, 1-pole		3NH3 030							
Fuse base, 3-pole		3NH4 030							
Fuse puller		3NX1 011							
Fused switch disconnector		3NP40/3NP50							
Switch disconnector with fuses		3KL50 30-1.B00 3KM50 30-1.B00							3KL5230-1.B00 3KM5230-1.B00

Table 42-18

1) Temperature rise and power dissipation when used in an l.v.h.b.c. fuse base
2) Minimum required connection cross-section when using the fuse base and switch disconnector, refer to Section2.3

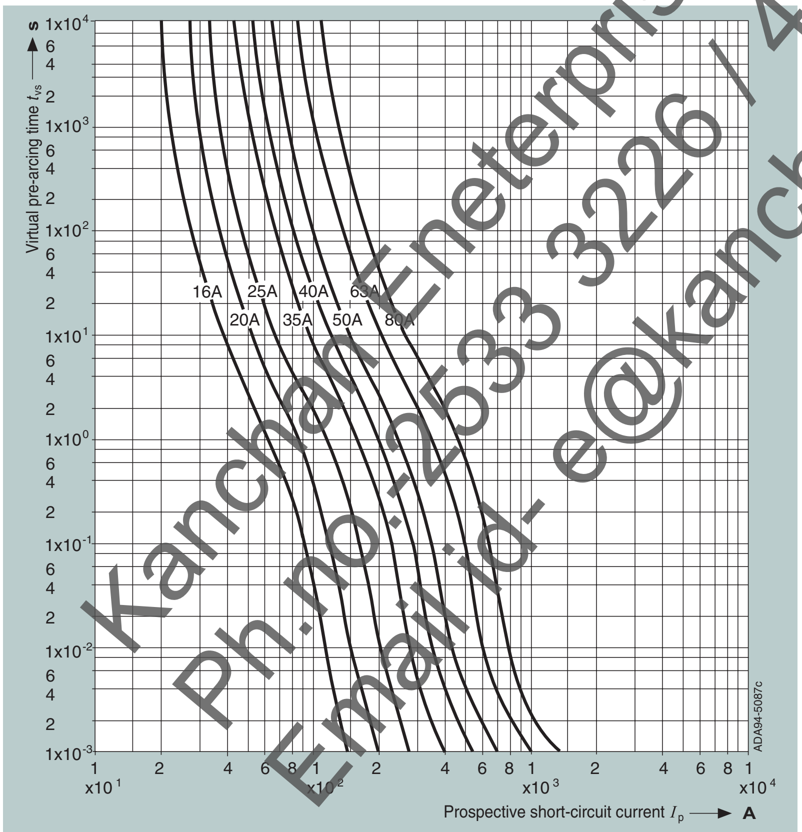


Fig. 42-29 *Time/current characteristics*

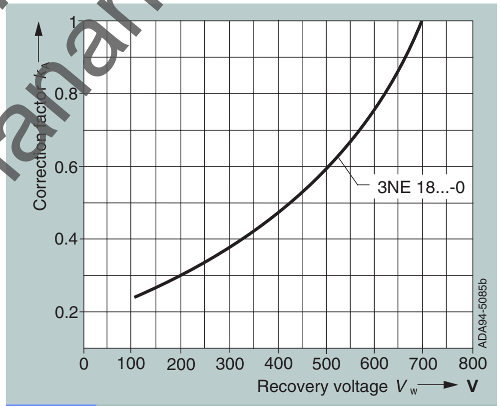


Fig. 42-30 *Correction factor k_A for clearing I^2t value*

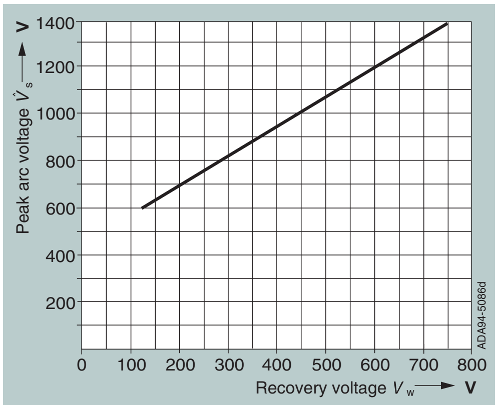


Fig. 42-31 *Arc voltage*

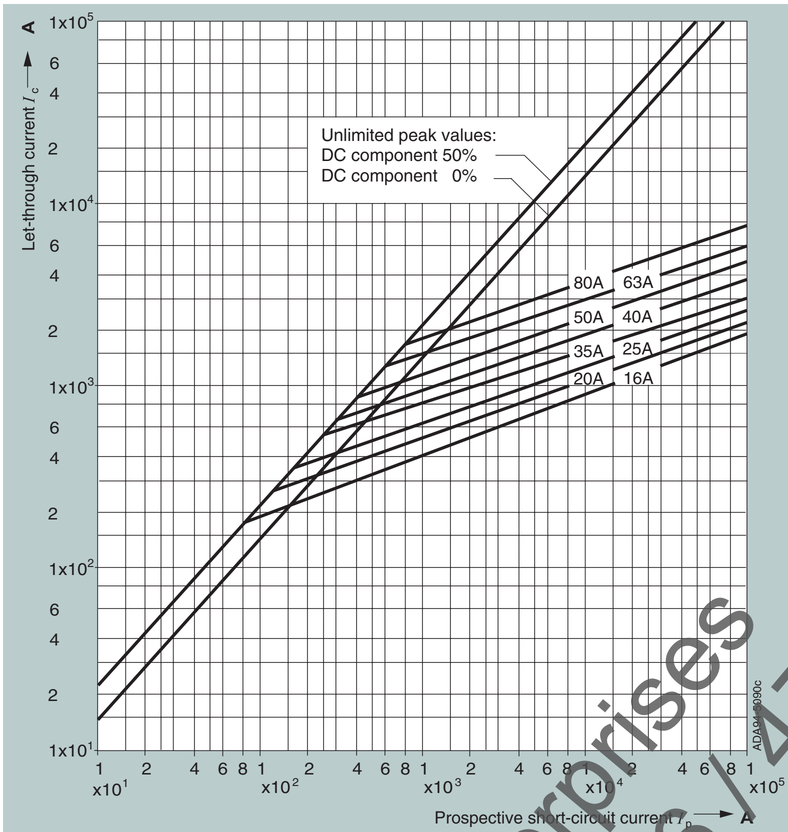


Fig. 43-32 *Let-through characteristics (current limiting at 50 Hz)*

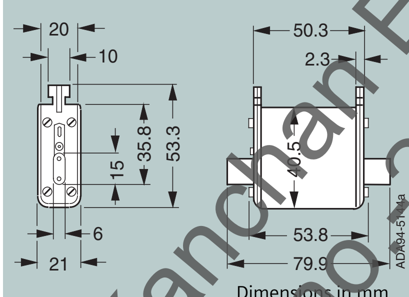


Fig. 43-33

3.1.6 3NE1 0..-0 (IEC 60 269-2-1, Size 00), 3NE1 2..-0 (IEC 60 269-2-1, Size 1)

Order No.		3NE1 021-0	3NE1 022-0	3NE1 224-0	3NE1 225-0	3NE1 227-0	3NE1 230-0
Utilization category (IEC 60 269)		gR/gS	gR/gS	gR/gS	gR/gS	gR/gS	gR/gS
Rated voltage V_n	V	690	690	690	690	690	690
Rated current I_n	A	100	125	160	200	250	315
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	3100	6000	7400	14500	29500	46100
Clearing I^2t value I^2t_A at V_n	A^2s	33000	63000	60000	100000	200000	310000
Temperature rise at I_n (center of the fuse body) 1)	K	36	40	60	65	75	80
Power dissipation at I_n 1)	W	10	11	24	27	30	38
Cyclic load factor *WL*		1.0	1.0	1.0	1.0	1.0	1.0
Weight, approx.	kg	0.20	0.20	0.55	0.55	0.55	0.55
Accessories 2)							
Fuse base, 1-pole		3NH3 030		3NH3 230			3NH3 330
Fuse base, 3-pole		3NH4 030		3NH4 230			
Fuse puller		3NX1 011					
Fused switch disconnector		3NP40 3NP50		3NP42 3NP52			3NP53
Switch disconnector with fuses		3KL52 30-1.B00 3KM52 30-1.B00		3KL55 30-1.B00 3KM55 30-1.B00			3KL57 30-1.B00 3KM57 30-1.B00

Table 44-19

1) Temperature rise and power dissipation when used in an l.v.h.b.c. fuse base
2) Minimum required connection cross-section when using the fuse base and switch disconnector, refer to Section 2.3

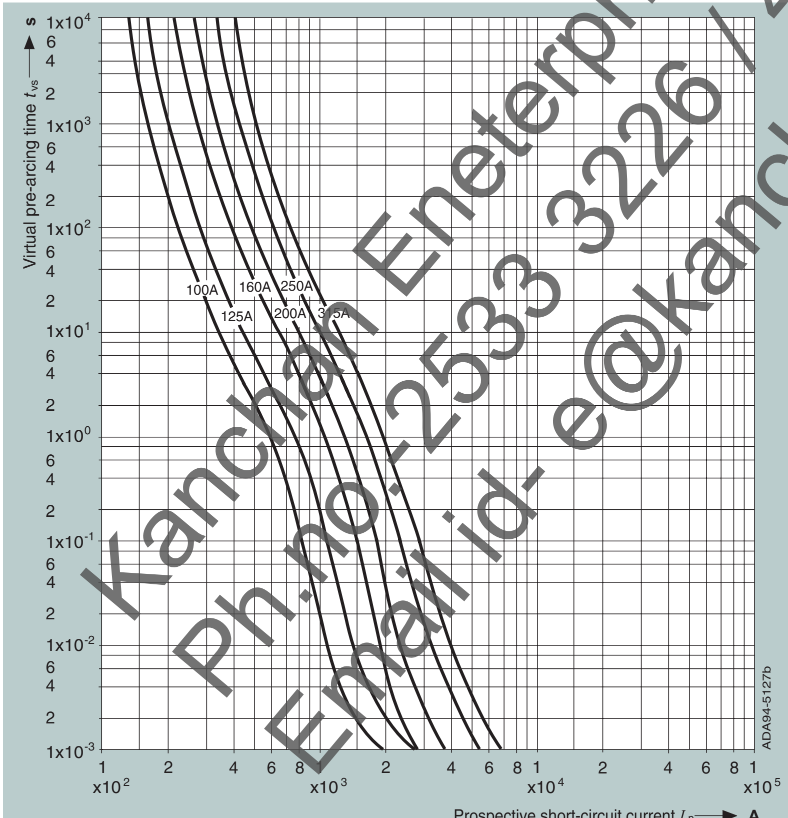


Fig. 44-34 *Time/current characteristics*

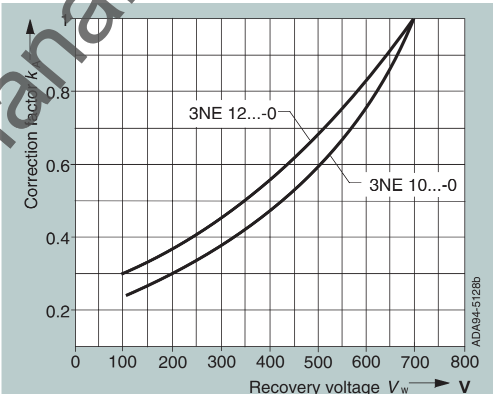


Fig. 44-35 *Correction factor k_A for clearing I^2t value*

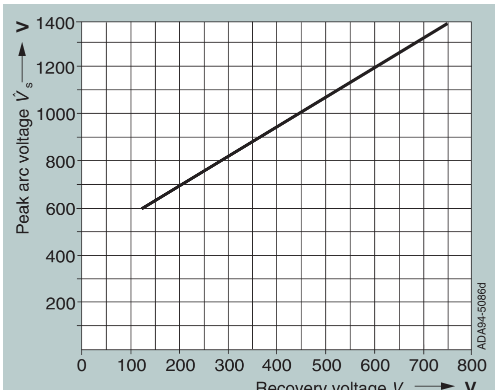


Fig. 44-36 *Arc voltage*

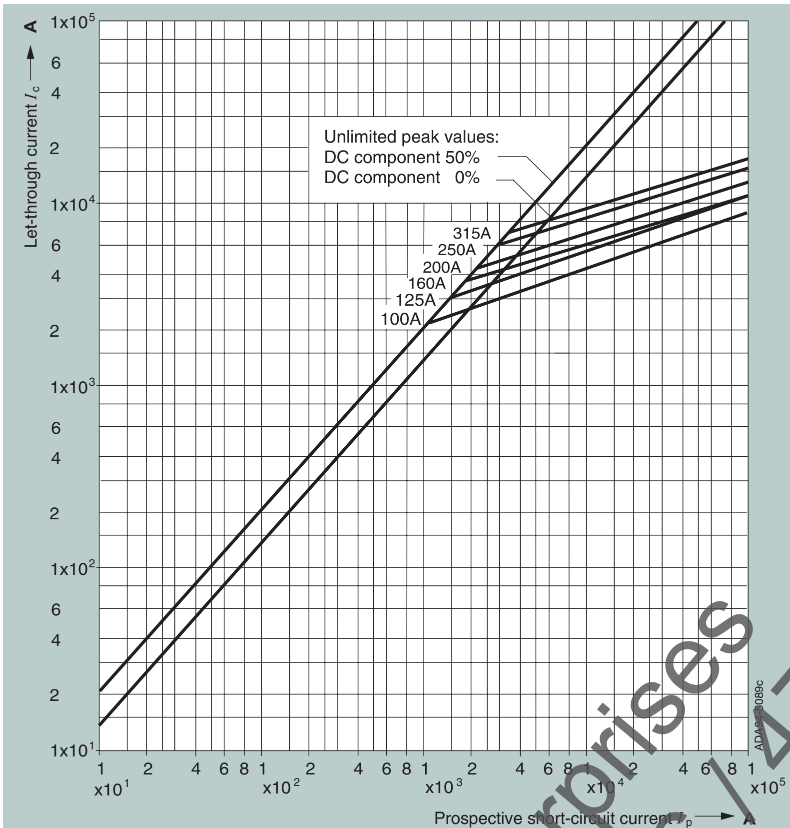


Fig. 45-37 *Let-through characteristics (current limiting at 50 Hz)*

3NE1 0..-0

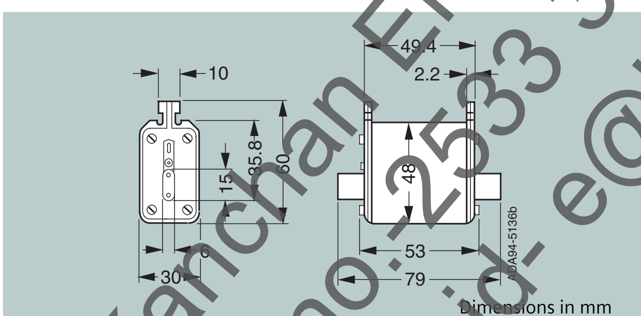


Fig. 45-38

3NE1 2..-0

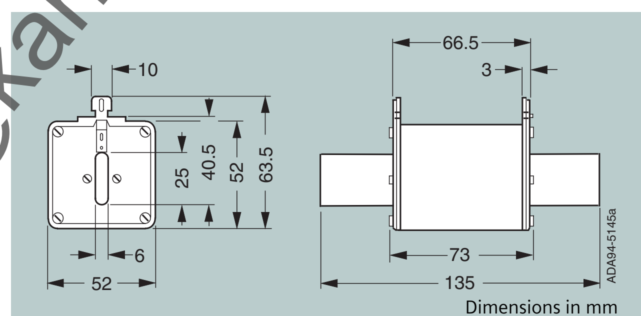


Fig. 45-39

3.1.7 **3NE1 3..-0** (IEC 60 269-2-1, Size 2), **3NE1 4..-0** (IEC 60 269-2-1, Size 3)

Order No.		3NE1 331-0	3NE1 332-0	3NE1 333-0	3NE1 334-0	3NE1 435-0	3NE1 436-0	3NE1 437-0	3NE1 438-0
Utilization category (IEC 60 269)		gR/gS	gR/gS	gR/gS	gR/gS	gR/gS	gR/gS	gR/gS	gR/gS
Rated voltage V_n	V	690	690	690	690	690	690	690	690
Rated current I_n	A	350	400	450	500	560	630	710	800
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	58000	84000	104000	149000	215000	293000	437000	723000
Clearing I^2t value I^2t_A at V_n	A^2s	430000	590000	750000	950000	1700000	2350000	3400000	5000000
Temperature rise at I_n (center of the fuse body) 1)	K	75	85	85	90	65	70	68	70
Power dissipation at I_n 1)	W	42	45	53	56	50	55	60	59
Cyclic load factor *WL*		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Weight. approx.	kg	0.7	0.7	0.7	0.7	0.95	0.95	0.95	0.95
Accessories 2)									
Fuse base, 1-pole		3NH3 330		3NH3 430					
Fuse puller		3NX1 011							
Fused switch disconnector		3NP53		3NP54				3NP54	
Switch disconnector with fuses		3KL57 30-1.B00 3KM57 30-1.B00		3KL61 30-1AB0				3KL62	

Table 46-20

1) Temperature rise and power dissipation when used in an l.v.h.b.c. fuse base
2) Minimum required connection cross-section when using the fuse base and switch disconnector, refer to Section 2.3

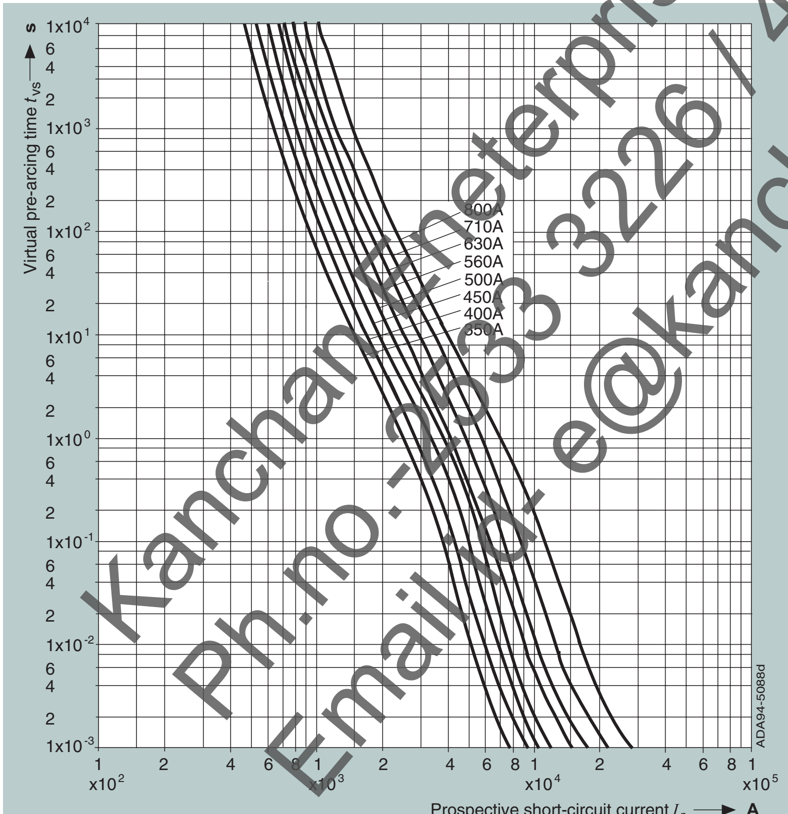


Fig. 46-40 *Time/current characteristics*

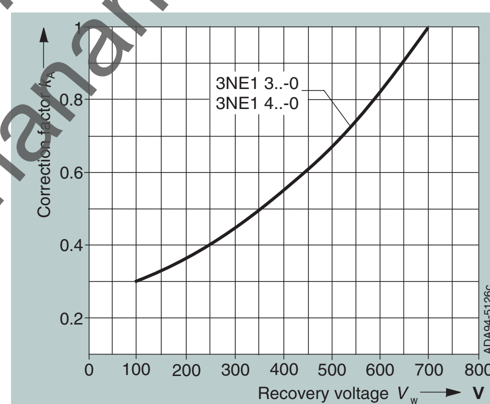


Fig. 46-41 *Correction factor k_A for clearing I^2t value*

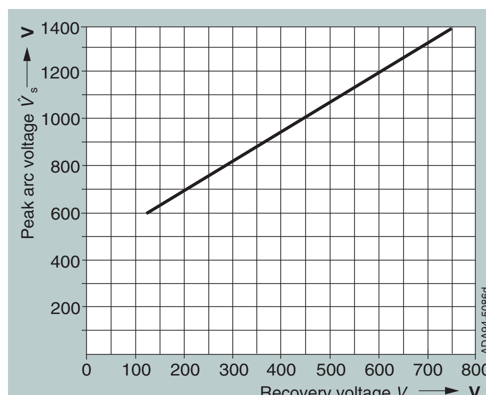


Fig. 46-42 *Arc voltage*

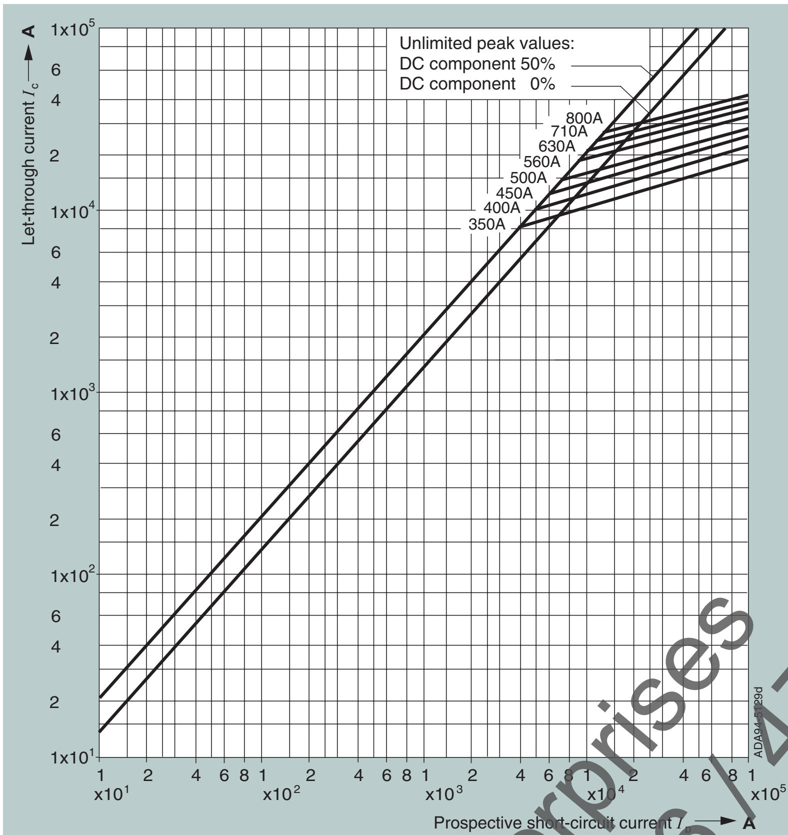


Fig. 47-43 *Let-through characteristics (current limiting at 50 Hz)*

3NE1 3..-0

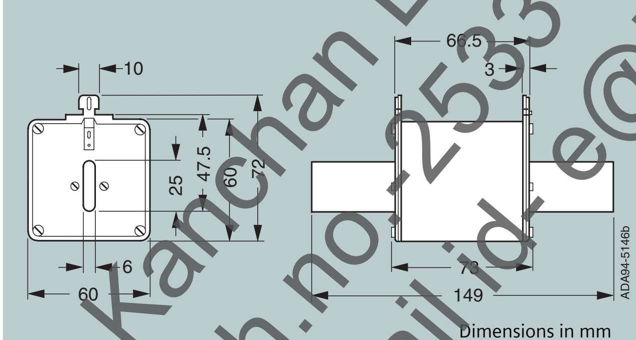


Fig. 47-44

3NE1 4..-0

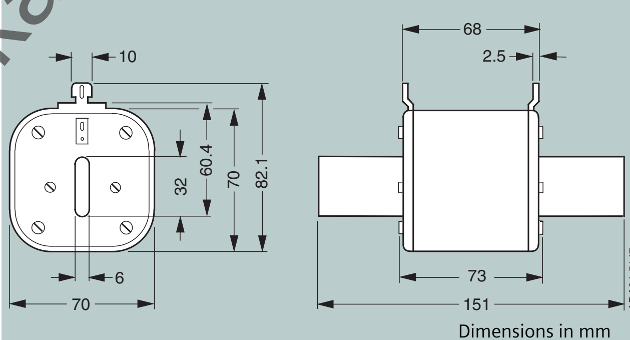


Fig. 47-45

3.1.8 **3NE1 4..-1** (IEC 60 269-2-1, Size 3)

Order No.		**3NE1 437-1**	**3NE1 438-1**
Utilization category (IEC 60 269)		gR	gR
Rated voltage V_n	V	600	600
Rated current I_n	A	710	800
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	321000	437000
Clearing I^2t value I^2t_A at V_n	A^2s	2460000	3350000
Temperature rise at I_n (center of the fuse body) 1)	K	85	95
Power dissipation at I_n 1)	W	65	72
Cyclic load factor *WL*		1.0	1.0
Weight, approx.	kg	0.95	0.95
Accessories 2)			
Fuse base, 1-pole		3NH3 430	
Fuse puller		3NX1 011	
Fused switch disconnector		3NP54	
Switch disconnector with fuses		3KL62 30	

Table 48-21
1) Temperature rise and power dissipation when used in an l.v.h.b.c. fuse base
2) Minimum required connection cross-section when using the fuse base and switch disconnector, refer to Section 2.3

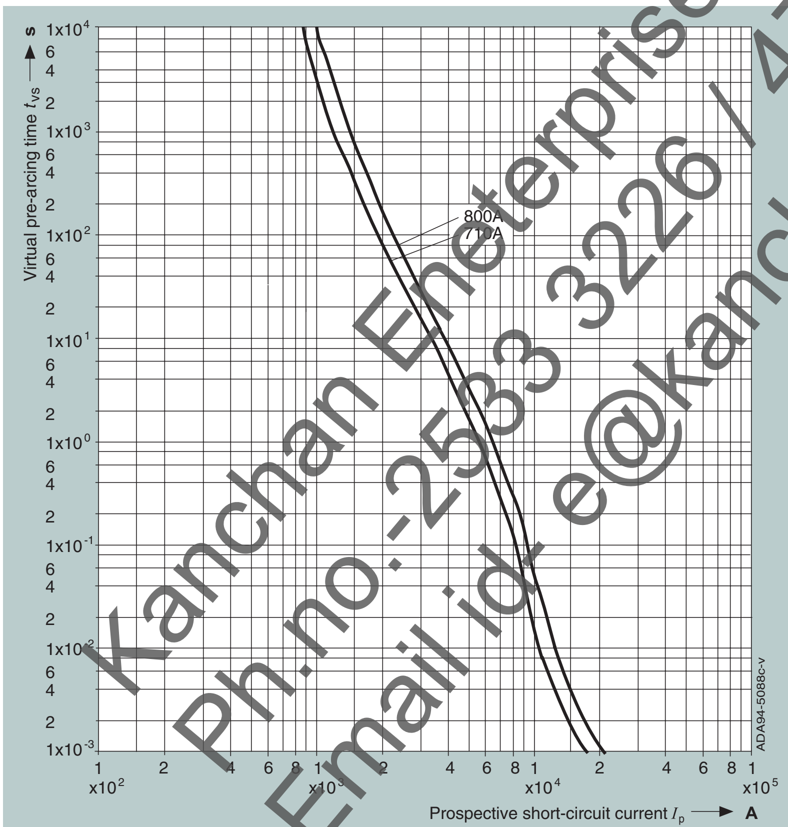


Fig. 48-46 *Time/current characteristics*

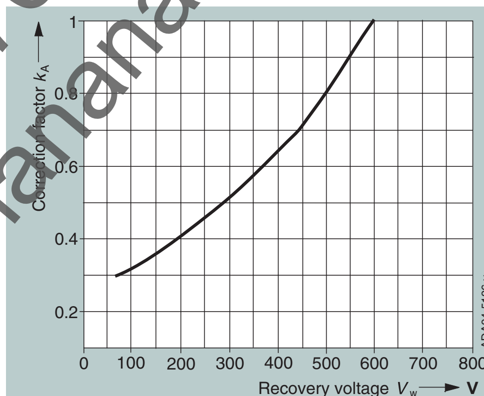


Fig. 48-47 *Correction factor k_A for clearing I^2t value*

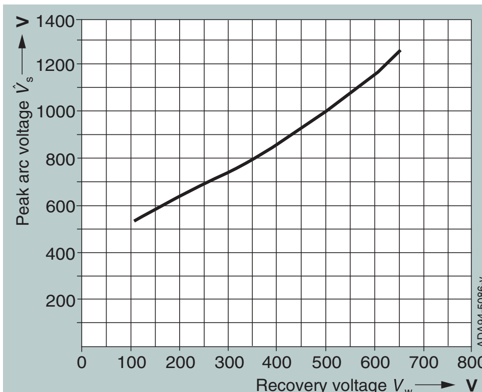


Fig. 48-48 *Arc voltage*

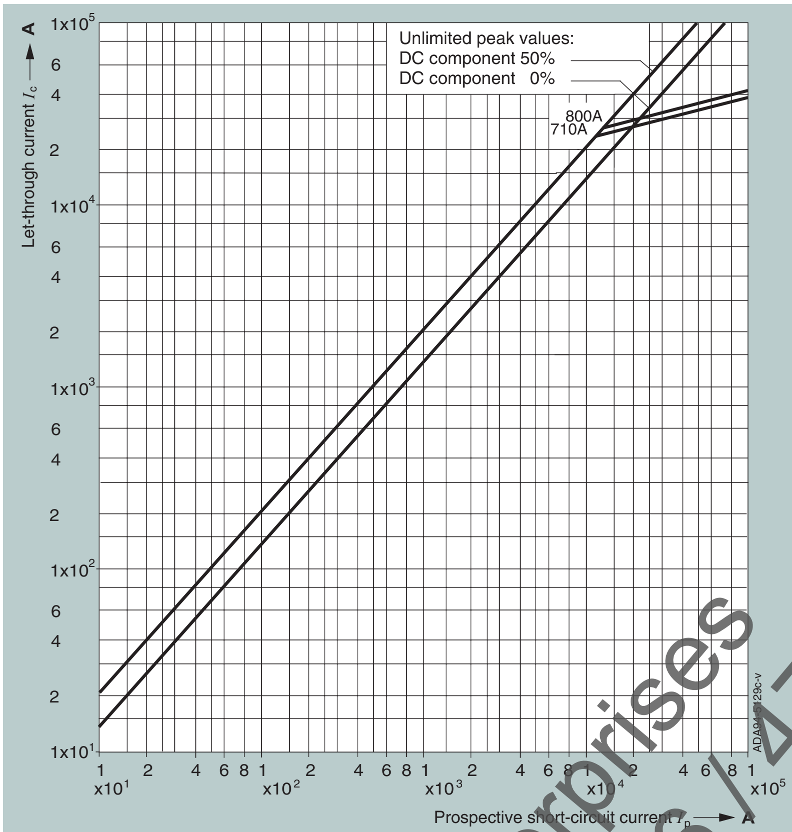


Fig. 49-49

Let-through characteristics (current limiting at 50 Hz)

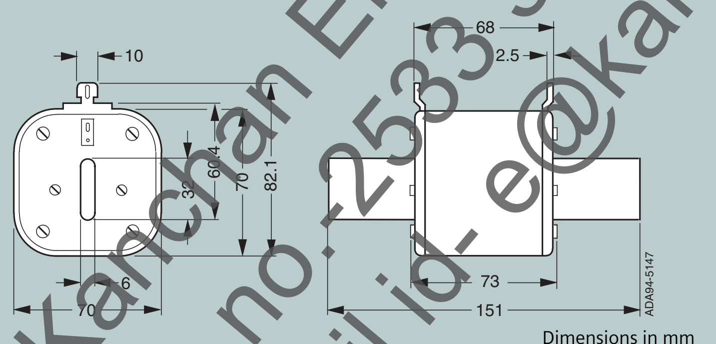


Fig. 49-50

3.1.9 **3NE1 0..-2** (Size 00), **3NE1 2..-2** (Size 1), **3NE1 3..-2** (Size 2), IEC 60 269-2-1

Order No.		**3NE1 022-2**	**3NE1 224-2**	**3NE1 225-2**	**3NE1 227-2**	**3NE1 230-2**	**3NE1 331-2**	**3NE1 333-2**	**3NE1 334-2**
Utilization category (IEC 60 269)		gR	gR	gR	gR	gR	gR	gR	gR
Rated voltage V_n	V	690	690	690	690	690	690	690	690
Rated current I_n	A	125	160	200	250	315	350	450	500
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	3115	2650	5645	11520	22580	29500	46100	66400
Clearing I^2t value I^2t_A at V_n	A^2s	23000	15840	44000	68800	135500	177000	276000	398000
Temperature rise at I_n (center of the fuse body) 1)	K	55	70	62	70	75	82	100	100
Power dissipation at I_n 1)	W	13.5	30	28	35	42	44	62	65
Cyclic load factor *WL*		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Weight, approx.	kg	0.2	0.55	0.55	0.55	0.55	0.7	0.7	0.7
Accessories 2)									
Fuse base, 1-pole		3NH3 030	3NH3 230			3NH3 330		3NH3 340	
Fuse puller		3NX1 011							
Fused switch disconnector		3NP50	3NP52			3NP53		3NP54	
Switch disconnector with fuses		3KL52	3KL55			3KL57		3KL61	

Table 50-22

1) Temperature rise and power dissipation when used in an l.v.h.b.c. fuse base
2) Minimum required connection cross-section when using the fuse base and switch disconnector, refer to Section 2.3

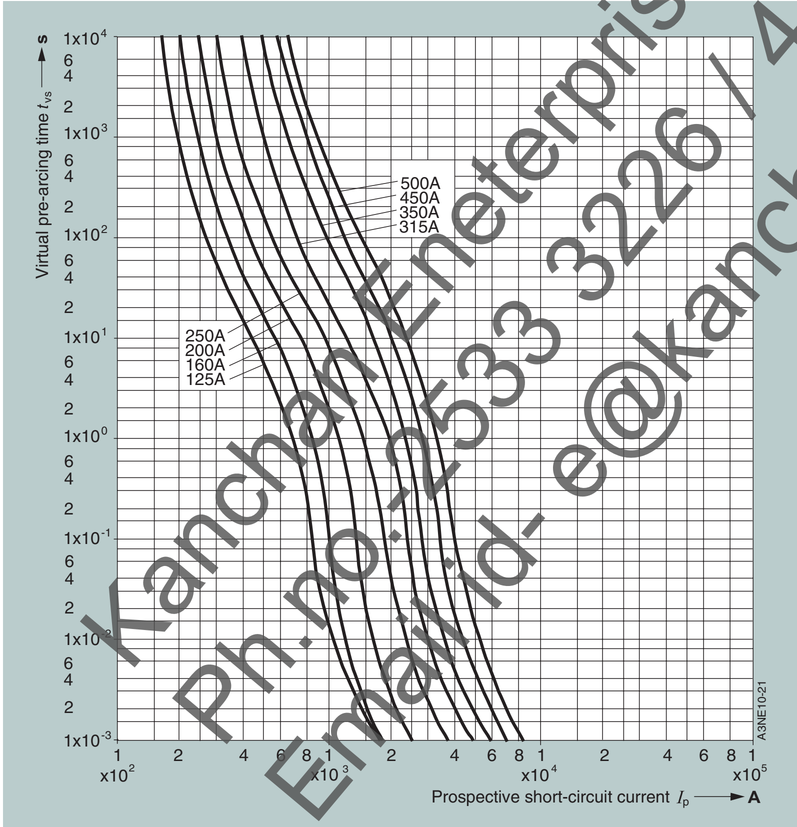


Fig. 50-51 *Time/current characteristics*

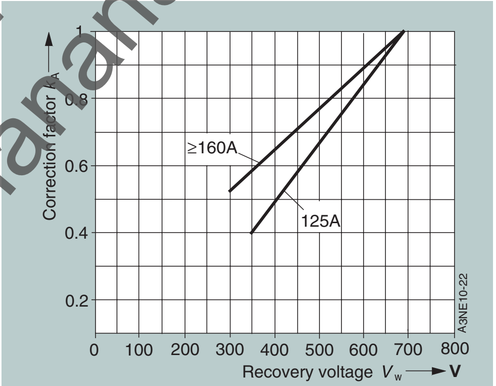


Fig. 50-52 *Correction factor k_A for clearing I^2t value*

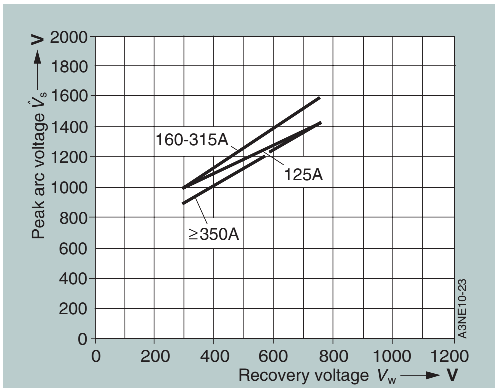


Fig. 50-53 *Arc voltage*

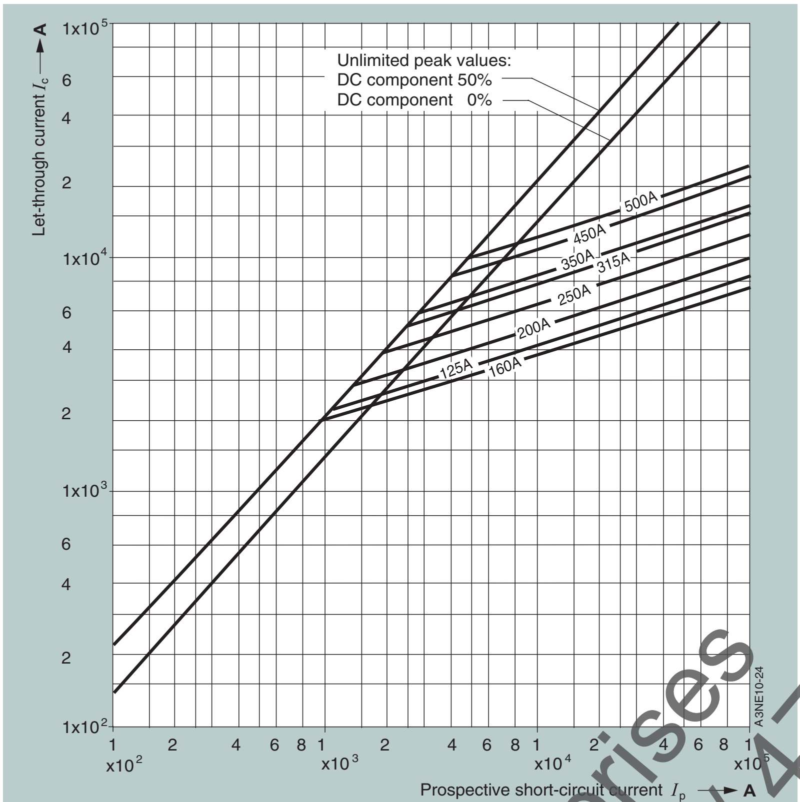


Fig. 51-54 *Let-through characteristics (current limiting at 50 Hz)*

3NE1 0..-2

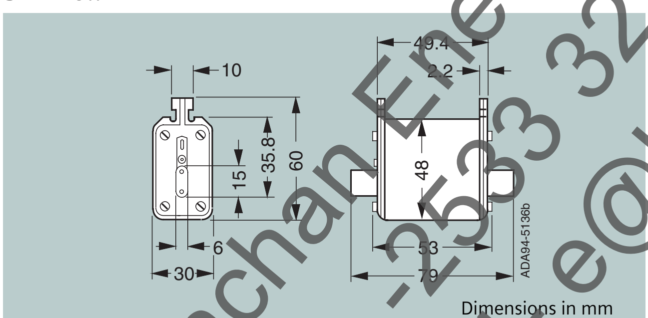


Fig. 51-55

3NE1 2..-2

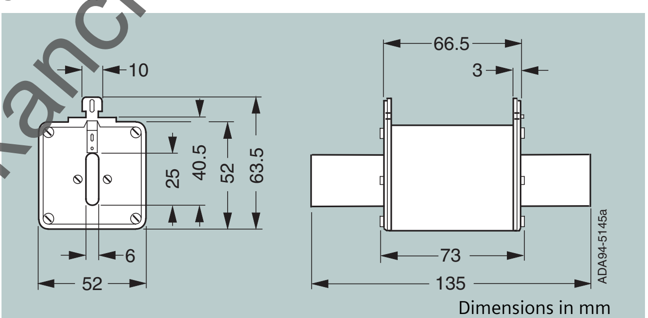


Fig. 51-56

3NE1 3..-2

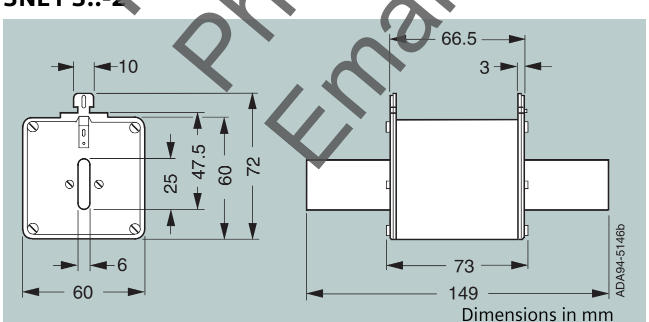


Fig. 51-57

3.1.10 **3NE1 4..-2** (IEC 60 269-2-1, Size 3)

Order No.		**3NE1 435-2**	**3NE1 436-2**	**3NE1 447-2**	**3NE1 437-2**	**3NE1 438-2**	**3NE1 448-2**
Utilization category (IEC 60 269)		gR	gR	gR	gR	gR	gR
Rated voltage V_n	V	690	690	690	690	690	690
Rated current I_n	A	560	630	670	710	800	850
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	130000	203000	240000	265000	361000	520000
Clearing I^2t value I^2t_A at V_n	A^2s	845000	1320000	1557000	1725000	2348000	3381000
Temperature rise at I_n (center of the fuse body) 1)	K	80	82	90	90	95	95
Power dissipation at I_n 1)	W	60	62	65	72	82	76
Cyclic load factor WL		1.0	1.0	1.0	1.0	1.0	1.0
Weight, approx.	kg	1.0	1.0	1.0	1.0	1.0	1.0
Accessories 2)							
Fuse base, 1-pole		3NH3 340					
Fuse puller		3NX1 011					
Fused switch disconnector		3NP54		3NP54			
Switch disconnector with fuses		3KL61		3KL62			

Table 52-23

1) Temperature rise and power dissipation when used in an l.v.h.b.c. fuse base
2) Minimum required connection cross-section when using the fuse base and switch disconnector, refer to Section 2.3

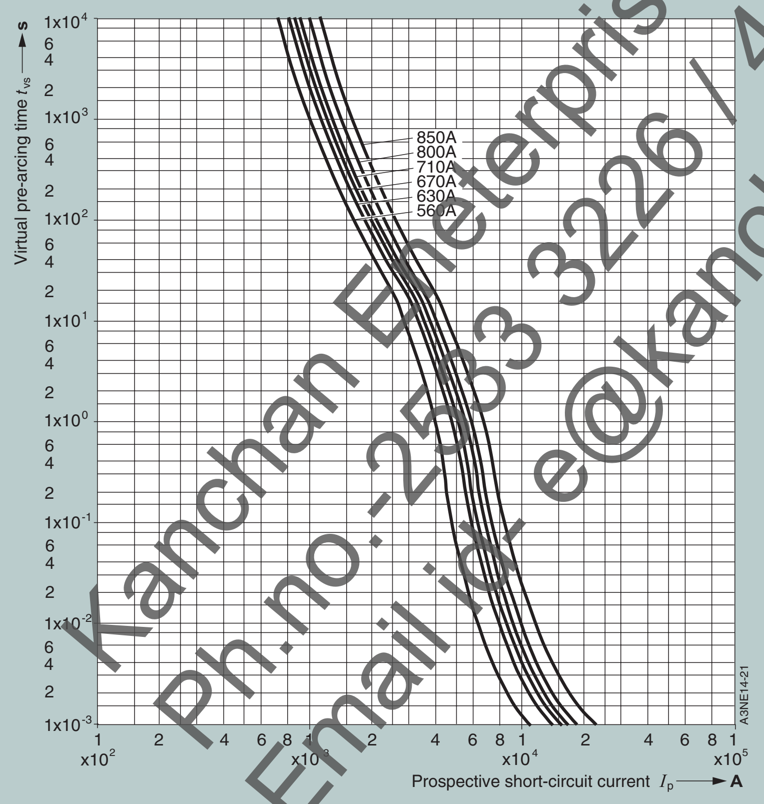


Fig. 52-58 *Time/current characteristics*

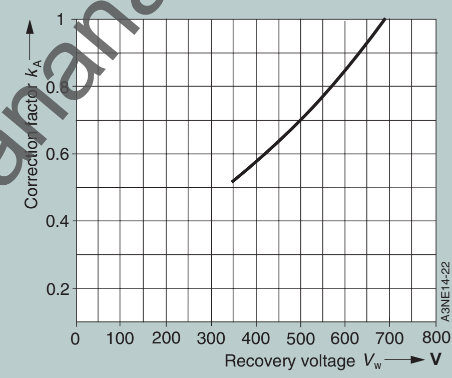


Fig. 52-59 *Correction factor k_A for clearing I^2t value*

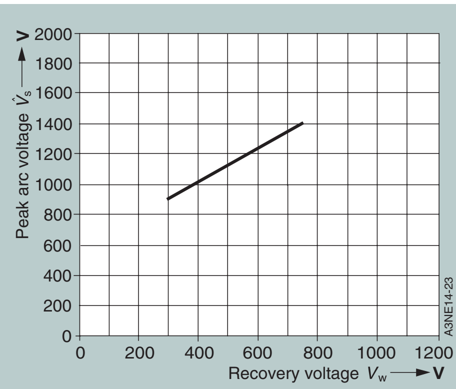


Fig. 52-60 *Arc voltage*

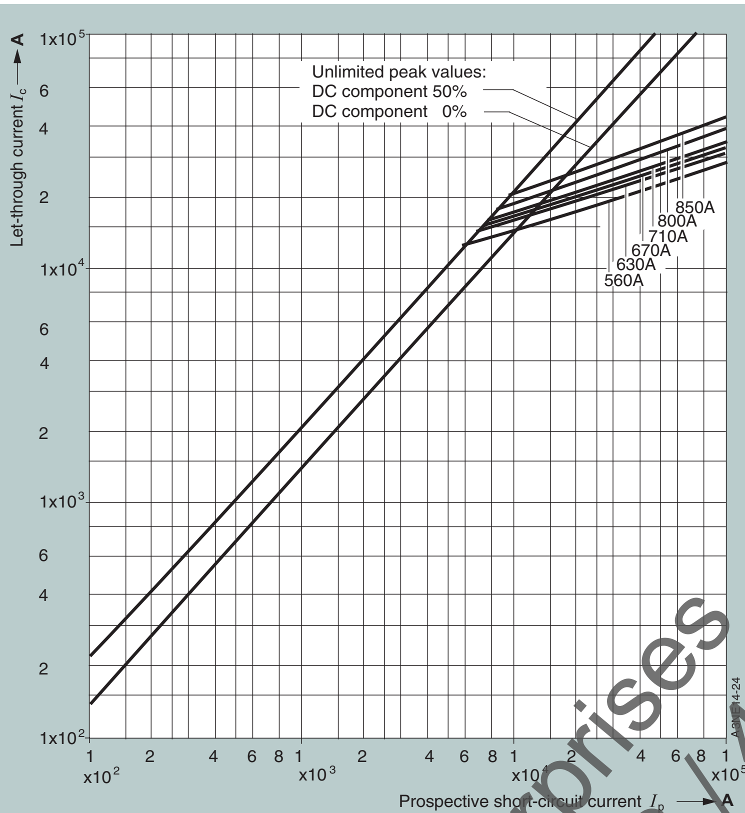
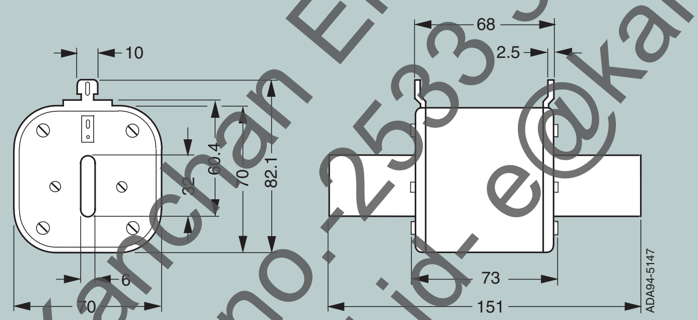


Fig. 53-61

Let-through characteristics (current limiting at 50 Hz)



Dimensions in mm

Fig. 53-62

3.1.11 **3NE8 0..-1** (IEC 60 269-2-1, Size 00)

Order No.		3NE8015-1	3NE8003-1	3NE8017-1	3NE8018-1	3NE8020-1	3NE8021-1	3NE8022-1	3NE8024-1
Utilization category (IEC 60 269)		gR	gR	gR	gR	aR	aR	aR	aR
Rated voltage V_n	V	690	690	690	690	690	690	690	690
Rated current I_n	A	25	35	50	63	80	100	125	160
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	30	70	120	260	450	850	1400	2800
Clearing I^2t value I^2t_A at V_n	A^2s	180	400	700	1400	2400	4200	6500	13000
Temperature rise at I_n (center of the fuse body)	K	35	45	65	70	80	90	110	130
Power dissipation at I_n	W	7	9	14	16	19	22	28	38
Cyclic load factor *WL*		0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Weight, approx.	kg	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Accessories [1]									
Fuse base, 1-pole		3NH3 030							
Fuse base, 3-pole		3NH4 030							
Fuse puller		3NX1 011							
Fused switch disconnector		3NP40 3NP50							
Switch disconnector with fuses		3KL50 30-1.B00 3KM50 30-1.B00				3KL52 30-1.B00 3KM52 30-1.B00			

Table 54-24

1) Max. current and min. required connection cross-section when using fuse bases and switch disconnector, refer to Section 2.3

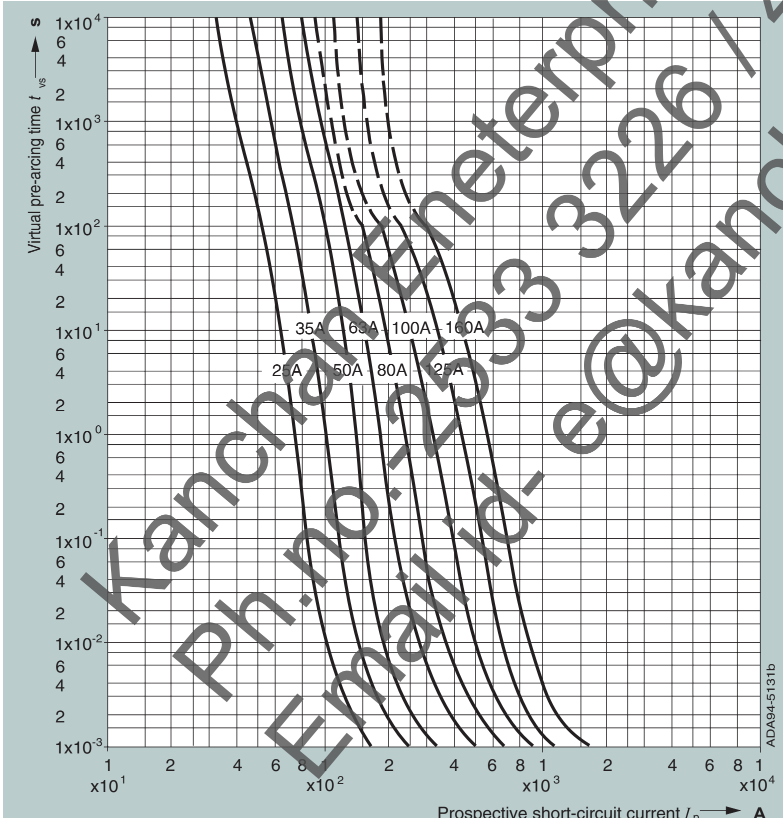


Fig. 54-63 *Time/current characteristics*

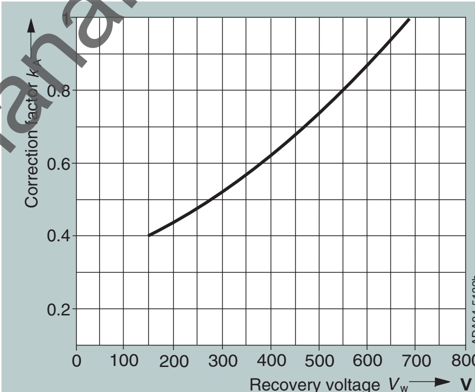


Fig. 54-64 *Correction factor k_A for clearing I^2t value*

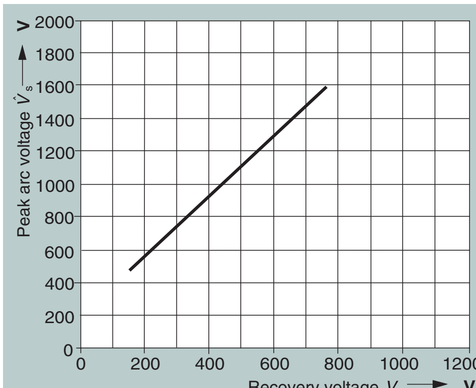


Fig. 54-65 *Arc voltage*

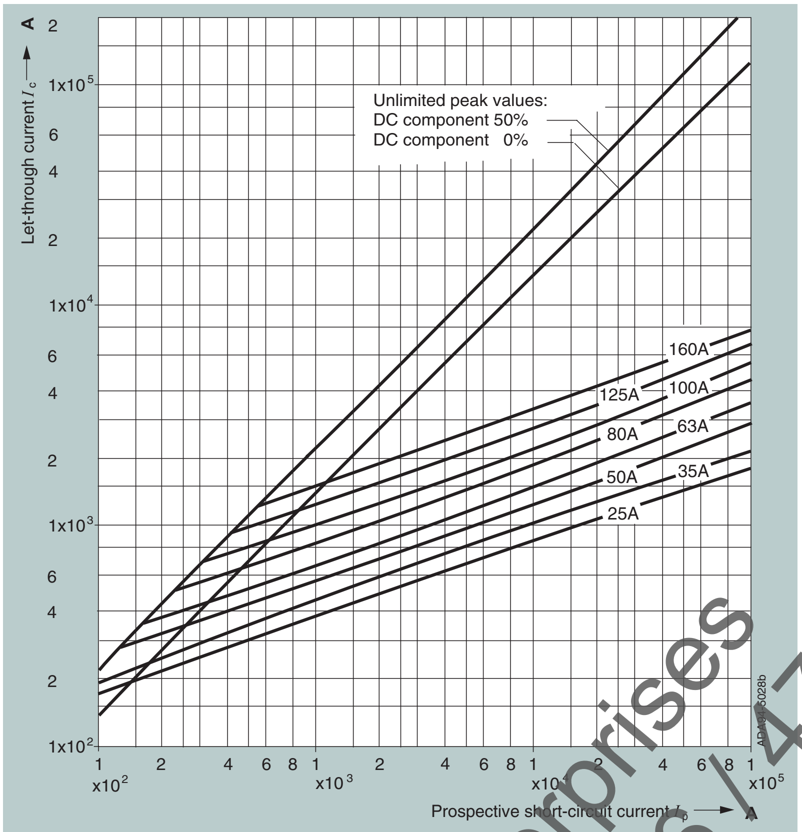


Fig. 55-66 *Let-through characteristics (current limiting at 50 Hz)*

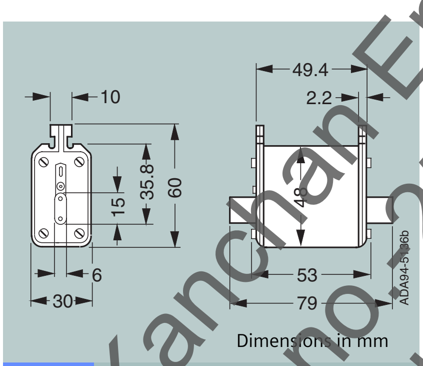


Fig. 55-67

3.1.12 **3NE4 3..-0B, 3NE4 337** (IEC 60 269-4-1, Size 2/110) [1)]

Order No.		3NE4 327-0B	3NE4 330-0B	3NE4 333-0B	3NE4 334-0B	3NE4 337
Utilization category (IEC 60 269)		aR	aR	aR	aR	aR
Rated voltage V_n	V	800	800	800	800	800
Rated current I_n	A	250	315	450	500	710
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	3600	7400	29400	42500	142000
Clearing I^2t value I^2t_A at V_n	A^2s	29700	60700	191000	276000	923000
Temperature rise at I_n (center of the fuse body)	K	175	170	190	195	170
Power dissipation at I_n	W	105	120	140	155	155
Cyclic load factor *WL*		0.85	0.85	0.85	0.85	0.95
Weight, approx.	kg	0.7	0.7	0.7	0.7	0.7
Accessories [2)]						
Fuse base, 1-pole		3NH3 330		3NH3 430		
Fuse puller		3NX1 011				
Fused switch disconnector		3NP53		3NP54		3NP54
Switch disconnector with fuses		3KL57 30-1.B00 3KM57 30-1.B00		3KL61		3KL62

Table 56-25

1) Envelope dimension and pullers correspond to IEC 60269-2-1; however contact blades are slotted according to IEC 60269-4-1
2) Max. current and min. required connection cross-section when using fuse bases and switch disconnector, refer to Section 2.3

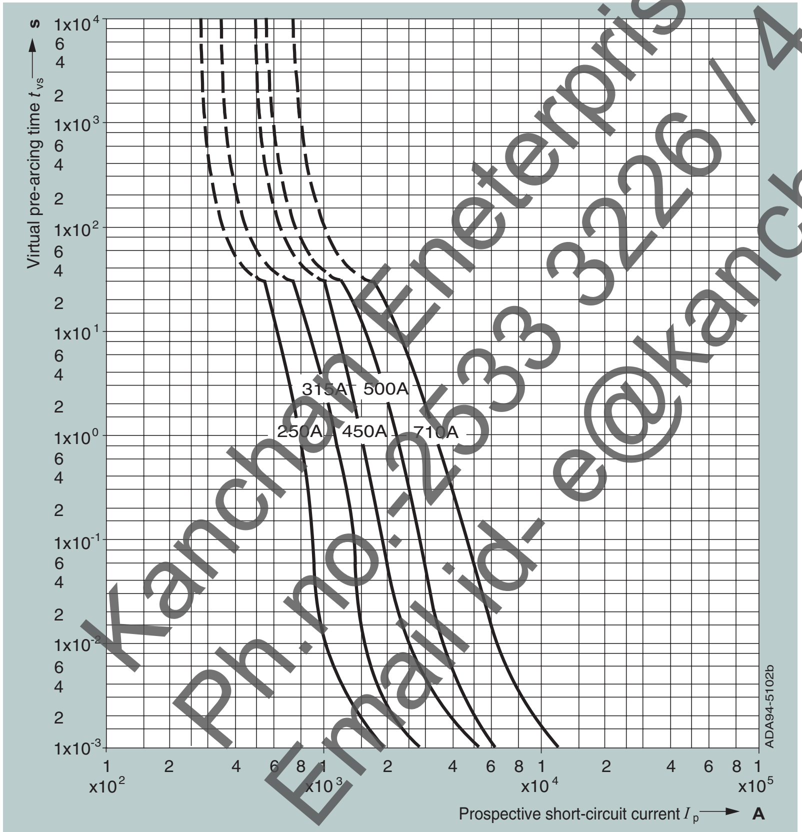


Fig. 56-68 *Time/current characteristics*

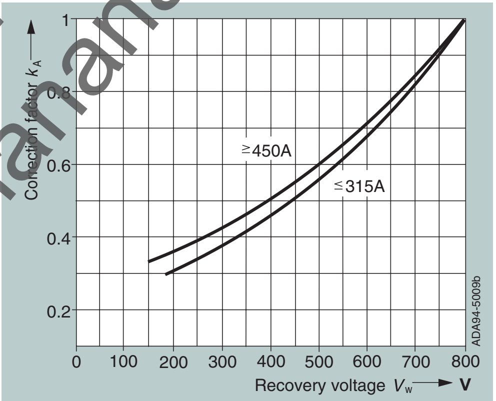


Fig. 56-69 *Correction factor k_A for clearing I^2t value*

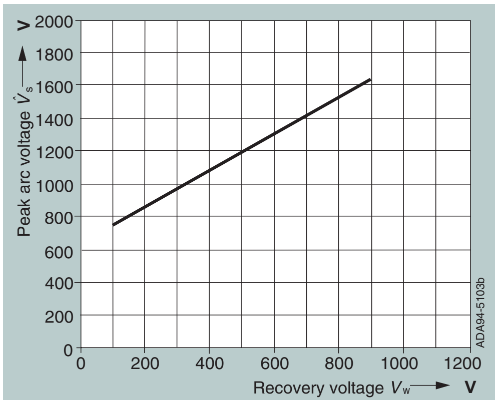


Fig. 56-70 *Arc voltage*

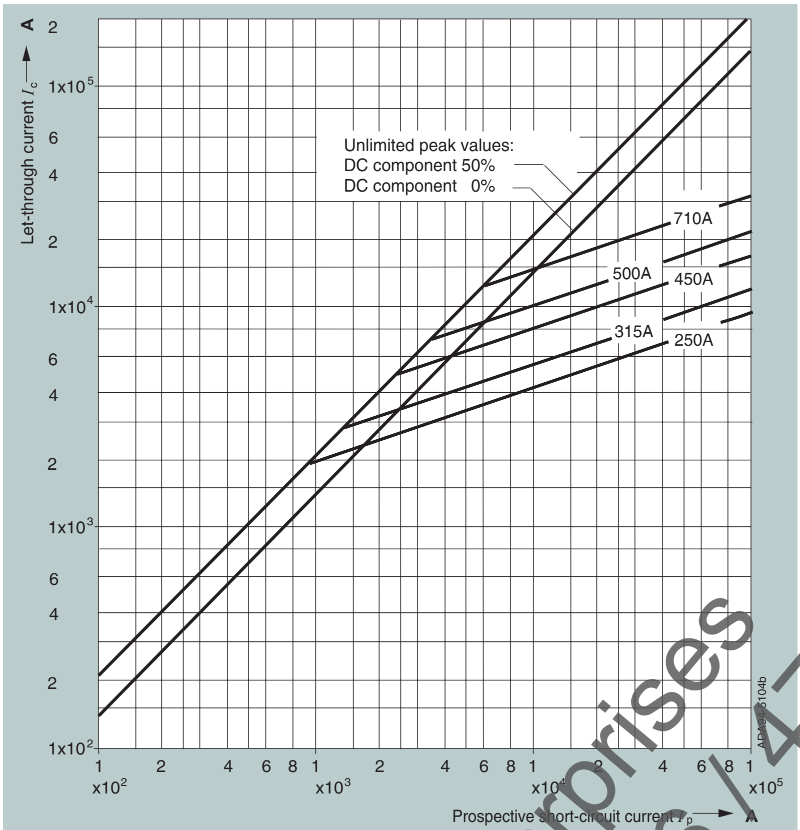
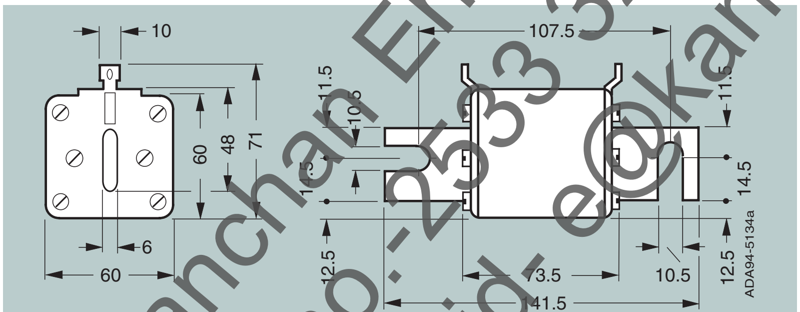


Fig. 57-71 *Let-through characteristics (current limiting at 50 Hz)*



Dimensions in mm

Fig. 57-72

3.1.13 **3NE4 1..** (IEC 60 269-2-1, Size 0)

Order No.		3NE4 101	3NE4 102	3NE4 117	3NE4 118	3NE4 120	3NE4 121	3NE4 122	3NE4 124
Utilization category (IEC 60 269)		gR	gR	gR	aR	aR	aR	aR	aR
Rated voltage V_n	V	1000	1000	1000	1000	1000	1000	1000	1000
Rated current I_n	A	32	40	50	63	80	100	125	160
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	40	75	120	230	450	900	1800	3600
Clearing I^2t value I^2t_A at V_n	A^2s	280	500	800	1500	3000	6000	14000	29000
Temperature rise at I_n (center of the fuse body)	K	45	50	65	78	82	85	100	120
Power dissipation at I_n	W	12	13	16	20	22	24	30	35
Cyclic load factor *WL*		0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Weight, approx.	kg	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
Accessories [1]									
Fuse base, 1-pole		3NH3 120							
Fuse base, 3-pole		3NH4 230							
Fuse puller		3NX1 011							
Fused switch disconnector		3NP42, 3NP52							
Switch disconnector with fuses		3KL55 30-1.B00 3KM55 30-1.B00							

Table 58-26

1) Max. current and min. required connection cross-section when using fuse bases and switch disconnector, refer to Section 2.3

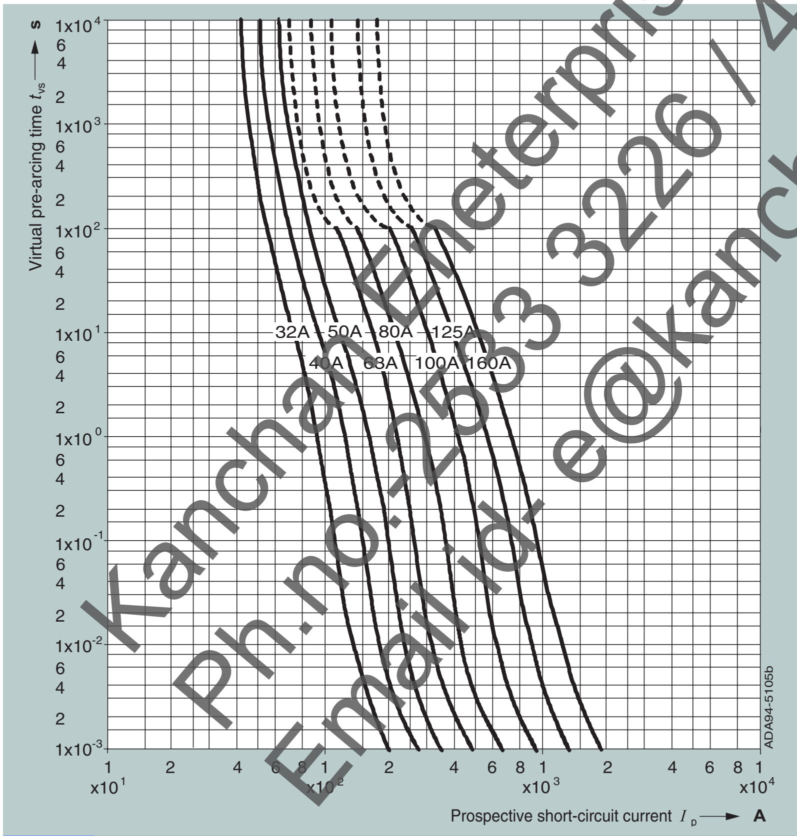


Fig. 58-73

Time/current characteristics

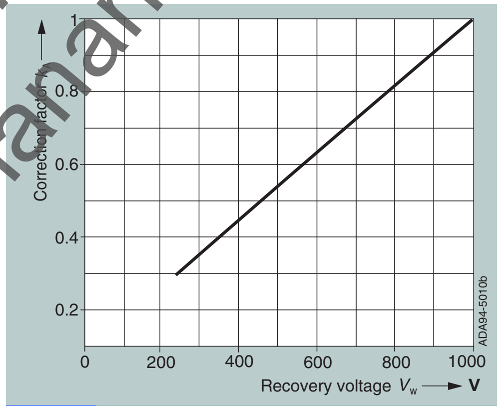


Fig. 58-74

Correction factor k_A for clearing I^2t value

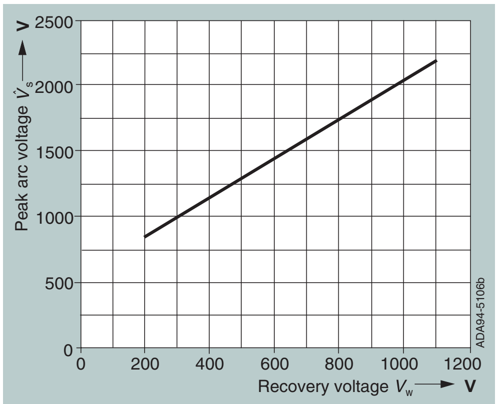


Fig. 58-75

Arc voltage

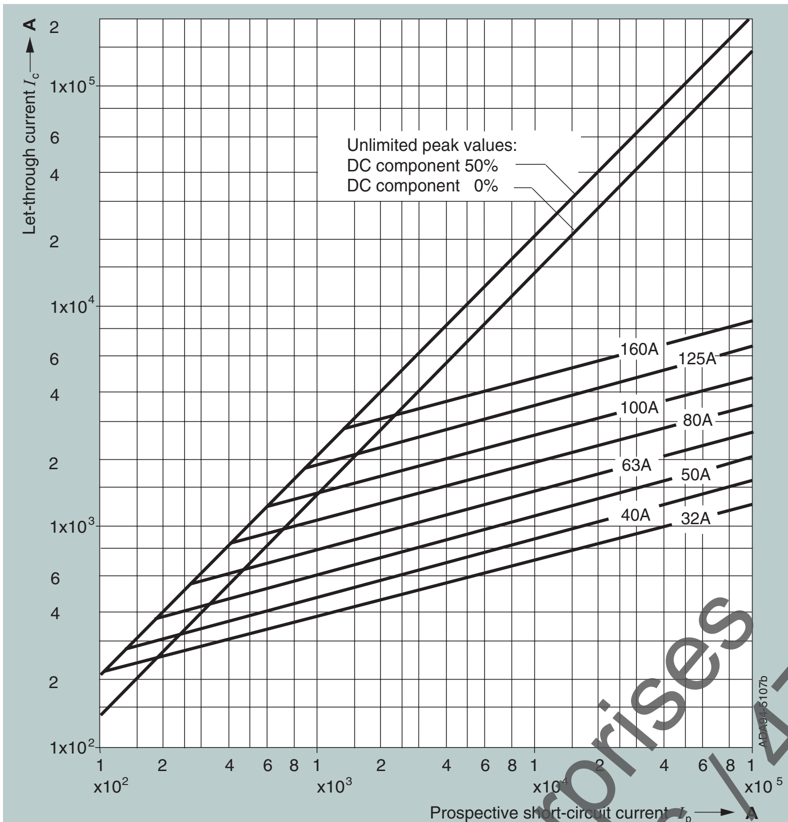
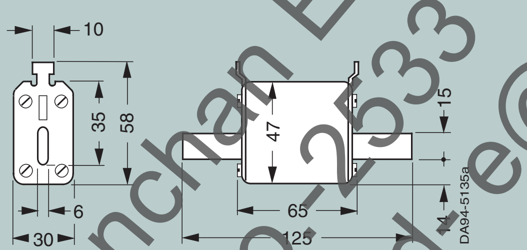


Fig. 59-76

Let-through characteristics (current limiting at 50 Hz)



Dimensions in mm

Fig. 59-77

3.1.14 3NE3 22. (IEC 60 269-4-1, Size 1/110) [1]

Order No.		3NE3 221	3NE3 222	3NE3 224	3NE3 225	3NE3 227
Utilization category (IEC 60 269)		aR	aR	aR	aR	aR
Rated voltage V_n	V	1000	1000	1000	1000	1000
Rated current I_n	A	100	125	160	200	250
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	665	1040	1850	4150	6650
Clearing I^2t value I^2t_A at V_n	A^2s	4800	7200	13000	30000	48000
Temperature rise at I_n (center of the fuse body)	K	65	70	90	80	90
Power dissipation at I_n	W	28	36	42	42	50
Cyclic load factor *WL*		0.95	0.95	1.0	1.0	1.0
Weight, approx.	kg	0.55	0.55	0.55	0.55	0.55

Accessories [2]	
Fuse base, 1-pole	3NH3 230
Fuse base, 3-pole	3NH4 230
Fuse puller	3NX1 011
Fused switch disconnector	3NP42, 3NP52
Switch disconnector with fuses	3KL55 30-1.B00
	3KM55 30-1.B00

Table 60-27

1) Envelope dimension and pullers correspond to IEC 60269-2-1; however contact blades are slotted according to IEC 60269-4-1
2) Max. current and min. required connection cross-section when using fuse bases and switch disconnector, refer to Section 2.3

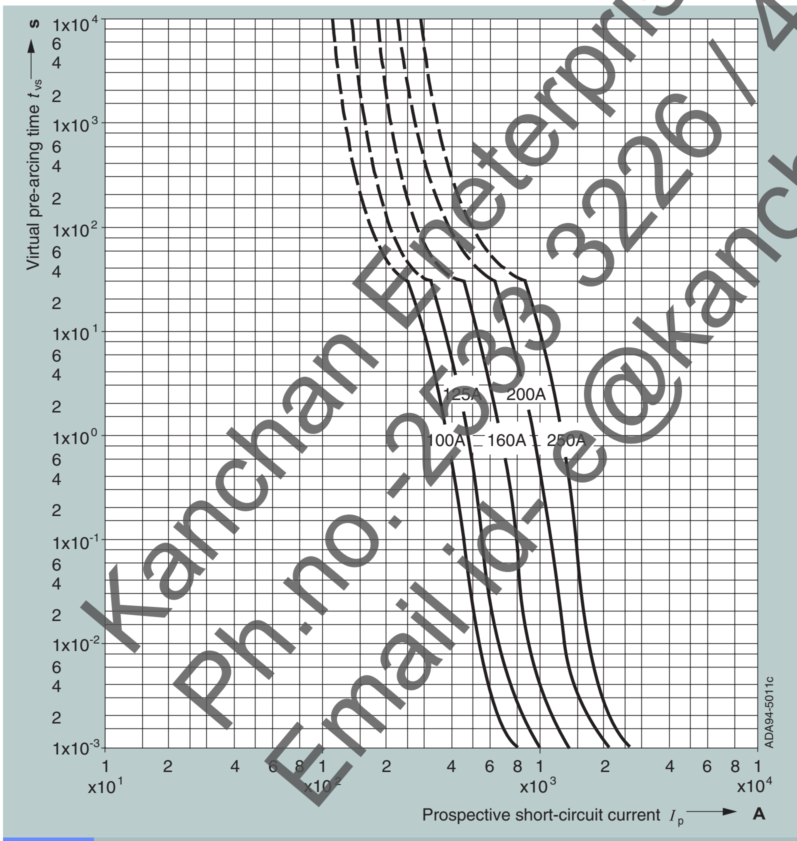


Fig. 60-78 *Time/current characteristics*

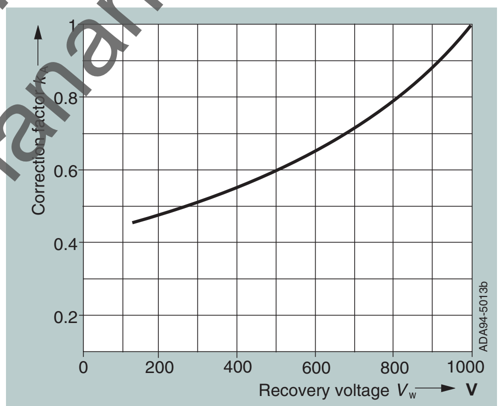


Fig. 60-79 *Correction factor k_A for clearing I^2t value*

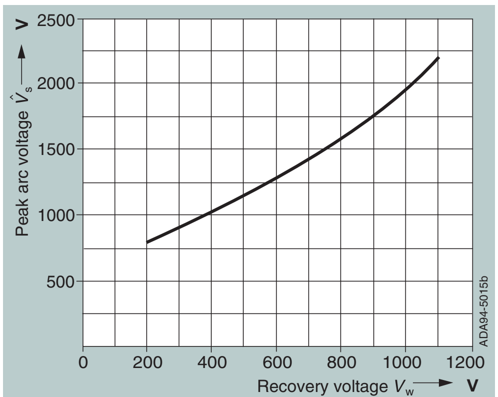


Fig. 60-80 *Arc voltage*

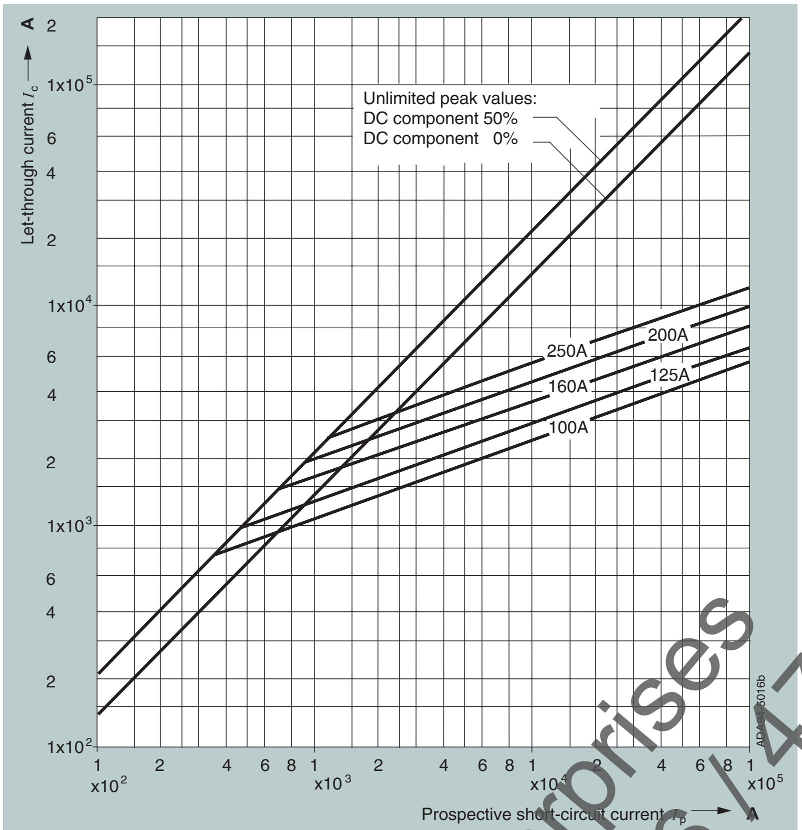


Fig. 61-81 *Let-through characteristics (current limiting at 50 Hz)*

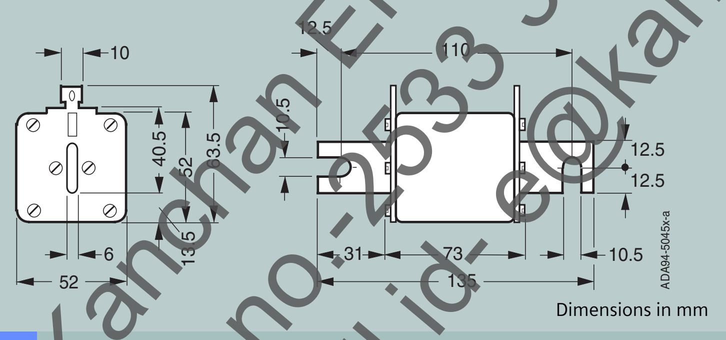


Fig. 61-82

3.1.15 3NE3 23. (IEC 60 269-4-1, Size 1/110) [1)]

Order No.		3NE3 230-0B	3NE3 231	3NE3 232-0B	3NE3 233
Utilization category (IEC 60 269)		aR	aR	aR	aR
Rated voltage V_n	V	1000	1000	1000	1000
Rated current I_n	A	315	350	400	450
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	13400	16600	22600	29500
Clearing I^2t value I^2t_A at V_n	A^2s	80000	100000	135000	175000
Temperature rise at I_n (center of the fuse body)	K	100	120	140	130
Power dissipation at I_n	W	65	75	85	95
Cyclic load factor *WL*		0.95	0.9	0.9	0.9
Weight, approx.	kg	0.55	0.55	0.55	0.55
Accessories [2)]					
Fuse base, 1-pole		3NH3 330			
Fuse puller		3NX1 011			
Fused switch disconnector		3NP53			
Switch disconnector with fuses		3KL57 30-1.B00 3KM57 30-1.B00			

Table 62-28

1) Envelope dimension and pullers correspond to IEC 60269-2-1; however contact blades are slotted according to IEC 60269-4-1
2) Max. current and min. required connection cross-section when using fuse bases and switch disconnector, refer to Section 2.3

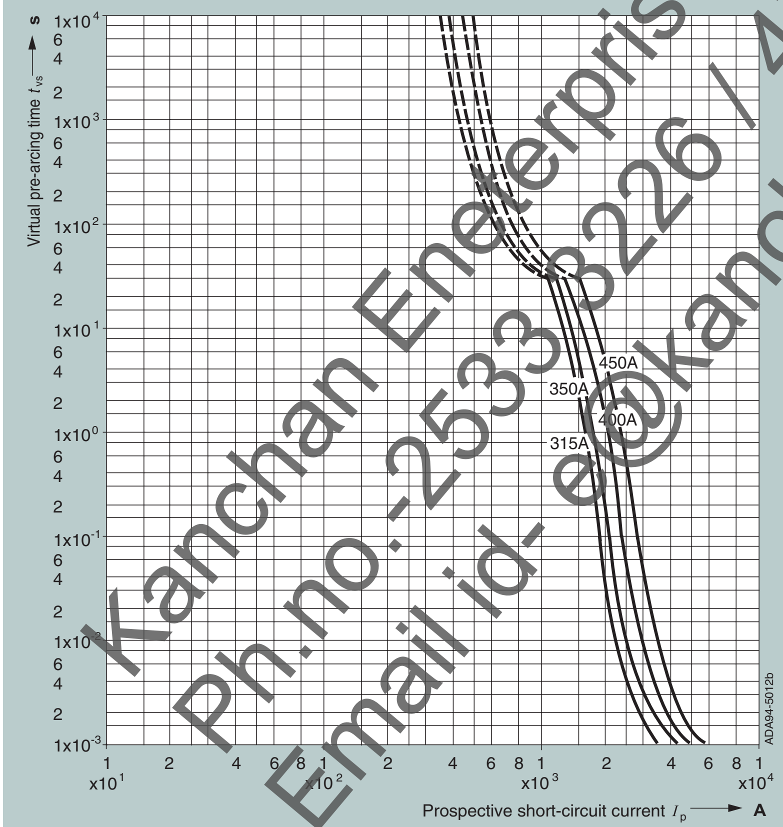


Fig. 62-83 *Time/current characteristics*

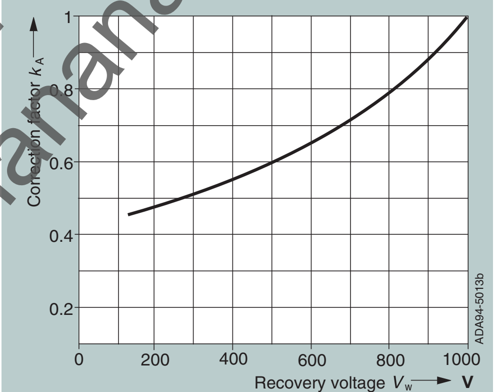


Fig. 62-84 *Correction factor k_A for clearing I^2t value*

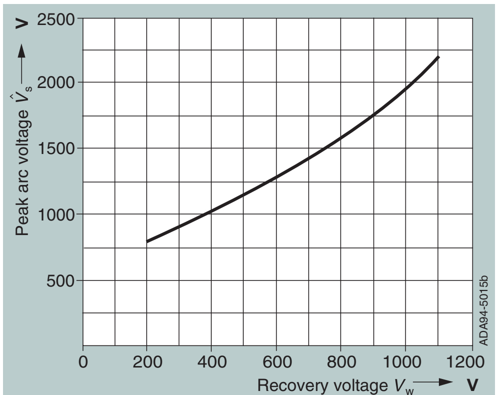


Fig. 62-85 *Arc voltage*

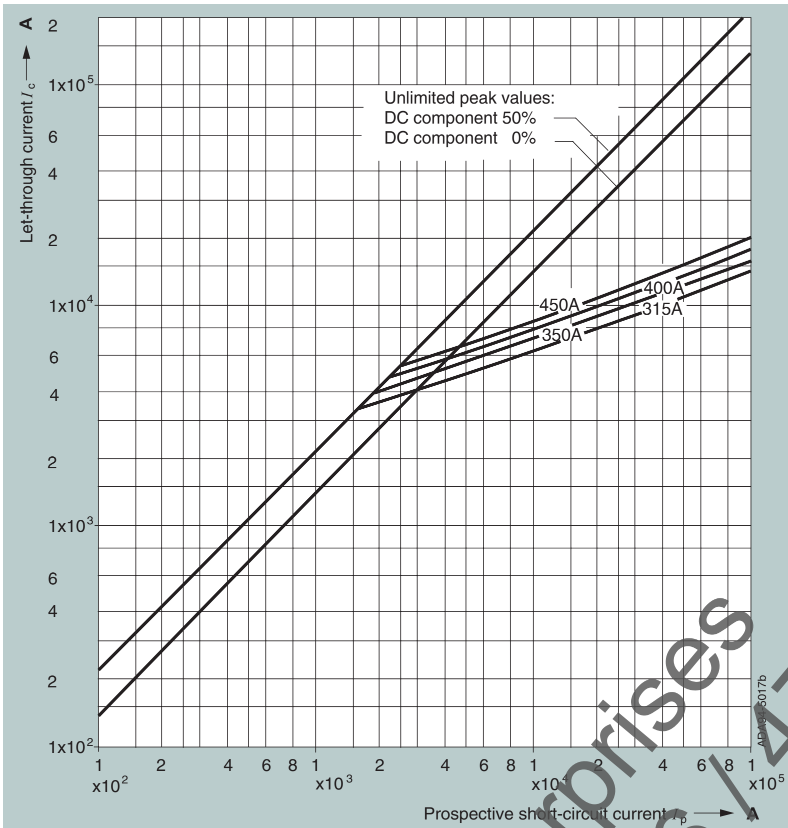


Fig. 63-86 *Let-through characteristics (current limiting at 50 Hz)*

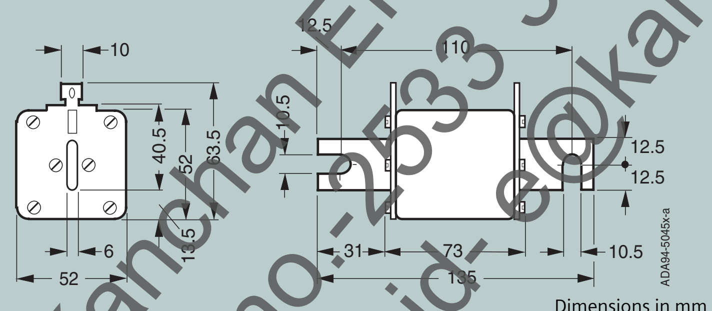


Fig. 63-87

3.1.16 **3NE3 3..** (IEC 60 269-4-1, Size 2/110) [1)]

Order No.		**3NE3 332-0B**	**3NE3 333**	**3NE3 334-0B**	**3NE3 335**	**3NE3 336**	**3NE3 337-8**	**3NE3 338-8**	**3NE3 340-8**
Utilization category (IEC 60 269)		aR	aR	aR	aR	aR	aR	aR	aR
Rated voltage V_n	V	1 000	1 000	1 000	1 000	1 000	900	800	690
Rated current I_n	A	400	450	500	560	630	710	800	900
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	22 600	29 500	46 100	66 400	104 000	149 000	184 000	223 000
Clearing I^2t value I^2t_A at V_n	A^2s	135 000	175 000	260 000	360 000	600 000	800 000	850 000	1 300 000
Temperature rise at I_n (center of the fuse body)	K	120	125	115	120	110	125	140	160
Power dissipation at I_n	W	85	90	90	95	100	105	130	165
Cyclic load factor *WL*		1.0	1.0	1.0	1.0	1.0	1.0	0.95	0.95
Weight, approx.	kg	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Accessories [2)]									
Fuse base, 1-pole		3NH3 430							
Fuse puller		3NX1 011							
Fused switch disconnector		3NP54							
Switch disconnector with fuses		3KL61 30-1AB0				3KL62			

Table 64-29

1) Envelope dimension and pullers correspond to IEC 60269-2-1; however contact blades are slotted according to IEC 60269-4-1
2) Max. current and min. required connection cross-section when using fuse bases and switch disconnector, refer to Section 2.3

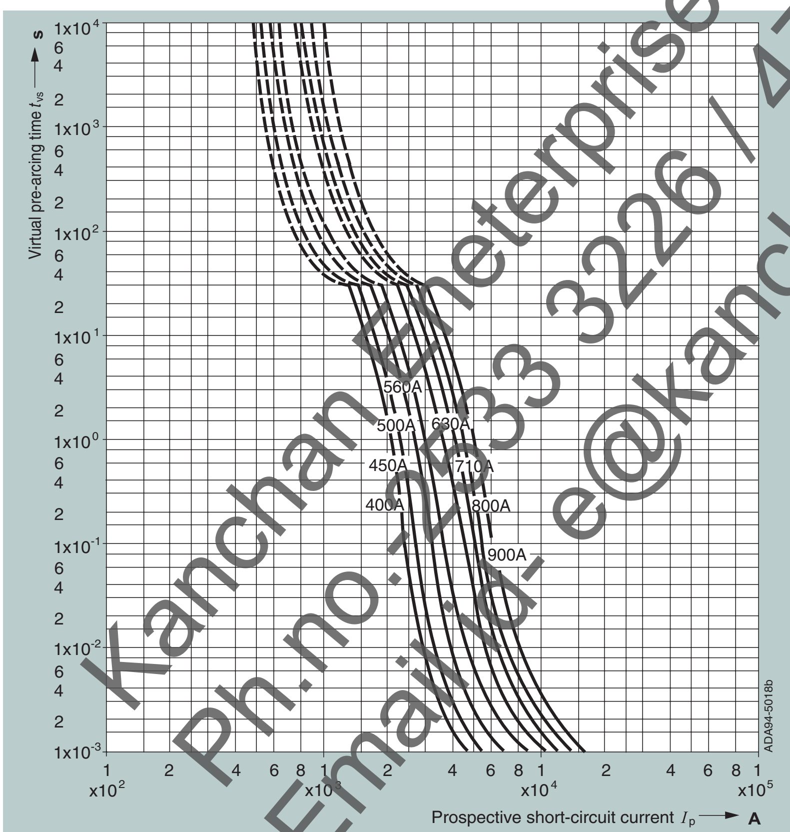


Fig. 64-88 *Time/current characteristics*

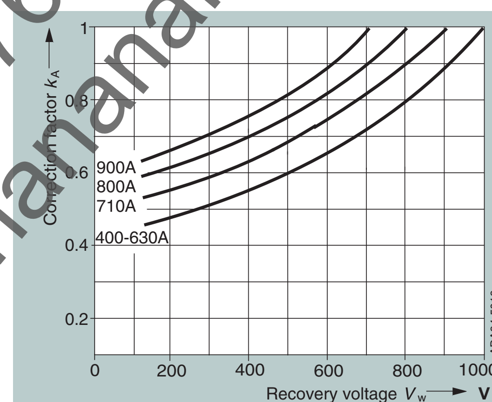


Fig. 64-89 *Correction factor k_A for clearing I^2t value*

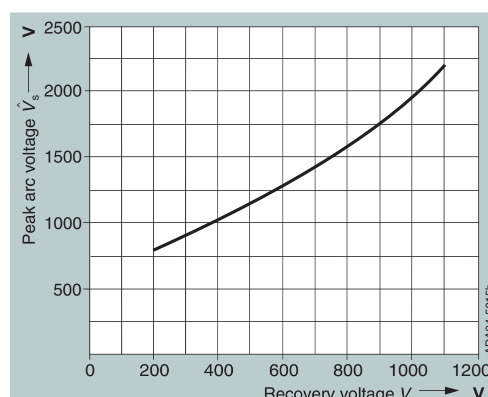


Fig. 64-90 *Arc voltage*

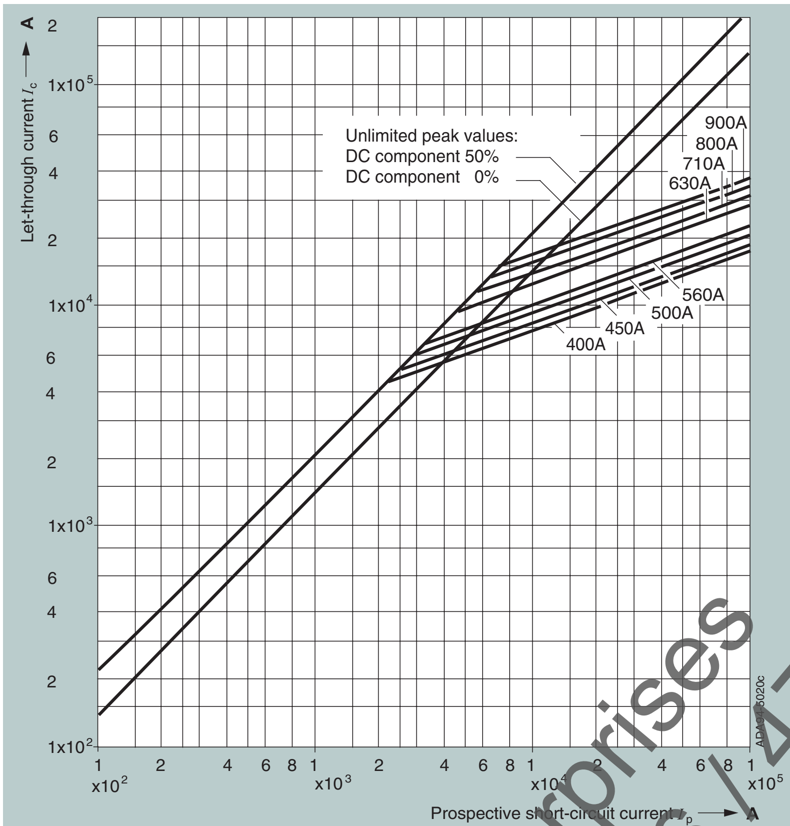


Fig. 65-91

Let-through characteristics (current limiting at 50 Hz)

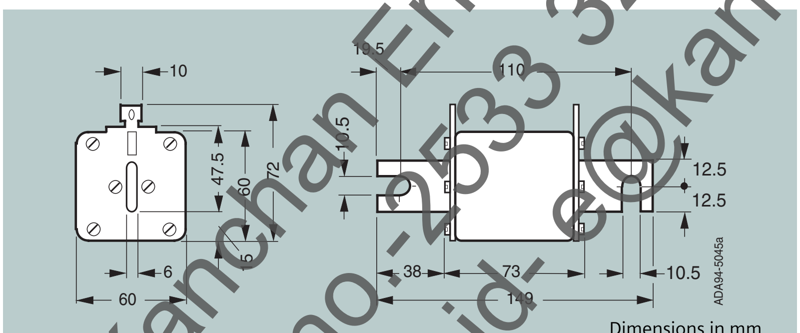


Fig. 65-92

3.1.17 **3NE3 4.., 3NE3 6..** (IEC 60 269-4-1, Size 3/130)

Order No.		**3NE3 421**	**3NE3 626**	**3NE3 430**	**3NE3 432**	**3NE3 635, 3NE3 635-6**	**3NE3 434**	**3NE3 636**	**3NE3 637, 3NE3 637-1** [1)]
Utilization category (IEC 60 269)		aR	aR	aR	aR	aR	aR	aR	aR
Rated voltage V_n	V	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000
Rated current I_n	A	100	224	315	400	450	500	630	710
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	1 800	7 200	29 000	48 500	65 000	116 000	170 000	260 000
Clearing I^2t value I^2t_A at V_n	A^2s	13 500	54 000	218 000	364 000	488 000	870 000	1 280 000	1 950 000
Temperature rise at I_n (center of the fuse body)	K	45	140	120	130	150	120	136	170
Power dissipation at I_n	W	25	85	80	110	110	95	132	145
Cyclic load factor *WL*		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Weight, approx.	kg	1.15	1.15	1.15	1.15	1.15	1.15	1.15	1.15

Table 66-30

1) Inside caliper 140 mm, M 12-screw connection

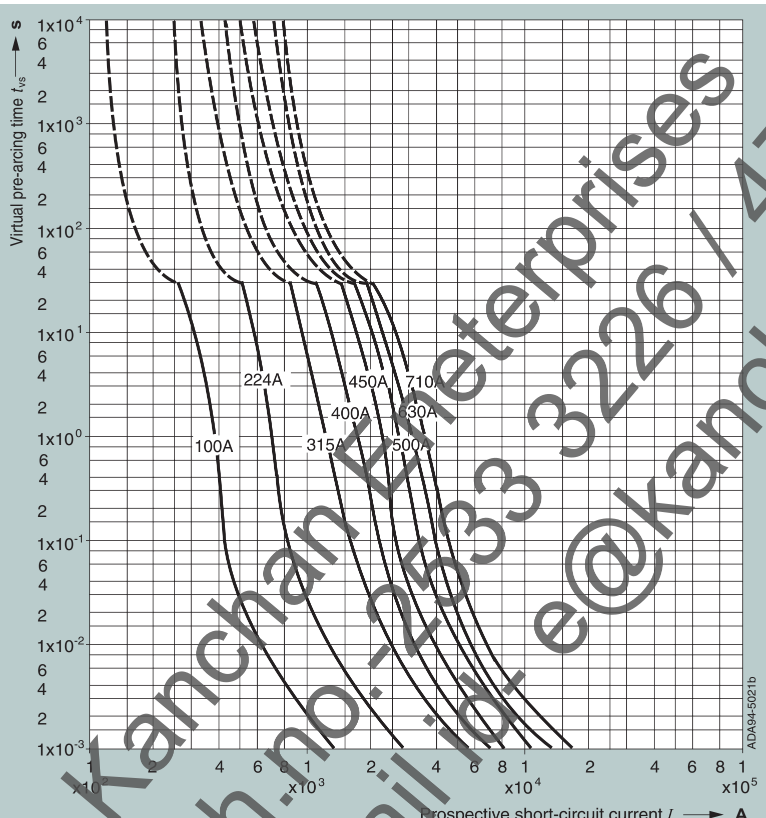


Fig. 66-93 *Time/current characteristics*

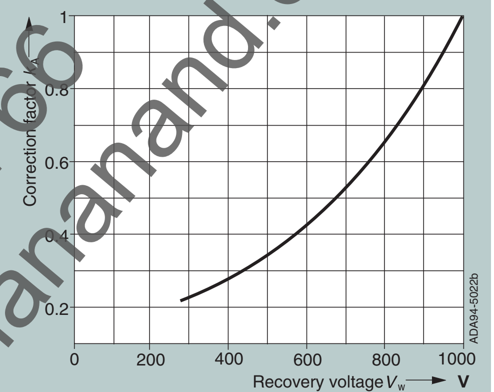


Fig. 66-94 *Correction factor k_A for clearing I^2t value*

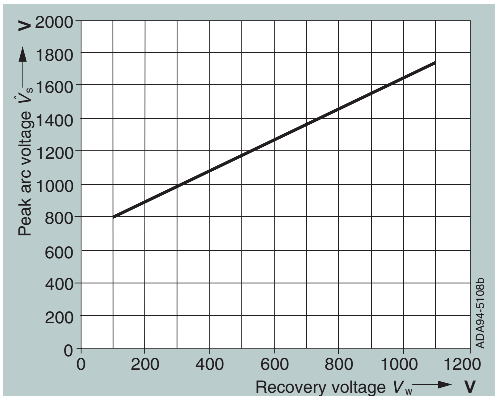


Fig. 66-95 *Arc voltage*

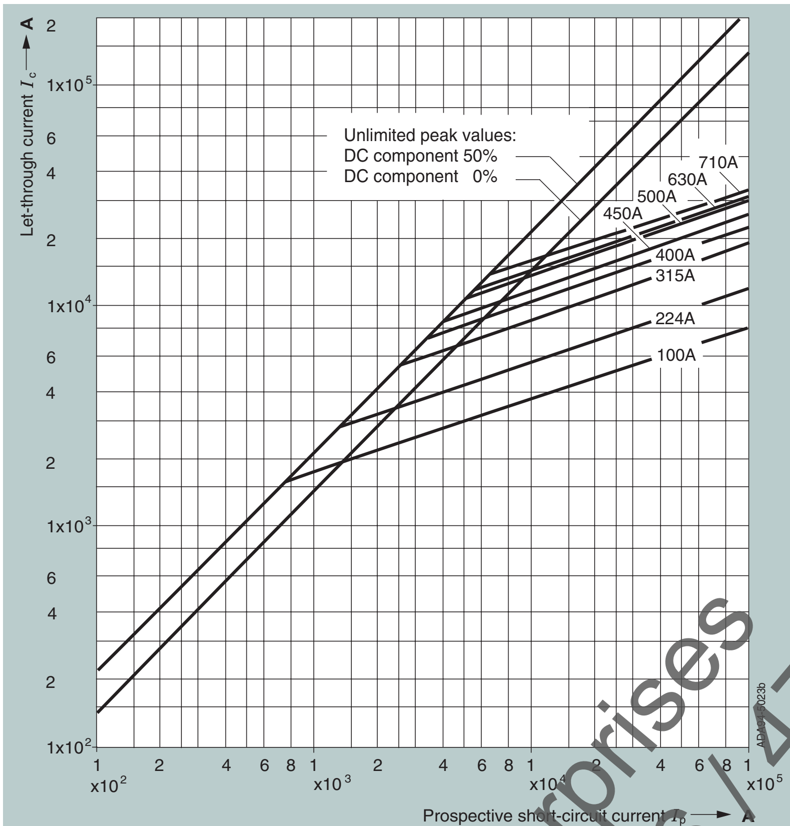
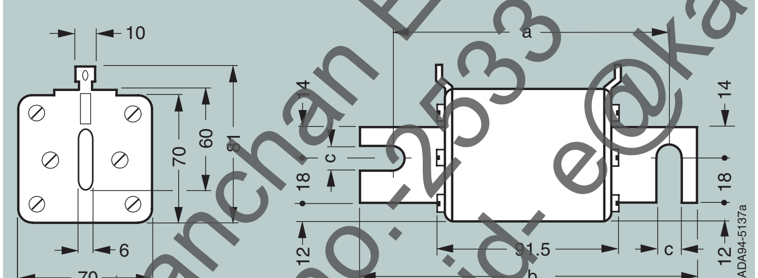


Fig. 67-96 *Let-through characteristics (current limiting at 50 Hz)*

3NE3 4.., 3NE3 6.., 3NE3 6..-1

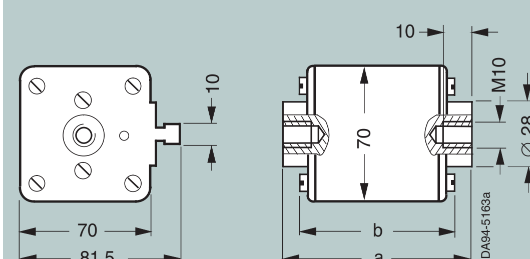


Order No.	a	b	c
3NE3 4..	128	160	11.5
3NE3 6..	128	160	11.5
3NE3 6..-1	138	170	13

Dimensions in mm

Fig. 67-97

3NE3 635-6



Dimensions in mm

Fig. 67-98

3.1.18 **3NE5 4.., 3NE5 433-1** (IEC 60 269-4-1, Size 3/210)

Order No.		3NE5 424	3NE5 426	3NE5 430	3NE5 431	3NE5 433 3NE5 433-1
Utilization category (IEC 60 269)		aR	aR	aR	aR	aR
Rated voltage V_n	V	1500	1500	1500	1500	1500
Rated current I_n	A	160	224	315	350	450
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	7200	18400	41500	57000	116000
Clearing I^2t value I^2t_A at V_n	A^2s	54000	138000	311000	428000	870000
Temperature rise at I_n (center of the fuse body)	K	75	100	125	150	150
Power dissipation at I_n	W	56	80	115	135	145
Cyclic load factor WL		1.0	1.0	1.0	1.0	0.95
Weight, approx.	kg	1.95	1.95	1.95	1.95	1.95

Table 68-31

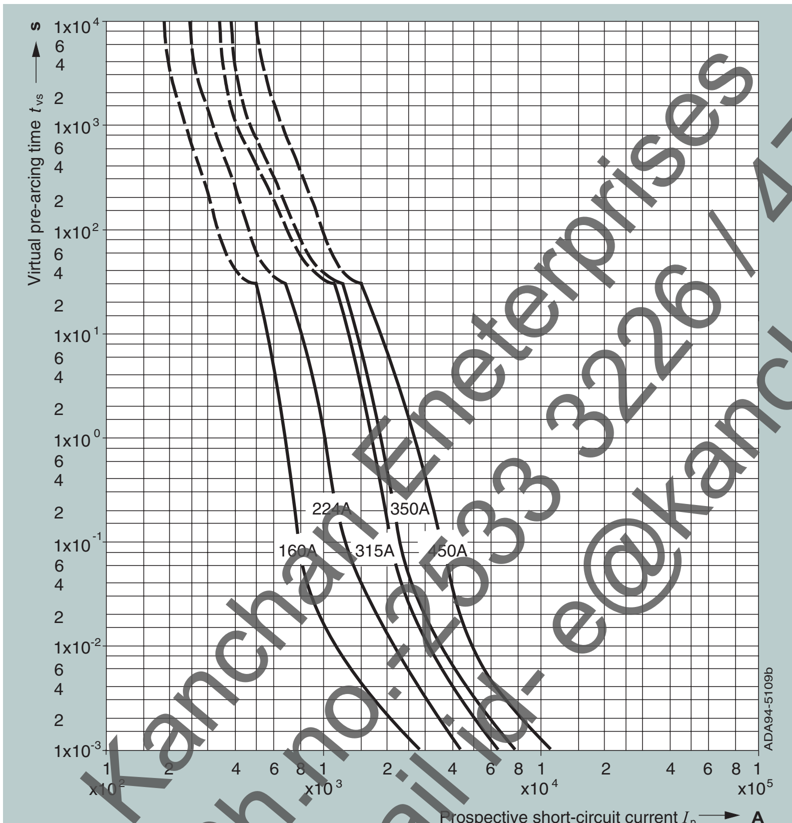


Fig. 68-99 *Time/current characteristics*

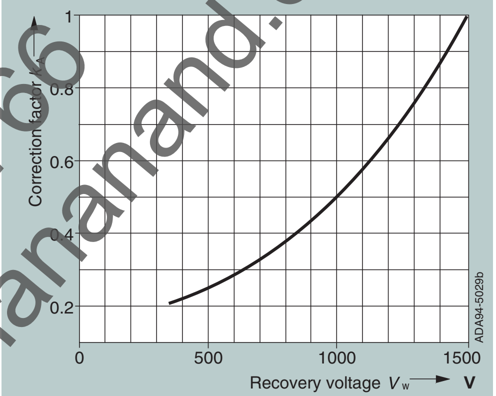


Fig. 68-100 *Correction factor k_A for clearing I^2t value*

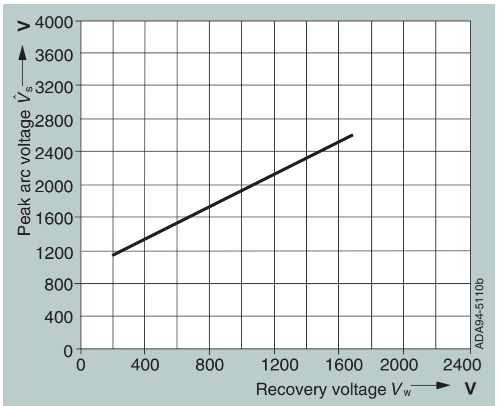


Fig. 68-101 *Arc voltage*

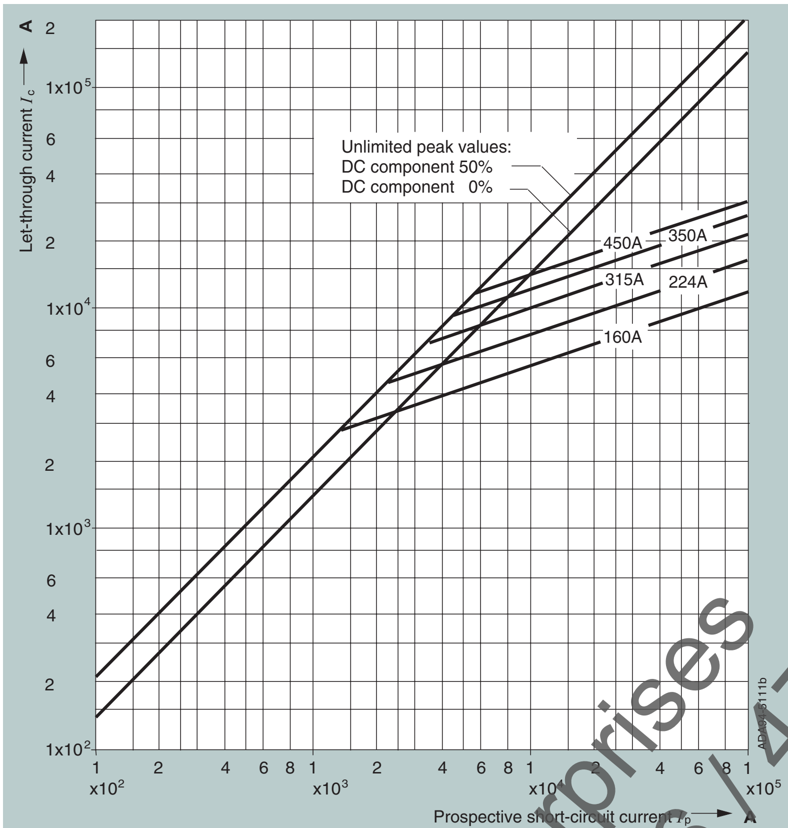
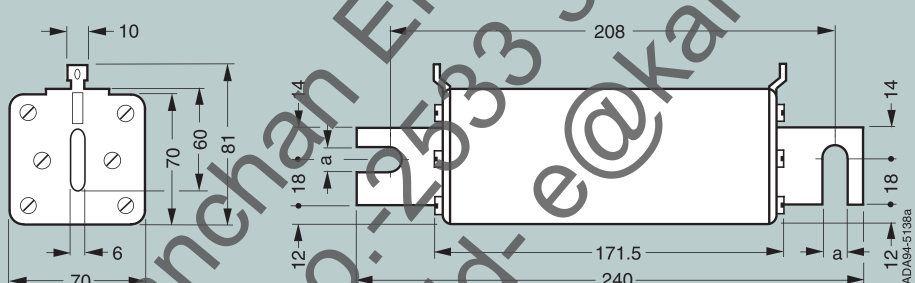


Fig. 69-102

Let-through characteristics (current limiting at 50 Hz)



Order No.	a
3NE5 4..	11.5
3NE5 4..-1	13

Dimensions in mm

Fig. 69-103

3.1.19 **3NE5 6..** (IEC 60 269-4-1, Size 3/170)

Order No.		3NE5 627	3NE5 633	3NE5 643
Utilization category (IEC 60 269)		aR	aR	aR
Rated voltage V_n	V	1 500	1 500	1 500
Rated current I_n	A	250	450	600
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	11 200	78 500	260 000
Clearing I^2t value I^2t_A at V_n	A^2s	84 000	590 000	1 950 000
Temperature rise at I_n (center of the fuse body)	K	170	170	160
Power dissipation at I_n	W	130	160	145
Cyclic load factor *WL*		1.0	1.0	1.0
Weight, approx.	kg	1.6	1.6	1.6

Table 70-32

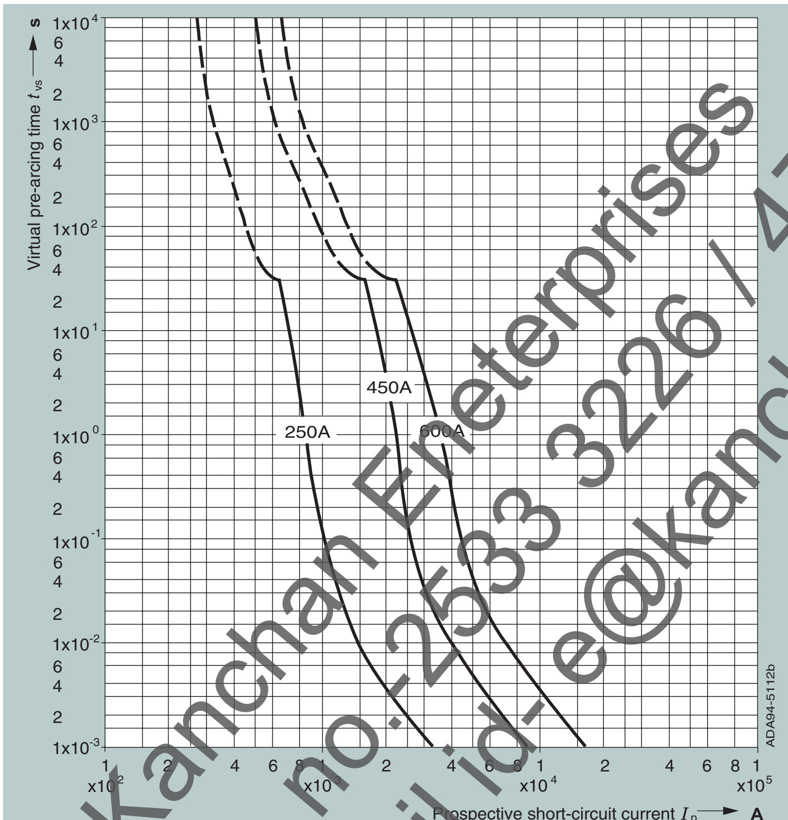


Fig. 70-104 *Time/current characteristics*

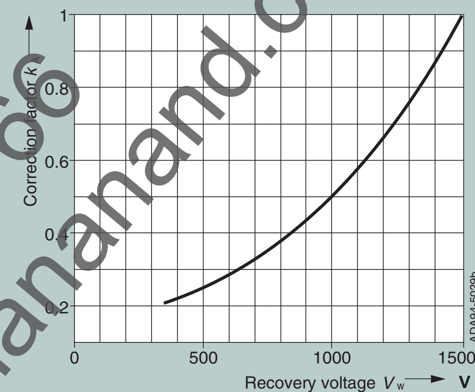


Fig. 70-105 *Correction factor k_A for clearing I^2t value*

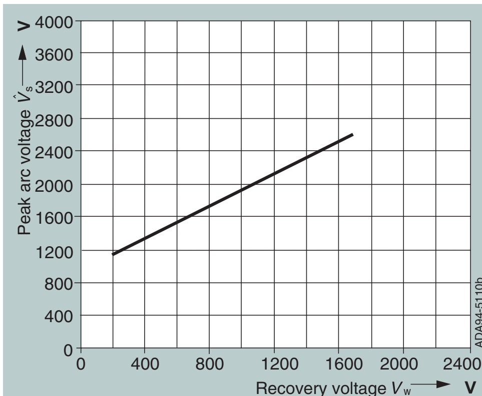


Fig. 70-106 *Arc voltage*

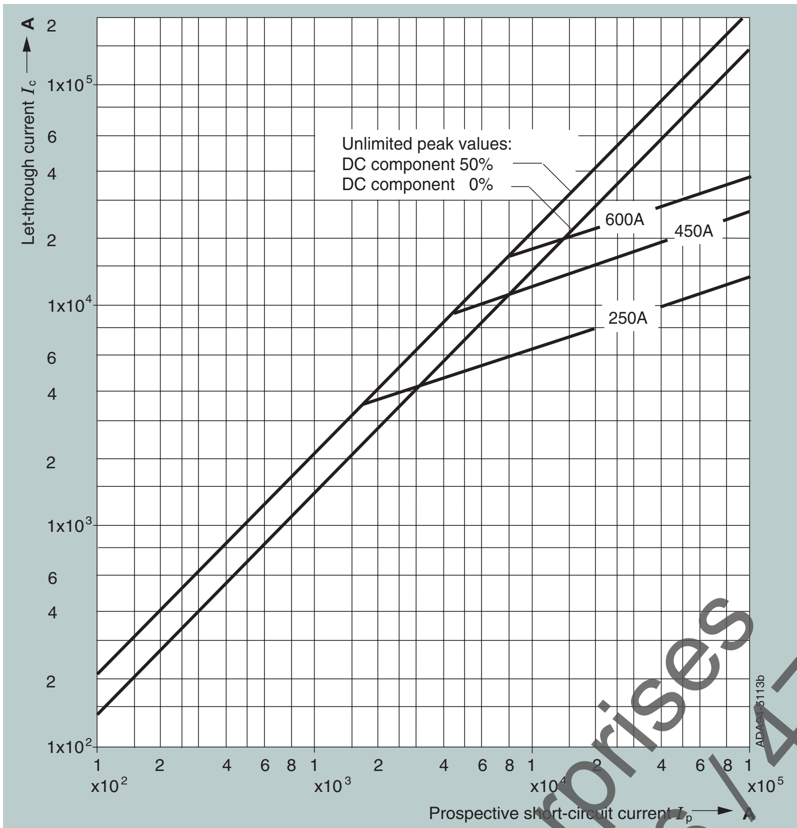
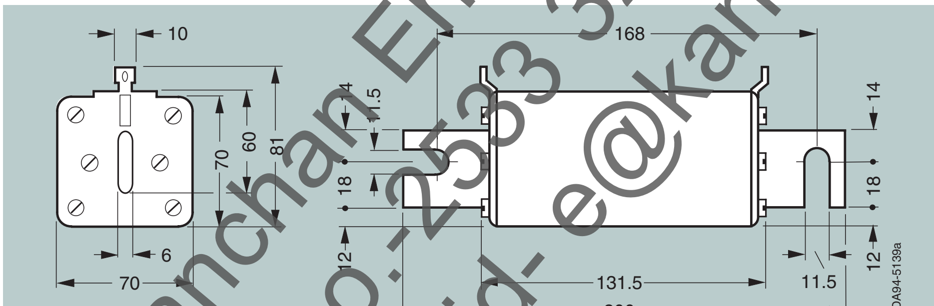


Fig. 71-107 *Let-through characteristics (current limiting at 50 Hz)*



Dimensions in mm

Fig. 71-108

3.1.20 **3NE7 4.., 3NE7 6..** (IEC 60 269-4-1, Size 3/210)

Order No.		**3NE7425**	**3NE7427**	**3NE7431**	**3NE7432**	**3NE7633, 3NE7633-1** [1)]	**3NE7648-1** [1)]	**3NE7636, 3NE7636-1** [1)]	**3NE7637-1** [1)]
Utilization category (IEC 60 269)		aR	aR	aR	aR	aR	aR	aR	aR
Rated voltage V_n	V	2000	2000	2000	2000	2000	2000	2000	2000
Rated current I_n	A	200	250	350	400	450	525	630	710
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	18400	29000	74000	116000	128000	149000	260000	415000
Clearing I^2t value I^2t_A at V_n	A^2s	138000	218000	555000	870000	960000	1120000	1950000	3110000
Temperature rise at I_n (center of the fuse body)	K	85	110	105	130	165	210	200	230
Power dissipation at I_n	W	75	110	120	150	160	210	220	275
Cyclic load factor *WL*		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Weight, approx.	kg	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95

Table 72-33

1) M 12-screw connection

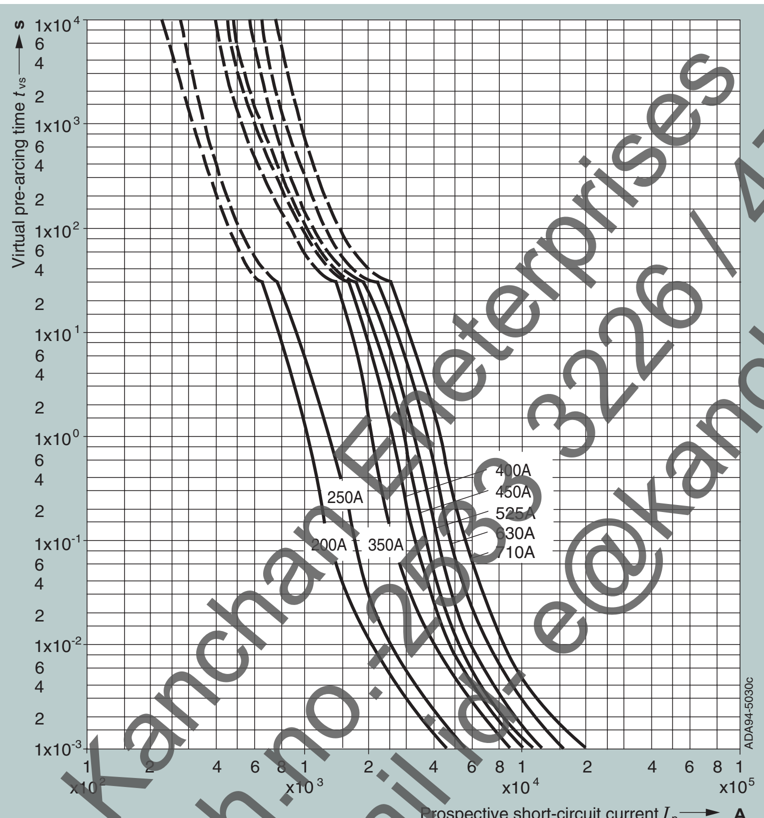


Fig. 72-109 *Time/current characteristics*

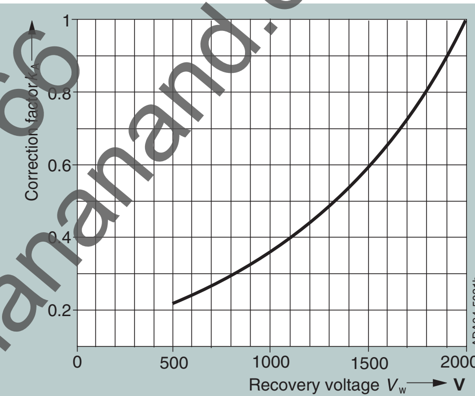


Fig. 72-110 *Correction factor k_A for clearing I^2t value*

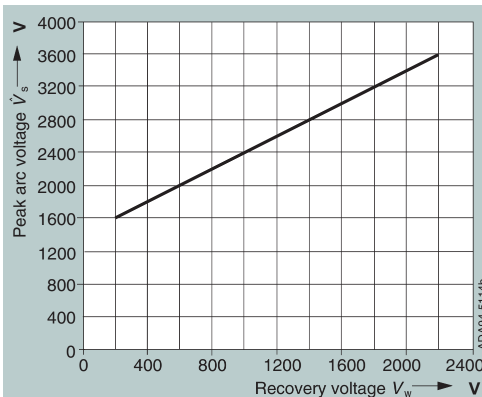


Fig. 72-111 *Arc voltage*

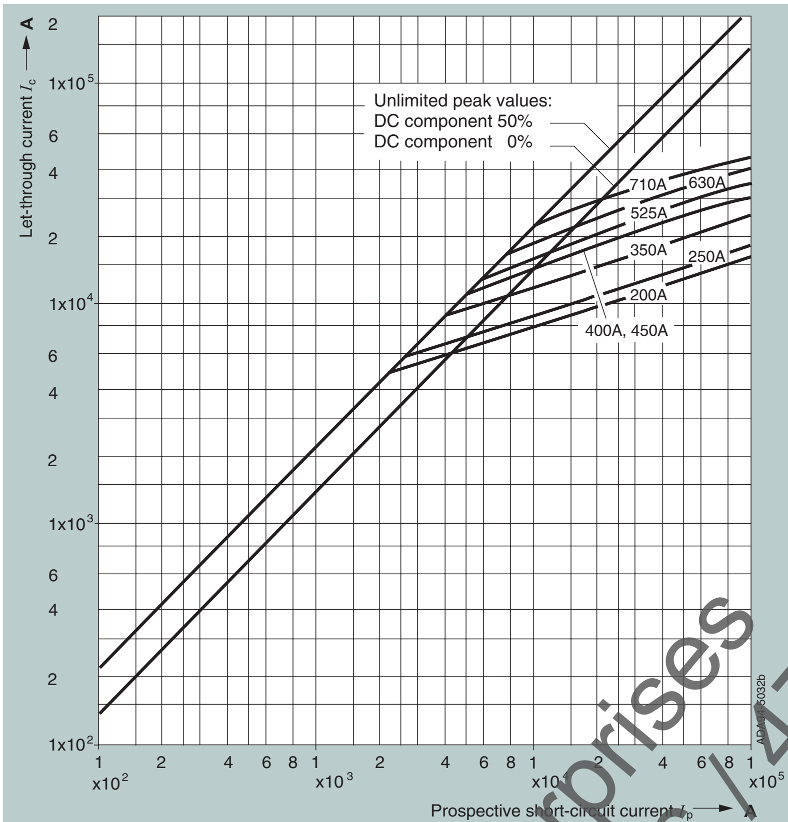
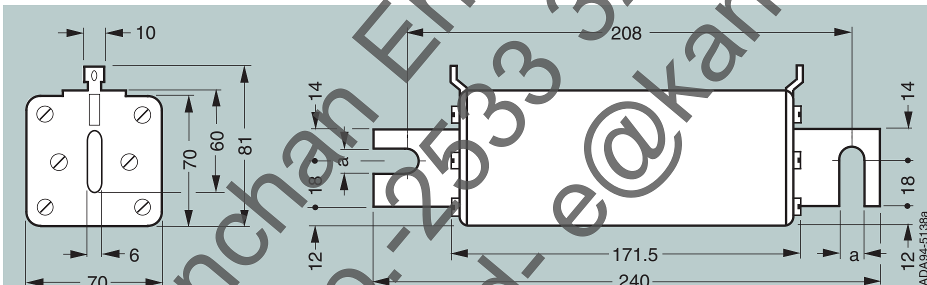


Fig. 73-112 *Let-through characteristics (current limiting at 50 Hz)*



Order No.	a
3NE7 4..	11.5
3NE7 6..	11.5
3NE7 6..-1	13

Dimensions in mm

Fig. 73-113

3.1.21 **3NE9 6..** (IEC 60 269-4-1, Size 3/260)

Order No.		3NE9 632-1	3NE9 634-1	3NE9 636-1A
Utilization category (IEC 60 269)		aR	aR	aR
Rated voltage V_n	V	2500	2500	2500
Rated current I_n	A	400	500	630
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	81000	170000	385000
Clearing I^2t value I^2t_A at V_n	A^2s	620000	1270000	2800000
Temperature rise at I_n (center of the fuse body)	K	160	180	198
Power dissipation at I_n	W	205	235	275
Cyclic load factor *WL*		1.0	1.0	1.0
Weight, approx.	kg	2.5	2.5	2.5

Table 74-34

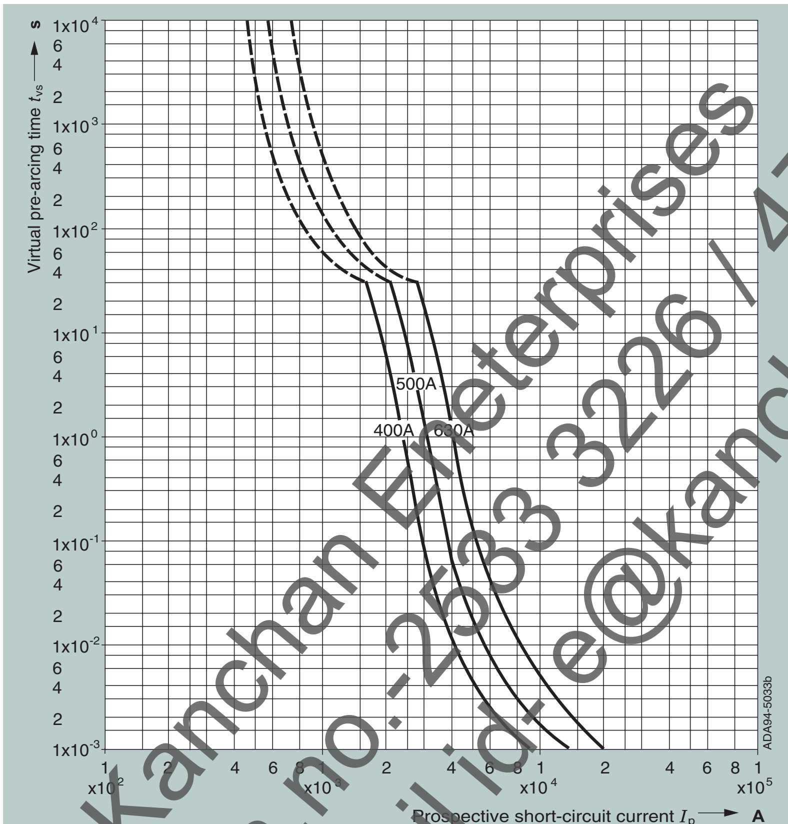


Fig. 74-114 *Time/current characteristics*

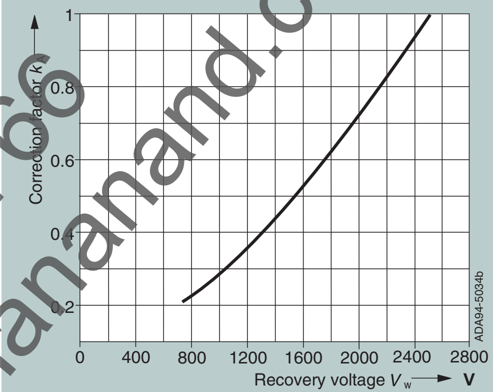


Fig. 74-115 *Correction factor k_A for clearing I^2t value*

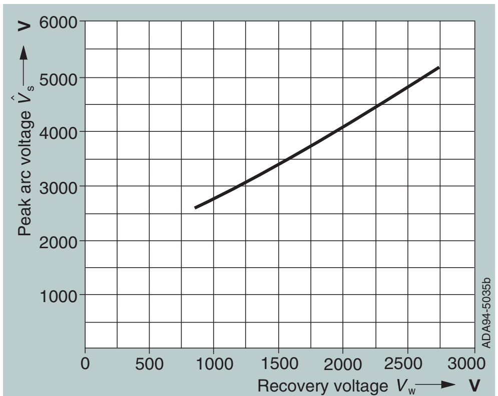


Fig. 74-116 *Arc voltage*

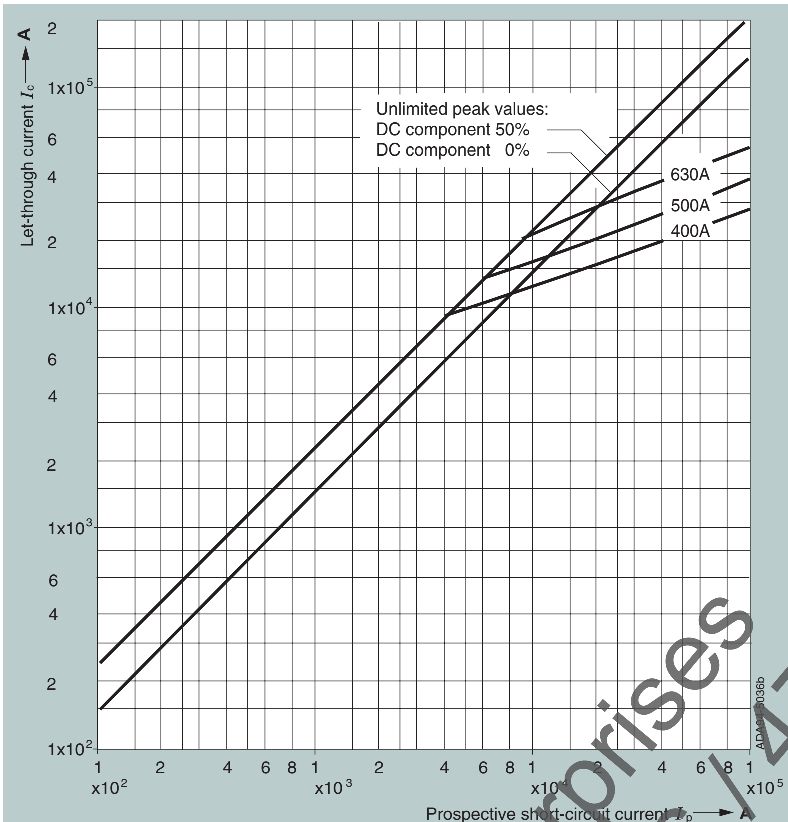
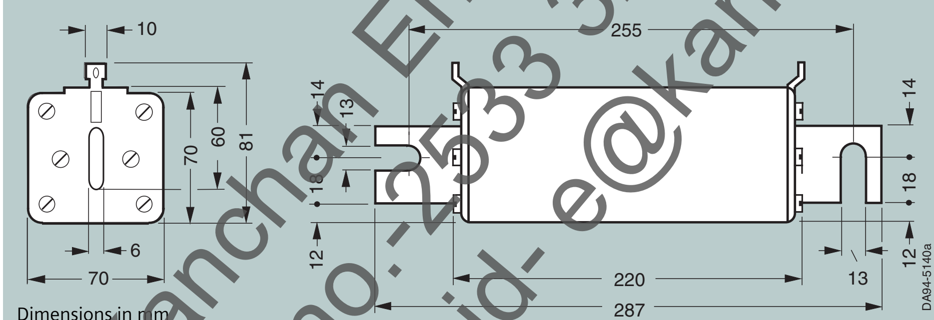


Fig. 75-117 *Let-through characteristics (current limiting at 50 Hz)*



Dimensions in mm

Fig. 75-118

3.1.22 **3NC1 0..** (IEC 60 269-2-1/III, Size 10 x 38 mm)

Order No.		3NC1 003	3NC1 006	3NC1 008	3NC1 010	3NC1 012	3NC1 016	3NC1 020	3NC1 025	3NC1 032
Utilization category (IEC 60 269)		aR	aR	aR	aR	aR	aR	aR	aR	aR
Rated voltage V_n	V	600	600	600	600	600	600	600	600	600
Rated current I_n	A	3	6	8	10	12	16	20	25	32
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	3	4	6	9	15	25	34	60	95
Clearing I^2t value I^2t_A at V_n	A^2s	8	30	50	70	120	150	260	390	600
Temperature rise at I_n (center of the fuse body)	K	30	30	25	40	50	60	80	90	110
Power dissipation at I_n	W	1.2	1.5	2	2.5	3	3.5	4.8	6	7.5
Cyclic load factor *WL*		–	–	–	–	–	–	–	–	–
Weight, approx.	kg	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Table 76-35

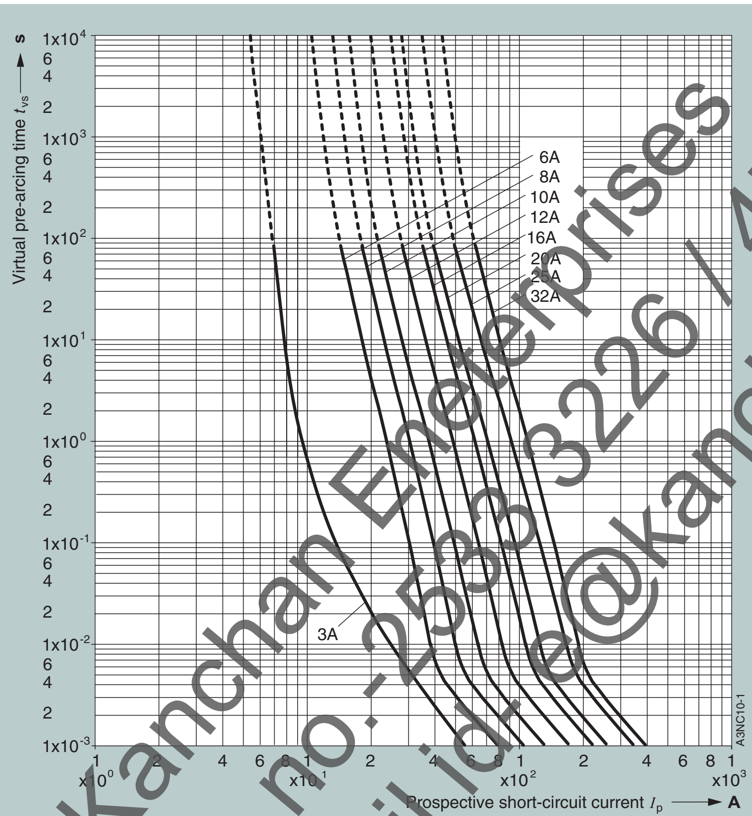


Fig. 76-119 *Time/current characteristics*

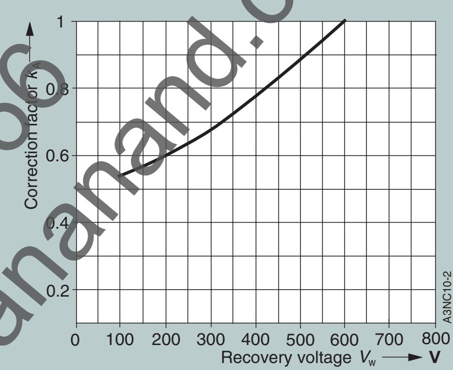


Fig. 76-120 *Correction factor k_A for clearing I^2t value*

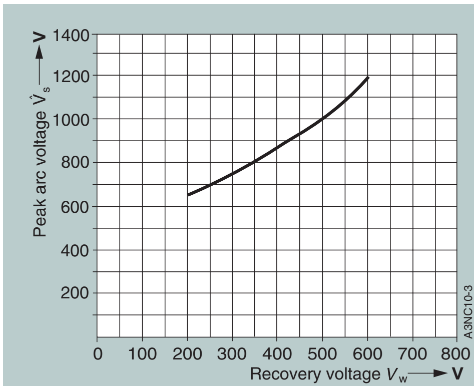


Fig. 76-121 *Arc voltage*

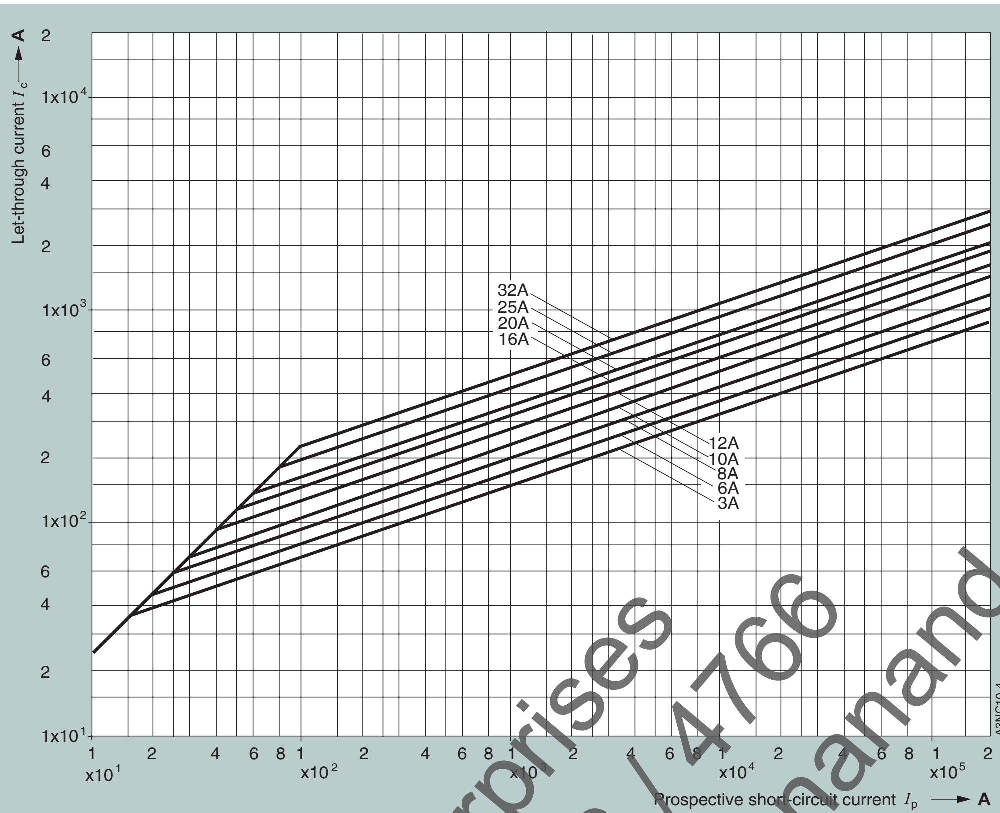


Fig. 77-122 *Let-through characteristics (current limiting at 50 Hz)*

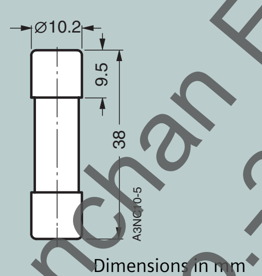


Fig. 77-123

3.1.23 **3NC1 1..** (Size 10 x 38 mm, Midget Fuse)

Order No.		**3NC1 103**	**3NC1 105**
Utilization category (IEC 60 269)		CLASS CC	CLASS CC
Rated voltage V_n	V	600	600
Rated current I_n	A	3	5
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s		
Clearing I^2t value I^2t_A at V_n	A^2s		
Temperature rise at I_n (center of the fuse body)	K	50	45
Power dissipation at I_n	W	2.5	2
Cyclic load factor *WL*			
Weight, approx.	kg	0.01	0.01

Table 78-36

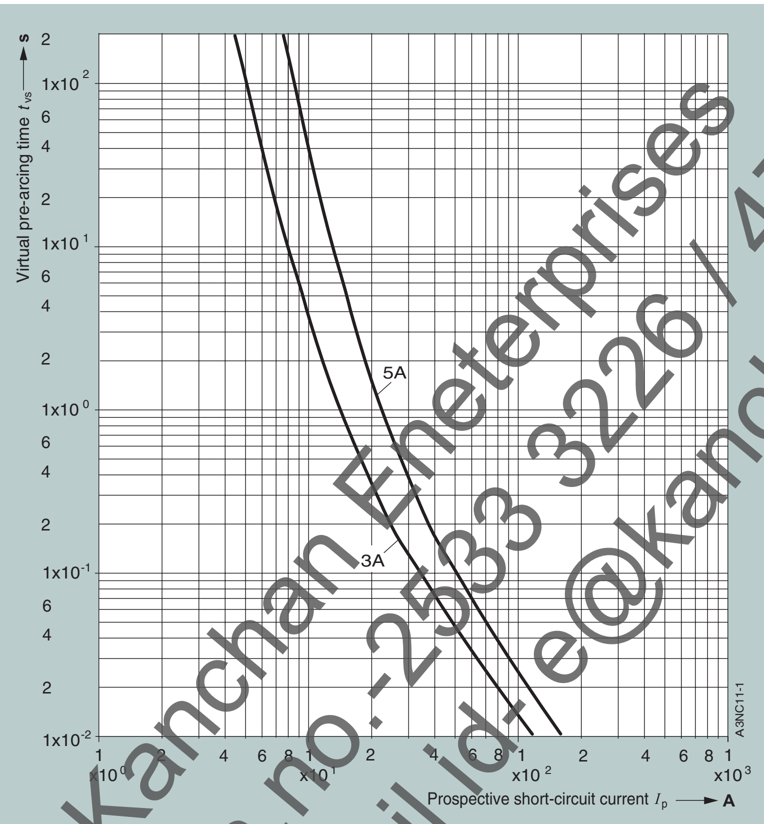


Fig. 78-124 *Time/current characteristics*

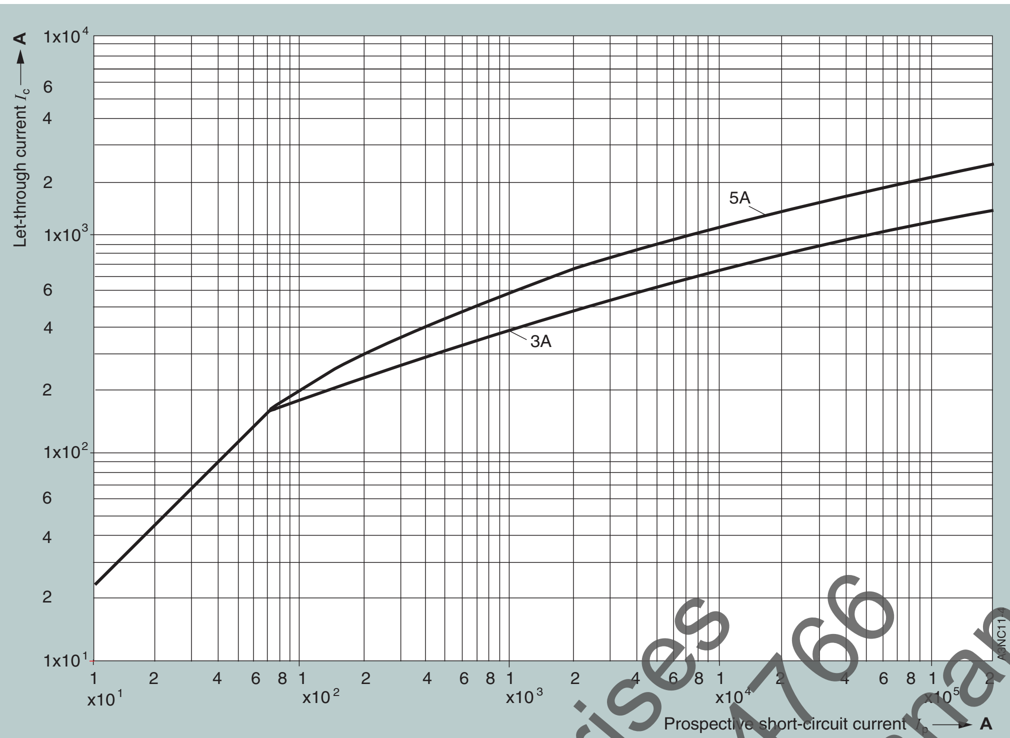


Fig. 79-125

Let-through characteristics (current limiting at 50 Hz)

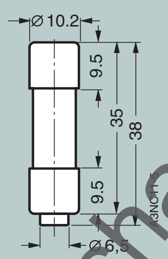


Fig. 79-126

3.1.24 3NC1 4.. (IEC 60 269-2-1/III, Size 14 x 51)

Order No.		3NC1 401	3NC1 402	3NC1 403	3NC1 404	3NC1 405	3NC1 406	3NC1 410
Utilization category (IEC 60 269)		aR	aR	aR	aR	aR	aR	aR
Rated voltage V_n	V	660	660	660	660	690	690	690
Rated current I_n	A	1	2	3	4	5	6	10
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	–	–	–	–	1.6	–	3.6
Clearing I^2t value I^2t_A at V_n	A^2s	–	–	–	–	11	–	22
Temperature rise at I_n (center of the fuse body)	K	90	30	40	50	20	30	50
Power dissipation at I_n	W	5	3	2.5	–	1.5	1.5	4
Cyclic load factor *WL*		–	–	–	–	–	–	–
Weight, approx.	kg	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Table 80-37

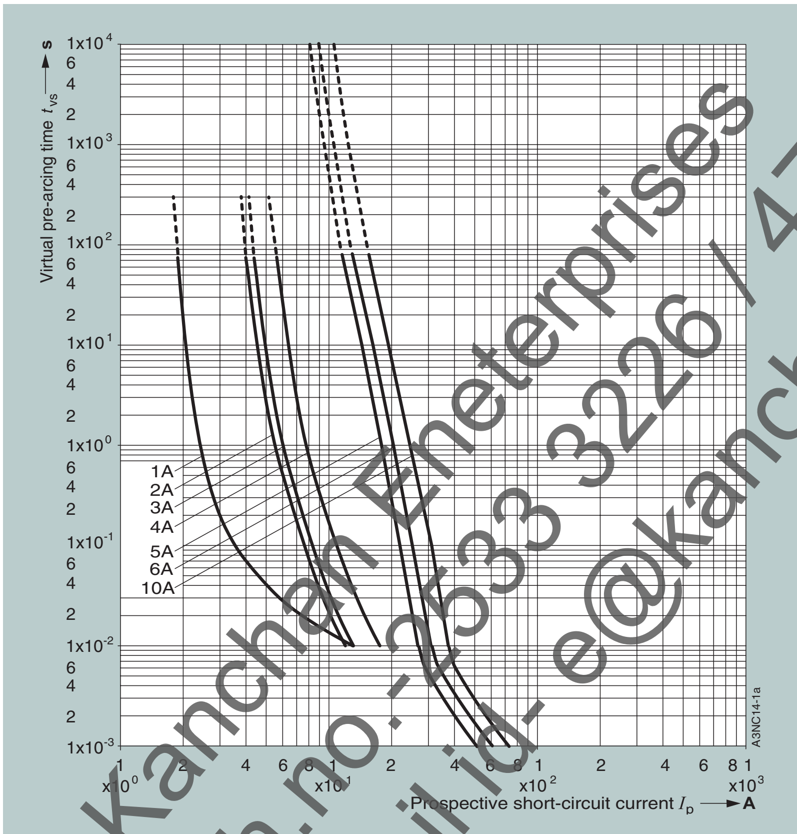


Fig. 80-127 *Time/current characteristics*

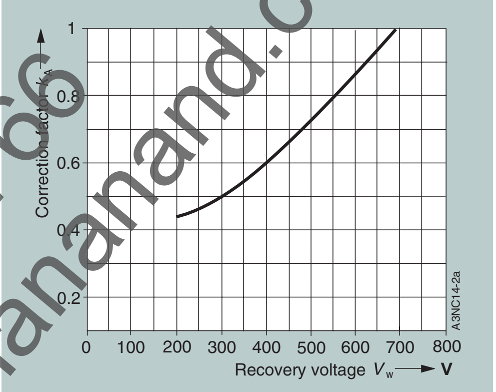


Fig. 80-128 *Correction factor k_A for clearing I^2t value*

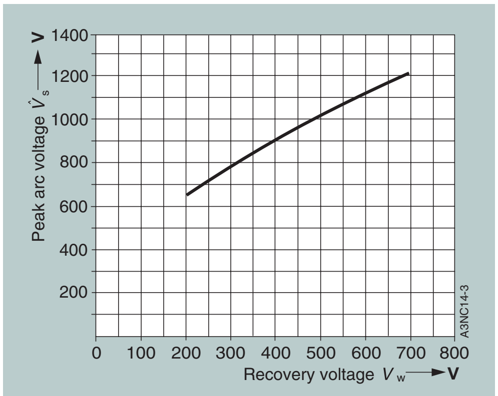


Fig. 80-129 *Arc voltage*

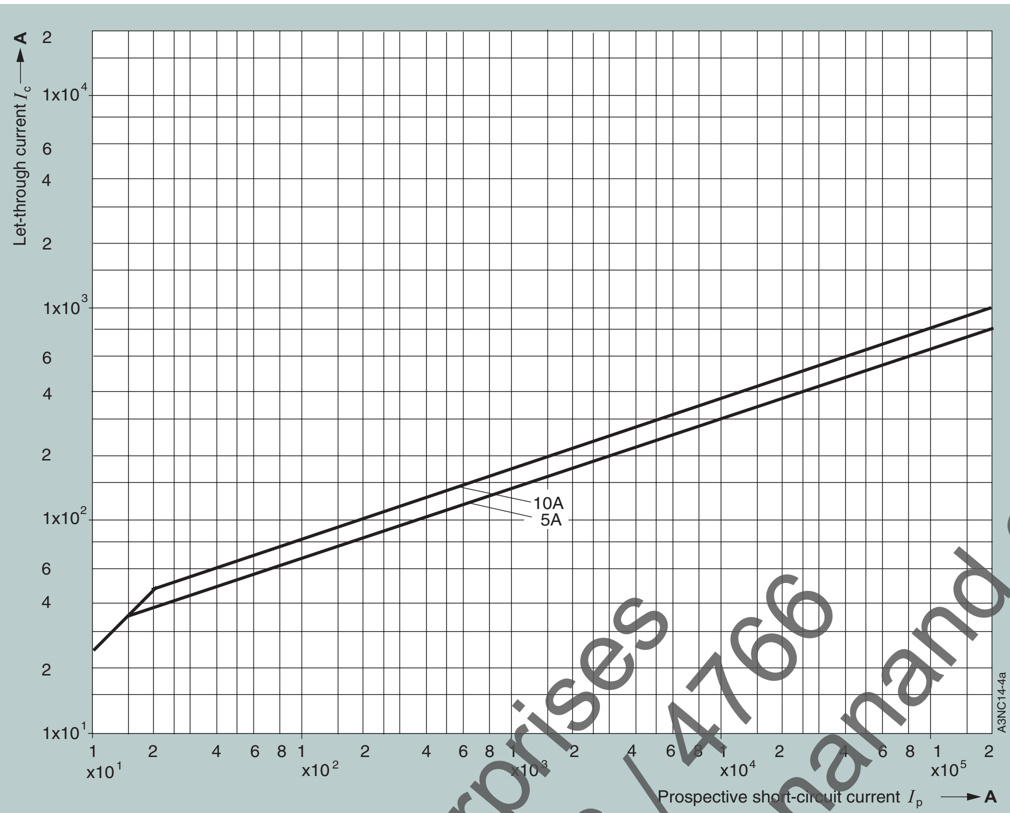


Fig. 81-130 *Let-through characteristics (current limiting at 50 Hz)*

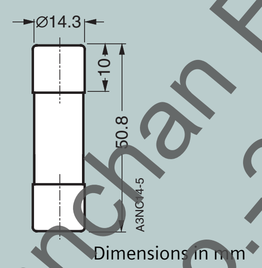


Fig. 81-131

3.1.25 **3NC1 4..** (IEC 60 269-2-1/III, Size 14 x 51)

Order No.		3NC1 415	3NC1 420	3NC1 425	3NC1 430	3NC1 432	3NC1 440	3NC1 450
Utilization category (IEC 60 269)		aR	aR	aR	aR	aR	aR	aR
Rated voltage V_n	V	690	690	690	690	690	690	690
Rated current I_n	A	15	20	25	30	32	40	50
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	10	26	44	58	95	110	220
Clearing I^2t value I^2t_A at V_n	A^2s	22	60	130	150	800	980	1 800
Temperature rise at I_n (center of the fuse body)	K	60	70	80	80	80	100	110
Power dissipation at I_n	W	5.5	6	7	9	7.6	8	9
Cyclic load factor *WL*		–	–	–	–	–	–	–
Weight, approx.	kg	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Table 82-38

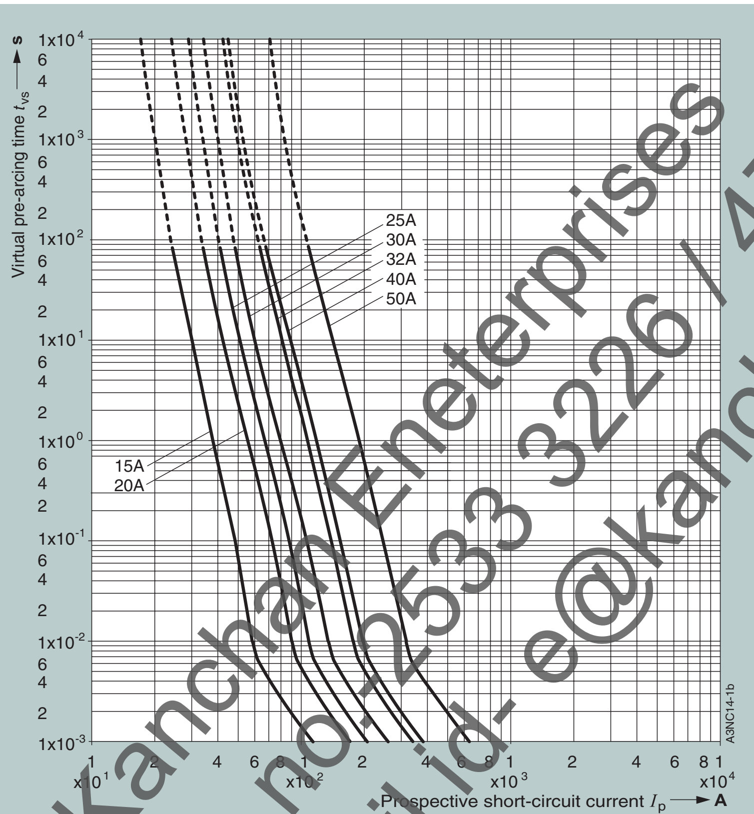


Fig. 82-132 *Time/current characteristics*

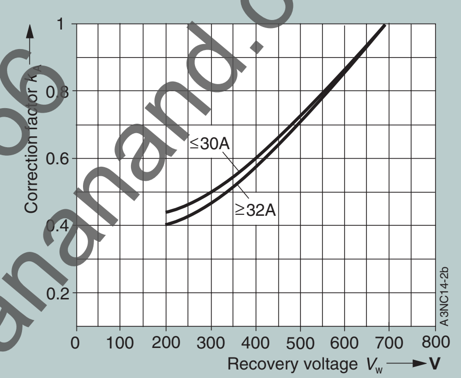


Fig. 82-133 *Correction factor k_A for clearing I^2t value*

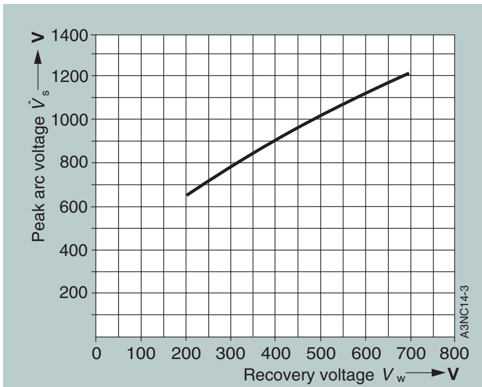


Fig. 82-134 *Arc voltage*

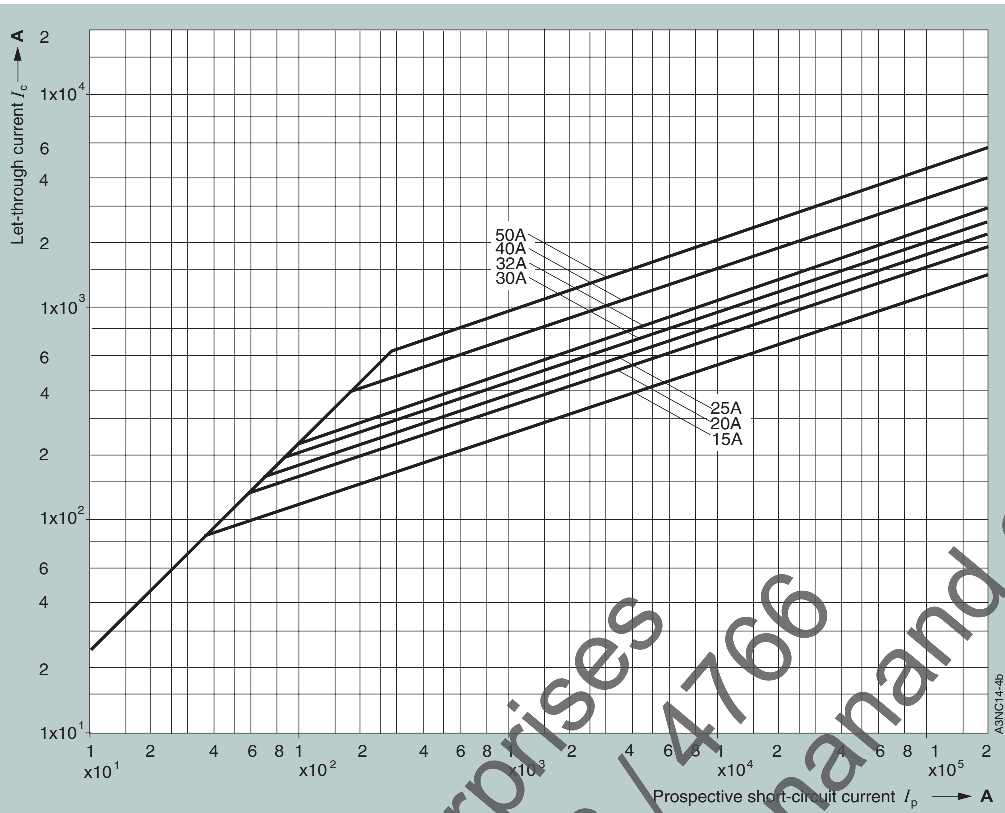


Fig. 83-135 *Let-through characteristics (current limiting at 50 Hz)*

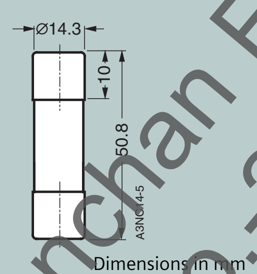


Fig. 83-136

3.1.26 **3NC1 5..** (IEC 60 269-2-1/III, Size 14 x 51)

Order No.		**3NC1 504**	**3NC1 506**	**3NC1 516**
Utilization category (IEC 60 269)		gG	gG	gG
Rated voltage V_n	V	690	690	690
Rated current I_n	A	4	6	16
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	44	60	250
Clearing I^2t value I^2t_A at V_n	A^2s	150	200	850
Temperature rise at I_n (center of the fuse body)	K	–	–	30
Power dissipation at I_n	W	1.0	1.15	2.2
Cyclic load factor *WL*				
Weight, approx.	kg	0.02	0.02	0.02

Table 84-39

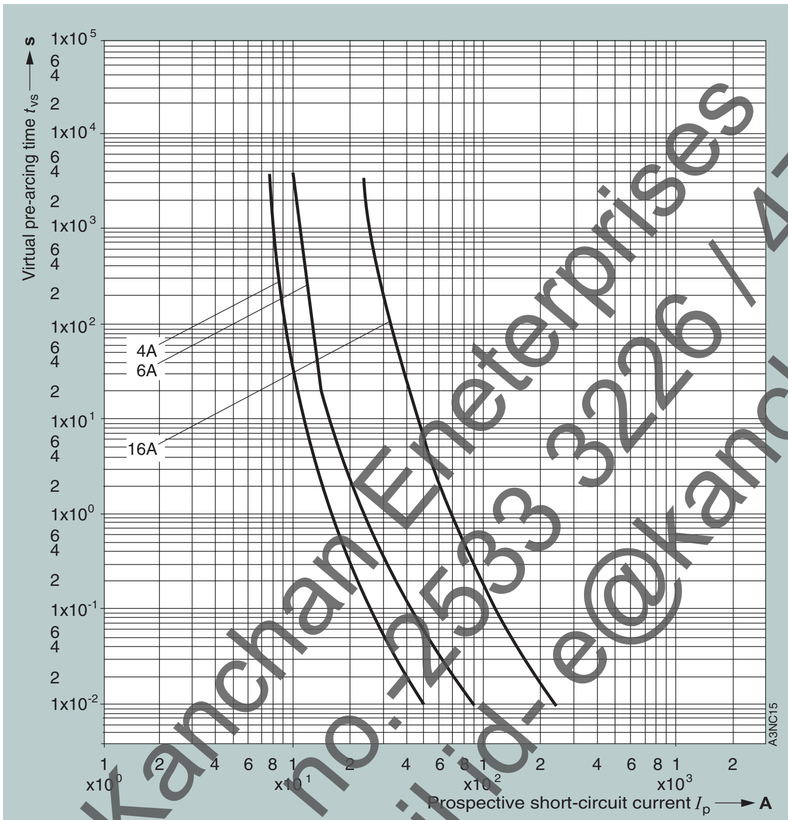


Fig. 84-137 *Time/current characteristics*

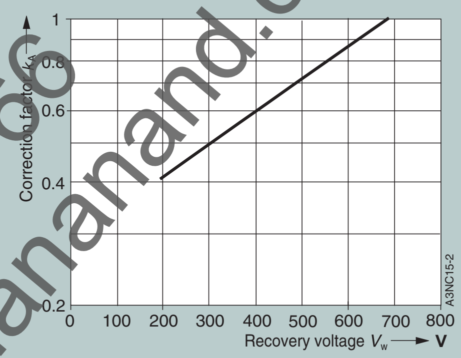


Fig. 84-138 *Correction factor k_A for clearing I^2t value*

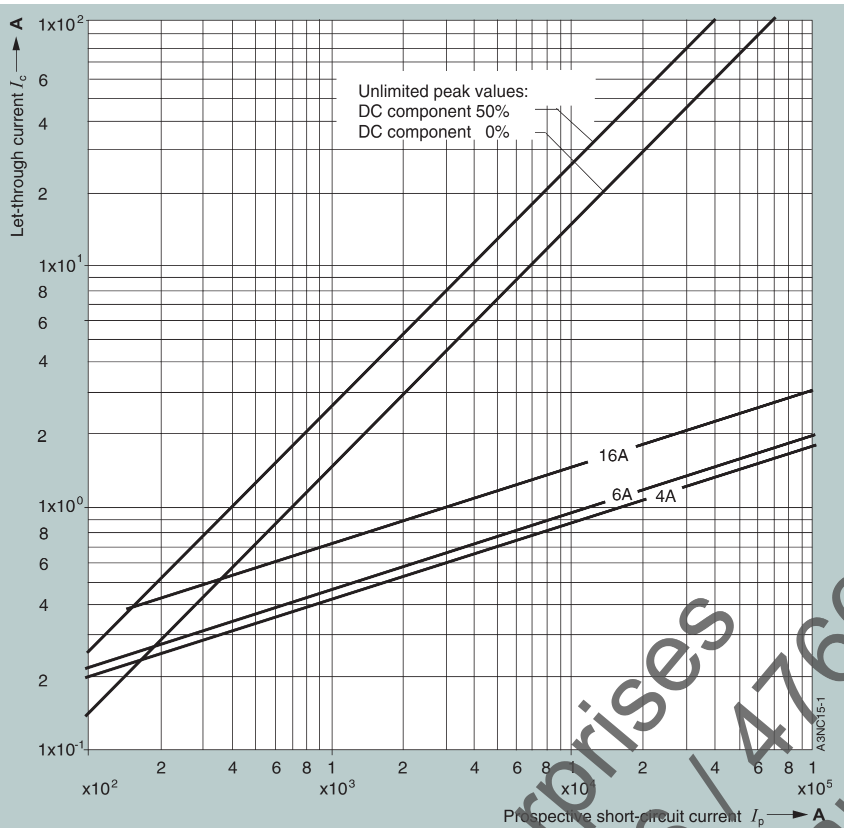


Fig. 85-139 *Let-through characteristics (current limiting at 50 Hz)*

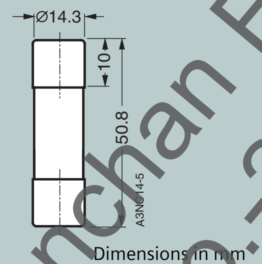


Fig. 85-140

3.1.27 3NC2 2.. (IEC 60 269-2-1/III, Size 22 x 58)

Order No.		3NC2 220	3NC2 225	3NC2 232	3NC2 240	3NC2 250	3NC2 263	3NC2 280	3NC2 200
Utilization category (IEC 60 269)		aR	aR	aR	aR	aR	aR	aR	aR
Rated voltage V_n	V	690	690	690	690	690	690	690	600
Rated current I_n	A	20	25	32	40	50	63	80	100
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	34	60	95	185	155	310	620	1 250
Clearing I^2t value I^2t_A at V_n	A^2s	370	560	850	1 350	1 120	2 700	5 100	10000
Temperature rise at I_n (center of the fuse body)	K	40	50	65	80	90	100	110	110
Power dissipation at I_n	W	4.6	5.6	7	8.5	9.5	11	13.5	16
Cyclic load factor *WL*		–	–	–	–	–	–	–	–
Weight, approx.	kg	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06

Table 86-40

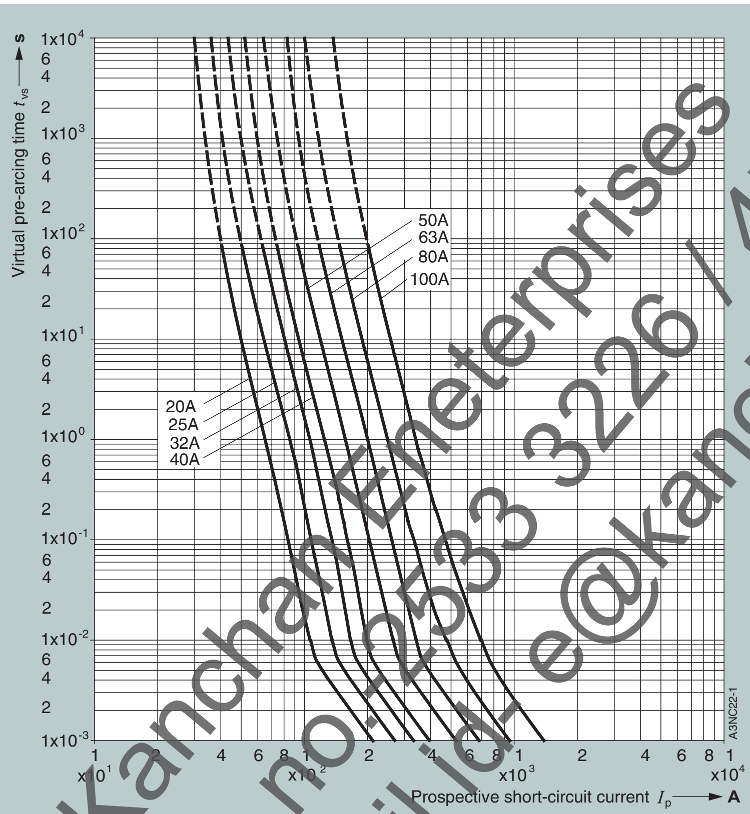


Fig. 86-141 *Time/current characteristics*

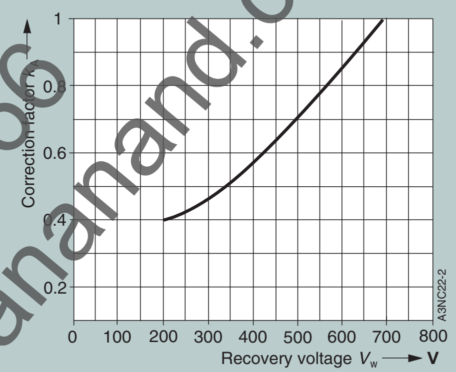


Fig. 86-142 *Correction factor k_A for clearing I^2t value*

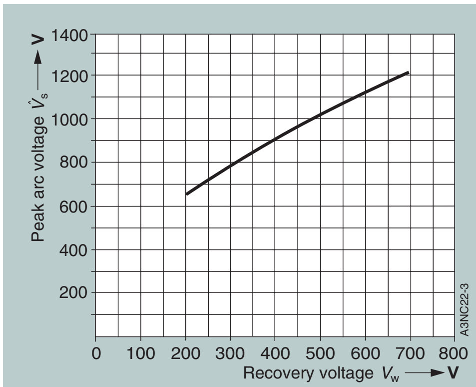


Fig. 86-143 *Arc voltage*

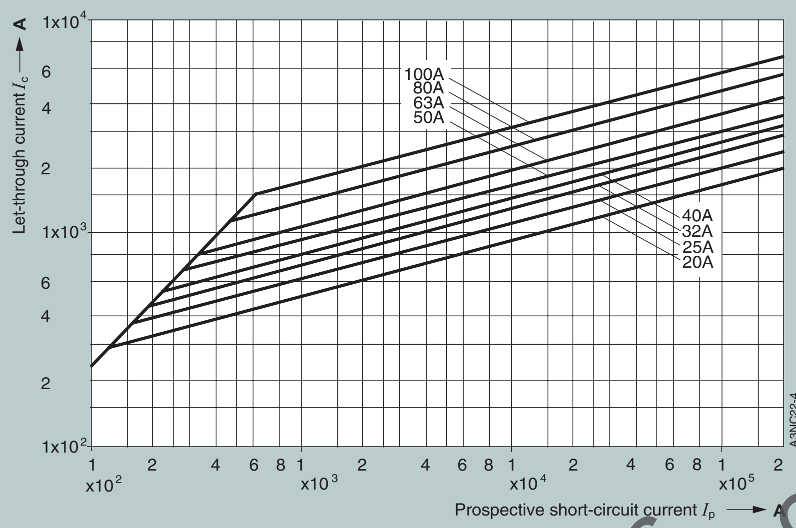


Fig. 87-144

Let-through characteristics (current limiting at 50 Hz)

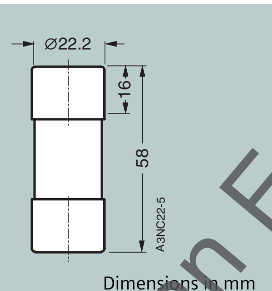


Fig. 87-145

3.2 SITOR fuse links for special applications

3.2.1 3NE3 5..-5, 3NE4 1..-5

Order No.		3NE4 117-5	3NE4 121-5	3NE4 146-5	3NE3 525-5 1)	3NE3 535-5 1)
Utilization category (IEC 60 269)		gR	aR	aR	aR	aR
Rated voltage V_n	V	1000	1000	800	1000	1000
Rated current I_n	A	50	100	170	200 2)	450 2)
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	135	900	7370	7150	64500
Clearing I^2t value I^2t_A at V_n	A^2s	1100	7400	60500	44000	395000
Temperature rise at I_n (center of the fuse body)	K	95	135	142	75	130
Power dissipation at I_n	W	20	35	43	50	90
Cyclic load factor *WL*		0.85	0.85	0.85	0.85	0.85
Weight, approx.	kg	0.28	0.28	0.28	0.7	0.7

Table 88-41

1) Maximum tightening torque M 10 blind tapping: 35 Nm, screw-in penetration depth ≥ 9mm
2) Cooling air velocity 0.5 m/s. For natural air cooling, reduced by 5%

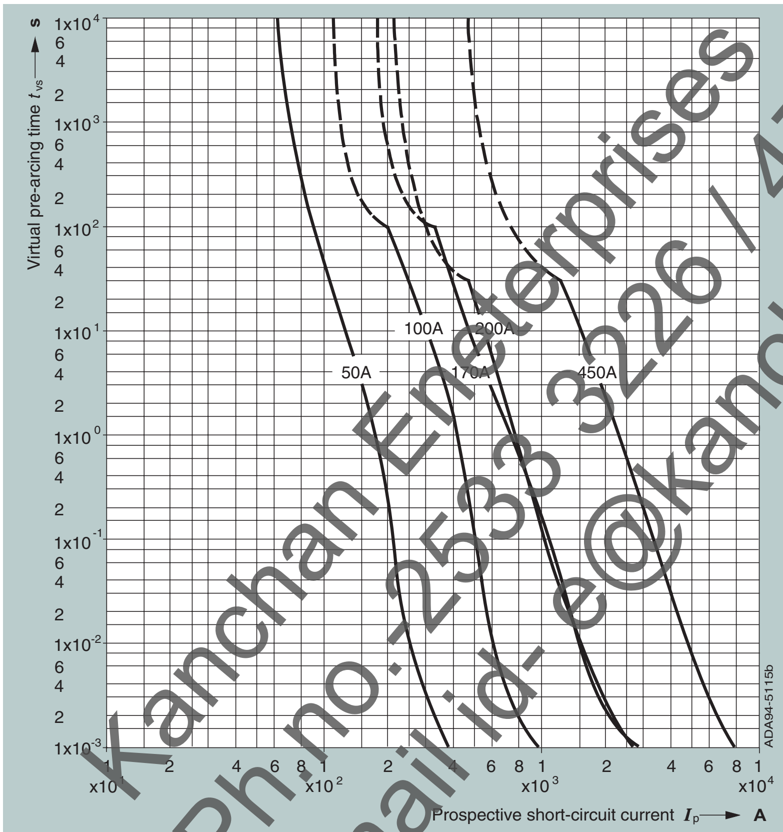


Fig. 88-146 *Time/current characteristics*

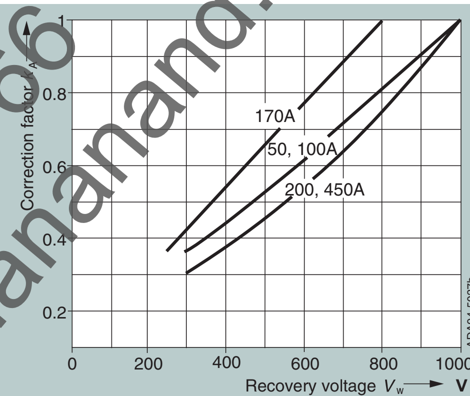


Fig. 88-147 *Correction factor k_A for clearing I^2t value*

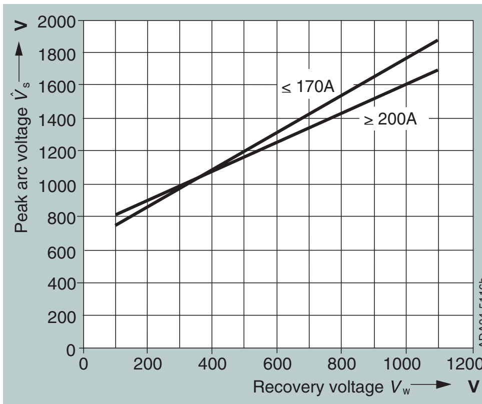


Fig. 88-148 *Arc voltage*

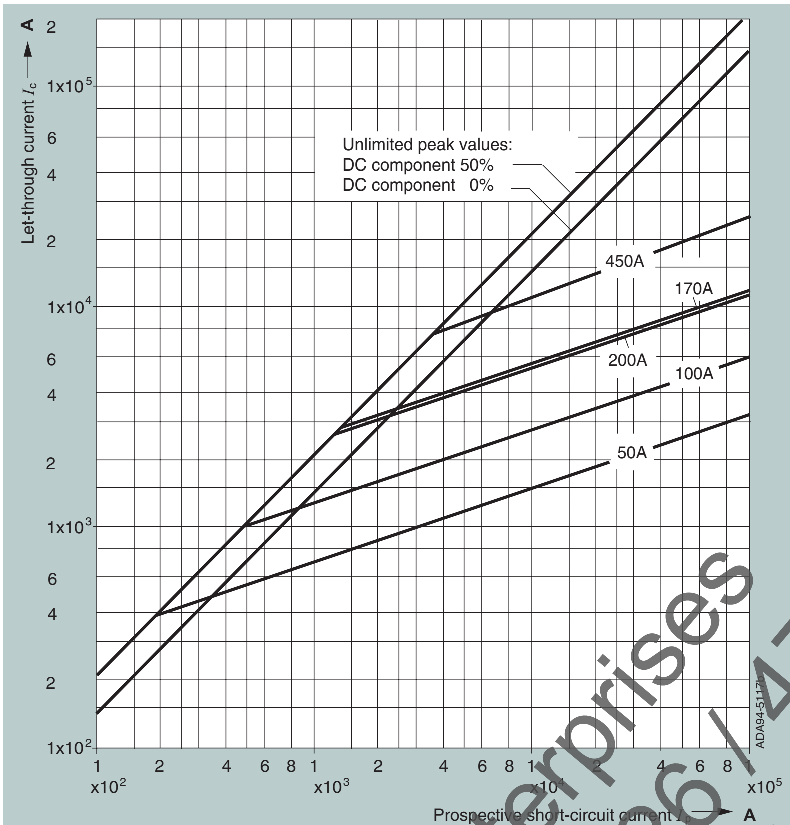


Fig. 89-149 *Let-through characteristics (current limiting at 50 Hz)*

3NE3 5..-5

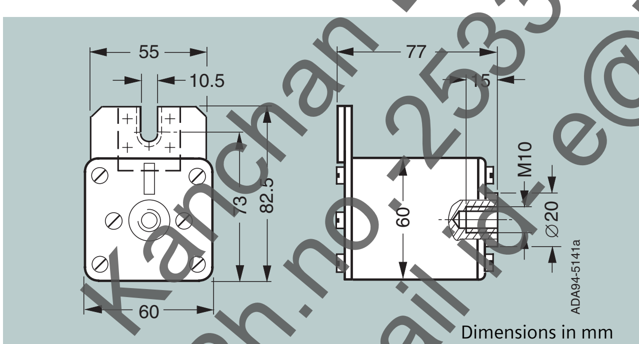


Fig. 89-150

3NE4 1..-5

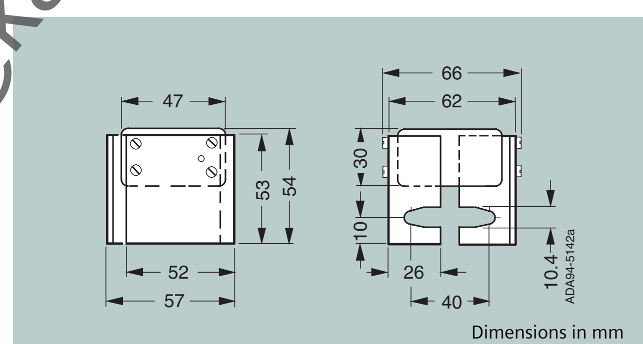


Fig. 89-151

3.2.2 3NE4 3..-6B, 3NE4 337-6

Order No.		3NE4 327-6B [1]	3NE4 330-6B [1]	3NE4 333-6B [1]	3NE4 334-6B [1]	3NE4 337-6 [1]
Utilization category (IEC 60 269)		aR	aR	aR	aR	aR
Rated voltage V_n	V	800	800	800	800	800
Rated current I_n	A	250	315	450	500	710
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	3600	7400	29400	42500	142000
Clearing I^2t value I^2t_A at V_n	A^2s	29700	60700	191000	276000	923000
Temperature rise at I_n (center of the fuse body)	K	175	170	190	195	170
Power dissipation at I_n	W	105	120	140	155	155
Cyclic load factor *WL*		0.85	0.85	0.85	0.85	0.95
Weight, approx.	kg	0.65	0.65	0.65	0.65	0.65

Table 90-42

1) Maximum tightening torque M 10 blind tapping: 35 Nm, screw-in penetration depth ≥ 9 mm

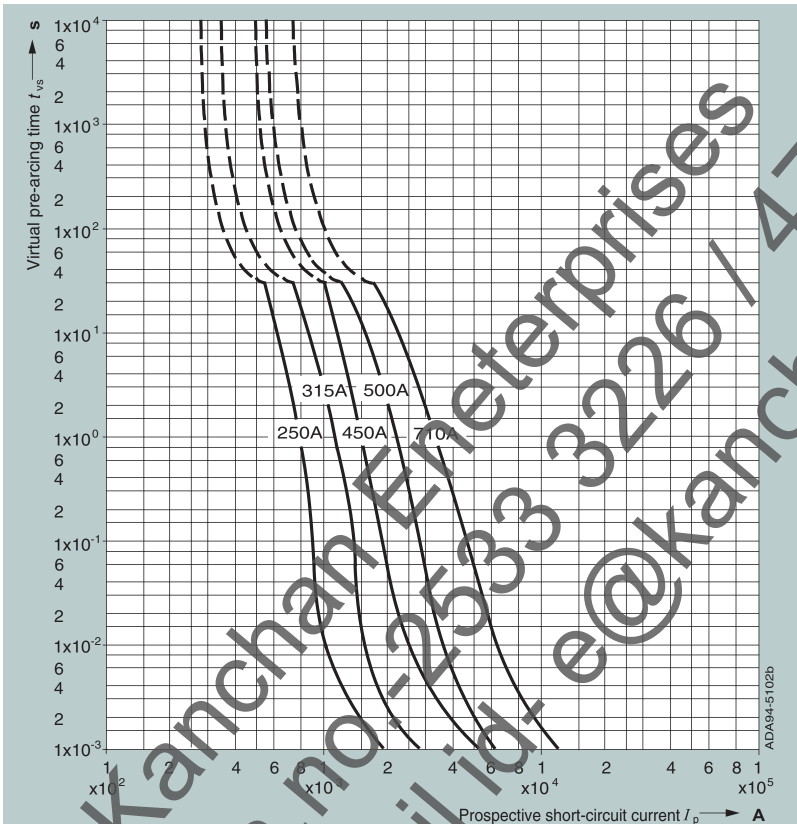


Fig. 90-152 *Time/current characteristics*

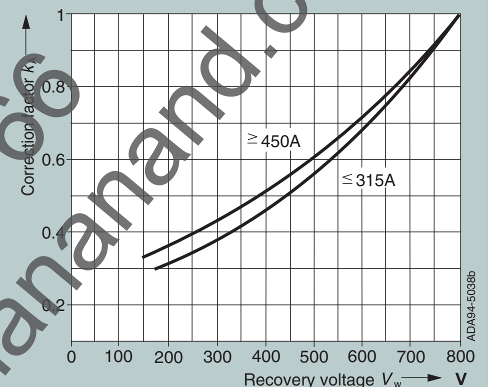


Fig. 90-153 *Correction factor k_A for clearing I^2t value*

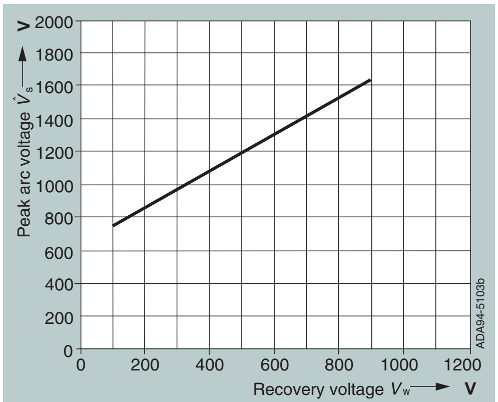


Fig. 90-154 *Arc voltage*

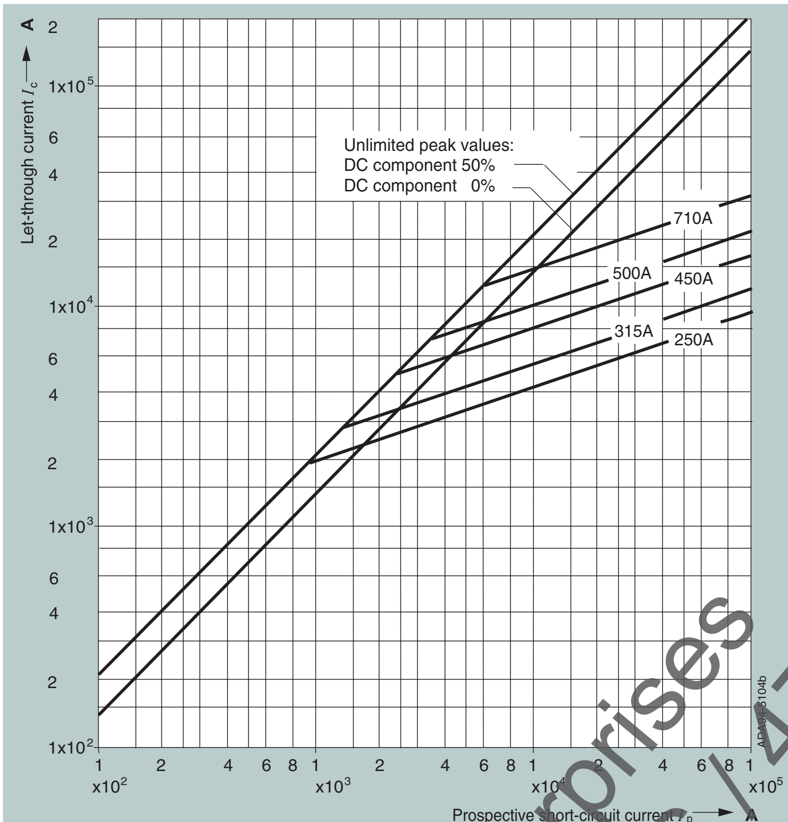


Fig. 91-155 *Let-through characteristics (current limiting at 50 Hz)*

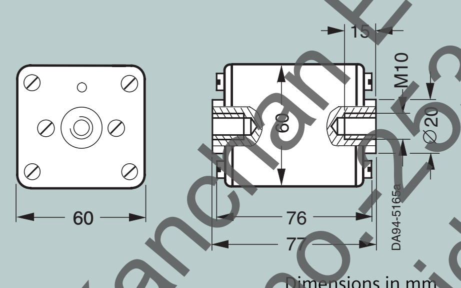


Fig. 91-156

3.2.3 3NC5 531, 3NC5 8..

Order No.		3NC5 531 [1]	3NC5 841 [1]	3NC5 840 [1]	3NC5 838 [1]
Utilization category (IEC 60 269)		aR	aR	aR	aR
Rated voltage V_n	V	800	800	1000	1000
Rated current I_n	A	350 [2]	630 [2]	600 [2]	800 [2]
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	66000	185000	185000	360000
Clearing I^2t value I^2t_A at V_n	A^2s	260000	888000	888000	1728000
Temperature rise at I_n (center of the fuse body)	K	200	110	110	130
Power dissipation at I_n	W	80	145	150	170
Cyclic load factor *WL*		0.9	0.9	0.9	0.9
Weight, approx.	kg	0.67	1.2	1.4	1.2

Table 92-43

1) Maximum tightening torque:
- M 10 thread (with indicator): 40 Nm
- M 10 blind tapping: 50 Nm, screw-in penetration depth ≥ 9 mm
- M 24 x 1.5 thread: 60 Nm

2) Temperature of the water-cooled busbar, max. +45 °C

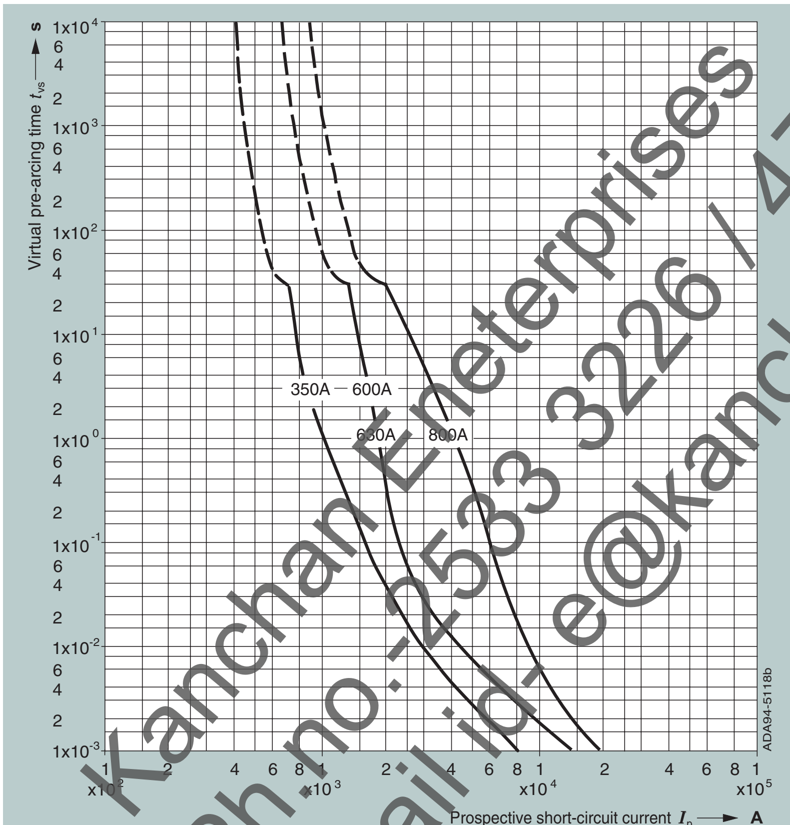


Fig. 92-157 *Time/current characteristics*

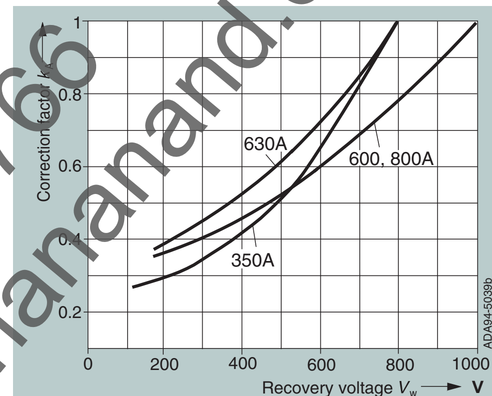


Fig. 92-158 *Correction factor k_A for clearing I^2t value*

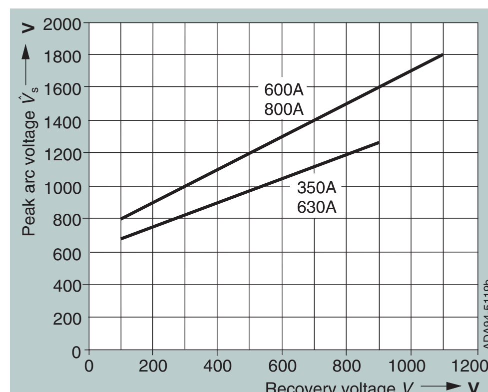


Fig. 92-159 *Arc voltage*

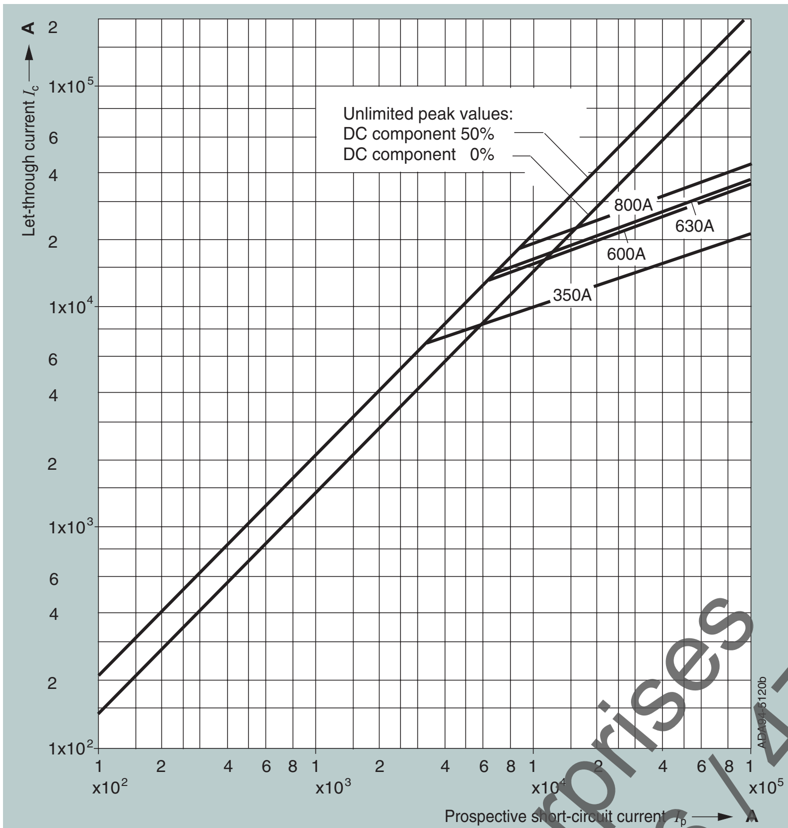
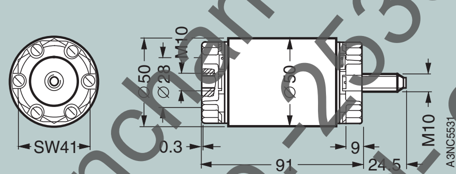


Fig. 93-160 *Let-through characteristics (current limiting at 50 Hz)*

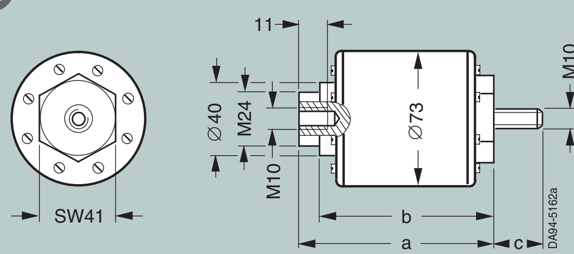
3NC5 531



Dimensions in mm

Fig. 93-161

3NC5 8..



Order No.	a	b	c
3NC5 841	98	88.5	25
3NC5 840	119	109.5	20.5
3NC5 838	98	88.5	25

Dimensions in mm

Fig. 93-162

3.2.4 3NE6 4.., 3NE9 450, 3NE6 437-7, 3NE9 440-6, 3NE9 450-7

Order No.		3NE9 440-6	3NE9 450	3NE6 437	3NE6 444	3NE9 450-7	3NE6 437-7
Utilization category (IEC 60 269)		gR	aR	aR	aR	aR	aR
Rated voltage V_n	V	600	600	900	900	600	900
Rated current I_n [1]	A	850	1250 [2]	710 [2]	900 [2]	1250 [3]	710 [3]
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	400000	400000	100000	400000	400000	100000
Clearing I^2t value I^2t_A at V_n	A^2s	2480000	2480000	620000	1920000	2480000	620000
Temperature rise at I_n (center of the fuse body)	K	74	80	80	80	105	110
Power dissipation at I_n	W	85	210	150	170	210	150
Cyclic load factor *WL*		1.0	0.9	0.9	0.9	0.9	0.9
Weight, approx.	kg	1.0	1.0	1.0	1.1	1.0	1.0

Table 94-44

1) Maximum tightening torque M 10 blind tapping: 35 Nm, screw-in penetration depth ≥ 9 mm
2) Cooling air velocity ≥ 2 m/s
3) Lower (cooled) connection, max. +60 °C, upper connection (M 10) max. +110 °C

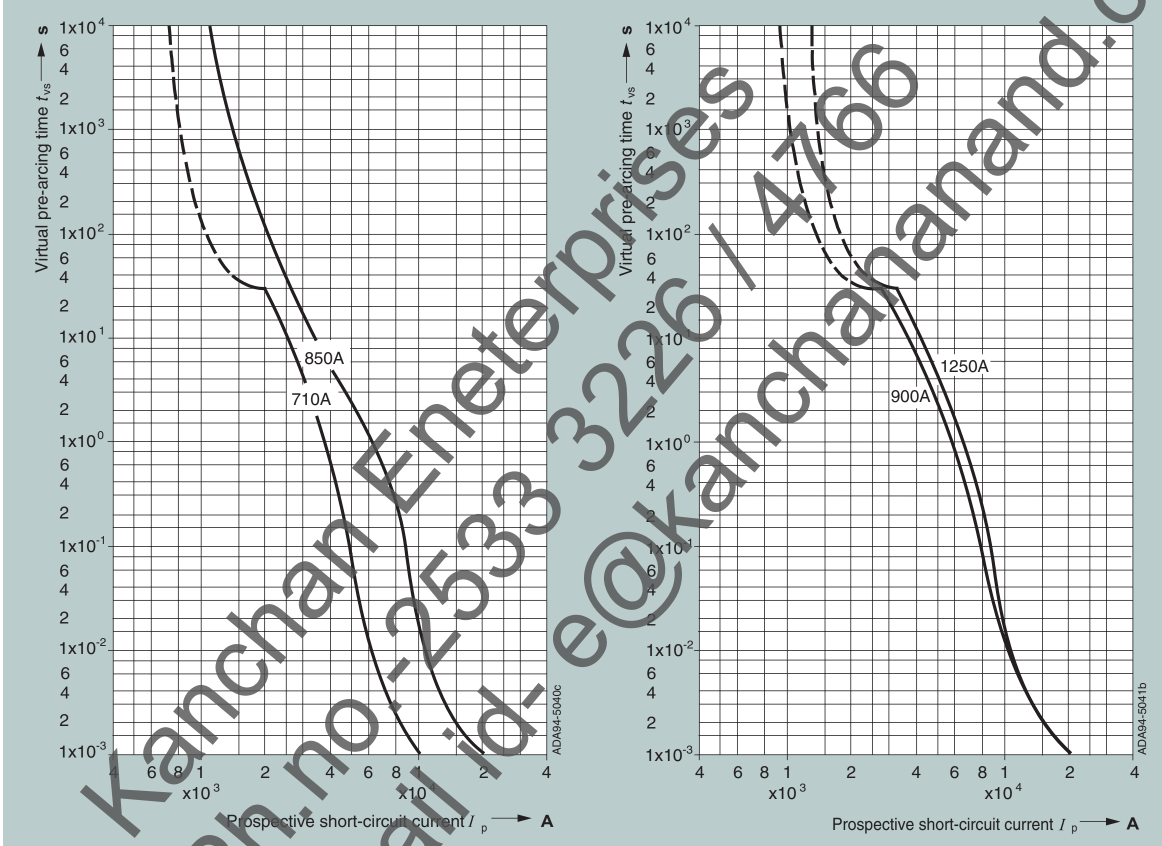


Fig. 94-163 *Time/current characteristics*

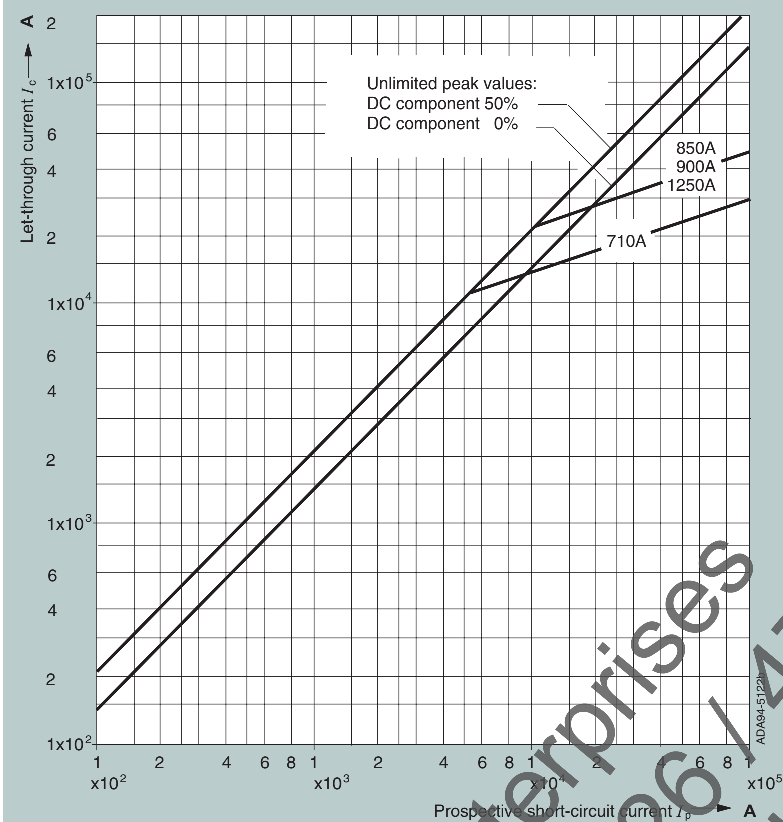


Fig. 95-165 *Let-through characteristics (current limiting at 50 Hz)*

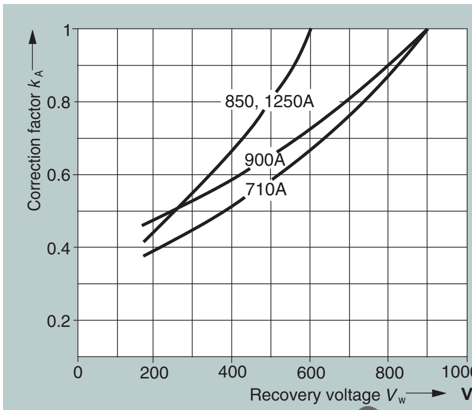


Fig. 95-164 *Correction factor k_A for clearing I^2t value*

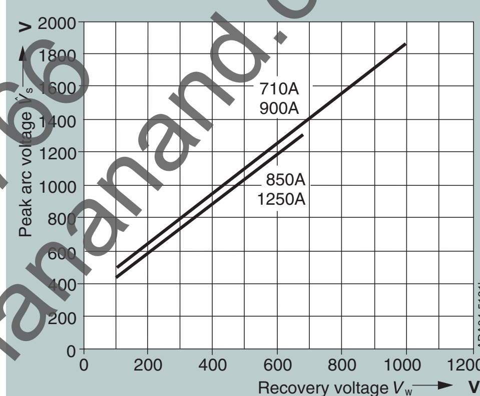
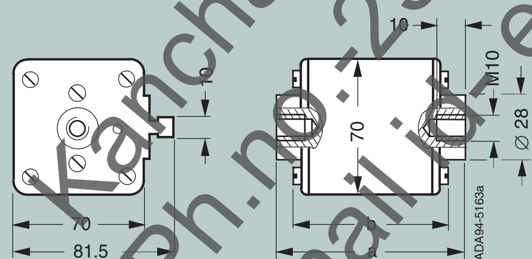


Fig. 95-166 *Arc voltage*

3NE6 4.., 3NE9 4.., 3NE9 4..-6

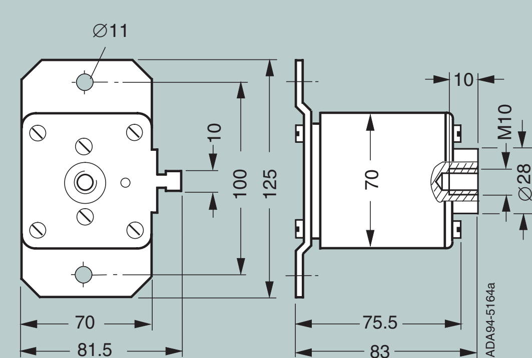


Order No.	a	b
3NE9 440-6	89	76
3NE9 450	89	76
3NE6 437	89	76
3NE6 444	99	86

Dimensions in mm

Fig. 95-167

3NE6 4..-7, 3NE9 4..-7



Dimensions in mm

Fig. 95-168

3.2.5 3NC7 3..-2

Order No.		3NC7 327-2	3NC7 331-2
Utilization category (IEC 60 269)		aR	aR
Rated voltage V_n	V	680	680
Rated current I_n	A	250	350
Pre-arcing I^2t value I^2t_s (t_{vs} = 1 ms)	A^2s	244000	550000
Clearing I^2t value I^2t_A at V_n	A^2s	635000	1430000
Temperature rise at I_n (center of the fuse body)	K	45	66
Power dissipation at I_n	W	25	32
Cyclic load factor *WL*		0.9	0.9
Weight, approx.	kg	0.7	0.7

Table 96-45

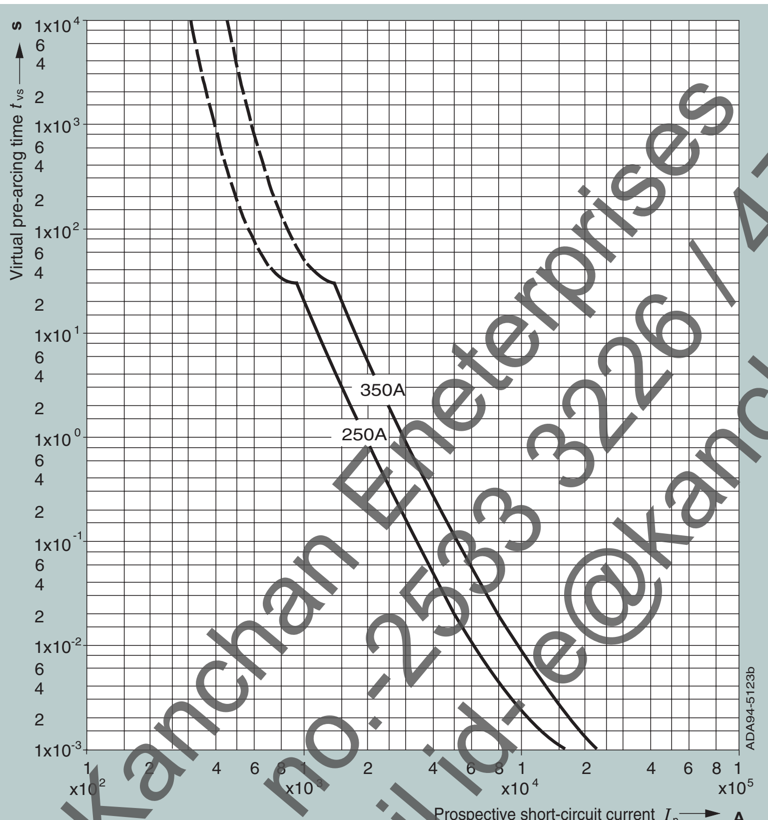


Fig. 96-169 *Time/current characteristics*

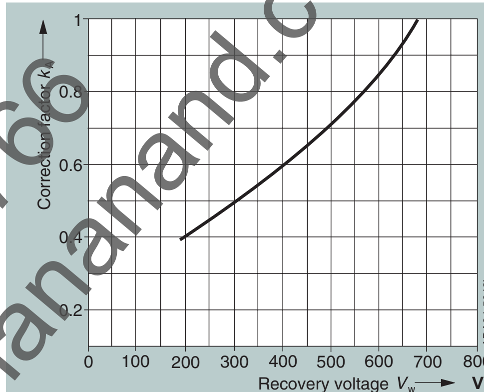


Fig. 96-170 *Correction factor k_A for clearing I^2t value*

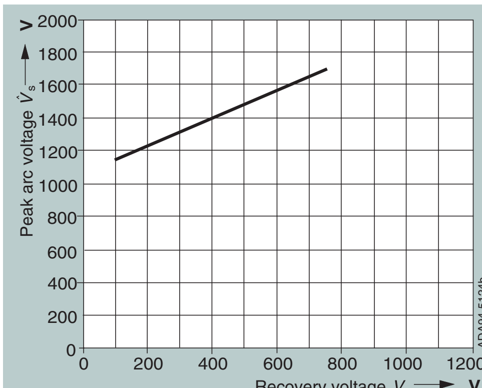


Fig. 96-171 *Arc voltage*

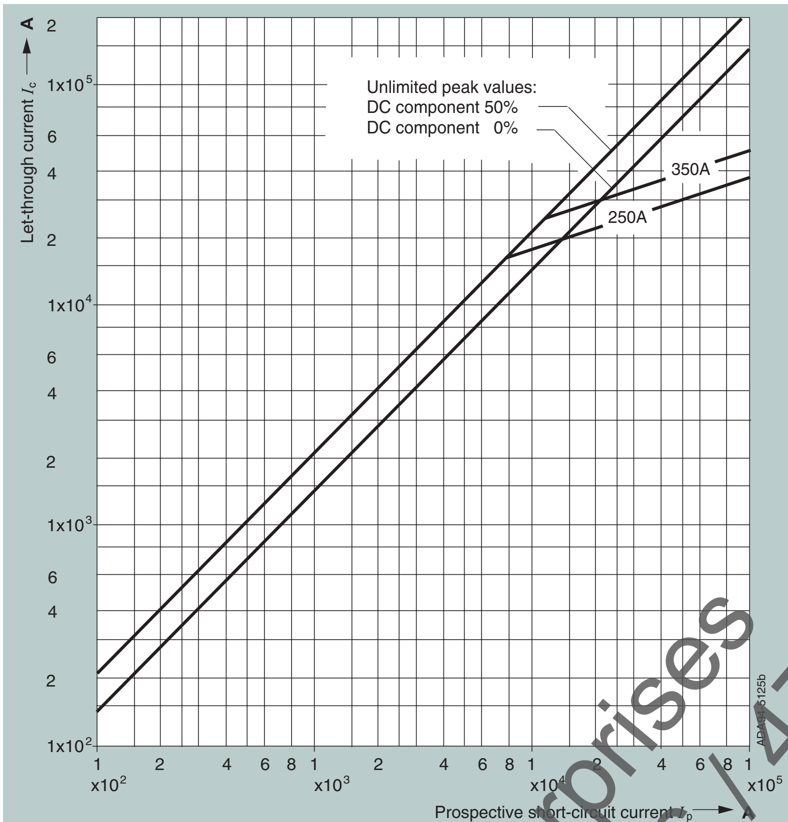
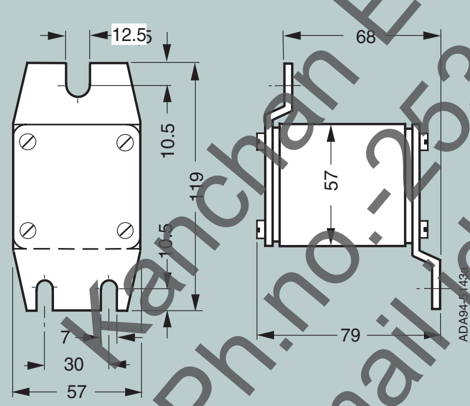


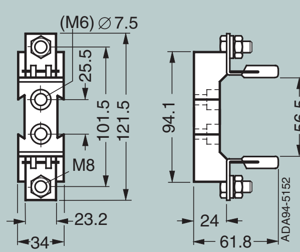
Fig. 97-172 *Let-through characteristics (current limiting at 50 Hz)*



Dimensions in mm

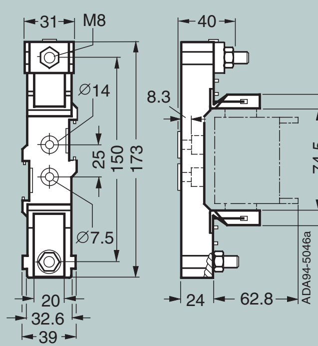
Fig. 97-173

Dimension Drawings
Accessories



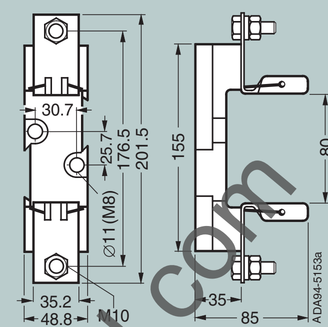
Dimensions in mm

Fig. 98-174 *Fuse base 3NH3 030*



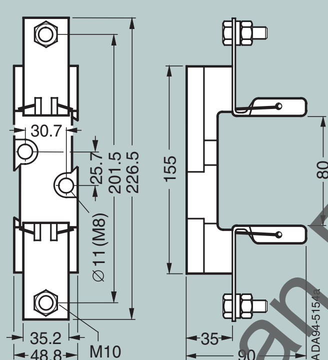
Dimensions in mm

Fig. 98-175 *Fuse base 3NH3 120*



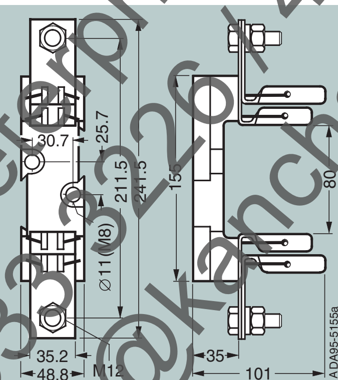
Dimensions in mm

Fig. 98-176 *Fuse base 3NH3 230*



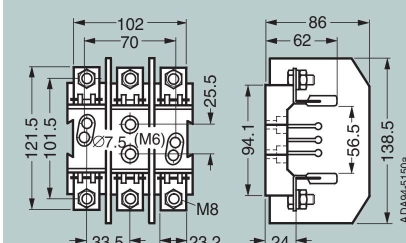
Dimensions in mm

Fig. 98-177 *Fuse base 3NH3 330*



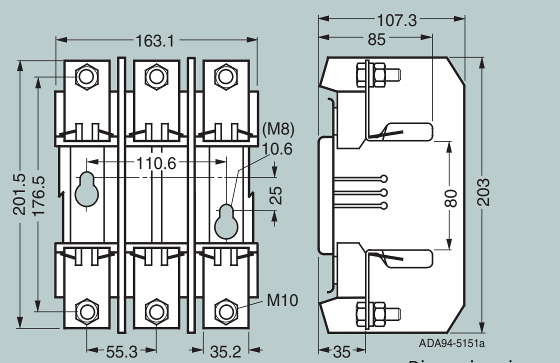
Dimensions in mm

Fig. 98-178 *Fuse base 3NH3 430*



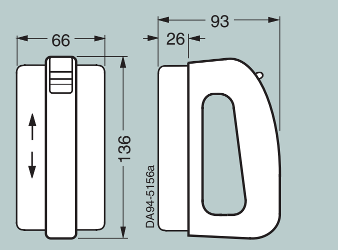
Dimensions in mm

Fig. 98-179 *Fuse base 3NH4 030*



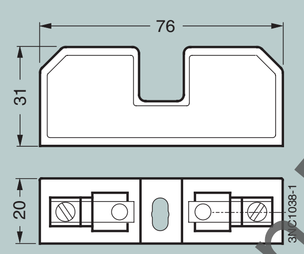
Dimensions in mm

Fig. 99-180 *Fuse base 3NH4 230*



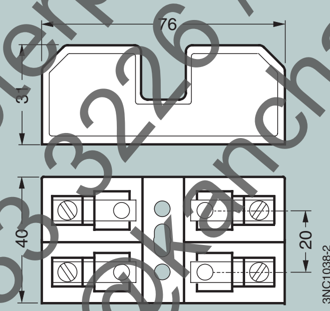
Dimensions in mm

Fig. 99-181 *Fuse puller 3NX1 011*



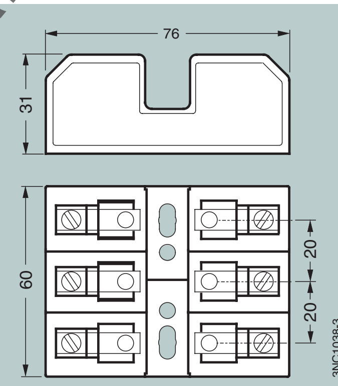
Dimensions in mm

Fig. 99-182 *Fuse base 3NC1 038-1*



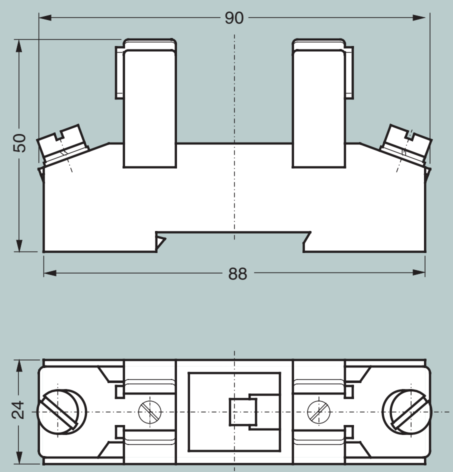
Dimensions in mm

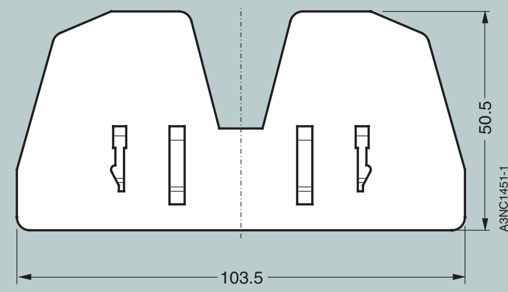
Fig. 99-183 *Fuse base 3NC1 038-2*



Dimensions in mm

Fig. 99-184 *Fuse base 3NC1 038-3*





Dimensions in mm

Fig. 100-185

Fuse base 3NC1 451-1

Phase barrier for 3NC1451-1

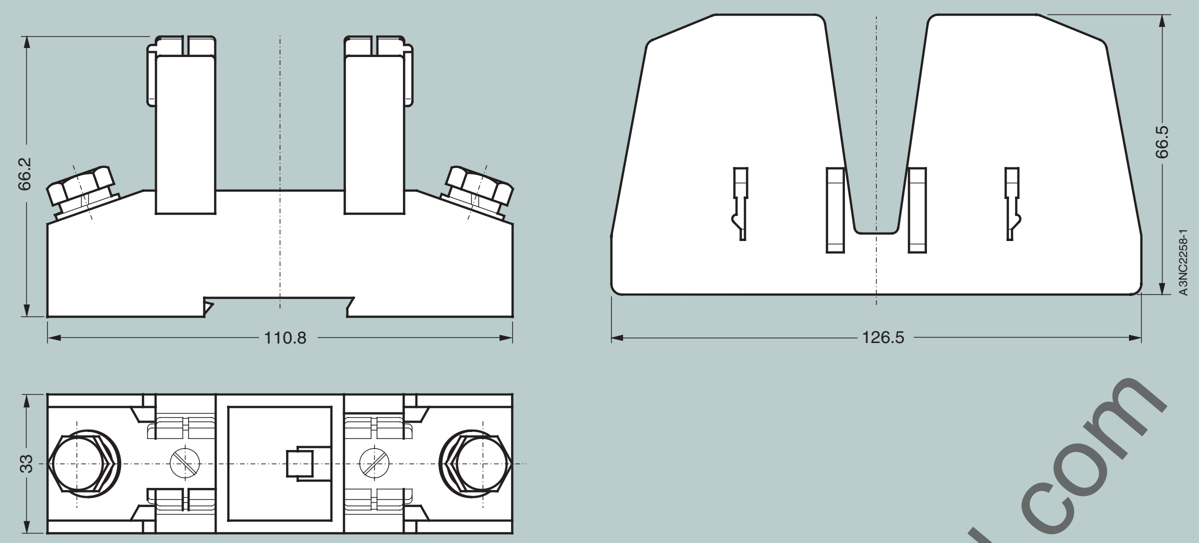


Fig. 101-186

Fuse base 3NC2258-1

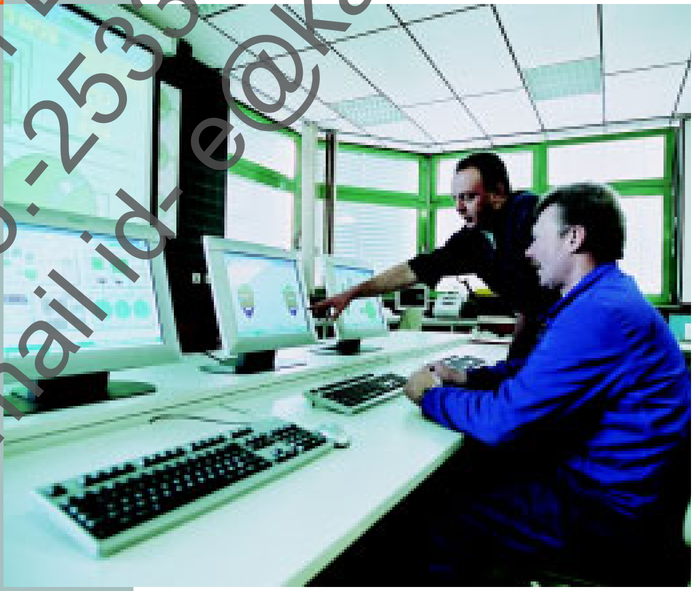
Phase barrier for 3NC2258-1

Technical Description and Terminology

Technical Information

Determining the Rated Current

Terminology



4

Technical Information

Fuse links are selected according to the rated voltage, rated current, clearing I^2t value I^2t_A and the cyclic load factor taking into account the other conditions specified in Section 4 *'Technical Description and Terminology'*. Unless otherwise noted, all of the following data and information refer to AC operation at frequencies of between 45 and 62 Hz.

4.1 Rated voltage V_n

The rated voltage of a SITOR fuse link is the RMS value of an AC voltage which is specified in the Ordering and Engineering Data, and the Characteristic Values as well as on the fuse link itself.

The rated voltage of a fuse link should be selected so that it reliably clears the voltage which is driving the short-circuit current. The driving voltage may not exceed a value of V_n + 10 %. It should be noted that the supply voltage V_{v0} of a converter can increase by 10 %. If two branches of a converter circuit are in series in the short-circuit path, then for an adequately high short-circuit current it can be assumed that the voltage is evenly distributed. In this case it is imperative that the information and instructions in Section 4.11.2 '*Fuse links in series*' is carefully observed.

4.1.1 Rectifier operation

For converters which only operate in the rectifier mode, the connection voltage V_{v0} is the driving voltage.

4.1.2 Inverter operation

For converters which also operate in the inverter mode, inverter commutation faults can occur when a fault develops. In this case, the driving voltage V_{WK} in the short-circuit is the sum of the supplying DC voltage (e.g. EMF of the DC motor) and the connection voltage on the three-phase side. In order to dimension the fuse link, this sum can be replaced by an AC voltage whose RMS value corresponds to 180% of the connection voltage on the three-phase side (V_{WK} = 1.8 V_{v0}). The fuse links must be dimensioned so that they reliably clear voltage V_{WK}.

4.2 Rated current I_n, load capacity

The rated current of a SITOR fuse link is the RMS value of an AC current for a frequency range of between 45 and 62 Hz specified in Sections 2 and 3 '*Ordering and Engineering Data*' and '*Characteristics and Dimension Drawings*' as well as the current specified on the fuse link itself.

When fuse links are used with the rated current, the standard operating conditions are as follows:

- Natural air cooling with an ambient temperature of +45 °C
- Connection cross-sections the same as the test cross-sections (refer to Section 4.2.1), when used in l.v.h.b.c. fuse bases and switch disconnectors, refer to Section 2 *'Ordering and Engineering Data'*
- Current conduction angle of half a period 120 °el
- Continuous maximum load with the rated current

For operating conditions which deviate from these, the permissible load current In' of the SITOR fuse link is determined using the following formula

$I_n' = k_u \times k_q \times k_\lambda \times k_l \times WL \times I_n$

with

I_n... rated current of the fuse link [1)]

k_u... correction factor, ambient temperature (Section 4.2.2)

k_q... correction factor, connection cross-section (Section 4.2.3)

k_λ... correction factor, current conduction angle (Section 4.2.4)

k_l... correction factor, forced air cooling (Section 4.2.5)

WL...cyclic load factor (Section 4.2.6)

1) *When using SITOR fuse links in l.v.h.b.c. fuse bases according to IEC/EN 60269-2-1 as well as in fused switch disconnectors and switch disconnectors with fuses, the information in Section 2 'Ordering and Engineering Data' must also be observed.*

4.2.1 Test cross-sections

Rated current I_n A	Test cross-section (series 3NC10, 3NC11, 3NC14, 3NC15, 3NC22, 3NE1..., 3NE8 0.., 3NE41) Cu mm^2	Test cross-section (all of the remaining series) Cu mm^2
10	1.0	–
16	1.5	–
20	2.5	45
25	4	45
35	6	45
40	10	45
50	10	45
63	16	45
80	25	45
100	35	60
125	50	80
160	70	100
200	95	125
224	–	150
250	120	185
315	2 x 70	240
350	2 x 95	260
400	2 x 95	320
450	2 x 120	320
500	2 x 120	400
560	2 x 150	400
630	2 x 185	480
710	2 x (40 x 5)	560
800	2 x (50 x 5)	560
900	2 x (80 x 4)	720
1 000	–	720
1 250	–	960

Table 105-46 *Test cross-sections of SITOR fuse links*

4.2.2 Correction factor, ambient temperature k_u

The influence of the ambient temperature on the permissible load placed on the SITOR fuse link is taken into account using correction factor k_u corresponding to the following diagram.

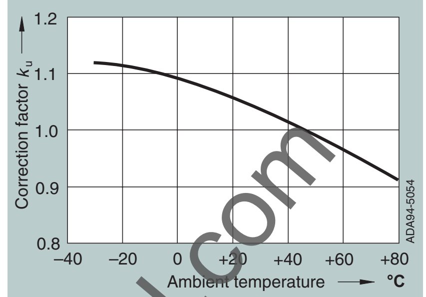
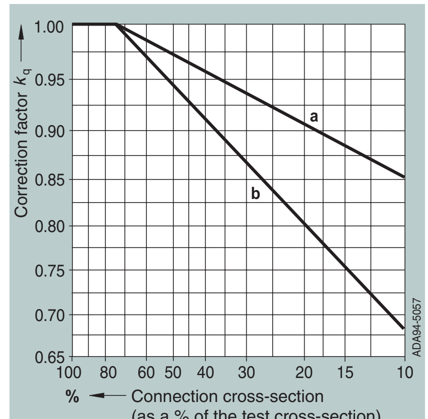


Fig. 105-187 *Correction factor, ambient temperature*

4.2.3 Correction factor, connection cross-section k_q

The rated current of SITOR fuse links is valid for use with connection cross-sections which correspond to the particular test cross-section (refer to Section 4.2.1).

For reduced connection cross-sections, correction factor k_q, as shown in the following diagram, should be applied.



a) Cross-section reduction of one connection
b) Cross-section reduction of both connections

Fig. 105-188 *Correction factor, connection cross-section*

4.2.4 Correction factor, current conduction angle k_λ

The rated current of SITOR fuse links is based on a sinusoidal AC current (45 Hz to 62 Hz). In converter operation, the fuses in the branch have to conduct an intermittent current whereby the current conduction angle in most cases is either 180 °el or 120 °el. When the load current has this waveform, the fuse link can still conduct the full rated current. The current must be reduced corresponding to the following diagram for lower current conduction angles.

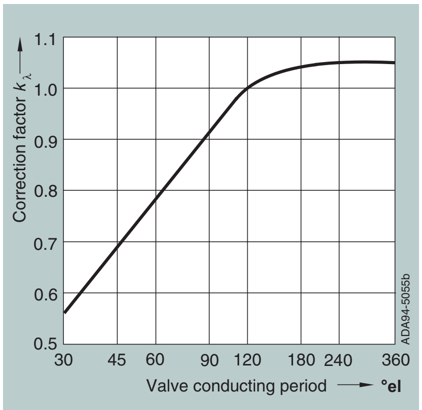


Fig. 106-189 *Correction factor, valve conducting period*

4.2.5 Correction factor for increased air cooling k_l

With increased air cooling, the load capacity of the fuse links increases with the air velocity; air velocities > 5 m/s significantly increases the load capacity.

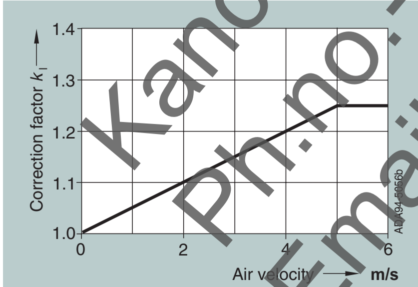


Fig. 106-190 *Correction factor for increased air cooling*

4.2.6 *Cyclic load factor WL*

The cyclic load factor WL is a reduction factor which can be used to determine the ageing-free load capacity of a fuse link for any load duty cycle. SITOR fuse links have different cyclic load factors as a result of the mechanical design. The particular cyclic load factor WL for >10000 load cycles (1 hour "on", 1 hour "off") during the expected operating time of the fuse links is specified in Section 3 '*Characteristics and Dimension Drawings*'. For a lower number of load cycles during the expected operating time of the fuse links, then according to the following diagram, a fuse link with a lower cyclic factor WL is adequate.

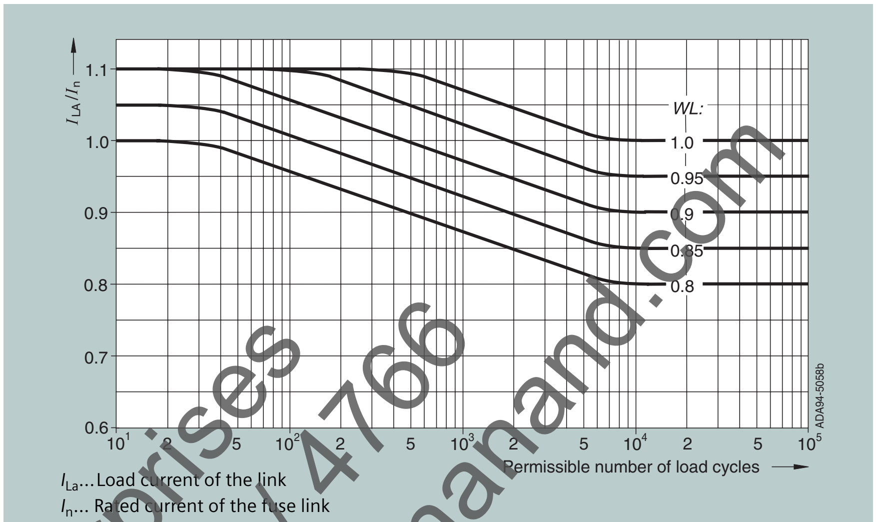


Fig. 106-191 *Cyclic load factor WL characteristic for load cycles*

For a uniform load (no load duty cycles and no interrupt operations), then a cyclic load factor WL = 1 can be assumed. For load duty cycles as well as interrupt operations, which last longer than 5 min., and which occur more frequently than 1 x per week, then the cyclic load factor WL specified for the individual fuse links in Section 3 '*Characteristics and Dimension Drawings*' should be selected.

4.2.7 Fuse currents when used in a converter

The RMS value of the fuse current for the most usual converter circuit configurations can be calculated from the (smoothed) DC current Id and from the phase current IL according to the following table.

Converter circuit configuration		**RMS value of the phase current** (phase fuse)	**RMS value of the branch current** (branch fuse)
Single-pulse center-tap circuit	(M1)	1.57 I_d	–
2-pulse center-tap circuit	(M2)	0.71 I_d	–
3-pulse center-tap circuit	(M3)	0.58 I_d	–
6-pulse center-tap circuit	(M6)	0.41 I_d	–
Double 3-pulse center-tap circuit (parallel)	(M3.2)	0.29 I_d	–
2-pulse bridge circuit	(B2)	1.0 I_d	0.71 I_d
6-pulse bridge circuit	(B6)	0.82 I_d	0.58 I_d
Single-phase bi-directional circuit	(W1)	1.0 I_L	0.71 I_L

Table 107-47 *Fuse currents when used in a converter*

4.3 I^2t values

When a short-circuit develops, the current through the fuse link increases, during the pre-arcing time t_s up to the let-through current I_c (peak melting current).

During the arc time t_L the arc forms and the short-circuit current is cleared (refer to the following diagram).

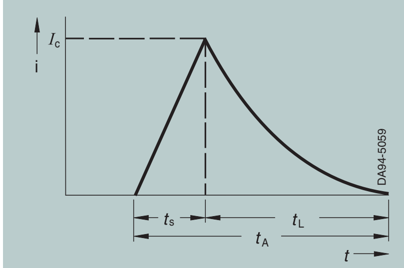


Fig. 108-192 *Current characteristic when a fuse ruptures*

The integral of the square of the current over the complete clearing time (t_s+t_L) – also known as the clearing I^2t value, defines the heat which the semiconductor component is subject to, which is to be protected, during the interrupt operation.

$(\int i^2 dt)$

In order to provide adequate protection, the clearing I^2t value of the fuse link must be less than the I^2t value of the semiconductor component. The clearing I^2t value of the fuse link practically decreases the same as the I^2t value of a semiconductor component with increasing temperature, i.e. increasing pre-loading. This means that it is sufficient to compare the I^2t values in the non-loaded (cold) condition.

The clearing I^2t value (I^2t_A) is the sum of the pre-arcing I^2t value (I^2t_s) and the arcing I^2t value (I^2t_L).

$(\int i^2 dt)$ (semiconductor, t_{vj} = 25°C, t_p = 10 ms) > $(\int i^2 t_A)$ (fuse link)

4.3.1 Pre-arcing I^2t value I^2t_s

The pre-arcing I^2t value can be calculated for any time from the value pairs of the time/current characteristic of the fuse link.

For decreasing pre-arcing times, the pre-arcing I^2t value goes to a lower limit value where, during melting, almost no heat is dissipated from the notches of the fuse element to the environment. The pre-arcing I^2t values, specified in Sections 2 and 3 of the '*Ordering and Engineering Data*' und '*Characteristics and Dimension Drawing*' correspond to the pre-arcing time of t_{vs} = 1 ms.

4.3.2 Arcing I^2t value I^2t_L

While the pre-arcing I^2t value is a characteristic of the fuse link, the arcing I^2t value depends on the circuit data, and more precisely

- on the recovery voltage V_w
- on the power factor cos φ of the short-circuit loop
- on the prospective current I_p (current at the location where the fuse link is mounted if this is bypassed)

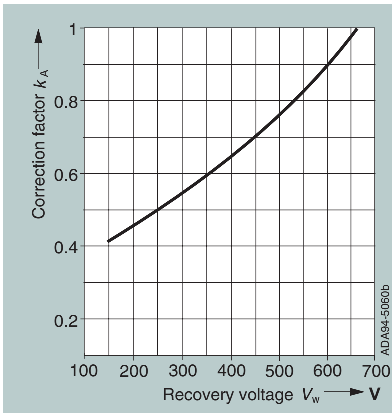
The maximum of the arcing I^2t value is reached, depending on the fuse type, at a current of between 10 I_n up to 30 I_n.

4.3.3 Clearing I^2t value I^2t_A, correction factor k_A

The clearing I^2t values of the fuse links are specified in Section 3 '*Characteristics and Dimension Drawings*' for rated voltage V_n. The correction factor k_A should be taken into account when determining the clearing-I^2t value for a recovery voltage V_w.

I^2t_A (for V_w) = I^2t_A (for V_n) x k_A

The "Correction factor k_A" characteristic (refer to the following diagram) is specified for the individual fuse series in Section 3 '*Characteristics and Dimension Drawing*'. The clearing I^2t values, determined in this fashion, are valid for prospective currents $I_p \geq 10 \times I_n$ and cos φ = 0.35.



Example: Series 3NE8 0...

Fig. 108-193 *Correction factor k_A for clearing I^2t value*

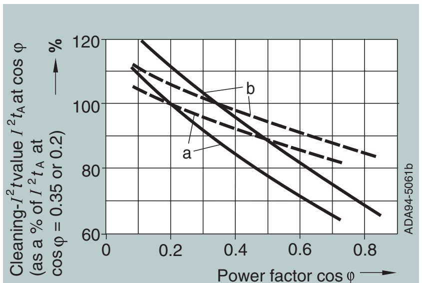
4.3.4 Taking into account the recovery voltage V_w

The recovery voltage V_w is obtained from the voltage which drives the short-circuit current. The driving voltage is, in most fault situations, the same as the supply voltage V_{v0}. For inverter commutation faults, it is 180% of the supply voltage V_{v0} (refer to Section 4.1 '*Rated voltage*'). If two branches of a converter circuit are located in the short-circuit loop, and there are therefore two fuse links in series, when the short-circuit current is sufficiently high (refer to Section 4.11.2), then it can be assumed that the voltage will be evenly distributed. This means $V_w = 0.5\ V_{v0}$ or, for inverter commutation faults, $V_w = 0.9\ V_{v0}$.

4.3.5 Influence of the power factor cos φ

The data provided in Section 3 '*Characteristics and Dimension Drawings*' for the clearing I^2t values (I^2t_A) refers to a power factor of cos φ = 0.35 (exception: For SITOR fuse links 3NC5 8.., 3NE6 4.., 3NE9 4.. , then cos φ = 0.2 applies).

The following diagram shows the relationship between the clearing I^2t values and the power factor cos φ at 1.0 V_n and at 0.5 V_n.



for 1.0 U_n

for 0.5 U_n

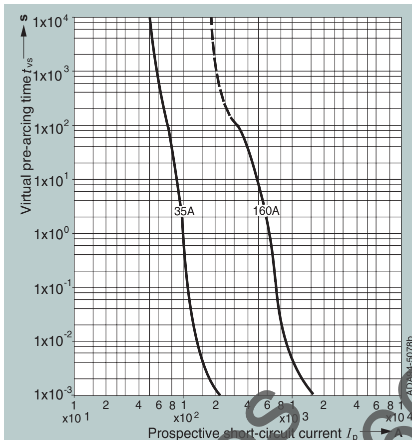
a) for SITOR fuse links 3NC5 8..., 3NE6 4..., 3NE9 4.. (reference to cos φ = 0,2)

b) for all other SITOR fuse links (reference to cos φ = 0,35)

Fig. 109-194 *Clearing I^2t value I^2t_A for SITOR fuse links as a function of power factor cos φ*

4.4 Time/current characteristics

In the following diagram the time/current characteristics shown indicate the time up to melting for the unloaded fuse link from the cold state (max. +45 °C).



35 A: Utilization Category gR

160 A: Utilization Category aR

Fig. 109-195 *Time/current characteristics of fuse links*

If the time/current characteristic is shown as dotted line in the long time range (t_{vs} > 30 s) (fuse links, utilization Category aR), then this represents the limit of the permissible overload from the cold condition. If the dotted section of the characteristic is exceeded, there is a danger that the ceramic body of the fuse link could be damaged. The fuse link can only be used as short-circuit protection. In this case an additional protective device (overload relay, circuit-breaker) is required to provide overload protection. For closed-loop controlled converter units the closed-loop current limiting control is sufficient.

If the time/current characteristic is a solid line over the complete time range (fuse links, utilization Category gR or gS), then the fuse link can interrupt the current over the complete time range. This means that it can be used for overload and short-circuit protection.

4.5 Actual pre-arcing time

The virtual pre-arcing time t_{vs} is specified in the time/current characteristic as a function of the prospective current. This is a value which is valid for a squarewave current (di/dt) = ∞).

For pre-arcing times t_{vs} < 20 ms, the virtual pre-arcing time t_{vs} deviates from the actual pre-arcing time t_s. The actual pre-arcing time can (depending on the current rate-of-rise) be several milliseconds longer.

In the range of several milliseconds, over which time the increase of the short-circuit current can be considered to be linear, for a sinusoidal current increase and at 50 Hz, the actual pre-arcing time is given by:

$$t_s = \frac{3 x I^2 t_s}{I_c^2}$$

4.6 Taking into account the pre-loading condition, residual value factor *RW*

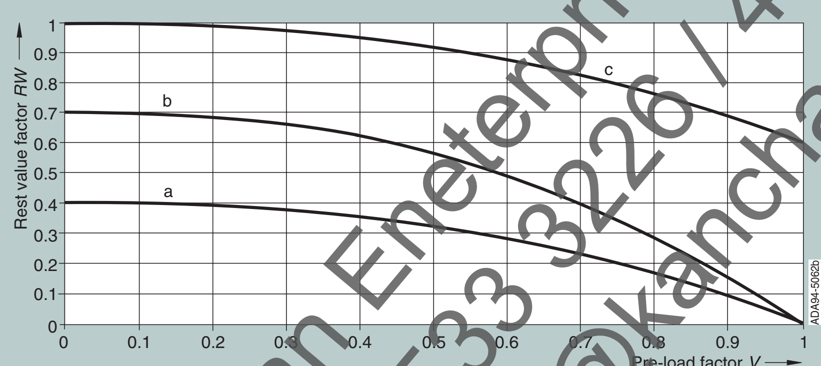
A pre-loading condition of the fuse link reduces the permissible overload duration and the pre-arcing time.

The residual value factor *RW* can be used to determine the time for which a fuse link can be operated, ageing-free at any overload current I_{La} during a periodic or non-periodic load duty cycle above the previously determined permissible load current I_n'.

The residual value factor RW depends on the pre-loading condition *V* (I_{rms} RMS fuse current during the load duty cycle to the permissible load current I_n')

$$V = \frac{I_{rms}}{I_n'}$$

as well as the frequency of the overload conditions (refer to the following diagram, characteristics a and b).



a) Frequent impulse/load duty cycle currents (> 1/week)
b) Seldom impulse/load duty cycle currents (< 1/week)
c) Pre-arcing time for pre-loading

Fig. 110-196 *Permissible overload and pre-arcing time for a pre-loading condition*

Permissible overload duration = residual value factor RW x pre-arcing time t_{vs} (time/current characteristic)

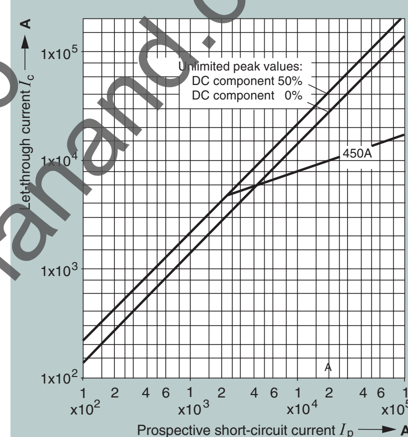
The reduction of the pre-arcing time of a fuse link for a specific pre-load condition can be taken from characteristic c.

Pre-arcing time = residual value factor RW x pre-arcing time t_{vs} (time/current characteristic)

4.7 Let-through current I_c

The let-through current I_c can be determined from the let-through characteristics (current limiting at 50 Hz) specified for the particular fuse link in Section 3 '*Characteristics and Dimension Drawings*'. The let-through current is dependent on the prospective current and the DC current element when the short-circuit actually occurs (instant of switch-on).

The let-through current I_c of a fuse link as a function of the prospective short-circuit current I_p is shown in the following diagram using as an example a SITOR fuse link 3NE4 333-0B.



Example:
SITOR fuse link 3NE4 333-0B

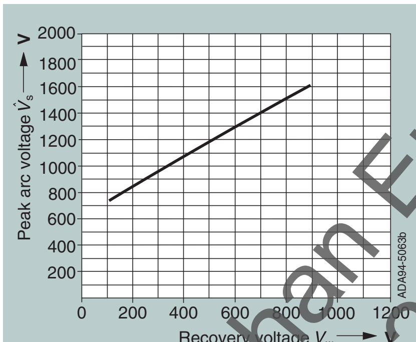
Fig. 110-197 *Let-through current I_c of a fuse link*

4.8 Rated interrupting capacity

The rated interrupting capacity of all SITOR fuse links is at least 50 kA if higher values are not specified in Section 3 '*Characteristics and Dimension Drawings*'. The data is valid for a test voltage of 1.1 x V_n, 45 to 62 Hz and $0.1 \leq \cos \varphi \leq 0.2$. For application voltages which lie below the rated voltage as well as for rated currents of the fuse links which lie below the maximum rated current of a fuse series, the interrupting capacity lies significantly above the rated interrupting capacity.

4.9 Arc voltage V_s [$\hat{U}_s$]

When extinguishing, an arc voltage V_s [$\hat{U}_s$] occurs at the connections of the fuse link. This arc voltage can significantly exceed the connection voltage. The magnitude of the arc voltage depends on the design of the fuse link and the magnitude of the recovery voltage. It is shown in the form of a characteristic as a function of the recovery voltage V_w (refer to the following diagram).



Example:
SITOR fuse link 3NE4 333-0B

Fig. 111-198 *Arc voltage*

The arc voltage occurs at the semiconductor components, which are not located in the short-circuit loop, as blocking voltage. In order to avoid a voltage-related hazard, the arc voltage may not exceed the peak blocking voltage of the semiconductor component.

4.10 Power dissipation, temperature rise

When the rated current is reached, the fuse elements of SITOR fuse links have a significantly higher temperature than the fuse elements of cable protection fuse links.

The power dissipation, specified in Section 3 '*Characteristics and Dimension Drawings*' is the upper spread value if the fuse link is conducting the rated current.

The power dissipation decreases at partial load corresponding to the following diagram.

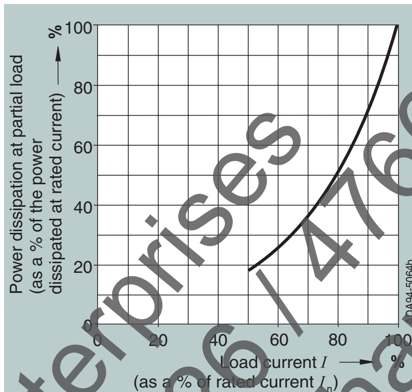


Fig. 111-199 *Power dissipation at partial load*

The temperature rise, specified in Section 3 '*Characteristics and Dimension Drawings*', is valid for the specified reference point and was determined when testing the fuse link (test setup in accordance with DIN VDE 0636, Part 23 and IEC 269-4).

4.11 Connecting fuse links in parallel and series

4.11.1 Parallel circuit

If several semiconductor components and therefore fuse links are connected in parallel in a branch when an internal short-circuit develops, then only the fuse link connected in series with the defective semiconductor component ruptures. This fuse link must extinguish the full connection voltage.

If it is necessary increase the current, two or several fuse links connected in parallel can be assigned to a semiconductor component without having to reduce the current. The resulting clearing-I^2t value then increases to the square of the number of fuse links connected in parallel. Only fuse links of the same type should be used in order to avoid that the current is unevenly distributed.

4.11.2 Fuse links in series

There are two types of series circuits:

- Series circuit in the converter branch
- Two fused converter branches conduct the short-circuit current in series

In both of these cases it can only be assumed that the voltage will be evenly distributed if the pre-arcing time of the SITOR fuse link does not exceed the values specified in the following Table.

SITOR fuse links Order No.	Maximum pre-arcing time for an even voltage distribution ms
3NC1 0..	10
3NC1 1..	10
3NC1 4..	10
3NC1 5..	10
3NC2 2..	10
3NC2 4..	40
3NC5 8..	10
3NC7 3..	10
3NC8 4..	10
3NE1 0..	10
3NE1 2..	10
3NE1 3..	10
3NE1 4..	20
3NE1 8..	10
3NE3 2..	10
3NE3 3..	10
3NE3 4..	20
3NE3 5..	20
3NE3 6..	20
3NE4 1..	10
3NE4 3..	10
3NE5 4..	20
3NE5 6..	20
3NE6 4..	10
3NE7 4..	20
3NE7 6..	20
3NE8 0..	10
3NE8 7..	10
3NE9 4..	10
3NE9 6..	20

Table 112-48 *Maximum pre-arcing times for even voltage distribution*

The cooling conditions of the fuse links connected in series should be approximately the same. If faults are to be expected where the specified pre-arcing times are exceeded due to the slower increase in the current-rate-of-rise, then it can no longer be assumed that the voltage will be evenly distributed. In this case, the fuse links should be dimensioned as far as the voltage is concerned so that one fuse link alone can extinguish the full connection voltage.

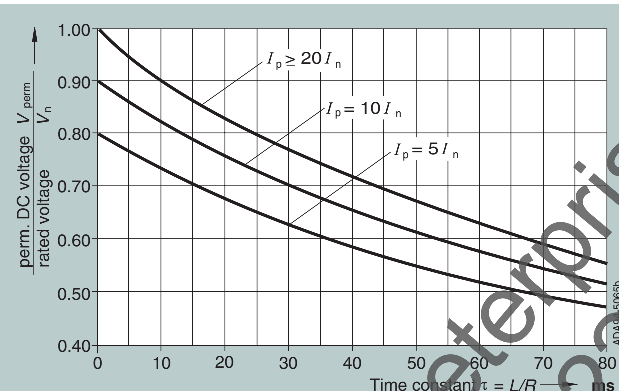
As far as possible a series circuit of fuse links in the branch of a converter circuit should be avoided. Instead, a single fuse link should be used with the correspondingly higher rated voltage.

4.12 DC current applications

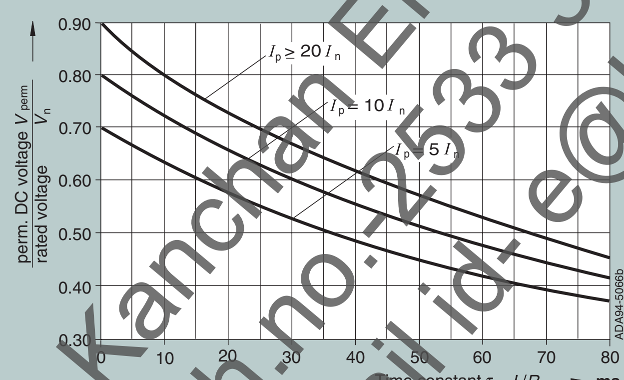
When fuse links are used in DC circuits, in some cases, other data apply than those specified for AC current in Section 3 '*Characteristics and Dimension Drawings*'.

4.12.1 Permissible DC voltage

The permissible DC voltage V_{perm} of the fuse link depends on the rated voltage V_n, the time constant τ = L/R in the DC link and the prospective current I_p.
The permissible DC voltage is referred to the rated voltage V_n and is specified as a function of time constant τ and the prospective current is a parameter (refer to the following diagram).



With the exception of series 3NE1 0.., 3NE1 8..



for the series 3NE1 0.., 3NE1 8..

Fig. 113-200 *Permissible DC voltage of a fuse link*

4.12.2 Clearing I^2t value I^2t_A

The clearing I^2t value I^2t_A depends on the voltage, the time constant τ = L/R and the prospective current I_p. It is calculated using the I^2t_A value at the rated voltage V_n, specified in Section 3 '*Characteristics and Dimension Drawings*' for the particular fuse link and correction factor k_A. However, instead of the recovery voltage V_w, that DC voltage is inserted against which the fuse link should switch.

The clearing I^2t value thus determined applies under the following prerequisites:

- Time constant L/R ≤ 25 ms for $I_p \geq 20\, I_n$
- Time constant L/R ≤ 10 ms for $I_p = 10\, I_n$

The clearing I^2t values increase by 20 %

- For $I_p \geq 20\, I_n$ and a time constant L/R = 60 ms
- For $I_p = 10\, I_n$ and a time constant L/R = 35 ms

4.12.3 Arc voltage $\hat{U}_s$

The arc voltage $\hat{U}_s$ is determined from the characteristic for the particular fuse link specified in Section 3 '*Characteristics and Dimension Drawings*'. However, instead of the recovery voltage V_w, that DC voltage is inserted against which the fuse link should switch.

The arc voltage thus determined applies under the following prerequisites:

- Time constant L/R ≤ 20 ms for $I_p \geq 20\, I_n$
- Time constant L/R ≤ 35 ms for $I_p = 10\, I_n$

The clearing I^2t values increase by 20 %

- For $I_p \geq 20\, I_n$ and a time constant L/R = 45 ms
- For $I_p = 10\, I_n$ and a time constant L/R = 60 ms

4.13 Indicators

An indicator is used to show when the fuse link has ruptured. SITOR fuse links have an indicator whose response voltage lies between
20 V ($V_n \leq 1000$ V) and
40 V ($V_n > 1000$ V).

4.14 Accessories

4.14.1 Fuse bases, fuse pullers

Some of the SITOR fuse links can be used in the appropriate fuse bases. The matching fuse bases (single-phase and three-phase) as well as the associated fuse pullers are listed in the Tables in Section 2.3 '*Accessories*' and Section 3 '*Characteristics and Dimension Drawings*'.

Note
Even if the rated voltage and/or current of the fuse bases are lower than that of the associated fuse link, the values of the fuse link apply.

4.14.2 Fused switch disconnectors, switch disconnectors with fuses

Certain series of SITOR fuse links are suitable for use in fused switch disconnectors 3NP4 and 3NP5 (refer to Catalog NS K) and in switch disconnectors with fuses 3KL and 3KM (refer to Catalog NS K).

The following points must be carefully observed when fuse links are used in switch disconnectors:

- The power dissipation of SITOR fuse links is higher when compared to l.v.h.b.c. cable protection fuses. This means that the permissible load current of the fuse links must in some cases be reduced (also refer to Section 2.3 '*Accessories*'.
- Fuse links with rated currents $I_n > 63$ A may then not be used as overload protection, if they correspond to duty Class gR.

Note
All 3NE1... fuse links with rated currents I_n from 16 A to 850 A and utilization Categories gR and gS can, on the other hand, be used to provide overload protection.

- The rated voltage and rated insulation voltage of the switch disconnectors must correspond, as a minimum, to the voltage being used.
- When using 3NE3 2.., 3NE3 3.., 3NE4 3.., 3NC2 4.. and 3NC8 4.. fuse links, the switching capacity of fused switch disconnectors may not be fully utilized due to the slotted knife contacts. It is permissible to occasionally switch currents up to the rated current of the fuse links.
- 3NE4 1.. fuse links when used in fused switch disconnectors may only be occasionally actuated and only when in a no-current condition as the fuse contact blades are subject to significant mechanical stresses.

The individual fuse links are assigned to the various switch disconnectors in Section 2.3 '*Accessories*'. The permissible load capacity of the fuse link and the required connection cross-section are also specified here.

Determining the Rated Current

4.15 Determining the rated current I_n for ageing-free operation with cyclic loads

Frequently, converters are not operated with a continuous load, but with cyclic loads which can also briefly exceed the rated converter current.

The selection techniques for ageing-free operation of SITOR fuse links will now be described for four typical load types.[1)]

- Continuous load
- Unknown cyclic load, however with a known maximum current
- Cyclic load with known load duty cycle
- Occasional impulse load from a pre-loaded condition with unknown impulse sequence

In this case the diagrams for the correction factors k_u, k_q, k_λ, k_l in Section 4.2 '*Rated current I_n, load capacity*' as well as the residual value factor *RW* in Section 4.6 'Taking into account the pre-loaded condition, residual value factor *RW*' of the '*Technical data*' should be observed. The cyclic load factor *WL* is specified for every fuse link in Section 3 '*Characteristics and dimension drawings*'.

The required rated current I_n of the fuse link is determined in two steps:

1. The rated current I_n is determined using the RMS value I_{rms} of the load current

   $$I_n > I_{rms} \times \frac{1}{k_u \times k_q \times k_\lambda \times k_l \times WL}$$

   Permissible load current I_n' of the selected fuse link.

   $I_n' = k_u \times k_q \times k_\lambda \times k_l \times WL \times I_n$

2. The permissible overload duration of the current blocks exceeding the permissible fuse load current I_n' is checked.

   Pre-arcing time t_{vs} (time/current characteristic) x residual value factor $RW \geq$ overload duration t_k

   In this case, the pre-loading factor

   $$V = \frac{I_{rms}}{I_n'}$$

   and the characteristics '*Permissible overload and pre-arcing time for a pre-loaded condition*' (Fig. 110-196, characteristic a) and "*Time/current characteristic*" for the selected fuse link are required.

If the determined overload duration is less than the associated, specified overload duration, then a fuse link with a higher rated current I_n (taking into account the rated voltage V_n and the permissible interrupting I^2t value) should be selected and the check repeated.

1) *Please contact us for cyclic loads which cannot be classified in one of the four specified typical load types.*

4.15.1 Continuous load

Rated current I_n of the fuse link

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

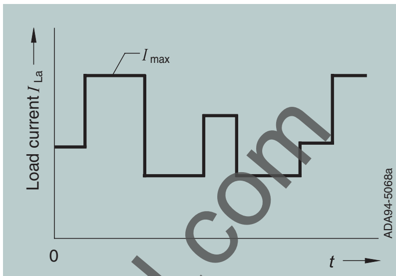
I_{La}... load current of the fuse link (RMS value)

Less than 1 interrupt oper./ week: WL = 1

More than 1 interrupt operation per week: WL = refer to characteristic values

Fig. 115-201 *Continuous load*

4.15.2 Unknown cyclic load – however with a known maximum current I_{max}



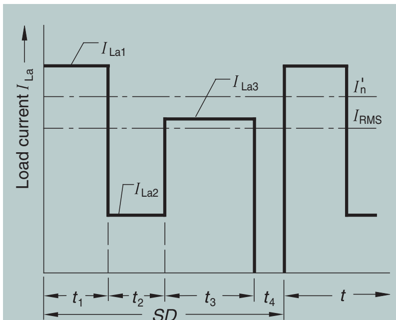
Rated current I_n of the fuse link

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

I_{max}... Max. load current of the fuse link (RMS value)

Fig. 115-202 *Unknown cyclic load*

4.15.3 Cyclic load with known load duty cycle



$$I_{rms} = \sqrt{\frac{\sum_{k=1}^{k=n} I_{Lak}^2 \times t_k}{SD}}$$

$$I_{rms} = \sqrt{\frac{I_{La1}^2 t_1 + I_{La2}^2 t_2 + I_{La3}^2 t_3}{SD}}$$

I_{LK}... Max. load current of the fuse link (RMS value)

Fig. 115-203 *AC load with known load duty cycle*

4.15.4 Occasional impulse load from a pre-loaded condition with unknown impulse sequence

The required rated current I_n of the fuse link is determined in two steps:

1. The rated current In is determined using the pre-loaded current I_{pre}.

   $$I_n > I_{pre} \times \frac{1}{k_u \times k_q \times k_\lambda \times k_l \times WL}$$

   Permissible load current I_n' of the selected fuse link.

   $I_n' = k_u \times k_q \times k_\lambda \times k_l \times WL \times I_n$

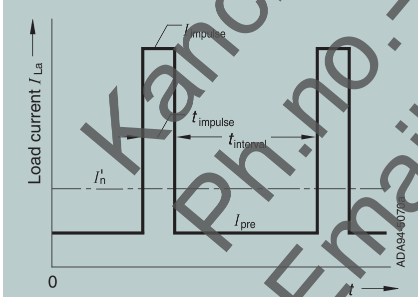
2. The permissible overload duration of the impulse current $I_{impulse}$ pre-arcing time t_{vs} (time/current characteristic) x residual value factor *RW* ≥ impulse time $t_{impulse}$ is checked

   In this case the pre-loading factor

   $$V = \frac{I_{rms}}{I_n'}$$

   and the characteristics *'Permissible overload and pre-arcing time for a pre-loaded condition'* (Fig. 196, characteristic a) and *'Time/current characteristic'* for the selected fuse link are required.

If the determined overload duration is less than the required overload duration $t_{impulse}$, then a fuse link with a higher rated current I_n (taking into account the rated voltage V_n and the permissible clearing I^2t value) should be selected and the check repeated.



Condition:

$t_{interval} \geq 3 \times t_{impulse}$

$t_{interval} \geq 5$ min

Fig. 116-204 *Occasional impulse load*

4.16 Selection examples

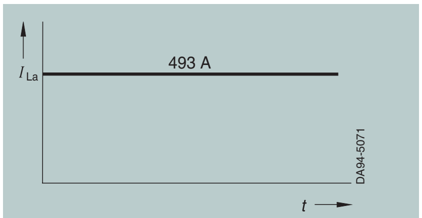
For a converter assembly with a circuit configuration (B6) A (B6) C, whose rated DC current I_{dn} = 850 A, fuse links should be selected which are then used as branch fuses. The selected fuse is shown for various operating modes of the converter assembly.

Converter assembly data

- Line supply voltage V_N = 3-ph. 400 V AC 50 Hz
- Recovery voltage V_W = 360 V = V_N x 0.9 (for inverter commutation faults)
- Thyristor T 508N (eupec company), I^2t value $\int i^2\,dt = 320 \times 10^3\,A^2s$ (10 ms, cold)
- Fuse links, natural air cooling, ambient temperature ϑ_u = +35 °C
- Connection cross-section for the fuse links, copper: 160 mm²
- Conversion factor DC current I_d/fuse load current I_{La}: $I_{La} = I_d \times 0.58$

For the following examples, for loads, which exceed the rated DC current of the converter assembly, it is assumed that the converter assembly is dimensioned for these load conditions.

4.16.1 Continuous, interruption-free load



DC current $I_d = I_{dn}$ = 850 A
$I_{La} = I_d \times 0.58$ = 493 A
Selected:
SITOR fuse link 3NE3 335
(560 A/1000 V), *WL* = 1
Clearing I^2t value
$I^2t_A = 360 \times 10^3 \times 0.53 = 191 \times 10^3\,A^2s$
Test cross-section acc. to Table 10-1: 400 mm²

The following correction factors should be applied:

k_u = 1.02 (ϑ_u = +35 °C)

k_q = 0.91 (connection cross-section at both ends, 40 % of the test cross-section)

k_λ = 1.0 (valve conducting period λ = 120°)

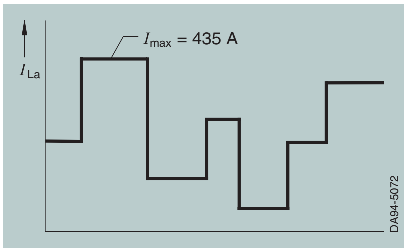
k_l = 1.0 (no forced air cooling)

Required rated current In of the SITOR fuse link:

$$I_n \geq I_{La} \times \frac{1}{k_u \times k_q \times k_\lambda \times k_l \times WL} = 493\ A$$

$$\frac{1}{1.02 \times 0.91 \times 1.0 \times 1.0 \times 1.0} = 531\,A$$

4.16.2 Unknown cyclic load, however with known maximum current



Max. DC current I_{dmax} = 750 A
Max. fuse current I_{max} = I_{dmax} x 0.58 = 435 A
Selected:
SITOR fuse link 3NE3 334-0B
(560 A/1000 V), WL = 1
Clearing I^2t value
I^2t_A = 260 x 10^3 x 0.53 = 138 x 10^3 A^2s
Test cross-section acc. to Table 10-1: 400 mm^2

The following correction factors should be applied:

k_u = 1.02 (ϑ_u = +35 °C)

k_q = 0.91 (connection cross-section at both ends, 40 % of the test cross-section))

k_λ = 1.0 (valve conducting period λ = 120°)

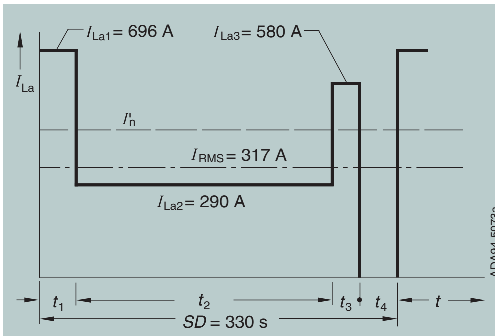
k_l = 1.0 (no forced air cooling)

Required rated current I_n of the SITOR fuse link:

$$I_n \geq I_{max} \times \frac{1}{k_u \times k_q \times k_\lambda \times k_l \times WL} = 435\ \text{A}$$

$$\frac{1}{1.02 \times 0.91 \times 1.0 \times 1.0 \times 1.0} = 469\ \text{A}$$

4.16.3 Cyclic load with known load duty



DC 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

RMS value of the load current

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

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

The following correction factors should be applied:

k_u = 1.02 (ϑ_u = +35 °C)

k_q = 0.94 (connection cross-section at both ends, 50 % of the test cross-section)

k_λ = 1.0 (valve conducting period λ = 120°)

k_l = 1.0 (no forced air cooling)

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

$$I_n \geq I_{rms} \times \frac{1}{k_u \times k_q \times k_\lambda \times k_l \times WL} = 317\ \text{A}$$

$$\frac{1}{1.02 \times 0.94 \times 1.0 \times 1.0 \times 1.0} = 331\ \text{A}$$

Permissible load current I_n' of the selected fuse link.

$I_n' = k_u \times k_q \times k_\lambda \times k_l \times WL \times I_n$ = 1.02 x 0.94 x 1.0 x 1.0 x 1.0 x 450 = 431 A

2. The permissible overload duration of the current blocks which exceed the permissible fuse load current I_n' is checked

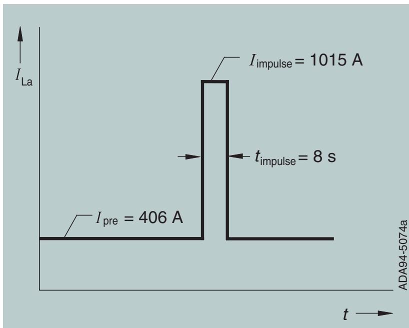
Pre-load factor: $V = \frac{I_{rms}}{I_n'} = \frac{317}{431} = 0.74$

Residual value factor RW: for V = 0.74 from characteristic a (Fig. 196, frequent impulse/load duty cycle currents) RW = 0.2

Current block I_{La1}: Pre-arcing time t_{vs}: 230 s (from the time/current characteristic for 3NE3 333) $t_{vs} \times RW$ = 230 s x 0.2 = 46 s > t_1

Current block I_{La3}: Pre-arcing time t_{vs}: 1200 s (from the time/current characteristic for 3NE3 333) $t_{vs} \times RW$ = 1200 s x 0.2 = 240 s > t_3

4.16.4 Occasional impulse load from a pre-loaded condition with known impulse sequence



DC current:
I_{dpre} = 700 A
$I_{dimpulse}$ = 500 A $t_{impulse}$ = 8 s

Fuse current:
$I_{pre} = I_{dpre} \times 0.58 = 406$ A
$I_{impulse} = I_{dimpulse} \times 0.58 = 1015$ A

The conditions
$t_{interval} \geq 3\ t_{impulse}$ and $t_{interval} \geq 5$ min are fulfilled.
Selected:
SITOR fuse link 3NE3 333
(560 A/1000 V), WL = 1
Clearing I^2t value $I^2t_A = 360 \times 10^3 \times 0.53 = 191 \times 10^3\ A^2s$
Test cross-section acc. to Table 10-1: 400 mm²

The following correction factors should be applied::

k_u = 1.02 (ϑ_u = +35 °C)

k_q = 0.91 (connection cross-section at both ends, 40 % of the test cross-section)

k_λ = 1.0 (valve conducting period λ = 120°)

k_l = 1.0 (no forced air cooling)

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

$$I_n \geq I_{pre} \times \frac{1}{k_u \times k_q \times k_\lambda \times k_l \times WL} = 406 \text{ A}$$

$$\frac{1}{1.02 \times 0.91 \times 1.0 \times 1.0 \times 1.0} = 437 \text{ A}$$

Permissible load current I_n' of the selected fuse link:
$I_n' = k_u \times k_q \times k_\lambda \times k_l \times WL \times I_n = 1.02 \times 0.91 \times 1.0 \times 1.0 \times 1.0 \times 560 = 520$ A

2. The permissible overload duration of the current blocks, which exceed the permissible fuse load current $I_{impulse}$ is checked

Pre-loading factor : $V = \frac{I_{pre}}{I_n'} = \frac{406}{520} = 0.78$

Residual value factor RW: for V = 0.78 from characteristic a (Fig. 196, frequent impulse/load duty cycle currents) RW = 0.18

Impulse current $I_{impulse}$: Pre-arcing time t_{vs}: 110 s (from the time/current characteristic for 3NE3 333)
$t_{vs} \times RW = 110 \text{ s} \times 0.18 = 19.8 \text{ s} > t_{impulse}$

Fuse Monitoring

The following fuse monitoring devices represent a low-ohmic bypass (circuit-breaker). These monitoring devices are intended for semiconductor protection fuse links which are only used to protect semiconductor components as either phase or branch fuses and are not intended to be used to bring the converter into a no-voltage condition.

3NP4 and 3NP5 fuse switch disconnectors are available with integrated 3RV.. circuit-breakers (up to 690 V) or with electronic fuse monitoring (up to 500 V).

For more detailed information, refer to Catalog NS K Section 12.

According to DIN VDE 0100, monitoring devices for fuse links which are also intended to simultaneously disconnect the voltage, may only be used if the monitoring circuit is positively disconnected together with the main circuit. When monitoring cable protection fuse links, fused switch disconnectors with mounted circuit-breaker are used as listed in Catalog NS K.

4.17 Circuit-breakers

4.17.1 Applications

3RV1611 circuit-breakers (refer to Catalog NS K) are used to monitor phase fuses for connection voltages up to 690 V.

A circuit-breaker is not suitable to monitor fuses of converters where inverter commutation faults can occur or for those converters where, when a fault occurs, DC voltages > 250 V/pole can be fed back into the line supply.

In the DC circuit of a converter, fuse links cannot be monitored using 3RV1611 circuit-breakers.

4.17.2 Mode of operation

Each of the phase fuses to be monitored is connected in parallel to a circuit-breaker path (refer to the following diagram). When the fuse link ruptures, the circuit-breaker trips and signals that the fuse has ruptured.

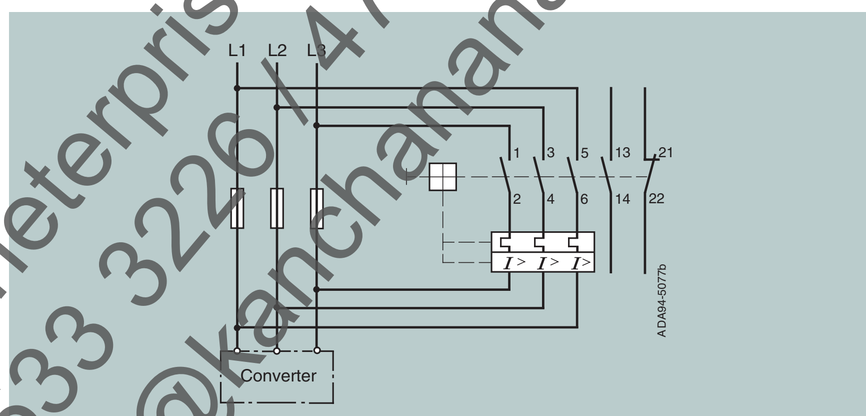


Fig. 119-205 *Monitoring phase fuses using 3RV1611 circuit-breaker*

Terminology

This glossary explains the most important terms when using fuse links to protect semiconductor components.

Additional definitions are included in DIN VDE 0636, Part 1 and Part 10.

Rated interrupting capacity

The rated interrupting capacity specifies the highest prospective short-circuit current I_p which a fuse link can interrupt at 1.1x rated voltage and under specified conditions.

Rated frequency

The rated frequency is the frequency for which the fuse link is designed regarding the power dissipation, current, voltage, characteristics and interrupting capacity.

Rated voltage V_n

The rated voltage is the voltage stamped on the fuse and which is defined according to the test conditions and the operating voltage limits.

For SITOR fuse links, the rated voltage is always an RMS AC voltage.

Rated current I_n

The rated current of a fuse link is the current which is stamped on the fuse link and which the fuse can conduct under the specified conditions (refer to Section '*Technical information*') without having a negative impact on the function of the fuse.

Utilization Category

The utilization Category is a designation of the Function Class of a fuse link in conjunction with the element to be protected.

- Utilization Category gS:
  Full range semiconductor protection fuse for use in fused switchgear and switching devices
- Utilization Category gR:
  Full range semiconductor protection
- Utilization Category aR:
  Partial range semiconductor protection

Let-through current I_c

The let-through current I_c is the highest instantaneous current value which is reached when a fuse ruptures.

Let-through current characteristic

The let-through current characteristic specifies the let-through current at 50 Hz as a function of the prospective current.

Function Class

The function class designates the capability of a fuse link to conduct specific currents without damage and to interrupt overcurrents within a specific range (range of the interrupting capacity).

Function Class a

Partial range fuses:
Fuse links which conduct currents up to at least their rated current and can interrupt currents above a certain multiple of their rated current up to the rated interrupting capacity.

Function Class g

Full range fuses:
Fuse links which can continually conduct currents up to at least their rated current and can interrupt currents from the smallest pre-arcing current up to the rated interrupting capacity.

I^2t value

The I^2t value (Joule integral) is the integral of the square of the current over a specified time interval:

$$I^2t = \int_{t_0}^{t_1} i^2 \mathrm{d}t$$

The I^2t values for pre-arcing (I^2t_s) and for clearing ($I^2t_A \triangleq$ sum of the pre-arcing and arcing I^2t value).

Power dissipation

The power dissipation is the power which is dissipated in a fuse-link which is conducting its rated current under specified conditions.

Arc voltage $\hat{U}_s$

The arc voltage is the highest voltage which occurs at the fuse link connections during the arcing time.

Residual value factor *RW*

The residual value factor is a reduction factor which is used to determine the permissible load duration of the fuse link with currents which exceed the permissible load current I_n' (refer to the rated current I_n).

Prospective short-circuit current I_p

The prospective short-circuit current is the RMS value of the AC current component at the line frequency or the value of the DC current which can be expected in the case of a short-circuit which occurs after the fuse if it is considered that the fuse will be replaced by an element with an impedance which can be neglected.

Virtual time t_v

The virtual time is the time which is obtained if the I^2t value is divided by the square of the prospective current:

$$t_v = \frac{\int i^2 \mathrm{d}t}{I_p^2}$$

The virtual pre-arcing time t_{vs} is specified in the time/current characteristic.

Cyclic load factor *WL*

The cyclic load factor is a reduction factor for the rated current for cyclic load states.

Recovery voltage V_w

The recovery voltage (RMS value) is the voltage which is present at the connections of a fuse link after the current has been interrupted.

Time/current characteristic

The time/current characteristic specifies, for specific operating conditions, the virtual time (e.g. the pre-arcing time) as a function of the prospective current.

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Notes