Industrial Motors

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Energy

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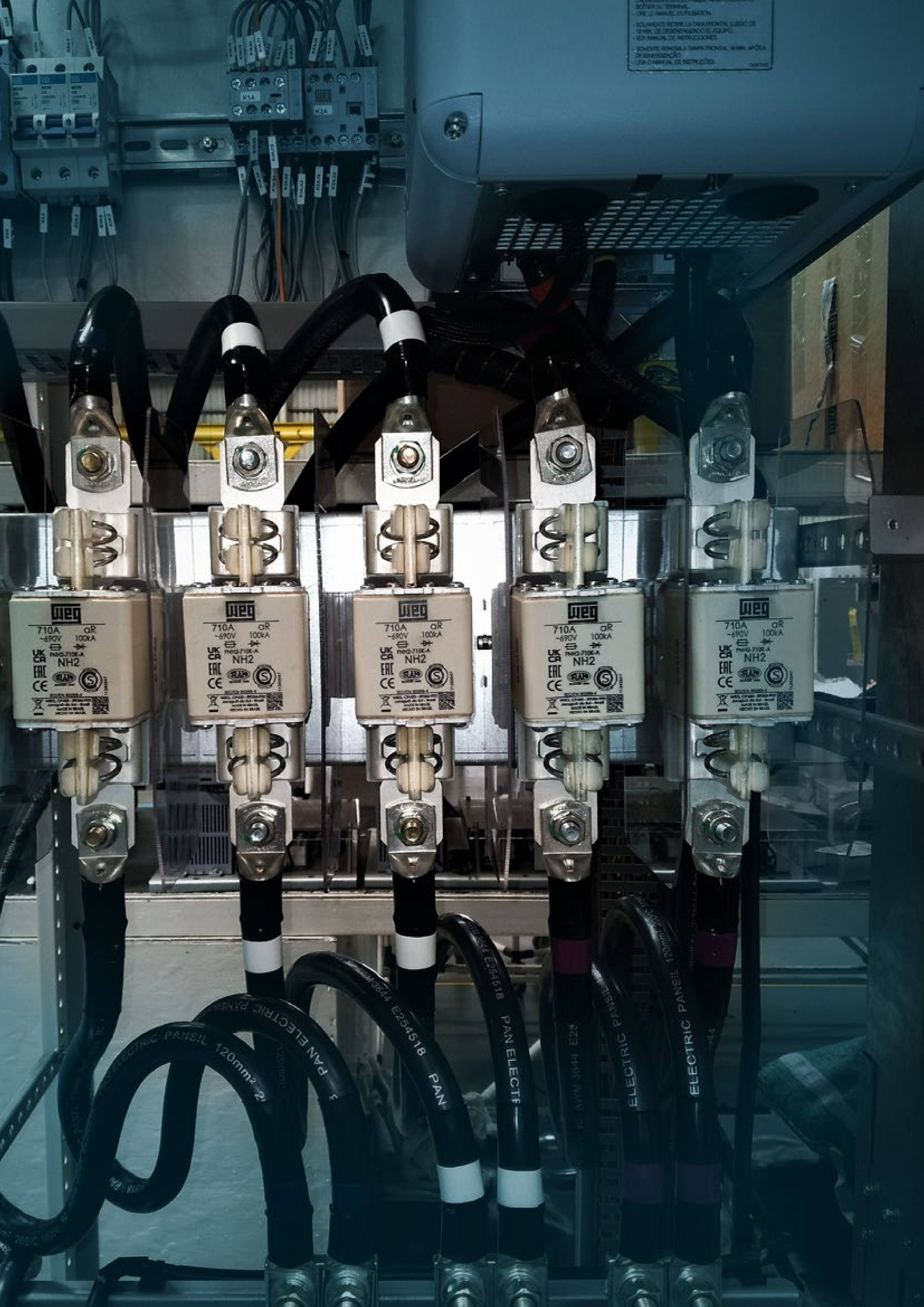
Coatings

aR NH Blade Contact and NH Flush-End Fuses

The **right protection** for your application

Driving efficiency and sustainability

SUMMARY


WEG
710A
~690V
aR
100kA
UK
CA
NH2
PAN ELECTRIC PANSIL 120mm²
E254518

THE RIGHT PROTECTION FOR YOUR APPLICATION

aR Fuses

WEG fuses are manufactured and tested according to international standards at currents from 20 to 2,000 A. They are available with the following construction and protection characteristics:

aR class high speed fuses, NH blade contact type and NH flush-end type

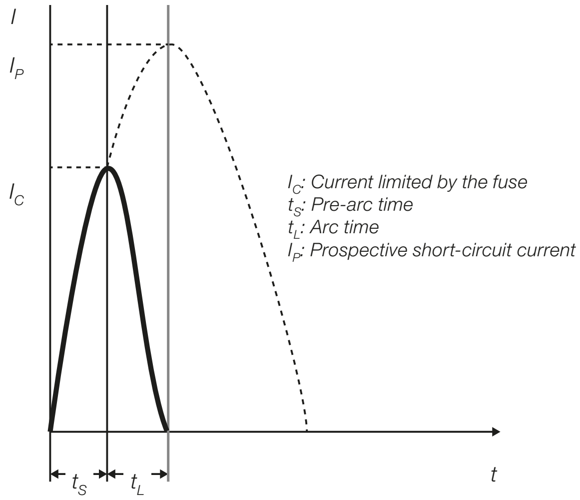
- For protection against short-circuit in semiconductors/electronic equipment up to 800 VAC.

General data

Fuse type	Maximum operating voltage	Breaking capacity	Current (I_n)	Sizes	Compliance standards
aR class high speed NH blade contact	690 VAC	100 kA / 690 VAC	20 to 1,000 A	000, 00, 1, 2 and 3	IEC 60269-4
aR class high speed NH blade contact	800 VAC	50 kA / 800 VAC	63 to 400 A	1 and 3	IEC 60269-4
aR class high speed NH flush-end type	690 VAC	200 kA / 690 VAC	450 to 2,000 A	3 and 23	IEC 60269-4

Fuse operation

Under short-circuit or overload, the fuse element melts, breaking the electrical circuit, interrupting the passage of current.
During the short-circuit, the prospective short-circuit current will be limited according to the figure alongside:



aR class fuses - high speed

Overview

The aR high speed fuses are intended for short-circuit protection of semiconductors found in low-voltage electronic devices, such as frequency inverters and soft-starters. Manufactured and tested according to IEC 60269-4 standard, with square or rectangular ceramic housings, the high speed fuses come in two types of construction:

With blade contact connection type

Available in models:

- FNH000 - size 000
- FNH00 - size 00
- FNH1 - size 1
- FNH2 - size 2
- FNH3 - size 3

With thread connection type (flush-end)

Available in models:

- FNH3FEM
- FNH23FEA (2 fuses in parallel)

Short-circuit protection in AC circuits

As the high speed fuses are aR class, they do not have overload protection.
They cannot operate above their rated current as indicated in the time x current curve. Otherwise, the fuse will be subjected to a thermal overload that will reduce its breaking capacity and its service life.
Therefore, an additional overload protection device must be used to fully protect the equipment.

Current limiter

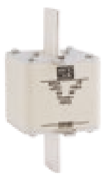
The fuse acts quickly for higher multiples of current values, breaking the circuit and preventing the prospective short-circuit current IP to be reached.

aR class fuses - NH blade contact type

Technical characteristics

The aR high speed NH blade contact type fuses are assembled in a high-quality ceramic housing, filled with impregnated quartz sand, having a pure silver fuse element and silver-plated copper blade/terminals.
Such construction provides excellent electrical insulation, mechanical robustness, resistance against thermal shocks during the fuse operation and lower I^2t values.

100 kA / 690 VAC

	Technical characteristics						Code
	Reference	Size	Current (A)	I^2t - pre-arc	I^2t total - arc	Dissipated power (W) $0.8I_n$	
				690 VAC (A^2s)			
	FNH000-20K-A	000	20	32	175	2.8	13735555
	FNH000-25K-A		25	46	330	3.5	13735656
	FNH000-35K-A		35	56	400	6.2	13737105
	FNH000-40K-A		40	110	670	6.2	13737107
	FNH000-50K-A		50	250	1,550	6.5	13737128
	FNH000-63K-A		63	410	2,200	8	13737129
	FNH000-80K-A		80	570	3,200	12	13737130
	FNH000-100K-A		100	980	6,200	14	13737131
	FNH000-125K-A		125	1,400	8,100	20.5	13737132
	FNH00-20K-A	00	20	16	240	3.2	10687494
	FNH00-25K-A		25	19	255	3.5	10701722
	FNH00-35K-A		35	23	430	5	10701721
	FNH00-40K-A		40	56	580	7	10702117
	FNH00-50K-A		50	130	1,430	9	10701718
	FNH00-63K-A		63	180	2,170	10.5	10705764
	FNH00-80K-A		80	270	2,710	13.5	10705995
	FNH00-100K-A		100	400	4,530	14	10707110
	FNH00-125K-A		125	810	6,350	16.5	10707231
	FNH00-160K-A		160	2,100	15,270	22.5	10701724
	FNH00-200K-A		200	2,900	25,870	26.5	10710732
	FNH00-250K-A		250	6,200	43,980	30.5	10711445
	FNH1-63K-A	1	63	63	770	15	10806688
	FNH1-80K-A		80	175	1,610	19	10807549
	FNH1-100K-A		100	320	3,050	21	10807553
	FNH1-125K-A		125	695	6,360	25	10807554
	FNH1-160K-A		160	1,460	13,090	29.5	10808545
	FNH1-200K-A		200	2,420	16,380	34.5	10809133
	FNH1-250K-A		250	4,920	29,810	40.5	10809489
	FNH1-315K-A		315	7,310	39,590	48	10809575
	FNH1-350K-A		350	11,430	64,870	52	10814896
	FNH1-400K-A		400	16,950	98,860	59	10815073
	FNH2-250K-A	2	250	3,390	24,370	45.5	10823581
	FNH2-315K-A		315	4,760	32,780	57.5	10823936
	FNH2-350K-A		350	7,990	60,150	66.5	10823996
	FNH2-400K-A		400	14,850	92,060	77	10824053
	FNH2-450K-A		450	18,420	132,990	91	10824055
	FNH2-500K-A		500	23,040	146,250	103	10824109
	FNH2-630K-A		630	49,130	298,820	127	10824110
	FNH2-710K-A		710	57,910	378,450	137.5	11393547
	FNH3-400K-A	3	400	6,520	66,830	70	10831217
	FNH3-450K-A		450	15,090	105,220	74.5	10832962
	FNH3-500K-A		500	18,770	107,200	79.5	10833056
	FNH3-630K-A		630	32,500	222,540	94	10833101
	FNH3-710K-A		710	56,620	308,900	105	10833591
	FNH3-800K-A		800	87,390	420,500	117	10833726
	FNH3-900K-A		900	129,380	636,150	130	11393564
	FNH3-1000K-A		1,000	197,890	893,350	150	11393565

Note: to install the fuse on a BNH base and FSW/RFW switch-disconnector, see the current reduction factor table on page 17.

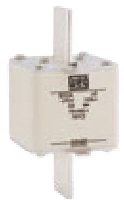
Reduction factor for I^2t at voltages below 690 VAC											
Voltage (V)	480	460	440	400	345	300	277	266	254	220	127
Factor to be applied	0.68	0.64	0.62	0.58	0.53	0.5	0.48	0.46	0.45	0.43	0.43

Note: for other voltage values, use the “I2t variation x applied voltage” curve on page 16.

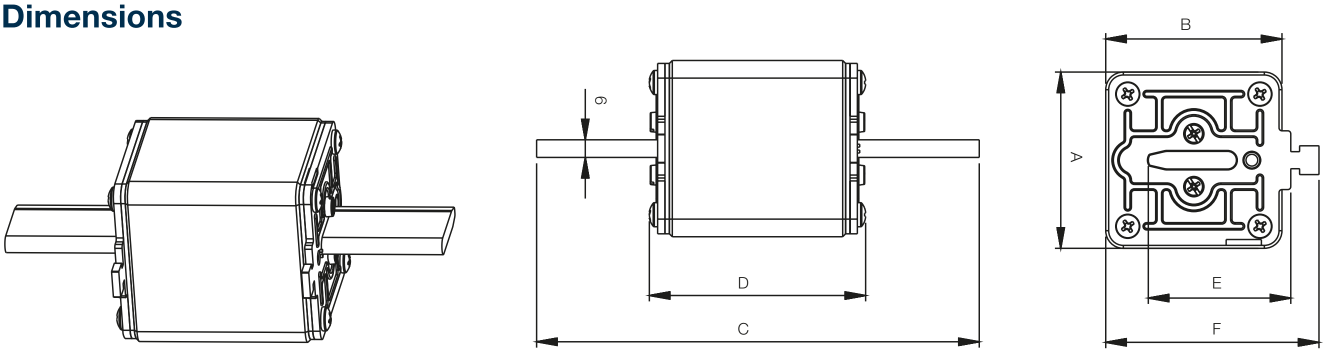
aR class fuses - NH blade contact type

Technical characteristics

50 kA / 800 V_{AC}

	Technical characteristics						Code
	Reference	Size	Current (A)	I^2t - pre-arc	I^2t total - arc	Dissipated power (W) $0.8I_n$	
				800 V_{AC} (A^2s)			
	FNH1-63S-A08	1	63	70	1,640	15	16538599
	FNH1-80S-A08		80	220	3,090	19	16539010
	FNH1-100S-A08		100	450	5,540	21	16539011
	FNH1-125S-A08		125	925	7,270	25	16539012
	FNH1-160S-A08		160	1,530	16,500	29.5	16539013
	FNH1-200S-A08		200	3,170	17,700	34.5	16539014
	FNH1-250S-A08		250	5,570	38,700	40.5	16539016
	FNH1-315S-A08		315	7,290	49,000	48	16539017
	FNH1-350S-A08		350	12,400	75,800	52	16854118
	FNH1-400S-A08		400	18,100	109,000	59	16854120
	FNH3-400S-A08	3	400	13,000	83,600	70	16854121
	FNH3-450S-A08		450	16,900	126,000	74.5	17197170
	FNH3-500S-A08		500	19,500	143,400	79.5	17197172
	FNH3-630S-A08		630	45,200	290,300	94	17197173
	FNH3-710S-A08		710	51,900	315,400	105	17197175
	FNH3-800S-A08		800	83,700	576,000	117	17197177
	FNH3-900S-A08		900	148,000	946,000	130	17197228

Dimensions



Class	Size	Current range (A)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	Weight (kg)
aR	000	20 to 125	20.5	40	78.5	54	35	51	0.11
	00	20 to 250	29.5	47.5	78.5	54	35	59.5	0.19
	1	63 to 400	51.5	51.5	135	73	40	63.5	0.54
	2	250 to 710	60	60	150	73	48	72.5	0.73
	3	400 to 1,000	73.60	73.60	150	73	60	87.5	1.01

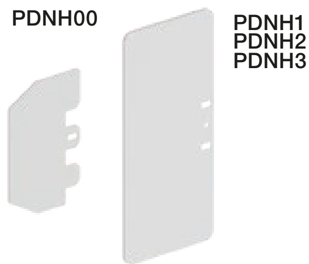
aR class fuses - NH blade contact type

Accessories

Fixing base of NH fuse blade contact (aR)

Reference	Fuse size	Code
BNH00-160	000 and 00	10409904
BNH1-250	1	10409905
BNH2-400	2	10185938
BNH3-630	3	10185939

Partition wall

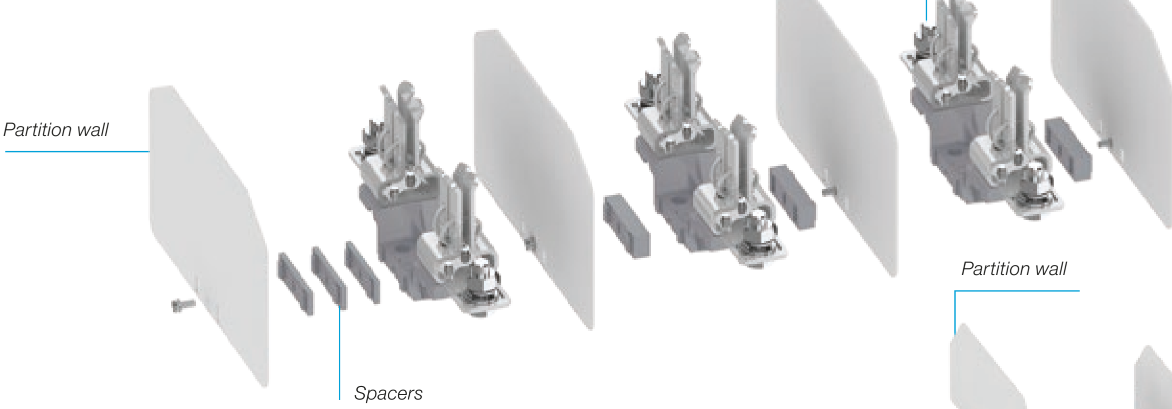


Reference	Fuse size	Code
PDNH00	000 and 00	10185940
PDNH1	1	10185941
PDNH2	2	10185942
PDNH3	3	10185943

Bases assembly partition walls

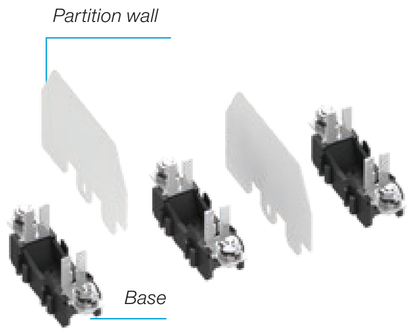
FNH1 / FNH2 / FNH3

- PDNH1: FNH1 mounting without spacer
- PDNH2: FNH2 assembly with one spacer
- PDNH3: FNH3 assembly with three spacers/partition insulating wall



FNH000 / FNH00

The BNH00 bases must be integrated only when the PDNH00 partition walls are used. In both assembly types, it is essential to keep always 25 mm between the live parts of the fuse and adjacent equipment.



NH fuse handle

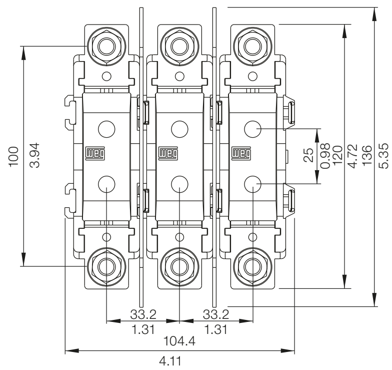
Reference	Code
PSFNH	10185944

aR class fuses - NH blade contact type

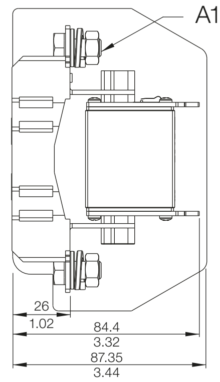
Dimensions

Base for BNH fuse and PDNH partition walls

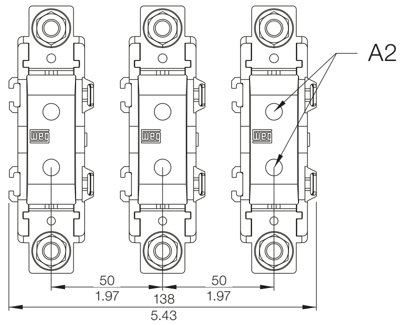
BNH00 + FNH000 + PDNH00
BNH00 + FNH00 + PDNH00



BNH00 + FNH000 + PDNH00
BNH00 + FNH00 + PDNH00

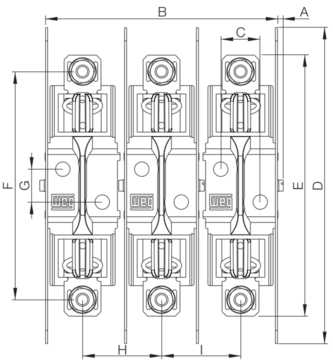


BNH00

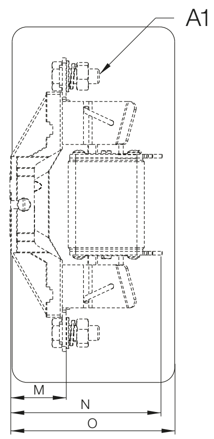


It is essential to keep always 25 mm between the live parts of the fuses and surrounding equipment.

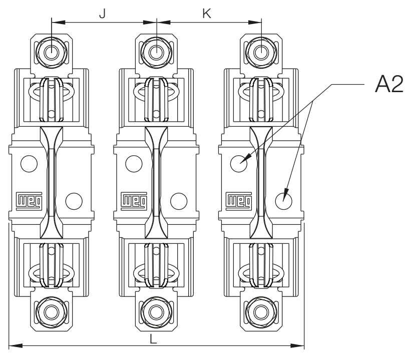
BNH1 + PDNH1
BNH2 + PDNH2
BNH3 + PDNH3



BNH1 + FNH1 + PDNH1
BNH2 + FNH2 + PDNH2
BNH3 + FNH3 + PDNH3



BNH1
BNH2
BNH3



mm in	BNH1 + FNH1	BNHH1 + FNH1 + PDNH1	BNH2 + FNH2	BNH2 + FNH2 + PDNH2	BNH3 + FNH3	BNH3 + FNH3 + PDNH3
A	3.5 0.14	-	3.5 0.14	-	3.5 0.14	-
B	-	180 7.09	-	200.2 7.88	-	245 9.65
C	30 1.18					
D	240 9.45					
E	198.3 7.81		225 8.86		240 9.45	
F	173.3 6.82		200 7.87		210 8.27	
G	25 0.98					
H	-	60 2.36	-	70 2.76	-	85 3.35
I						
J	70 2.76	-	80 3.15	-	95 3.74	-
K						
L	197 7.76	-	217 8.54	-	261 10.28	-
M	38 1.50		38.5 1.52		39 1.54	
N	102 4.02		111.5 4.39		112 4.41	
0	111.5 4.39		115.5 4.55		132.8 5.23	

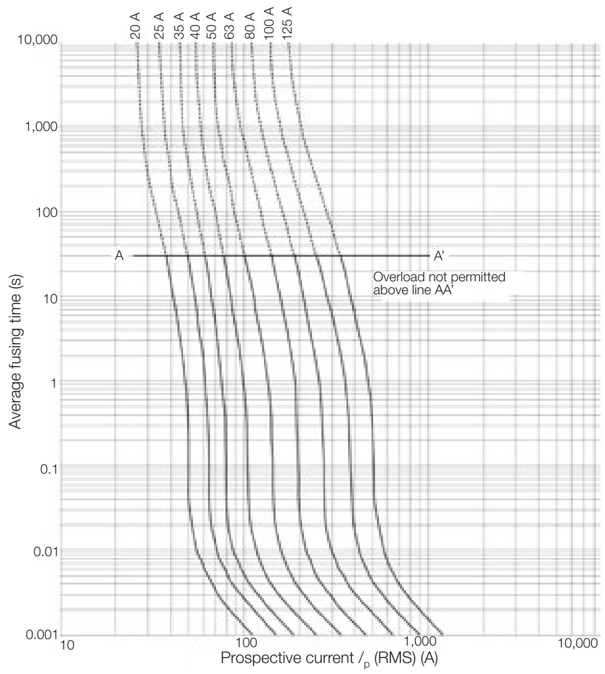
Installation			BNH00	BNH1	BNH2	BNH3
Fixing to the panel	Screw		M6	M8	M8	M8
	Tightening torque	N.M.	5	10	10	10
		lb.in.	44	88	88	88
Electrical connections	Screw		M8	M10	M10	M12
	Tightening torque	N.M.	10	21	21	38
		lb.in.	88	185	185	336
	Maximum terminal/ busbar thickness	(mm)	4	10	10	11.5
		(in)	0.16	0.4	0.4	0.45

aR class fuses - NH blade contact type

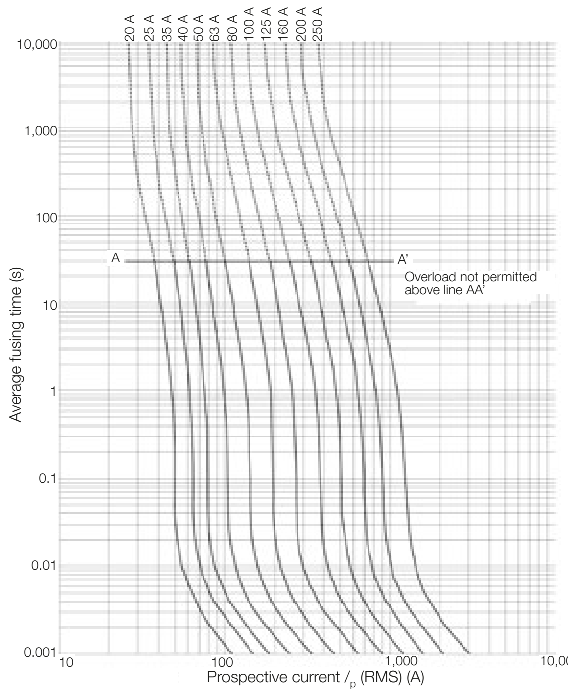
Time x current curves

The time x current curves provide a graphical representation of the average fusing time of the fuse elements at ambient temperature, also called pre-arc time, in relation to the rms prospective current IP. The FNH aR fuses with blade contact cannot operate above the 30-second time represented by line AA'. In order to protect the fuse against exposure to a condition above the line AA', an overload protection device must be used.

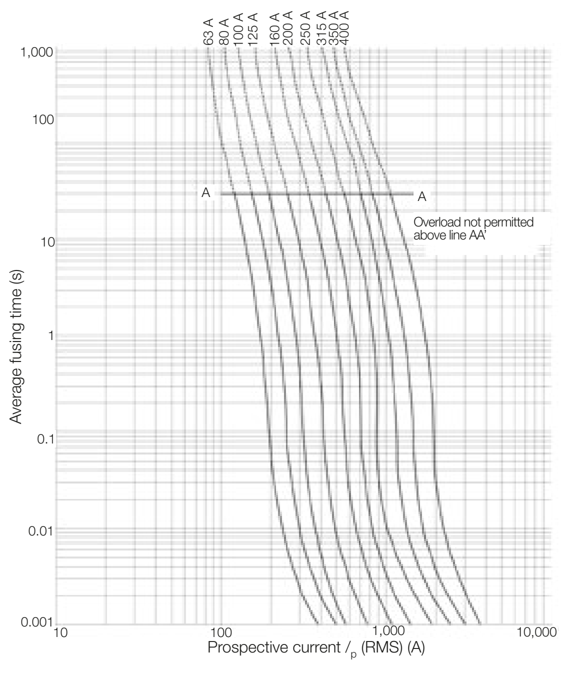
690 VAC FNH000 aR fuses



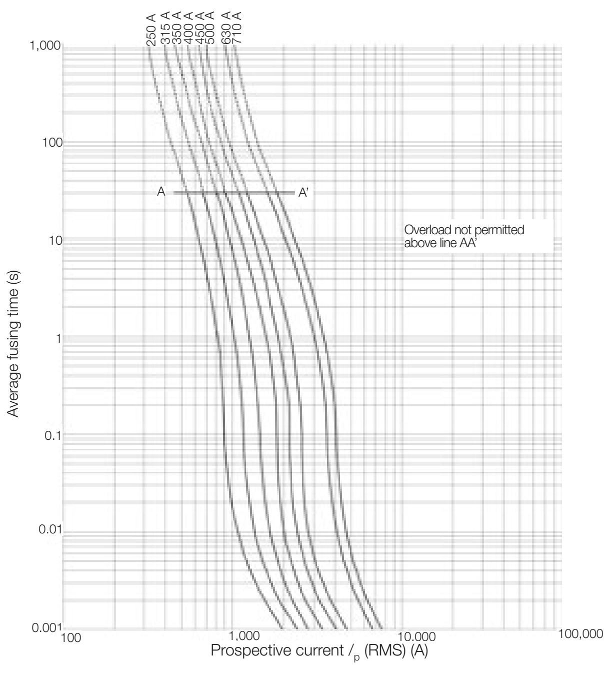
690 VAC FNH00 aR fuses



690 VAC FNH1 aR fuses



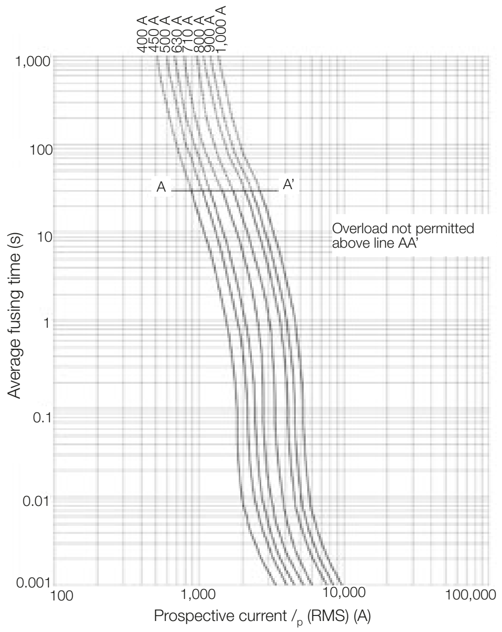
690 VAC FNH2 aR fuses



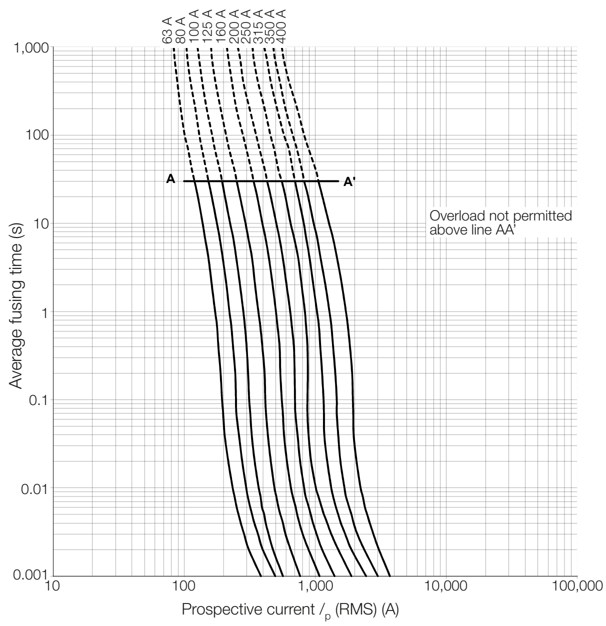
aR class fuses - NH blade contact type

Time x current curves

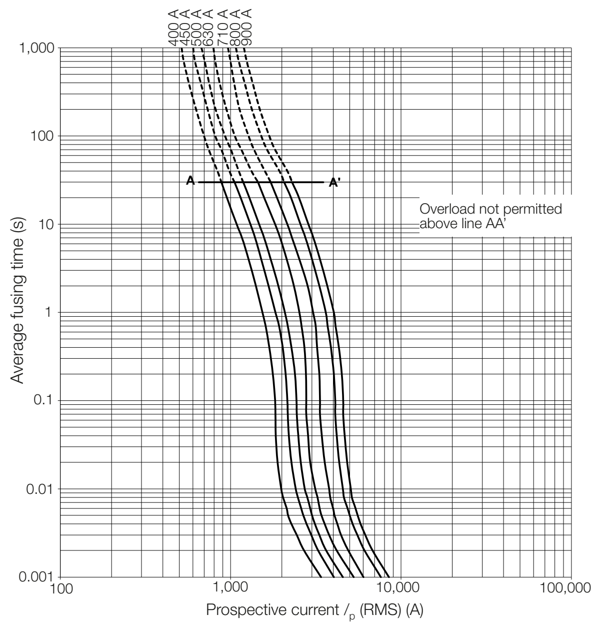
690 VAC FNH3 aR fuses



800 VAC FNH1 aR fuses



800 VAC FNH3 aR fuses



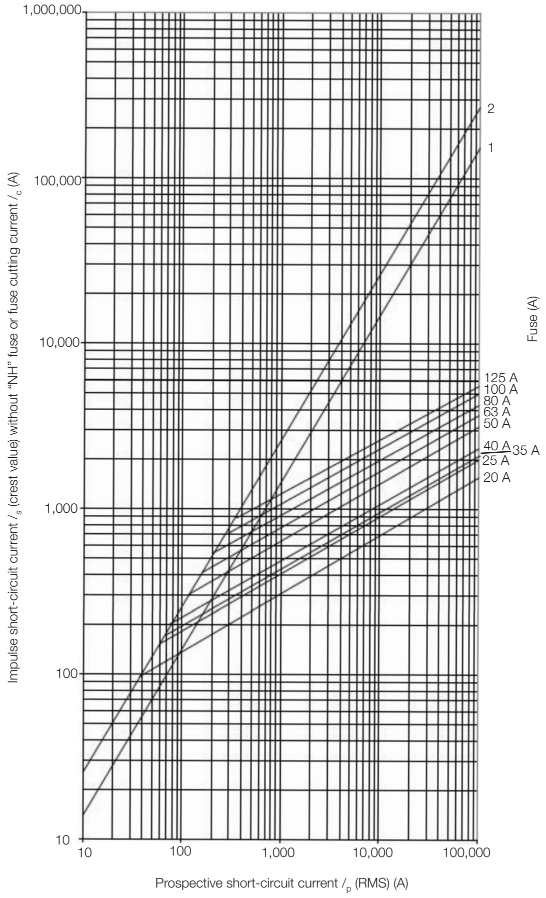
aR class fuses - NH blade contact type

Current limitation curve

The current limitation curves show the maximum current peak during a short-circuit in relation to the RMS value of the prospective short-circuit current.

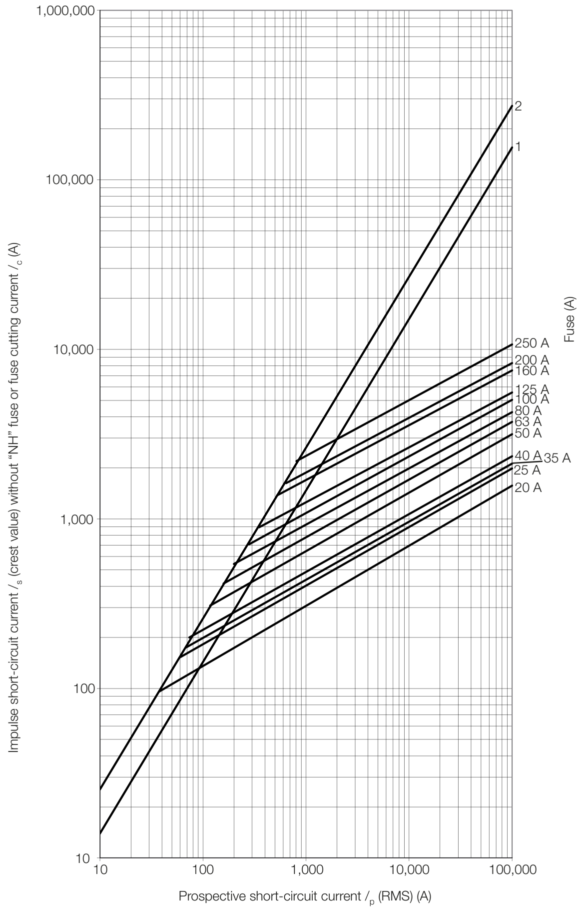
690 VAC FNH000 aR fuses

1 - Symmetric short-circuit current
2 - Asymmetric short-circuit current



690 VAC FNH00 aR fuses

1 - Symmetric short-circuit current $I_c = \sqrt{2}\, I_p$
2 - Asymmetric short-circuit current $I_c = 2.5 I_p$

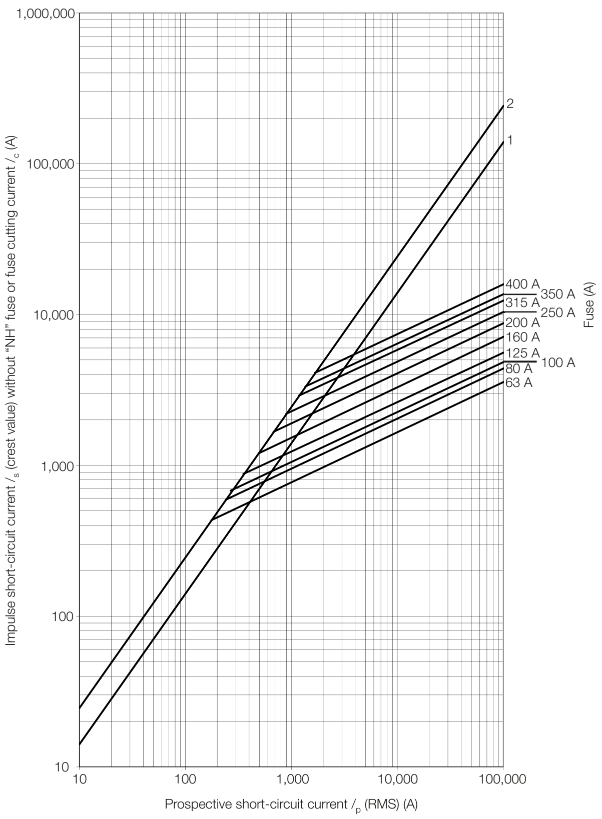


aR class fuses - NH blade contact type

Current limitation curve

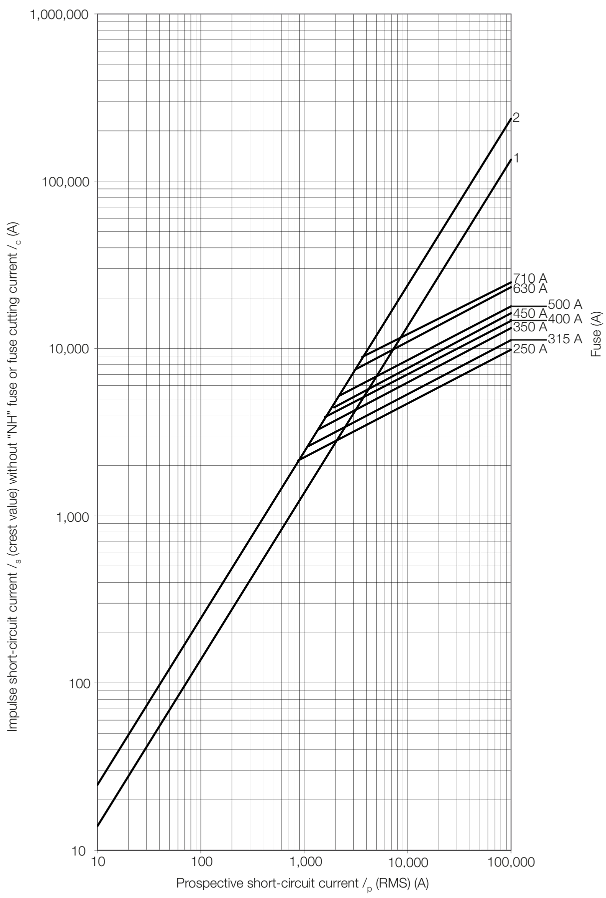
690 VAC FNH1 aR fuses

1 - Symmetric short-circuit current $I_c = \sqrt{2}\,I_p$
2 - Asymmetric short-circuit current $I_c = 2.5I_p$



690 VAC FNH2 aR fuses

1 - Symmetric short-circuit current $I_c = \sqrt{2}\,I_p$
2 - Asymmetric short-circuit current $I_c = 2.5I_p$



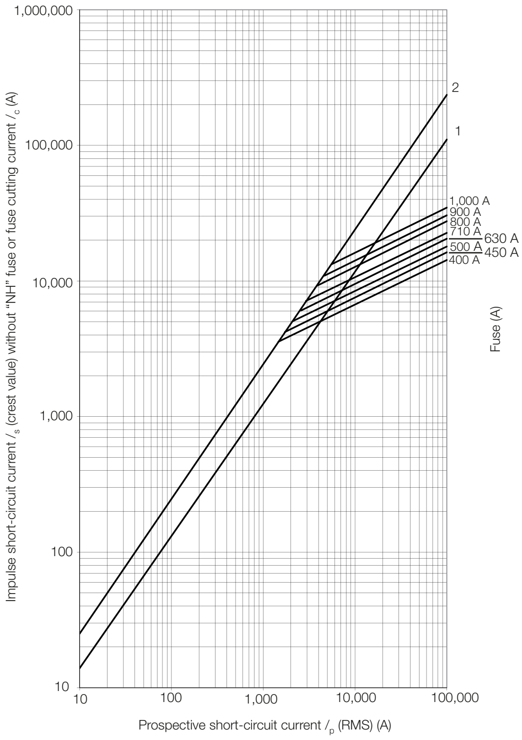
aR class fuses - NH blade contact type

Current limitation curve

690 VAC FNH3 aR fuses

1 - Symmetric short-circuit current $I_c = \sqrt{2}\, I_p$

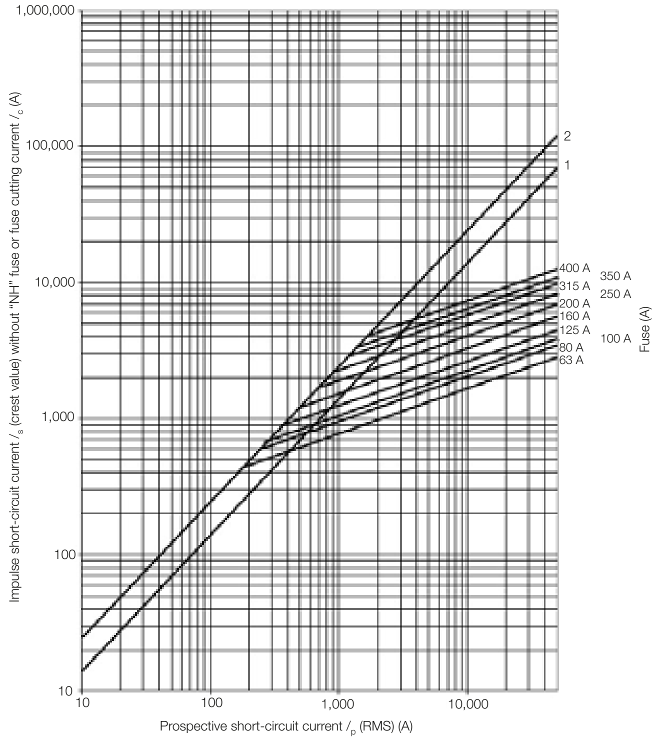
2 - Asymmetric short-circuit current $I_c = 2.5 I_p$



800 VAC FNH1 aR fuses

1 - Symmetric short-circuit current $I_c = \sqrt{2}\, I_p$

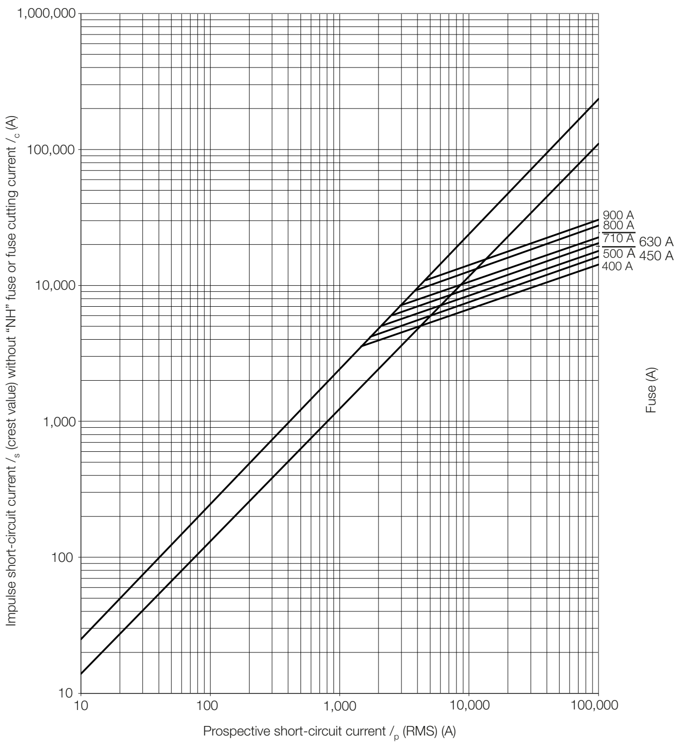
2 - Asymmetric short-circuit current $I_c = 2.5 I_p$



800 VAC FNH3 aR fuses

1 - Symmetric short-circuit current $I_c = \sqrt{2}\, I_p$

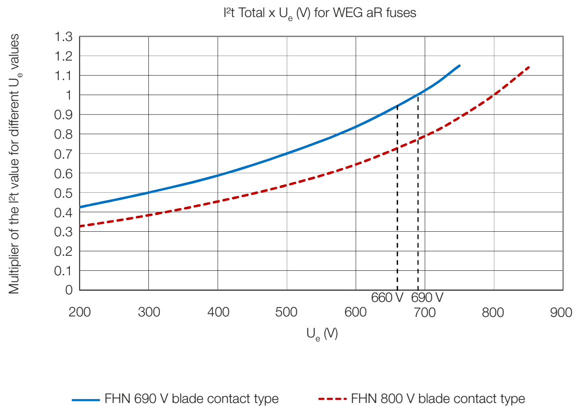
2 - Asymmetric short-circuit current $I_c = 2.5 I_p$



aR class fuses - NH blade contact type

Total I²t variation x applied voltage

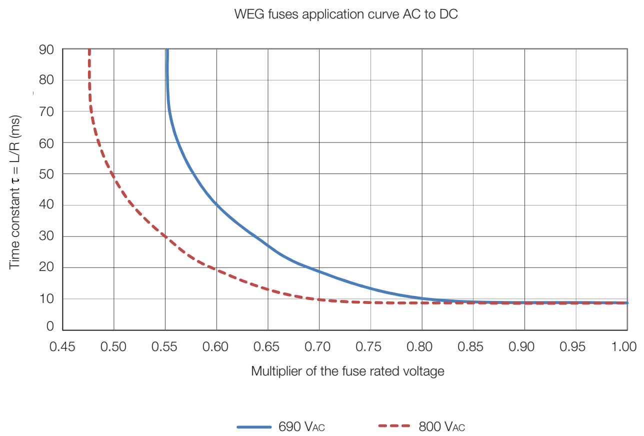
The presented I²t values refer to 690 VAC. For other voltages, the I²t varies according to the chart below.



New I²t total according to the applied voltage = multiplier x I²t total of the fuse

Application in DC voltage - definition of the DC fuse voltage

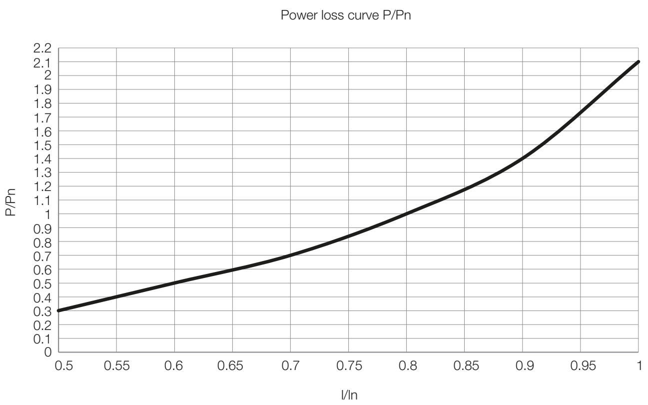
The curve indicates the rated voltage multiplier factor VAC of the fuse in order to obtain the maximum value of VDC voltage for different values of time constants L/R (rms) of the circuit.



VDC = "multiplier" x nominal voltage VAC

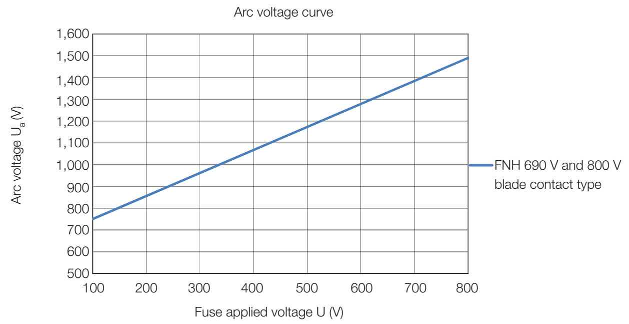
Coefficient for power loss

The curve determines the multiplier factor to calculate the power loss of the fuse for different multiples of the rated current.



Arc voltage curve

During the fault current breaking, an electric arc is formed on each strangulation of the fuse element, thus generating an arc voltage. This arc voltage varies according to the applied voltage on the fuse.



aR class fuses - NH blade contact type

Current deratings for installation of NH aR fuses with blade contact on BNH fuse base or FSW switch-disconnectors

Due to the high power dissipated by aR fuses, you must use the derating that determines the maximum allowable current for WEG FNH aR fuses with blade contacts installed on individual fixing bases or on the switch-disconnector.

Current deratings for installation of NH aR fuses with blade contact on BNH fuse base or FSW switch-disconnectors						
aR fuse reference	Fuse size	aR fuse rated current I_n (A)	Reduction factor			
			For installation in fuse base - BNH		For installation in FSW switch-disconnector	
			Reduction factor	Fuse base reference	Factor (FSW)	Reference FSW
FNH000-20K-A	000	20	1.00	BNH00-160 (10409904)	1.00	FSW100-3 (11884107)
FNH000-25K-A		25	1.00		1.00	
FNH000-35K-A		35	1.00		1.00	
FNH000-40K-A		40	1.00		1.00	
FNH000-50K-A		50	1.00		0.90	
FNH000-63K-A		63	1.00		0.85	
FNH000-80K-A		80	0.90		0.70	
FNH000-100K-A		100	0.85		0.70	
FNH000-125K-A		125	0.80		0.65	
FNH00-20K-A	00	20	1.00	BNH00-160 (10409904)	1.00	FSW160-3 (11884182)
FNH00-25K-A		25	1.00		1.00	
FNH00-35K-A		35	1.00		1.00	
FNH00-40K-A		40	1.00		1.00	
FNH00-50K-A		50	1.00		1.00	
FNH00-63K-A		63	1.00		1.00	
FNH00-80K-A		80	1.00		0.95	
FNH00-100K-A		100	1.00		0.90	
FNH00-125K-A		125	1.00		0.85	
FNH00-160K-A		160	0.90		0.75	
FNH00-200K-A		200	0.85		0.70	
FNH00-250K-A		250	0.80		0.60	
FNH1-63K-A	1	63	1.00	BNH1-250 (10409905)	0.95	FSW250-3 (11884179)
FNH1-80K-A		80	0.95		0.85	
FNH1-100K-A		100	0.95		0.85	
FNH1-125K-A		125	0.90		0.80	
FNH1-160K-A		160	0.85		0.75	
FNH1-200K-A		200	0.80		0.70	
FNH1-250K-A		250	0.75		0.70	
FNH1-315K-A		315	0.75		0.65	
FNH1-350K-A		350	0.70		0.65	
FNH1-400K-A		400	0.70		0.60	
FNH2-250K-A	2	250	0.90	BNH2-400 (10185938)	0.80	FSW400-3 (11884180)
FNH2-315K-A		315	0.90		0.80	
FNH2-350K-A		350	0.85		0.75	
FNH2-400K-A		400	0.80		0.70	
FNH2-450K-A		450	0.80		0.70	
FNH2-500K-A		500	0.75		0.65	
FNH2-630K-A		630	0.70		0.60	
FNH2-710K-A		710	0.70		0.55	
FNH3-400K-A	3	400	0.80	BNH3-630 (10185939)	0.75	FSW630-3 (11884181)
FNH3-450K-A		450	0.80		0.75	
FNH3-500K-A		500	0.75		0.70	
FNH3-630K-A		630	0.75		0.65	
FNH3-710K-A		710	0.75		0.65	
FNH3-800K-A		800	0.75		0.60	
FNH3-900K-A		900	0.70		0.55	
FNH3-1000K-A		1,000	0.63		0.55	

Notes: 1) BNH fuse bases allow the installation of 690 and 800 V_{AC} fuses.
2) FSW disconnectors do not allow the installation of 800 V_{AC} fuses.
Examples: how to calculate the maximum load current (continuous operation) for the fuse:
Considering that the dimensioned fuse is FNH2-630K-A (630 A, size 2).
Option 1 – installed on BNH2-400. The maximum continuous operation current the fuse withstands will be 630 A x 0.7 = 441 A.
Option 2 – installed on FSW400-3 switch-disconnector. The maximum continuous operation current the fuse withstands will be 630 A x 0.6 = 378 A.

aR class fuses - NH Flush-end type

Technical characteristics

The aR high speed NH flush-end fuses are mounted in high-quality ceramic housings. They have impregnated quartz sand filling, fuse elements of pure silver, and silver plated copper connections, providing excellent electric insulation, mechanical strength, resistance against thermal shocks during the fuse actuation and reduced I²t values. Its structure is prepared for direct fixation to the copper bar, not requiring individual fixation bases or switch-disconnectors..

200 kA / 690 V_{AC}

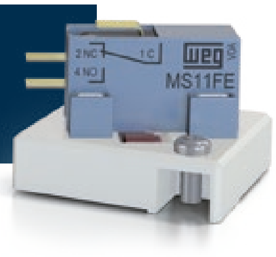
Technical characteristics of the aR FNH flush-end fuses

Reference	Size	Current I_n (A)	I²t pre-arc (A²s)	I²t arc (A²s)	Dissipated power (W) $1xI_n$	Code
			660 V_{AC} (A²s)			
FNH3FEM-450Y-A	3	450	32,000	94,500	115	12644962
FNH3FEM-500Y-A		500	40,000	129,000	115	12645317
FNH3FEM-550Y-A		550	66,500	177,000	120	12660187
FNH3FEM-630Y-A		630	84,000	227,000	120	12660583
FNH3FEM-700Y-A		700	100,000	309,000	125	12660657
FNH3FEM-800Y-A		800	140,500	470,000	135	12661660
FNH3FEM-900Y-A		900	180,000	650,000	135	12661662
FNH3FEM-1000Y-A		1,000	239,500	890,000	145	12661663
NH3FEM-1100Y-A		1,100	292,000	1,340,000	150	12661664
FNH3FEM-1250Y-A		1,250	385,000	1,970,000	155	12661665
FNH3FEM-1400Y-A		1,400	500,000	2,680,000	215	12661666
FNH23FEA-1000Y-A	23	1,000	151,000	446,000	230	12644745
FNH23FEA-1250Y-A		1,250	213,000	822,000	250	12661667
FNH23FEA-1400Y-A		1,400	279,000	1,050,000	270	12661688
FNH23FEA-1600Y-A		1,600	360,000	1,760,000	295	12661689
FNH23FEA-1800Y-A		1,800	529,000	2,430,000	320	12661690
FNH23FEA-2000Y-A		2,000	710,000	3,170,000	365	12661692

aR class fuses - NH flush-end type

Accessories

Auxiliary contact for flush-end fuse



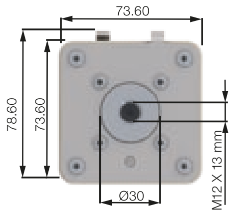
Reference	Description	Code
MS11FE	Microswitch fusible Flush-End MS11FE	12626734

Technical characteristics MS11FE			
Auxiliary contacts		1NC and 1NO	
Rated voltage (U_e)		250 VAC	
Rated current (I_e)		15 A	
WEG MS11FE microswitch technical data			
Breaking capacity	Resistive load	250 VAC @ 50/60 Hz	15 A
		8 VDC	15 A
		30 VDC	10 A
		125 VDC	0.6 A
		250 VDC	0.3 A
	Inductive load[1]	250 VAC @ 50/60 Hz	10 A
		8 VDC	10 A
		30 VDC	10 A
		125 VDC	0.6 A
		250 VDC	0.3 A
Dielectric withstand	Between non-continuous terminals		1,000 VAC
-	Between terminals and power circuit		1,500 VAC
Minimum voltage / permissible current - IEC 60947-5-4			20 V / 50 mA
Degree of protection according to IEC 60529			IP00
Flammability according to UL 94			V-0
Terminals			Faston #187

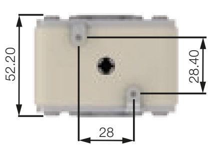
Note: 1) Power factor 0.4 min. (VAC) and time constant of 7ms max. (VDC).

Dimensions

FNH3FEM

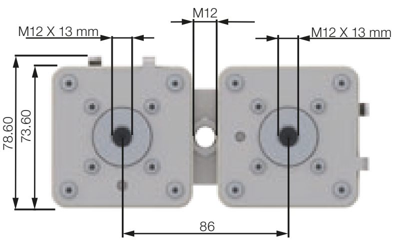


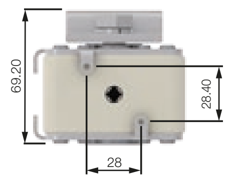
Mass: 820 g



FNH23FEA

Mass: 1,970 g



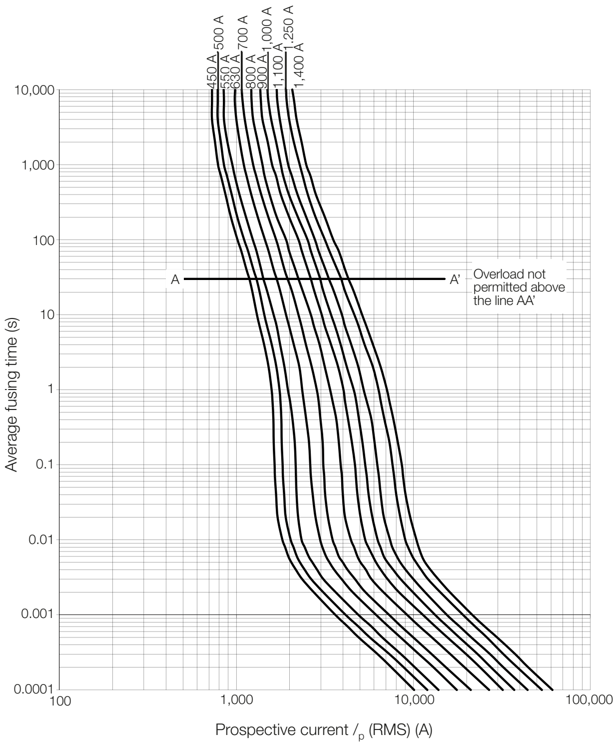


aR class fuses - NH flush-end type

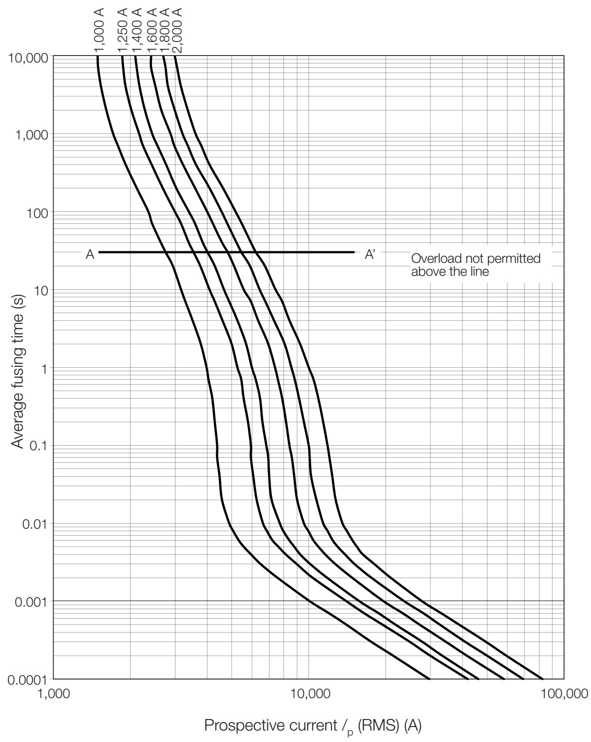
Time x current curves

The time x current curves provide a graphical representation of the average fusing time of the fuse elements at ambient temperature, also called pre-arc time, in relation to the rms prospective current IP. The FNH flush-end fuses cannot operate above the 30-second time represented by line AA'. In order to protect the fuse against exposure to a condition above the line AA', an overload protection device must be used.

FNH3FEM fuse



FNH23FEA fuse



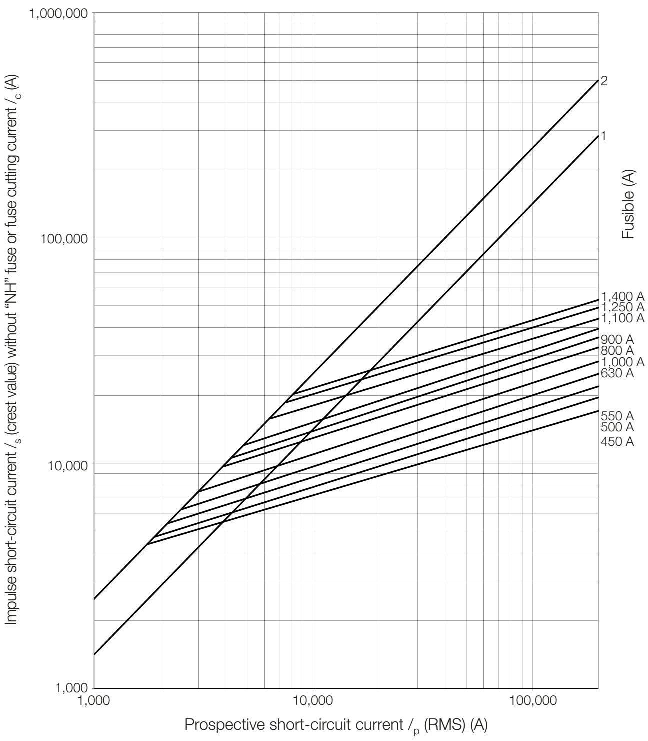
aR class fuses - NH flush-end type

Current limitation curves

The current limitation curves show the maximum current peak during a short-circuit in relation to the RMS value of the prospective short-circuit current.

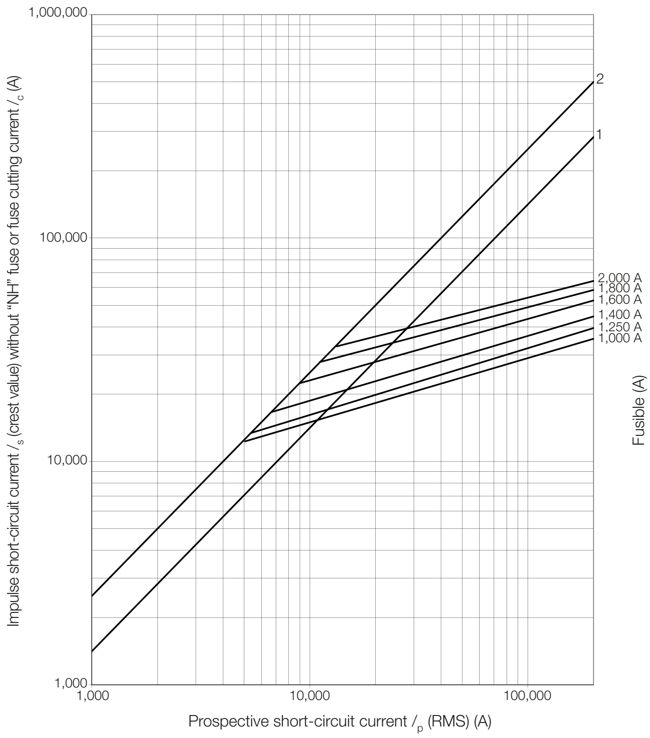
FNH3FEM fuse

1 - Symmetric short-circuit current $I_c = \sqrt{2}\,I_p$
2 - Asymmetric short-circuit current $I_c = 2.5I_p$



FNH23FEA fuse

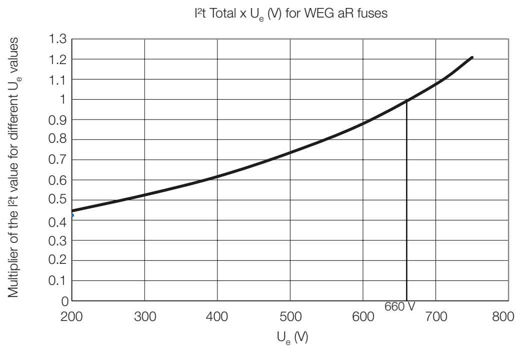
1 - Symmetric short-circuit current $I_c = \sqrt{2}\,I_p$
2 - Asymmetric short-circuit current $I_c = 2.5I_p$



aR class fuses - NH flush-end type

Total I²t variation x applied voltage

The presented I²t values refer to 690 VAC. For other voltages, the I²t reduces according to the chart below.

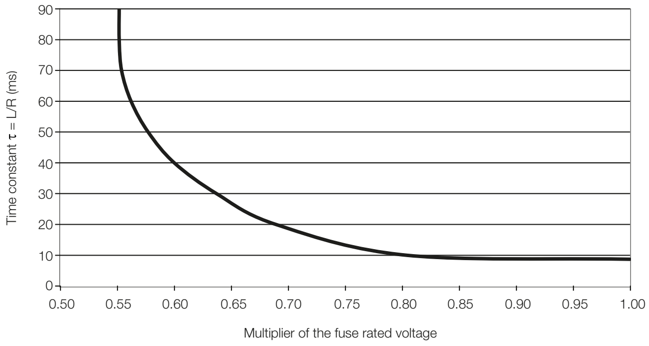


Application in DC voltage - definition of the DC fuse voltage

The curve indicates the rated voltage multiplier factor VAC of the fuse in order to obtain the maximum value of VDC voltage for different values of time constants L/R (rms) of the circuit.

VDC = "multiplier" x 690 VAC

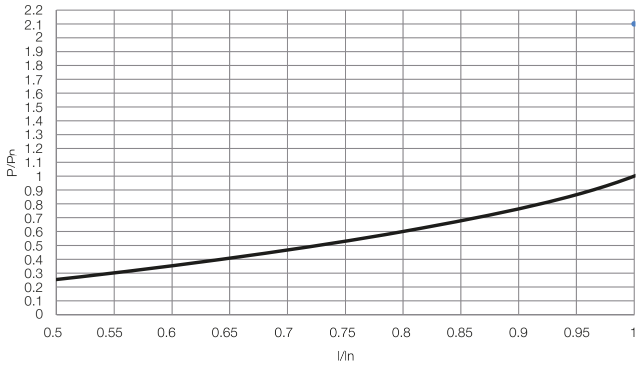
WEG fuses application curve AC to DC



Coefficient for power loss

The curve determines the multiplier factor to calculate the power loss of the fuse for different multiples of the rated current.

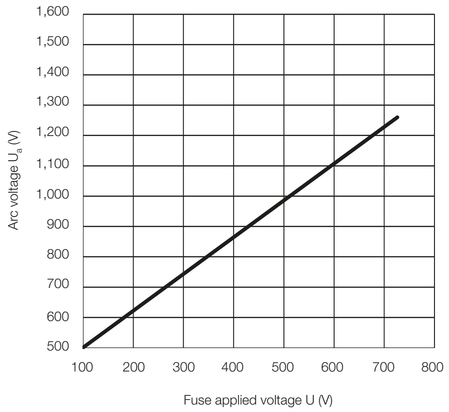
Power loss curve P/Pn



Arc voltage curve

During the fault current breaking, an electric arc is formed on each strangulation of the fuse element, thus generating an arc voltage. This arc voltage varies with the applied voltage on the fuse.

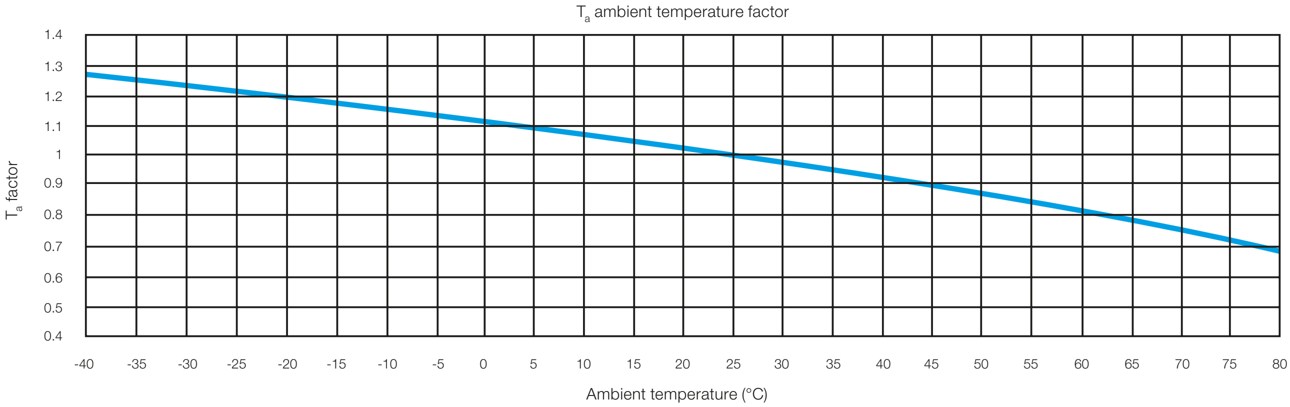
Arc voltage curve



aR class fuses - NH flush-end type

Ambient temperature

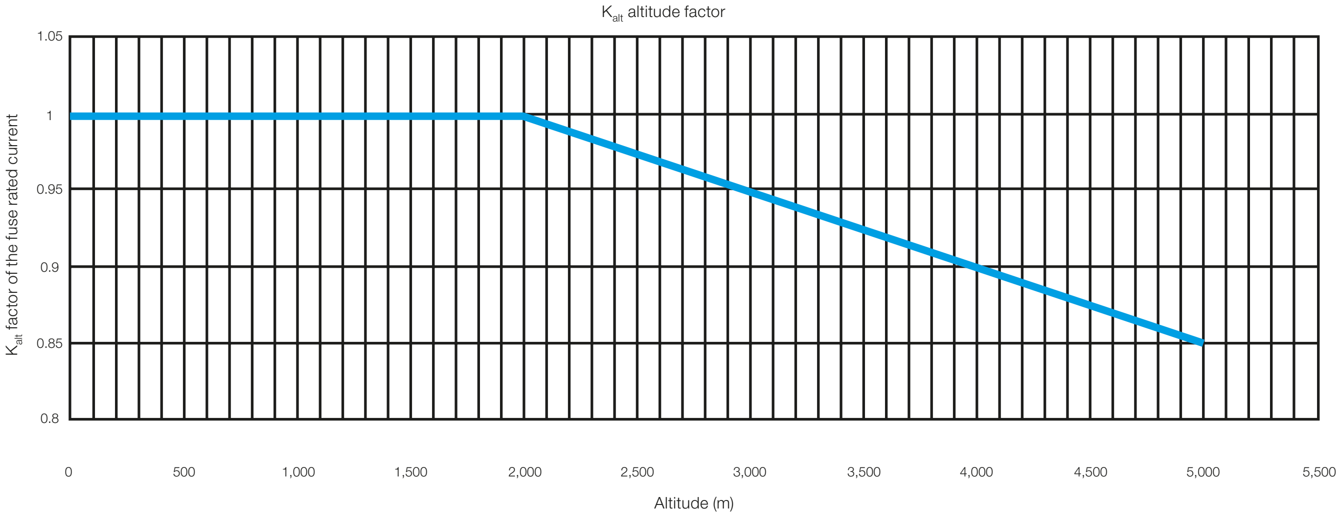
WEG aR fuses are sized to operate in environments at 25 ±5 °C. Fuses installed in environments with different temperatures have different heat dissipation rates, reducing or increasing their rated current. Thus, the T_a factor must be applied when sizing WEG aR fuses.



T_a ambient temperature factor of WEG aR fuses

Altitude

The installation of WEG aR fuses must not exceed 2,000 meters above sea level, according to IEC 60269. Above such altitude, the low atmospheric pressure directly influences the fuse thermal dissipation. Thus, the K_{alt} factor must be applied when sizing WEG aR fuses.



K_{alt} factor related to the application altitude of WEG aR fuses

Sizing criteria for high speed aR fuses with blade contact and flush-end

1. Conceptualization

aR class fuses, according to IEC 60269, feature low values of I^2t and are used for short-circuit protection in semiconductor applications. Due to this fact, they should not be used in situations of small overloads, since under such conditions the fuse may undergo thermal overloads, causing their improper operation and reduction of their breaking capacity.

Therefore, aR WEG high-speed fuses use a load constant A = 0.8. In other words, the fuse rated current must be at least 20% higher than the rated current of the circuit.

2. Sizing

Several conditions influence the current carrying capacity of a fuse, for example, ambient temperature, forced ventilation and the cross section of bars or cables. It is important to notice that cyclic overload events are the most critical condition which may cause the premature melting of the fuse element. Devices with built-in semiconductors and consequently high-speed fuses often undergo repeated or cyclical overloads. Under such conditions, the fuse element temperature rises, which may cause its melting or fatigue, resulting in improper operation. In order to avoid the consequences of cyclical overloads, WEG aR fuses must be sized so that their fusion current is preferably greater than the overload current for the same period, according to Table 1 below.

aR fuse connection type	Model	Fusion current multiples that the fuse must be greater than the overload current for the same period
Blade contact	FNH00	2.0
	FNH1	2.5
	FNH2	
	FNH3	
Flush end	FNH3FEM	2[1)]
	FNH23FEA	

Table 1 - Fusion current multiples that WEG aR fuse must be above the overload current for the same period.

Note: 1) Use 1.6 factor for WEG SSW line of soft-starters.

Example: for a rated current load of In = 150 A, which often has overloads of 450 A with 5-second durations, it is necessary to size the fuse for a fusion current of at least 900 A for 5s considering the size 00, or a current of 1,125 A for 5s for sizes 1, 2 or 3.

In general, the following points should be checked for the proper sizing of aR fuses:

- **Circuit current type - AC or DC.** For DC circuits, the maximum voltage on the fuse must respect the DC application characteristic curve of WEG fuses - see “aR and gL/gG Fuses” catalog.
- **I^2t of the fuse must be smaller than the I^2t value of the semiconductor.** This analysis must consider the fuse I^2t value in relation to the voltage applied to the fuse - see the “aR and gL/gG Fuses” catalogs and the value recommended by the semiconductor manufacturer.
- **The fuse rated current.** The rated current of the WEG aR fuse must be at least 20% greater than the load rated current for the conditions without any cyclical overload. In such cases, the current reduction values must also be observed for the fuses installed on individual bases and/or switch-disconnectors. For cyclical conditions, such as application of soft-starters and frequency inverters, the sizing of WEG aR fuses must respect the specifications of table 1 above.
- **Installation of aR fuses on BNH bases or SFW fuse switch-disconnectors.** The electric current value during constant operation applied to aR NH-type fuses must not exceed the “reduced” values for use on fuse bases and fuse switch-disconnectors - see the “Current reduction factors for installation of aR fuses on BNH fuse bases and SFW switch-disconnectors” in the “aR and gL/gG Fuses” catalog.
- **Association of fuses in parallel.** For this condition, in addition to complying with the specifications described in the previous topics, the fuses in parallel must have the same characteristics, that is, they must have the same size and rated current range to avoid unbalanced load. The bars or cables must have the same length to equalize all circuit impedances.

The I^2t value of fuses connected in parallel is calculated by:
$I^2t_{//} = I^2t \times n^2$, where:
$I^2t_{//}$ - is the value of I^2t of the equal fuse set connected in parallel.
I^2t – is the value of I^2t of the individual fuse, sized according to the circuit voltage.
n – is the number of equal fuses connected in parallel.

Sizing criteria for high speed aR fuses with blade contact and flush-end

3. Sizing examples

3.1 - SSW06 soft-starter (220 to 690 VAC) 130 A

Sizing a WEG aR fuse to protect a SSW06 soft-starter 130 A and its three-phase load with the following characteristics:

- Maximum I^2t of the fuse to protect the SSW06 130 A: 63,000 A^2s
- Supply voltage: Y 690 VAC
- Load rated current in continuous operation: I_n = 100 A
- Starting current: Ip = $3xI_n$ = 300 A
- Acceleration time: 30s

3.2 - Rated current of the fuse

The rated current of the fuse for continuous operation must be sized according to the equation below, considering:

- Rated current of the load = load I_{RMS} = 100 A
- For constant load, A1 = 0.8

$$\text{Thus: } I_n \geq \frac{I_{\text{RMS of the load}}}{A_1} = \frac{100}{0.8} = 125\ A$$

Therefore, considering only the constant load operation, a WEG fuse size 00 of **125 A** should be used for each phase, presenting I^2t = 6,350 A^2s at 690 V and derating factor of $1xI_n$, and $0.85xI_n$ when assembled on individual base and switch-disconnector respectively. However, as cyclic overloads of 300 A are present during the load starting, such fuse would operate improperly.

3.3 - Analysis of cyclic overload

The dimensioned fuse must observe Table 1 so as to avoid improper operation during the cyclic starting current of the load.

Thus, in case a WEG aR fuse size 00 is used, the fusion current in 30s must be at least 600 A (300 x 2). For WEG aR fuses sizes 1, 2 and 3, the fuse fusion current in 30 s must be at least 750 A (300 x 2.5). Through the time x current curves of the WEG aR fuse contained in the “aR and gL/gG Fuses” catalog, the conclusion is that the fuse for this application is **WEG aR FNH00 250 A** (which acts in 30 seconds with approximately 700 A).

3.4 - I^2t of the fuse

This fuse has I^2t of 43,980 at 690 V. As the power supply is in star connection, the fuse voltage is the phase voltage and not the line voltage of 690 V. Thus:

$$V_F = \frac{V_L}{\sqrt{3}} = \frac{690}{\sqrt{3}} = 398.3\ V$$

On the graphic “Variation of total I^2t x operating voltage” of the “aR and gL/gG Fuses” catalog, we observe that the I^2t value of WEG aR FNH00 250 A is reduced to 58% of the value at 690 V, resulting in 25,509 A^2s (0.58x43,980).

Specified fuse = FNH00-250K-A
For use on a SFW160-3 fuse switch-disconnector, we must check the maximum capacity of the switch with this fuse (see derating in the catalog). That is, the load current must not exceed the current limited by the fuse + switch-disconnector. In this case, the derating = 0.6.
The maximum allowed current in continuous operation is 250 x 0.6 = 150 A. As 150 A is greater than the load current (125 A), there is no limitation for the use of the **SFW160-3 + FNH00-250K-A**.

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Global Presence

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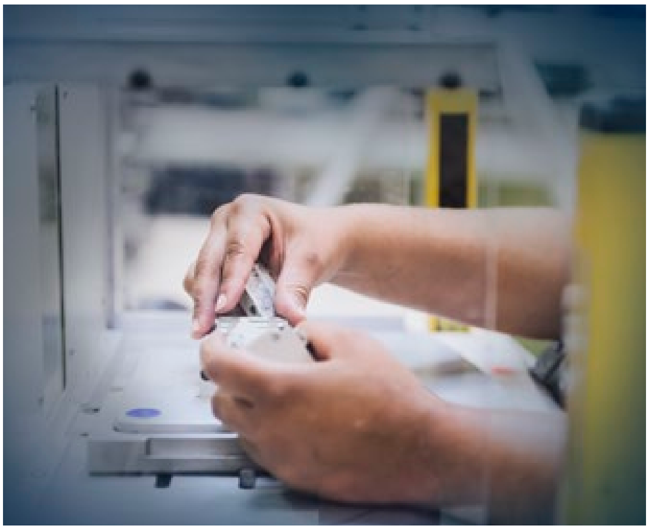
WEG's know-how guarantees our ***aR NH Blade Contact and NH Flush-End Fuses*** are the right choice for your application and business, assuring safety, efficiency and reliability.

Availability is to have a global support network

Partnership is to create solutions that suits your needs

Competitive edge is to unite technology and inovation



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