

PROTECTION OF PV INVERTERS



**New generation of NH gG fuse-links
 for cable protection in 800V a.c. system
 in standard NH sizes**

New directions in PV inverters development

New directions in PV inverters development...

PV inverters are getting larger and smarter, their characteristics better and better, they have become smart, safe, reliable and efficient.

Higher yields are reached by utilizing dynamic system efficiency optimization with intelligent technology. Achieved efficiency currently ranges above 98,5%. One of most important technical features of the new generation of PV inverters is 800V a.c. output voltage instead of 400V a.c. With this output voltage increase, we achieve a 75% decrease in a.c. connection wires losses. Yet, because of the increased output voltage modern PV central inverters demand a specially designed fuse-link for reliable short-circuit and over-current protection.

... and new fuse-links to answer the increased demands of their output protection

As one of the first among the producers of NH fuse-links, ETI has developed a new generation of NH gG fuse-links, specially designed for cable protection on 800V a.c. system voltage. With an innovative design of melting elements, adoption of high temperature and internal pressure resistant ceramic material, the final NH fuse-link construction can now be incorporated in a standard NH size dimensions.

At the moment ETI is offering sizes NH00, NH1 and NH3 gG fuse-links, from rated current 25A up to 250A, designed and tested on 800V a.c. with very low power dissipation and high breaking capacity. On a customer request, we are also ready to develop even higher rated currents.

Features and benefits

- ✓ Load switching capacity up to 800V a.c.
- ✓ Meets IEC photovoltaic standards
- ✓ In standard NH size dimensions
- ✓ Extremely low power dissipation
- ✓ High breaking capacity
- ✓ Designed to protect against a full range of overcurrents
- ✓ High temperature and internal pressure resistant ceramic material
- ✓ Innovative design of melting elements

Specifications

General characteristics	
Rated voltage	800V a.c.
Rated current	25A - 250A
Breaking capacity	50kA a.c. (NH1), 30kA a.c. (NH00, NH3)
Standards	IEC 60269-2
Characteristic	gG



Applications

- ✓ For cable protection on a.c. side of 1500V PV inverter

Fuse-link gG NV/NH 800V a.c.

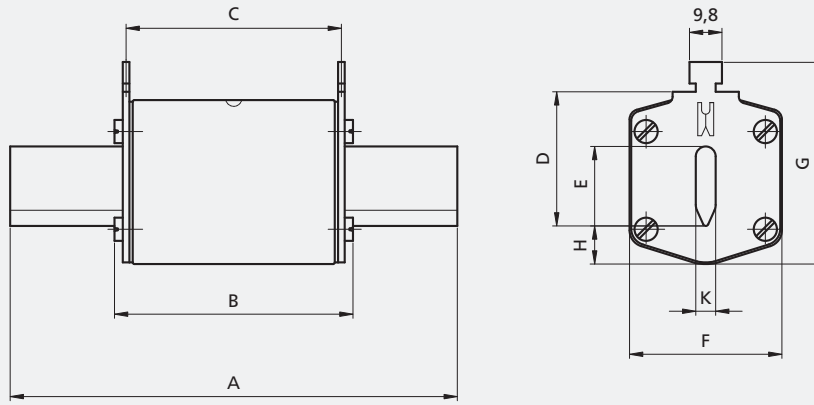
NV/NH gG 800V a.c.							
Size	I_n [A]	Standard indicator	Pre-arcing Joule integral [A ² s]	Operating Joule integral [A ² s]	Power dissipation [W]	Weight [g]	Packaging [pcs]
00	25	004184491	1.300	3.000	3,2	173	3/90
	35	004184492	2.000	6.000	3,8		
	40	004184493	2.500	7.000	4,0		
	50	004184494	4.000	11.000	5,4		
	63	004184495	9.000	19.000	7,0		
1	25	004184482*	560	9.000	3,2	430	3/24
	35	004184483*	2.200	24.000	3,4		
	40	004184484*	3.000	35.000	4,0		
	50	004184485*	3.500	40.000	4,4		
	63	004184486*	6.000	55.000	5,5		
	80	004184487*	12.000	77.000	6,9		
	100	004184488*	18.000	100.000	8,6		
	125	004184489*	31.000	145.000	9,7		
3	200	004184496	60.000	380.000	15,5	1200	3/15
	250	004184497	120.000	650.000	19,7		

*Kombi indicator



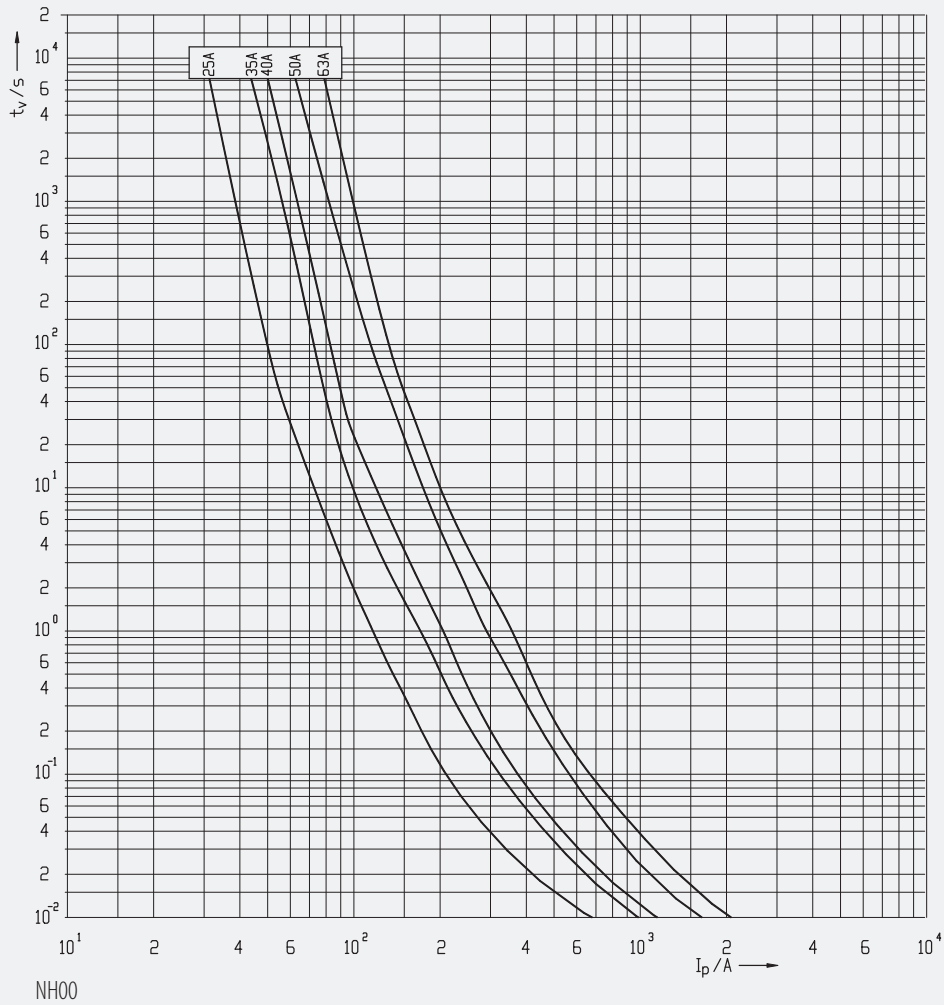
Recommended Accessories

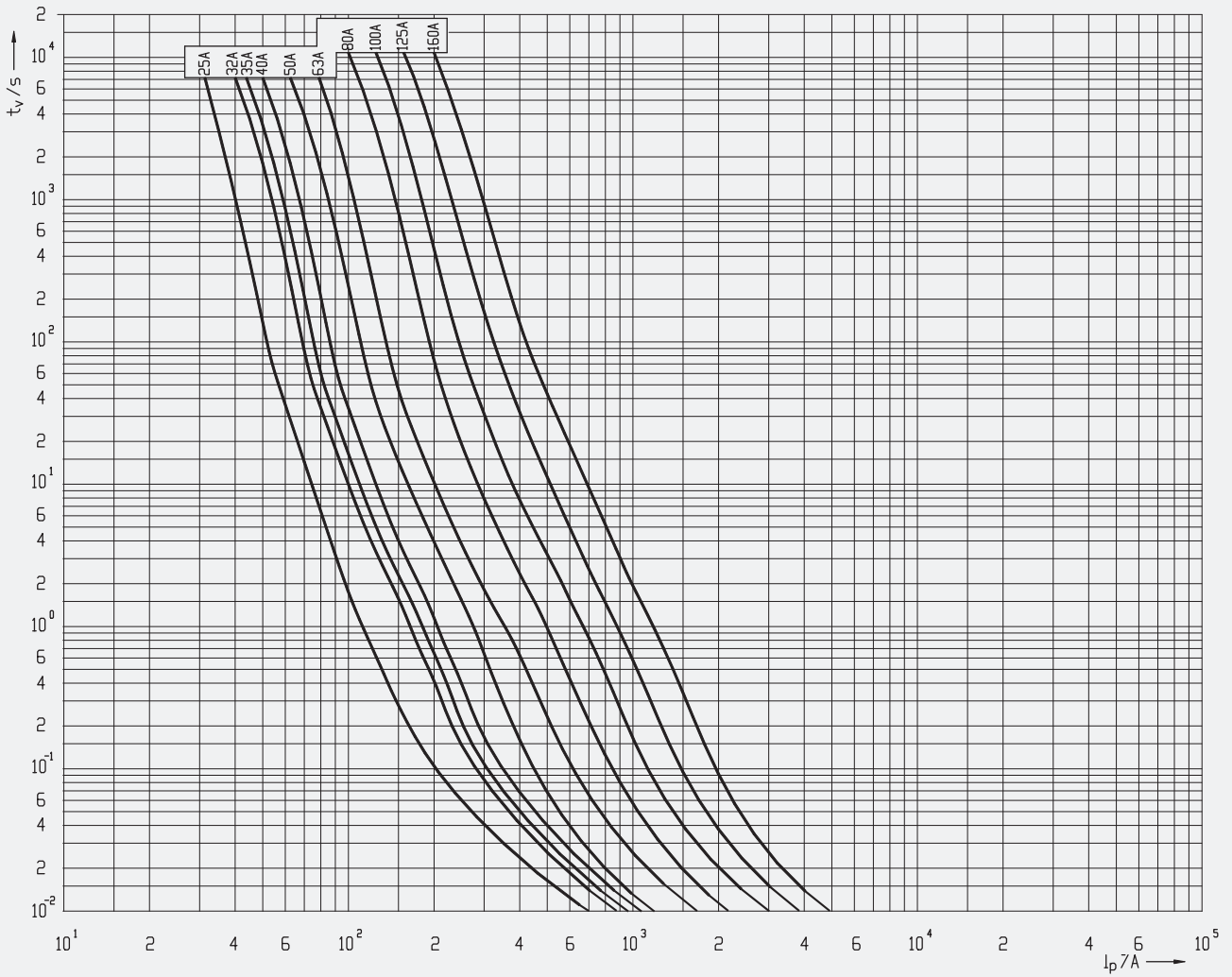
- ✎ Ceramic fuse bases
- ✎ Plastic fuse bases
- ✎ Fuse disconnectors



Size	Dimensions [mm]								
	A	B	C	D	E	F	G	H	K
00	79	53	47	35	15	28	56	12	6
1	135	72	65	40	20	46	65	14	6

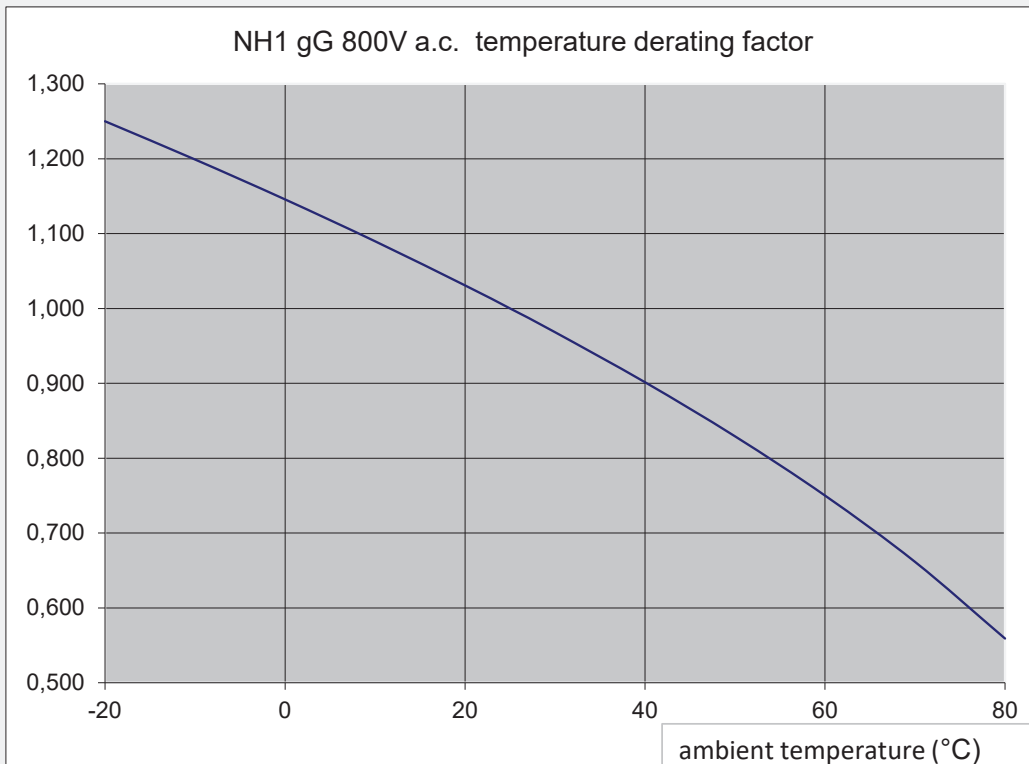
t-I characteristics

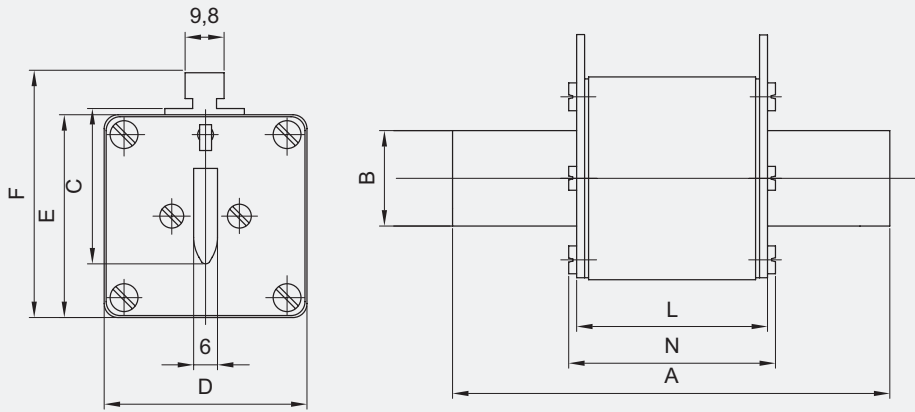




NH1

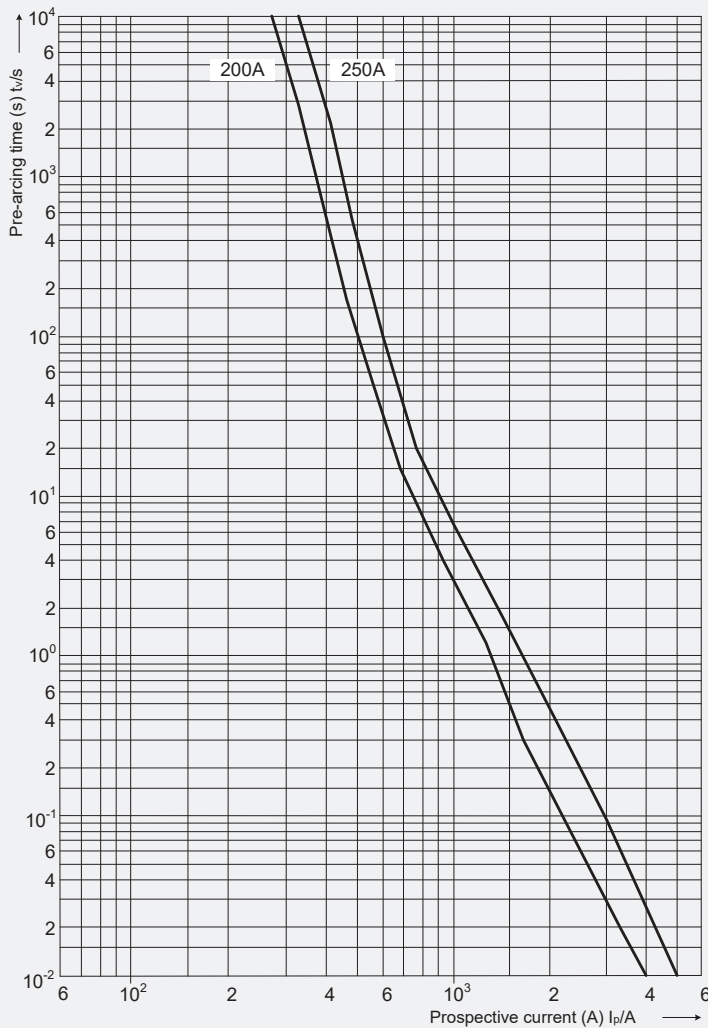
Temperature derating factor





Size	Dimensions [mm]								
	A	B	C	D	E	F	L	N	K
3	150	37	60	73	73	87	70	74	6

t-I characteristics

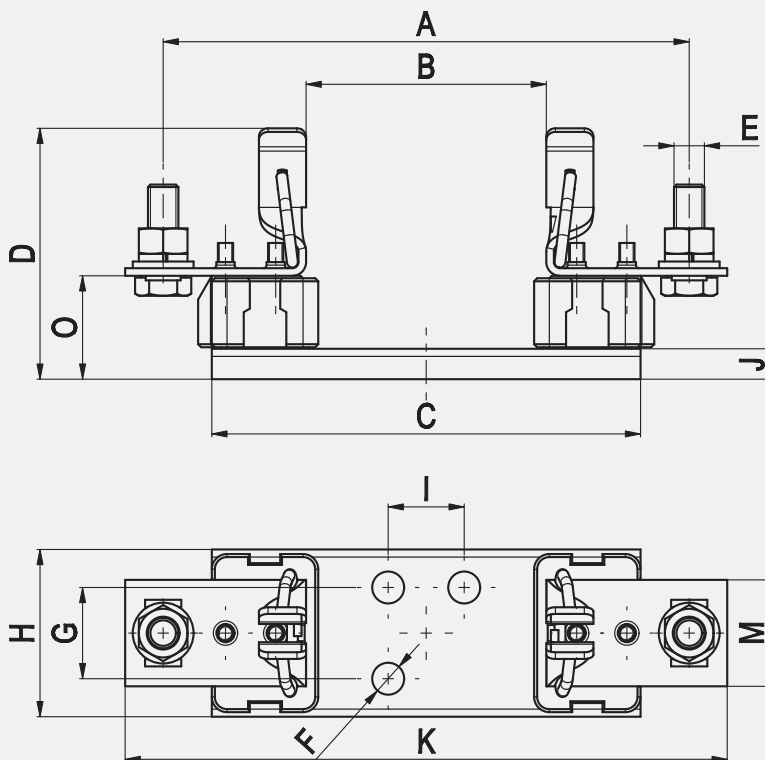


NH3

Fuse base PK1 and PK3 DC

General characteristics	
Rated voltage	1000V a.c./d.c.
Rated current	250A, 400A, 630A
Terminal torque	32 Nm
Cable lugs according to DIN 46235	25-150mm ² , 25-240mm ² , 25-300mm ²
Insulation class	C-VDE 0110
Degree of protection	IP00
Standards	EN 60269, IEC 60269, DIN VDE 0636, DIN 43620, DIN 43623

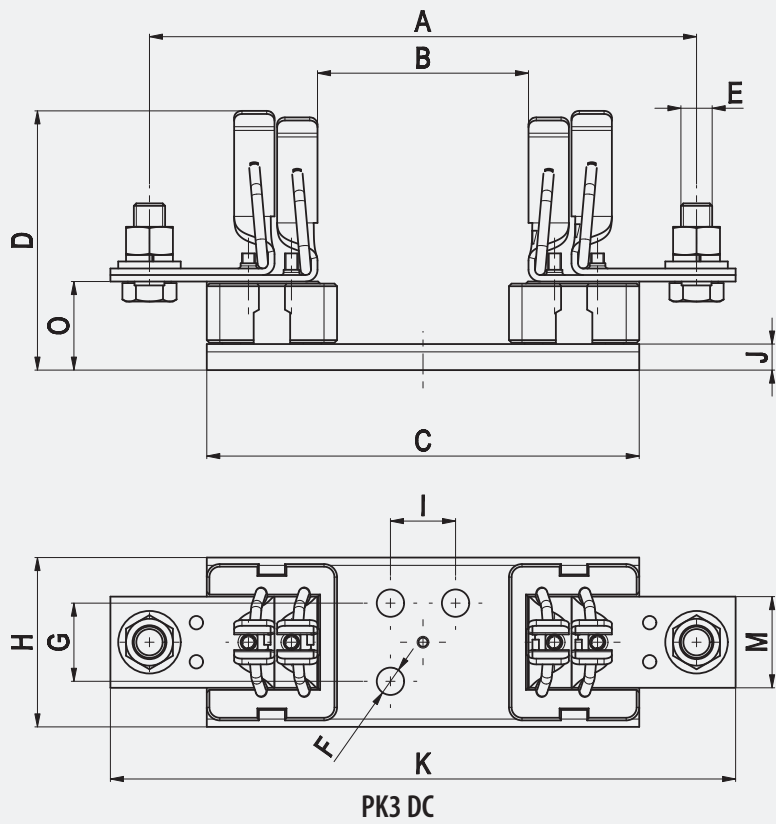
Fuse base PK					
Type	I _n [A]	Cable lugs according to DIN 46235 [mm ²]	Code No.	Weight [g]	Packaging [pcs]
PK 1 M10-M10 DC 1000V 1p	250	25-150	004122025	605	3/18
PK 3 M12-M12 DC 1000V 1p	630	25-300	004122023	1110	3/12



PK1 DC



Type	Dimensions [mm]												
	A	B	C	D	E	F	G	H	I	J	K	M	O
PK1 DC	175	80	141	82	M10-M10	Ø10,5	30	55,5	25	10	200	35	35



Type	Dimensions [mm]													
	A	B	C	D	E	F	G	H	I	J	K	M	O	
PK3 DC	210	80	166	99	M12-M12	Ø10,5	30	65	25	10	240	35	35	

Horizontal fuse-switch disconnecter type KVL

General characteristics											
Size		00			1			3			
Technical Characteristics											
Rated operational voltage	U_e	V	690 a.c.	800 a.c.	1000 a.c.	690 a.c.	800 a.c.	1000 a.c.	690 a.c.	800 a.c.	1000 a.c.
Rated operational current*	I_e	A	160	160	160	250	250	250	630	630	630
Conv. free air thermal current with fuse-links*	I_{th}	A	160			250			630		
Conv. free air thermal current with solid-links*	I_{th}	A	210			325			910		
Rated frequency	f	Hz	45-62			45-62			45-62		
Rated insulation voltage	U_i	V	800 a.c.			800 a.c.			800 a.c.		
Total power loss (without fuse)	P_v	W	1P - 3W, 3P - 9W			1P - 5W, 3P - 15W			1P - 17W, 3P - 51W		
Power loss at 80% I _{th} (without fuse-links), **	P_v	W	1P - 1,9W, 3P - 5,8W			1P - 3,2W, 3P - 9,6W			1P - 10,9W, 3P - 32,6W		
Rated impulse withstand voltage	U_{imp}	kV	8			8			8		
Utilisation category***			a.c.-21B	a.c.-20B	a.c.-20B	a.c.-21B	a.c.-20B	a.c.-20B	a.c.-21B	a.c.-20B	a.c.-20B
Rated conditional short-circuit current, ***, ****		kA	120 (500V), 100 (690V)			120 (500V), 100 (690V)			120 (500V), 100 (690V)		
Rated short-time withstand current	I_{cw}	kA	5/1s			8,6/1s			15/1s		
Fuse links											
Size - DIN VDE 0636-2	-	-	000/00			1			3		
Max. rated current (gG)	I_n	A	160	100	100	250	200	200	630	400	400
Max. permissible power loss per fuse link	P_a	W	12			23			48		
Cable terminal											
Flat terminal-Screw			M8			M10			M10 / M12		
Tightening torque	Ma	Nm	12-15			30-35			30-35		
Clip terminal, Clamping cross-section		mm ²	Round conductor: 1,5-70 Cu , Strip conductor: 6 x 9 x 0,8 Cu			Round conductor: 2,5-150 Cu , Strip conductor: 6 x 16 x 0,8 Cu			Strip conductor: 11 x 21 x 1 Cu		
Tightening torque	Ma	Nm	2,6			9,5			23		
Prism Clamp, Clamping cross-section		mm ²	(SP KVL00 P1); 10-70 Al/Cu , 35-95 Al/Cu			(SP KVL1 P1); 10-150 Al/Cu			(SP KVL3 P1); 120-300 Al/Cu		
Tightening torque	Ma	Nm	(SP KVL00 P1); 2,6			(SP KVL1 P1); 4,5			(SP KVL3 P1); 11		
Prism Clamp, Clamping cross-section		mm ²				(SP KVL1 P2); 2 x (10-150) Al/Cu			(SP KVL3 P2); 2 x (120-240) Al/Cu		
Tightening torque	Ma	Nm				(SP KVL1 P2); 4,5			(SP KVL3 P2); 11		
Frame clamp, Clamping cross-section		mm ²	1,5-95 Al/Cu , (Al 95: max. 125A), *****			35-150 Al/Cu			95-300 Al/Cu		
Torque	Ma	Nm	4,5			12			20		
Degree of Protection, front side device											
Front cover close	-	-	IP20			IP20			IP20		
Front cover open	-	-	IP10			IP10			IP10		
With clamp- and lateral cover	-	-	IP2XC			IP2XC			IP2XC		
Operating condition											
Ambient temperature *****	T_{amb}	°C	-25 ... +55			-25 ... +55			-25 ... +55		
Operating condition	-	-				Continuous operation					
Mounting	-	-				vertical, horizontal					
Altitude	-	m				≤ 2000					
Pollution degree	-	-				3					
Overvoltage category	-	-	III			III			III		
Endurance											
Mechanical cycles			1400			1400			800		
Electrical cycles			300			200			200		

* Mounting of several units in low voltage switchgear-combinations, please think about rated diversity factors acc. to DIN EN 61439.

** Reference value for replacement of devices acc. to DIN EN 61439-1 clause 10.10.4.2.

*** minimum distance to earthed, conductive parts: Lateral: 20mm/Above: 50mm

*** a) Lateral: 50mm/Above: 100mm

**** Type tested with NH fuse-links characteristic gG

***** 35°C Normal temperature, at 55°C with reduced operating current



3-pole, Baseplate mounting

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



BC95-BC95

3-pole, Baseplate mounting, LED indication

Size	Code No.	Type	Weight [kg]	Packaging [pcs]
00	001690880	KVL-00 3p M8-M8 LED	0,66	1
	001690881	KVL-00 3p BC95-BC95 LED	0,8	1
1	001690882	KVL-1 3p M10-M10 LED	2,06	1
3	001690884	KVL-3 3p M10-M10 LED	3,92	1



1-pole, Baseplate mounting

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



2-pole, Baseplate mounting

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



4-pole, Baseplate mounting

Size	Code No.	Type	Weight [kg]	Packaging [pcs]
00	001690900	KVL-00 4p M8-M8	1,19	1
1	001690901	KVL-1 4p M10-M10	2,91	1
3	001690902	KVL-3 4p M10-M10	5,76	1



Accessories			
Type	Code No.	Description	Packaging [pcs]
SP KVL00	001692701	Clip terminal, 1,5 – 70 mm ² Cu	set=3
SP KVL1	001692702	Clip terminal, 25– 150 mm ² Cu	set=3
SP KVL2	001692703	Clip terminal, 25– 240 mm ² Cu	set=3
SP KVL3	001692704	Clip terminal, 11x21 mm ² Cu	set=3
SP KVL00 P1	001692760	Prism clamp, 10 – 70 mm ² Al/Cu	set=3
SP KVL1 P1	001692761	Prism clamp, 70 – 150 mm ² Al/Cu	set=3
SP KVL2 P1	001692762	Prism clamp, 120 – 240 mm ² Al/Cu	set=3
SP KVL3 P1	001692763	Prism clamp, 120 – 300 mm ² Al/Cu	set=3
SP KVL1 P2	001692764	Prism clamp for 2-conductors connection, 2x70 – 95 mm ² Al/Cu	set=3
SP KVL2 P2	001692765	Prism clamp for 2-conductors connection, 2x120 – 150 mm ² Al/Cu	set=3
SP KVL3 P2	001692766	Prism clamp for 2-conductors connection, 2x120 – 240 mm ² Al/Cu	set=3
SP KVL-1 V	001690940	Frame clamp, 35-150mm ² Al/Cu	set=3
SP KVL-23 V	001690941	Frame clamp, 95-300mm ² Al/Cu	set=3
SP KVL-00 FC95	001690942	Feeding clamp, 25-95mm ² Cu/Al, isolated, terminal M8,*	set=3
I22 KVL-00 3p	001690943	Phase busbars, 2 x 3pole KVL-00 50mm ²	5
I23 KVL-00 3p	001690944	Phase busbars, 3 x 3pole KVL-00 50mm ²	5
I24 KVL-00 3p	001690945	Phase busbars, 4 x 3pole KVL-00 50mm ²	3
I25 KVL-00 3p	001690946	Phase busbars, 5 x 3pole KVL-00 50mm ²	3
MST KVL-00 1p	001690947	Switch position indicator, 1-pole, size 00, **	1
MST KVL-00 3p	001690948	Switch position indicator, 3-pole, size 00, **	1
MST KVL-123 1p/2p/3p	001690949	Switch position indicator, 1/2/3 -pole, size 1, 2, 3, **	1
MFM KVL-00 1p/2p/3p	001690950	Mechanical fuse monitor, size 00, **	3
MFM KVL-123 1p/2p/3p	001690951	Mechanical fuse monitor, size 1, 2, 3, **, ***	3
PRS KVL-00 3p L	001690952	Terminal cover, 3-pole, variable to open, Length 66mm, size 00	2
PRS KVL-00 3p S	001690953	Terminal cover, 3-pole, variable to open, Length 36mm, size 00	2
PRS KVL-1 3p	001690954	Terminal cover, 3-pole, variable to open, Length 42mm, size 1	2
PRS KVL-2 3p	001690955	Terminal cover, 3-pole, variable to open, Length 42mm, size 2	2
PRS KVL-3 3p	001690956	Terminal cover, 3-pole, variable to open, Length 42mm, size 3	2
PRS KVL-00 1p L	001690957	Terminal cover, 1-pole, variable to open, Length 66mm, size 00	2
PRS KVL-00 1p S	001690958	Terminal cover, 1-pole, variable to open, Length 36mm, size 00	2
PRS KVL-1 1p	001690959	Terminal cover, 1-pole, variable to open, Length 42mm, size 1	2
PRS KVL-3 1p	001690960	Terminal cover, 1-pole, variable to open, Length 42mm, size 3	2
DIN KVL-00 100-150	001690964	DIN rail fixing parts, For mounting on DIN rails, size 00	1
DIN KVL-1 100-150	001690965	DIN rail fixing parts, For mounting on DIN rails, size 1	1
EFMU KVL-00 3p	001690966	Electronic fuse monitoring unit, 3-pole, size 00, ****	1
EFMU KVL-1 3p	001690967	Electronic fuse monitoring unit, 3-pole, size 1, ****	1
EFMU KVL-2 3p	001690968	Electronic fuse monitoring unit, 3-pole, size 2, ****	1
EFMU KVL-3 3p	001690969	Electronic fuse monitoring unit, 3-pole, size 3, ****	1
MPFMU KVL-00 3p	001690974	Elektromechanical fuse monitoring unit (AM), 3-pole, size 00, ****	1
MPFMU KVL-1 3p	001690975	Elektromechanical fuse monitoring unit (AM), 3-pole, size 1, ****	1
MPFMU KVL-2 3p	001690976	Elektromechanical fuse monitoring unit (AM), 3-pole, size 2, ****	1
MPFMU KVL-3 3p	001690977	Elektromechanical fuse monitoring unit (AM), 3-pole, size 3, ****	1
CK KVL-00 2p/4p	001690970	Connecting kit 2- and 4-pole, For making of 2- and 4-pole disconnectors, size 00	1
CK KVL-123 2p/4p	001690971	Connecting kit 2- and 4-pole, For making of 2- and 4-pole disconnectors, size 1, 2, 3	1
LP KVL-00123	001690972	Interlock device, locking with padlock, diameter 6mm max., size 00, 1, 2, 3	10
IC KVL-00123	001690973	Contact cover interlock, only be operated by tool, size 00-3	10

* Feeding clamp, AC690V/DC1000V-250A

** 1 Changeover, AC250V, 10/3A (ohmic/ind.)

*** Only in combination with ETI fuse-links with striker-pin; not in combination with frame-clamp or 2-wire-prism clamp.

**** For monitoring of fuse-links with live gripping lugs



SP KVL



SP KVL...P1



DIN KVL-00 100-150



SP KVL-1 V



SP KVL-23 V



SP KVL-00 FC95



I22 KVL-00 3p



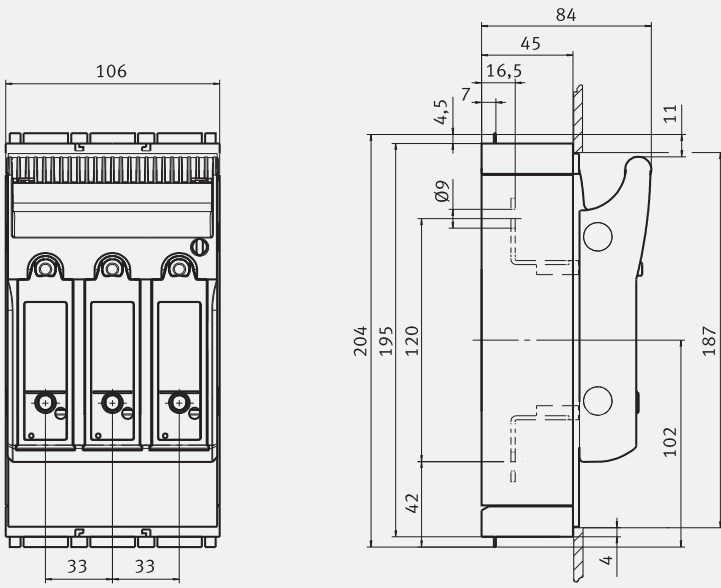
MST KVL- ...



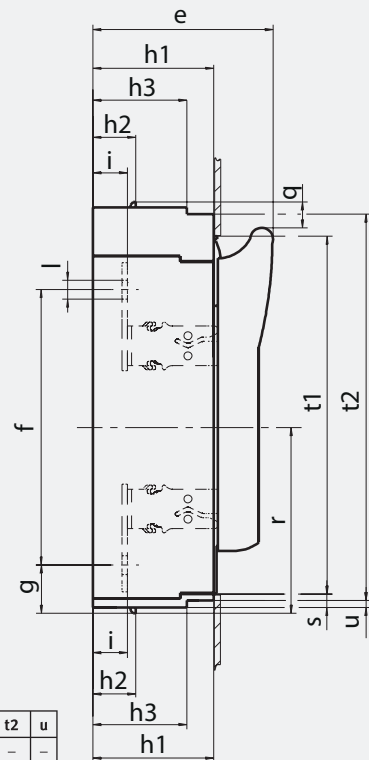
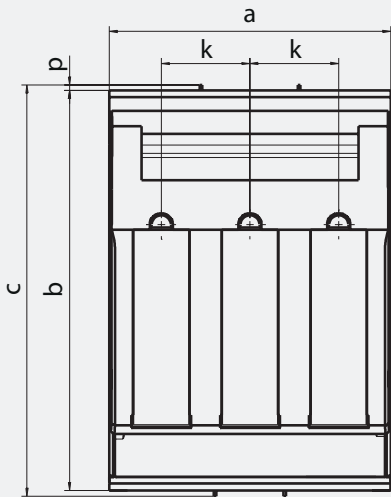
MFM KVL-123 1p 2p 3p



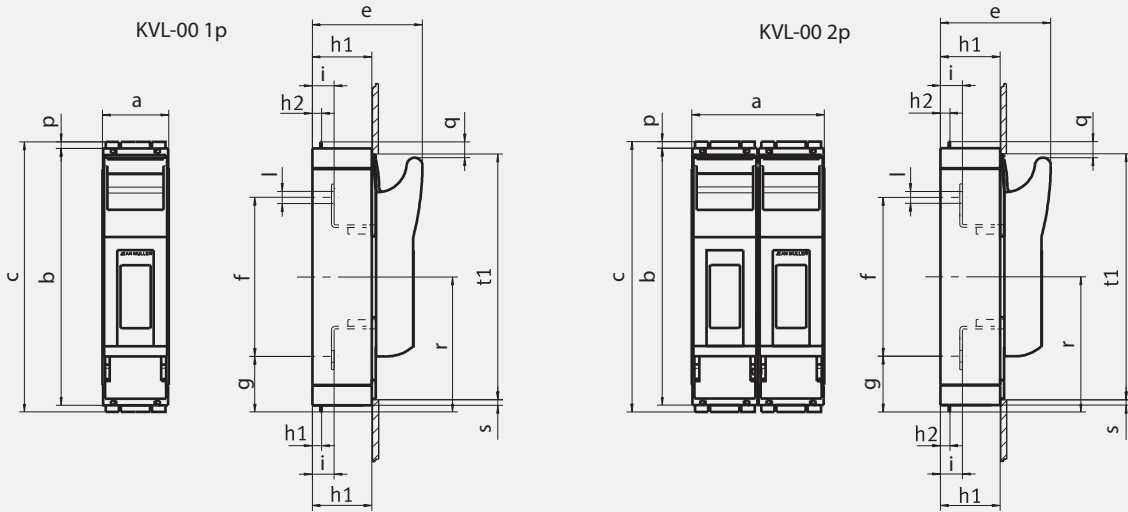
PRS KVL-... 3p



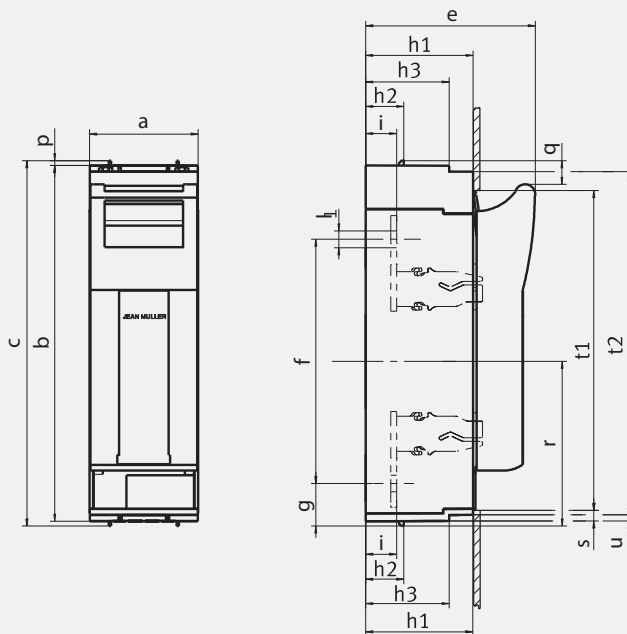
KVL-00 3p M8-M8
KVL-00 3p BC95-BC95
KVL-00 3p M8-M8 LED
KVL-00 3p BC95-BC95 LED



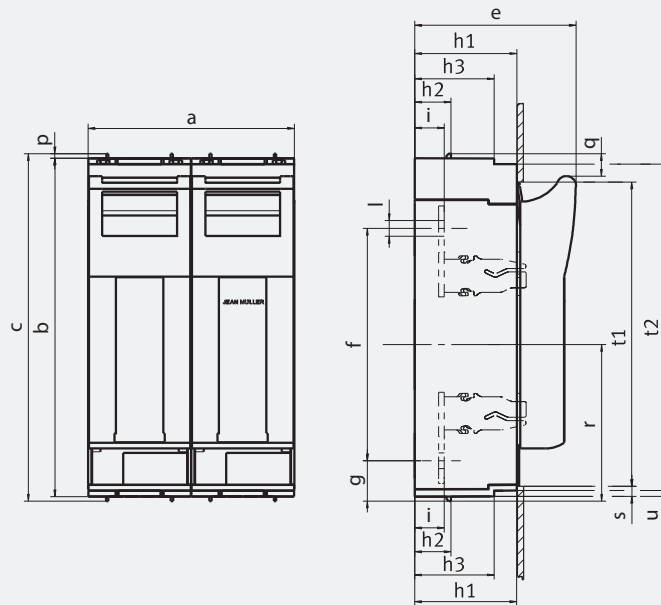
	a	b	c	e	f	g	h1	h2	h3	i	k	l	p	q	r	s	t1	t2	u
KVL-1 3p M10-M10 (LED)	184	298	306	117	185	46	70	32	-	25	58	Ø10,5	4	19	138	5	272	-	-
KVL-2 3p M10-M10 (LED)	210	298	306	134	205	36	90	32	70	26	66	Ø14	4	19	138	10	268	288	5
KVL-3 3p M10-M10 (LED)	250	298	306	143	205	36	90	32	70	26	82	Ø14	4	19	138	10	268	288	5



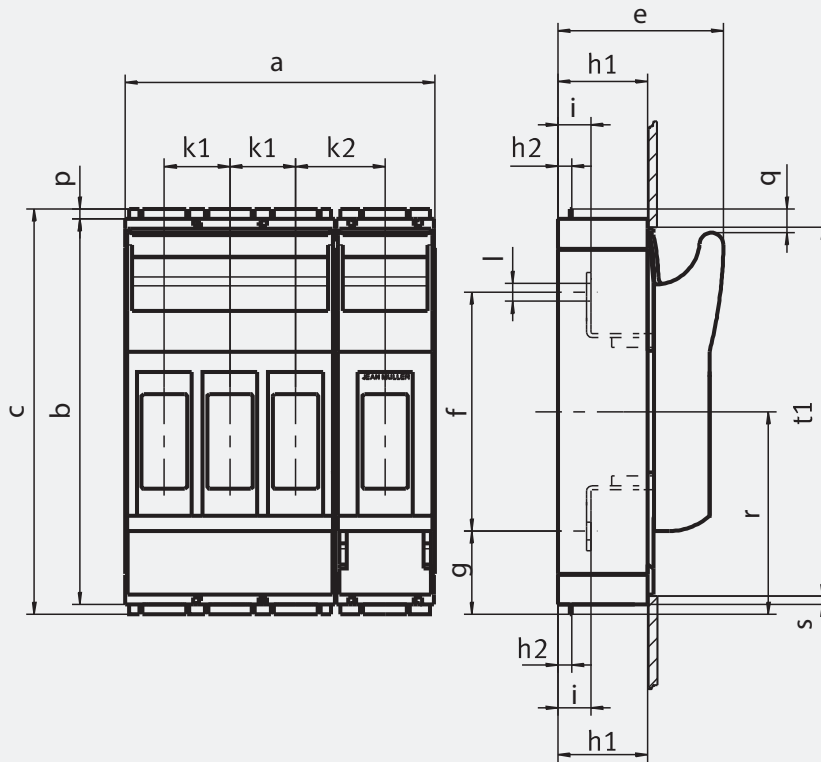
	a	b	c	e	f	g	h1	h2	h3	i	l	p	q	r	s	t1
KVL-00 1p M8-M8	50	195	204	84	120	42	45	7	-	16,5	∅9	4,5	12	102	5	187
KVL-00 2p M8-M8	100	195	204	84	120	42	45	7	-	16,5	∅9	4,5	12	102	5	187

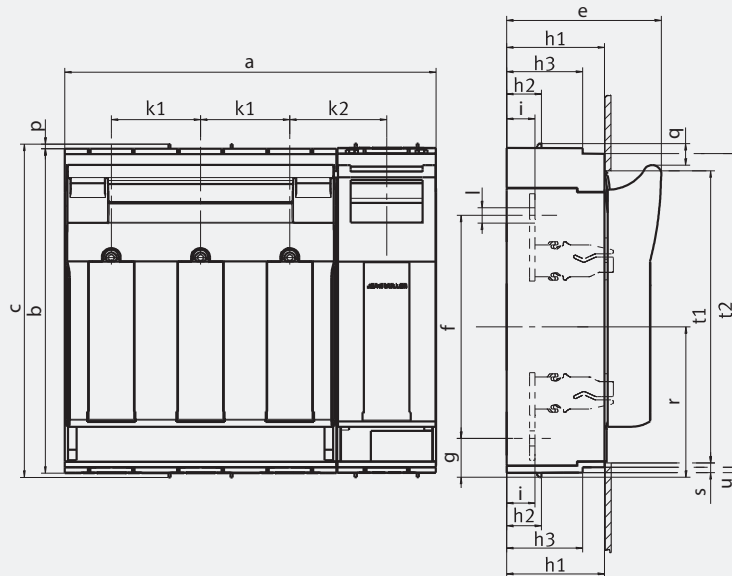


	a	b	c	e	f	g	h1	h2	h3	i	l	p	q	r	s	t1	t2	u
KVL-1 1p M10-M10	69	298	306	117	185	46	70	32	-	25	∅10,5	4	19	138	5	272	-	-
KVL-3 1p M10-M10	91	298	306	143	205	36	90	32	70	26	∅14	4	19	138	10	268	288	5



	a	b	c	e	f	g	h1	h2	h3	i	l	p	q	r	s	t1	t2	u
KVL-1 2p M10-M10	138	298	306	117	185	46	70	32	-	25	∅10,5	4	19	138	5	272	-	-
KVL-3 2p M10-M10	182	298	306	143	205	36	90	32	70	26	∅14	4	19	138	10	268	288	5





	a	b	c	e	f	g	h1	h2	h3	k1	k2	i	l	p	q	r	s	t1	t2	u
KVL-1 4p	254	298	306	117	185	46	70	32	-	58	69	25	∅10,5	4	19	138	5	272	-	-
KVL-3 4p	341,5	298	306	143	205	36	90	32	70	82	89	26	∅14	4	19	138	10	268	288	5

Technical data - Feeding clamps

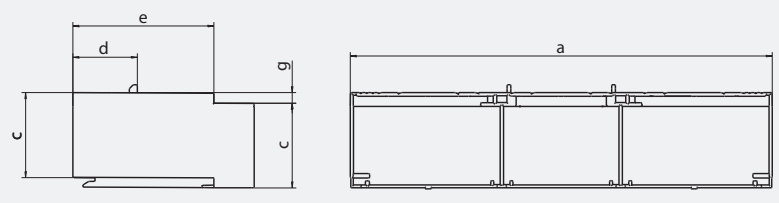
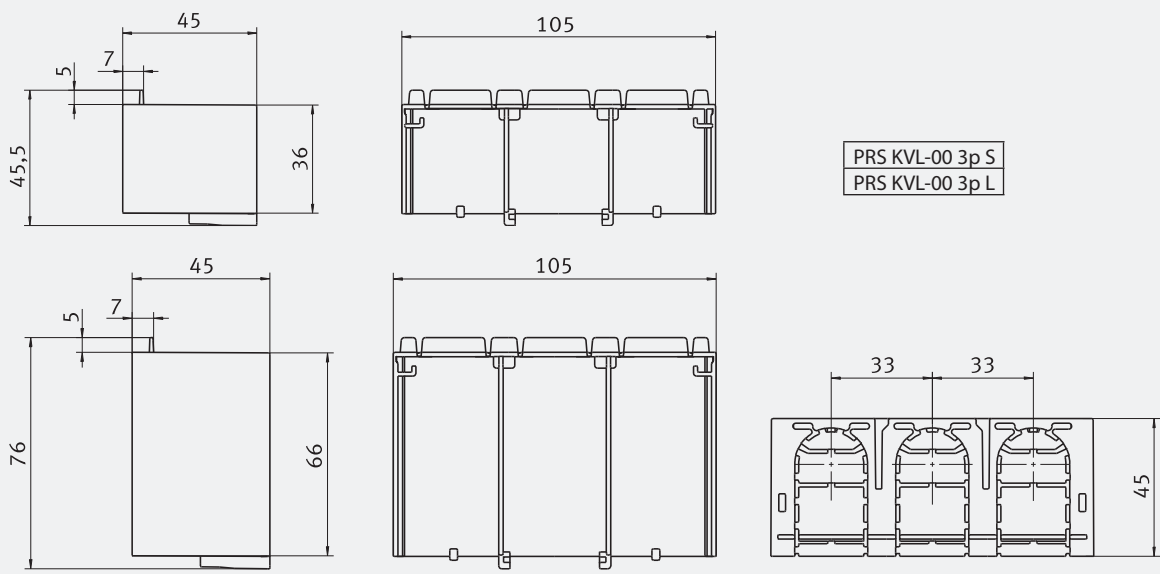
Technical Characteristics			
Max. electrical load			AC690V/DC1000V-250A
Heat deflection temp.			125°C UL94: V0
Comparative tracking index			600
Cross sections			
Conductor - Max. Diameter ∅14 mm			
single wire		mm ²	25 - 95
multi wire		mm ²	25 - 95
fine wire (with end sleeve)		mm ²	25 - 70
Torque	Ma	Nm	13
Degree of protection			IP20
Regulations			EN 60998-1:2004; EN 60998-2:2004; EN 60999-1:2000; EN 60999-2:2003

Important

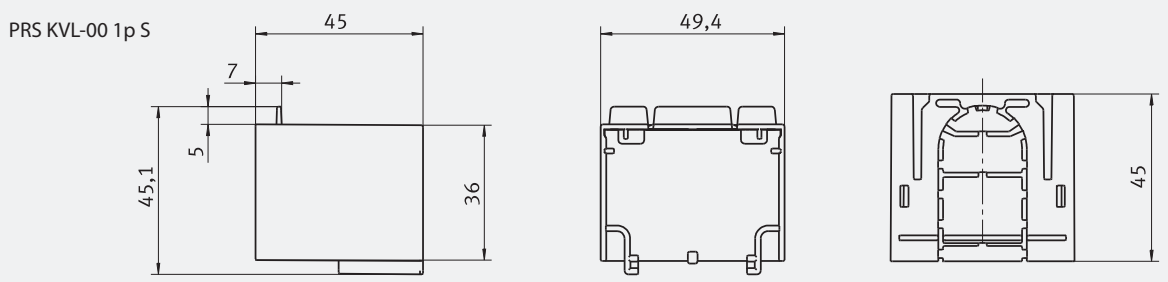
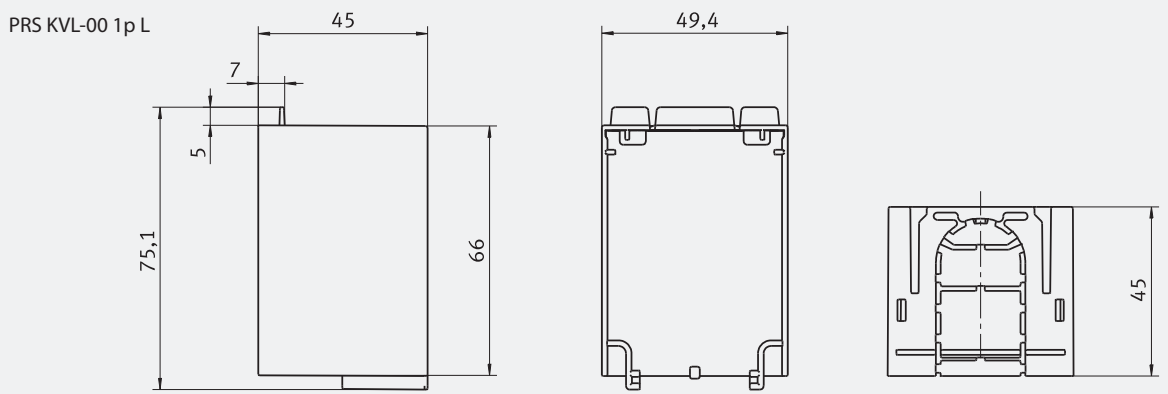
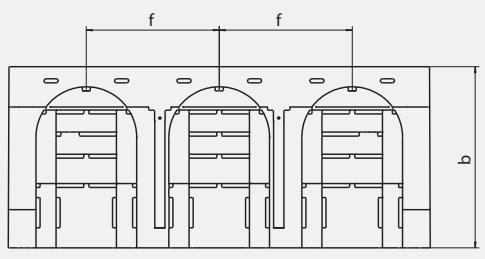
This Terminal is suitable for Al and Cu conductors. Please pay attention to the common handling guidelines when connecting the Aluminium conductors. Clean and brush the contact surfaces and lubricate them with an appropriate grease.

Technical data - Phase busbars

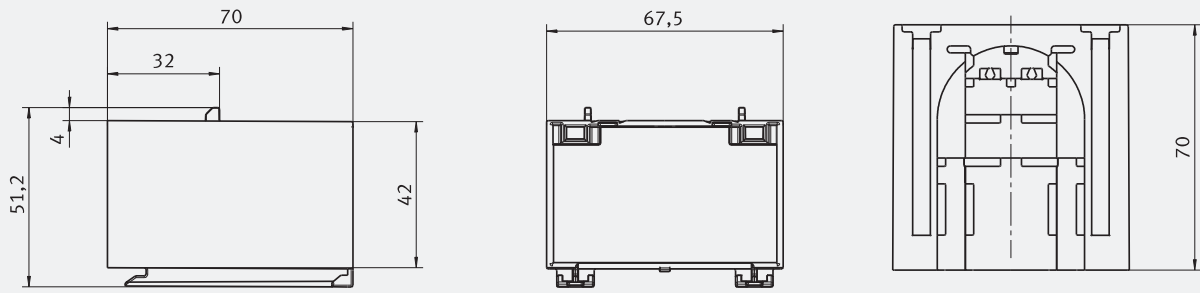
Technical Characteristics			
		mm ²	50
Impulse voltage strenght		kV	≥8,5
Min. air distance		mm	>8
Min. creeping distance		mm	>9
Max. operating voltage		V	AC690
Protection class			IP20
Short circuit rating			IPK=25kA/0,1s, Surge energy capacity IPK, ICC 100kA - NH3 355A gL 500V
Dielectric strenght		kV/mm	≥32
Capacity at 35°C ambient temperature depending of feeding point cross section		mm ²	50
Busbar lenght		mm	Max. 300
Feeding at beginning/ending			
Max. current Is /Phase		A	250
Connection cross current		mm ²	95
Other feedings			
Max. feeding current Ie /Phase		A	250
Connection cross current		mm ²	95
Insulation coordination			III / 2
Regulations			IEC 60947-1:2007



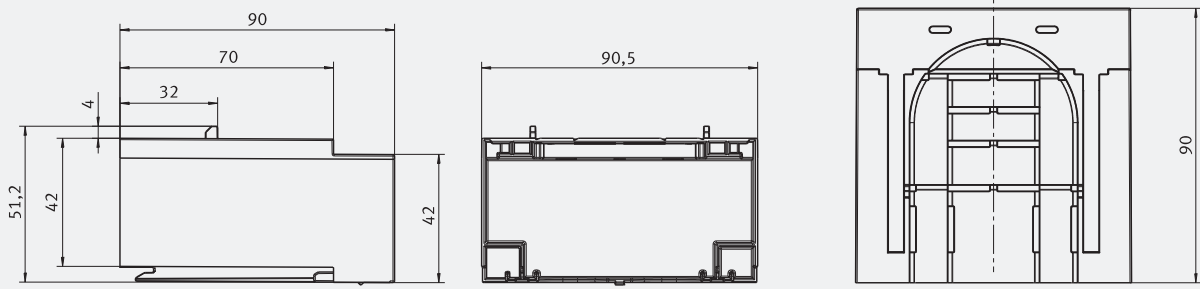
	a	b	c	d	e	f	g
PRS KVL-1 3p	184	70	42	32	-	58	-
PRS KVL-2 3p	210	90	42	32	70	66	5
PRS KVL-3 3p	250	90	42	32	70	82	5



PRS KVL-1 1p



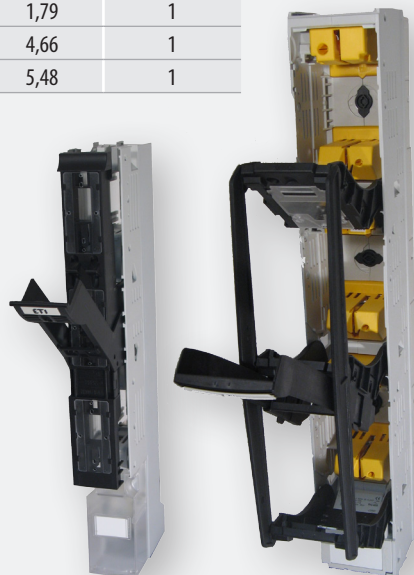
PRS KVL-3 1p

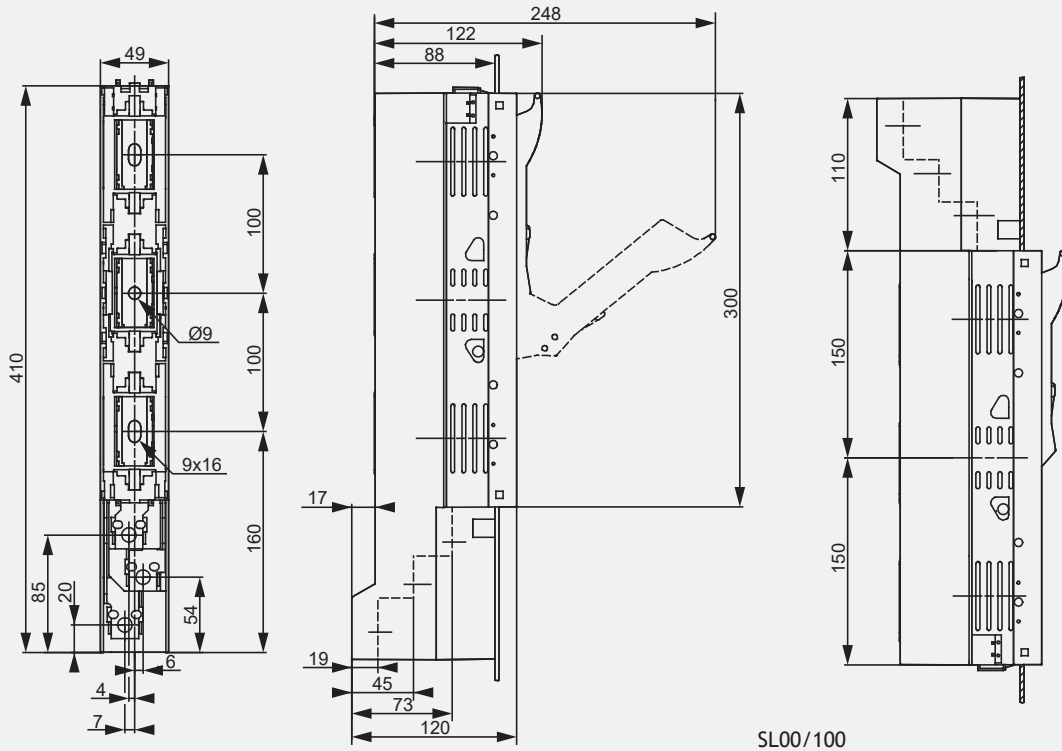


Fuse-switch disconnecter type SL 800V

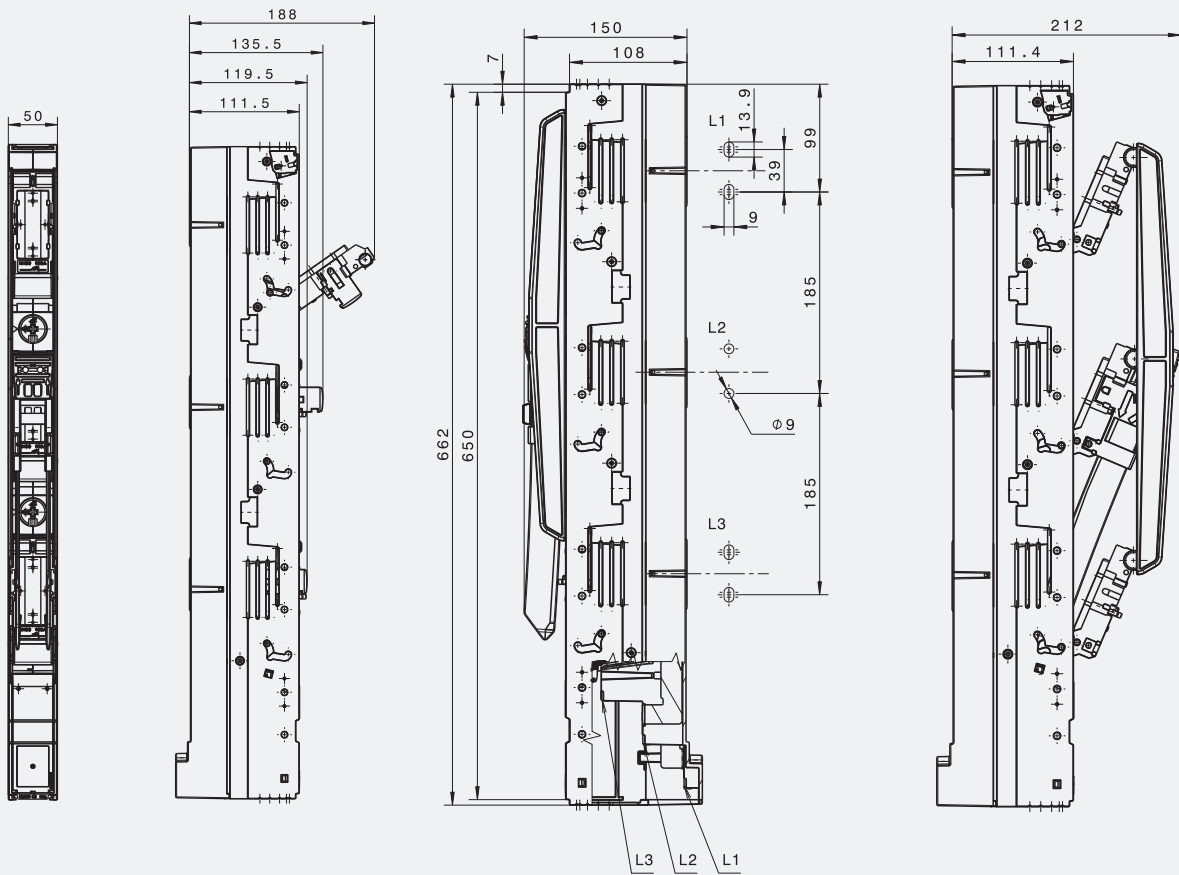
General characteristics						
Size			SL00/100	SL00/185	SL1	SL3
Technical Characteristics						
Rated operational voltage	U_e	V	800 a.c.	800 a.c.	800 a.c.	800 a.c.
Rated operational current	I_e	A	63	63	160	315
Rated frequency	f	Hz	40-60	40-60	40-60	40-60
Rated insulation voltage	U_i	V	800 a.c.	800 a.c.	800 a.c.	800 a.c.
Total power loss at I_{th} (without fuse)	P_v	W	18	23	23	115
Utilisation category			a.c.-21B (160A/800V)	a.c.-21B (160A/800V)	a.c.-21B (250A/800V)	a.c.-21B (315A/800V)
Fuse links						
Size - DIN 43620, IEC 60269-2	-	-	000/00		1	3
Max. permissible power loss per fuse link	P_a	W	12		32	48
Dimensions						
Mass	-	kg	100mm=1,40	185mm=2,40	4,9	5,6
Bubars (distance)	-	mm	100	185	185	48
Cable connection						
Screw			M8		M10	M12
Protection						
Operational state	-	-	IP30		IP30	IP30
Cover open	-	-	IP10		IP10	IP10
Operating condition						
Ambient temperature	T_{amb}	°C	-25 ... +55		-25 ... +55	-25 ... +55
Operating condition	-	-	Continuous operation			
Mounting	-	-	vertical, horizontal			
Altitude	-	m	≤ 2000			
Pollution degree	-	-	3			
Overvoltage category	-	-	III	III	III	III

SL 800V						
Size	Code No.	Busbar system	Type	Connection description	Weight [kg]	Packaging [pcs]
00	001690860	100	SL00/100 3P M8 800AC	flat connection – screw M8	0,85	1
	001690861	185	SL00 3P M8 800AC	flat connection – screw M8	1,79	1
1	001690862	185	SL1 3P M10 800AC	flat connection – screw M10	4,66	1
3	001690863	185	SL3 3P M12 800AC	flat connection – screw M12	5,48	1

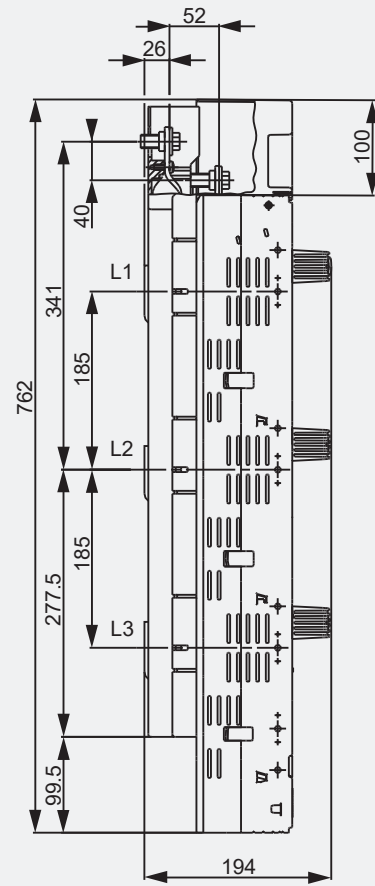
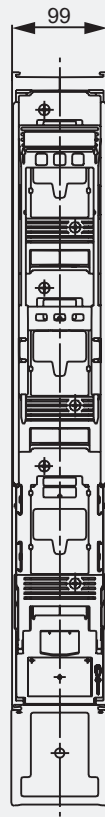
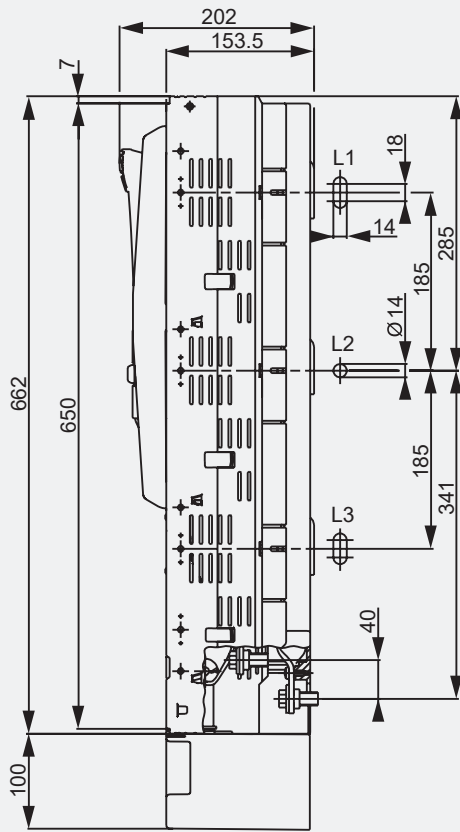




SL00/100



SL00/185



SL1, SL3



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