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Technical Product Documentation

Product / Product Range:
Public Electricity Network Distribution Assemblies (PENDA) in accordance with IEC 61439-5
Rated operational voltage (U_e) **400 VAC / 800 VAC –** Rated insulation voltage (U_i) **1,000 VAC –** Rated frequency (f_n) **50 Hz –** Rated current of the assembly (I_{nA}) **up to 653 A (680 A) / 288 A –** Rated conditional short-circuit current (I_{cc}) **60 kA / 30 kA**

Designation: **Outdoor Enclosures CDC (Cable Distribution Cabinets)**

Manufacturer: **Hager Electro GmbH & Co. KG**
Zum Gunterstal
66440 Blieskastel
Germany

The results verify the requirements given by the above-mentioned standard.

The results of test reports listed in this documentation are exclusively linked to the tested samples and compared or assessed variants.
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Pascal Polster
SDM PM Enclosures

Date: 25/07/24 Ver. 1.2

Cable Distribution Cabinets (CDC)

ZAK…GA

List of Design Verifications

No.	Characteristic to be verified	Clause or sub-clause	Verification by	Applicable document(s)	Verified product / range / series
1	Resistance to corrosion	10.2.2	Test	HPB18040315	ZAK…GA
	Thermal stability	10.2.3.1	Test	18-037LAB-BLK	
	Resistance to abnormal heat and fire due to internal electric effects	10.2.3.2	Test	252839-TL3-1	
	Dry heat	10.2.3.101	Test	18-037LAB-BLK	
	Category of flammability	10.2.3.102	Test	252839-TL3-1	
	Resistance to ultra-violet (UV) radiation	10.2.4	Test	131339-18_Hager	
	Lifting	10.2.5	N/A	-	
	Resistance to static load	10.2.101.2	Test	18-037LAB-BLK	
	Resistance to shock load	10.2.101.3	Test	18-037LAB-BLK	
	Resistance to torsional stress	10.2.101.4	Test	18-037LAB-BLK	
	Impact force withstand	10.2.101.5	Test	18-037LAB-BLK	
	Mechanical strength of doors	10.2.101.6	Test	18-037LAB-BLK	
	Resistance to axial load of metal inserts in synthetic material	10.2.101.7	N/A	-	

	Resistance to mechanical shock induced by sharp objects	10.2.101.8	Test	18-037LAB-BLK	
	Mechanical strength of a base intended to be embedded in the ground	10.2.101.9	Test	18-037LAB-BLK	
	Marking	10.2.7	Test	18-037LAB-BLK	
2	Degree of protection of enclosures	10.3	Test	18-011PM-L 21-146LAB-BLK	
3	Clearances	10.4	Test	21-013LAB-BLK	
4	Creepage distances	10.4	Drawing	21-013LAB-BLK	
5	Effective continuity between the exposed conductive parts of the assembly and the protective circuit	10.5.2	N/A	-	
	Short-circuit withstand strength of the protective circuit	10.5.3	Test	209425-CC3-1	
6	Incorporation of switching devices and components	10.6	Manufacturer	see manufacturer documentation	
7	Internal electrical circuits and connections	10.7	Manufacturer	see manufacturer documentation	
8	Terminals for external conductors	10.8	Manufacturer	see manufacturer documentation	
9	Power frequency withstand voltage	10.9.2	Test	18-037LAB-BLK, 21-013LAB-BLK	

	Impulse withstand voltage	10.9.3	Test	18-037LAB-BLK, 21-013LAB-BLK	
10	Temperature-rise limits	10.10	Test	18-037LAB-BLK, 21-013LAB-BLK	
11	Short-circuit withstand strength	10.11	Test	209425-CC3-1, 14600-21-0272-d	
12	Electromagnetic compatibility (EMC)	10.12	N/A	-	
13	Mechanical operation	10.13	Test	18-037LAB-BLK	

10.2 Strength of materials and parts

10.2.2 Resistance to corrosion
The ferrous metallic constructional parts of the listed assemblies were subjected to the damp heat cycling test of IEC 60028-2-30: Severity A – Temperature 55 °C, 6 cycles and variant 1. After the test, no inacceptable deteriorations were observed, in compliance with ISO 628-3:2016.

10.2.3 Properties of insulating materials
10.2.3.1 Thermal stability
The listed enclosures were tested in accordance with IEC 60068-2-2:2007, Test Bb, at a temperature of 70 °C, with natural air circulation, for a duration of 168 h and a recovery of 96 h. There appeared no cracks or other deteriorations on the housing surface.

10.2.3.2 Resistance of insulating materials to abnormal heat and fire due to internal electric effects
All insulating materials used in the listed references were subjected to the glow-wire test according to IEC 60695-2-10/-11. All requirements were fulfilled. The temperature of the glow-wire tip was

- 960 °C for parts necessary to retain current-carrying parts in position (housing material)
- 650 °C for all other parts, including parts necessary to retain the protective conductor and

10.2.3.101 Dry heat test
The listed references were heated according to the test specifications for a duration of 2-3 h at a temperature of (100 ± 2) °C and stored for 5 h at this level. No deteriorations occurred.

10.2.3.102 Verification of category of flammability
Representative specimens of each material of the housing, the internal covers and other insulating parts were tested in respect to their resistance against flammability in accordance with test method A – horizontal burning test – of IEC 60695-11-10:2013. All specimens fulfilled the criterion of flammability class HB40.

10.2.4 Resistance to ultraviolet (UV) radiation
Specimens of the housing material of the listed enclosures were UV tested in accordance with ISO 4892-2:2013, method A, cycle 1 for an overall duration of 500 h. The samples fulfilled the requirements and retained their values of flexural strength (ISO 178) and Charpy impact (ISO 179) for at least 70 %.

Test Criterion	Unit	Target	Value
before weathering			
Impact strength	KJ/m^2	--	47
Flexural modulus of elasticity	MPa	--	10,400
Flexural strength	MPa	--	136
Elongation at flexural strength	%	--	2.2
after weathering			
Impact strength	KJ/m^2	≥ 33	45
Flexural modulus of elasticity	MPa	≥ 7,280	10,000
Flexural strength	MPa	≥ 95	129
Elongation at flexural strength	%	≥ 1.5	2.2

10.2.5 Lifting
This clause is not applicable to the product range since there are no lifting devices for the enclosures.

10.2.101 Verification of mechanical strength
To verify the mechanical properties of the product range, the most critical assemblies were tested in order to cover all references. The following table contains the tested enclosures and the corresponding pedestals.

Test Specimens	
Enclosure	**Pedestal**
ZAK101GA	ZAX006
ZAL132	ZAX007

10.2.101.2 Verification of resistance to static load
The listed references were subjected to the described tests. An evenly distributed load of 8,500 N/m^2 were applied for a duration of 5 minutes to the roof of each enclosure. Afterwards, a force of 1,200 N was applied to the front and back upper edges of the respective enclosure roofs. The necessary minimum degree of protection, the electrical clearances and the function of the doors and closing mechanisms were not impaired by the stress.

10.2.101.3 Verification of resistance to shock load
After the execution of the sandbag test, the minimum degree of protection and electrical clearances were still satisfactory. The function of the doors and closing mechanisms were not impaired.

10.2.101.4 Verification of resistance to torsional strength

The enclosures were strained by a torsional force of 2 x 1,000 N for a duration of 30 s in both directions of rotation as shown in figures 106a and 106b of IEC 61439-5:2014. After the test, the doors remained closed, and the degree of protection remained unchanged.

10.2.101.5 Verification of impact force withstand
The verification was done in accordance with the requirements for switchgear and controlgear assemblies that are designed for operation at ambient temperatures between 40 °C and -25 °C, as described in clause 10.2.101.5.1. Thus, steel ball tests with an impact energy of 20 J were executed as described in this section of the standard, once after storage at room temperature and once after storage at a temperature of -25°C. After the tests, the degree of protection, the electrical clearances, and the functions of the doors and closing mechanisms remained as designed.

10.2.101.6 Verification of mechanical strength of doors
The doors of the assemblies were strained with a force of 50 N for a period of 3 s. No deteriorations were observed. The repetition with a force of 450 N is not necessary since the doors can be removed without tools.

10.2.101.7 Verification of resistance to axial load of metal inserts in synthetic material
No threaded metal inserts are used in this product range, so this part of the standard is not applicable.

10.2.101.8 Verification of resistance to mechanical shock impacts induced by sharp-edged objects
The listed test specimens were subjected to a mechanical shock impact test using a sharp-edged striker element and applying an impact energy of 20 J. Thereafter, there were no cracks in the enclosure walls or inacceptable material penetrations.

10.2.101.9 Test of mechanical strength of a base intended to be embedded in them ground
The test was conducted according to the standard specifications. After the strain, the pedestal was undamaged and the degree of protection unchanged.

10.2.7 Marking
The wipe test was done in sequence with water and a solvent, and the marking was still legible afterwards.

10.3 Degree of protection
The listed enclosures were inspected in accordance with IEC 60529:1989, IEC 60529:1989/AMD1:1999, and IEC 605291989/AMD2:2013. The value IPX4 is fulfilled since no water can enter the protected area inside the cabinets. The value IP4X is also fulfilled, except for the defined aeration area indicated on page 20. Here, we have a reduction to IP3XD between roof and back wall and between the door edges and the side walls. Thus, the standard requirements are fulfilled.

10.4 Clearances and creepage distances
The clearances and creepage distances are in accordance with the requirements (electrical clearances ≥ 14 mm, creepage distances ≥ 16 mm).

10.5 Protection against electric shock and integrity of protective circuits
10.5.2 Effective earth continuity between the exposed-conductive-parts of the class I

assembly and the protective circuit
This test is not applicable to this product range.

10.5.3 Short-circuit withstand strength of the protective circuit

The short-circuit tests were performed and the results can be seen on page 14ff., clause 10.11.

10.6 Incorporation of switching devices and components

These enclosures are designed to incorporate vertical NH-fuse switch disconnectors. Those must be tested in accordance with their respective product standard IEC 60947-3.

10.7 Internal electrical circuits and connections

The products are designed to fulfill the requirements of section 8.6 of IEC 61439-1:2020.

10.8 Terminals for external conductors

The external conductors are terminated connected directly to the busbar system, either by using cable lugs and M12 screws or by using V clamps for both aluminium and copper conductors. Further details are listed in annex A of IEC 61439-1:2020.

10.9 Dielectric properties

10.9.2 Power-frequency withstand voltage

All test specimens were subjected to the test voltage of 2,200 V (from table 8, IEC 61439-1:2020, Ui ≤ 1.000 V) for a duration of 60 s

a) between all live parts of the main circuit connected (including the auxiliary circuits connected to the main circuit) and exposed-conductive-parts, with the main contacts of all switching devices in the closed position or bridged by a suitable low resistance link.
b) between each live part of different potential of the main circuit and, the other live parts of different potential and exposed-conductive-parts connected, with the main contacts of all switching devices in the closed position or bridged by a suitable low resistance link.

During the test, there was no detectable current flow and no disruptive discharge.

10.9.3 Impulse withstand voltage

All specimens were subjected to a test voltage of 14.5 kV (400 VAC application) / 9.6 kV (800 VAC application) (from table 10, IEC 61439-1:2020, U_{imp} = 12 kV (400 VAC application) / U_{imp} = 8 kV (800 VAC application))

a) between all the live parts of different potential of the main circuit connected together (including the auxiliary circuits connected to the main circuit) and exposed-conductive parts, with the main contacts of all switching devices in the closed position or bridged by a suitable low-resistance link.

b) between each live part of different potential of the main circuit and the other live parts of different potential and exposed-conductive-parts connected, with the main contacts of all switching devices in the closed position or bridged by a suitable low resistance link.

10.9.4 Testing of enclosures made of insulating material

An insulation test was performed where an AC test voltage of 1.5 times of the above-mentioned value (3,300 V) was applied between a metal foil laid on outer surface of the enclosure over openings and joints, and the interconnected live and exposure-conductive parts within the assembly located next to the openings and joints.

During the test, there was no current and no disruptive discharge.

10.9.5 External door or cover mounted operating handles of insulating material
In analogy, an insulation test was performed for the door handles of the enclosures where the voltage was applied between the active parts and a metal foil completely enfolding the housing.

During the test, there was no current and no disruptive discharge.

10.10 Verification of temperature rise
The verification was performed by test as specified in 10.10.2 of IEC 61439-1:2020. The tested configurations were chosen in accordance with clause 10.10.2.2 as the most critical. The test was performed in accordance with 10.10.2.3.5 on the complete assembly.

Built-in Switching Devices and Components

- NH-fuse switch disconnectors

* devices tested also for 800 VAC application

Type	Reference	I_n / A	Manufacturer
NH3	LVTG1000TP	1000	Hager
NH3	LVSG3CPX	630	Hager
NH3*	LVSG3CPZ	630	Hager
NH2	LVSG2CPX	400	Hager
NH2	LVSR2VPVK4	400	Hager
NH2	L203100103	400	Jean Müller
NH2	9-E-EH241AAG	400	Pronutec
NH2	38864-0020	400	EFEN
NH2	38865-0200	400	EFEN
NH00*	LVSG00SPX	160	Hager

- Fuse links

* fuses for 800 VAC application

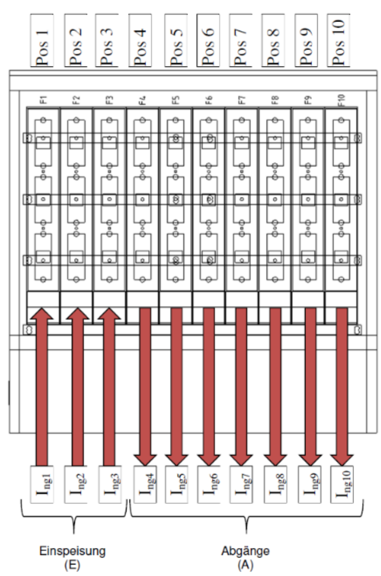
Type	Reference	I_n / A	U_n / V	P_V / W	Manufacturer
NH3*	N3035900	315	800	29	Jean Müller
NH3	LNH3500M	500	500	43	Hager
NH3	LNH3400M	400	500	34	Hager
NH2	LNH2400M	400	500	28.5	Hager
NH2	LNH2315M	315	500	25	Hager
NH2	LNH2160M	160	500	15	Hager
NH00	LNH0080M	80	500	6.5	Hager
NH00*	N5033814	63	800	7	Jean Müller

The given energy dissipation P_V refers to the nominal current I_n.

Tested enclosures

* also tested for 800 VAC application

Size	Height	Width	Depth	Reference	Busbars	Manufacturer	Type of reference
2	1005	1110	315	ZAK102-S	60 x 10	Hager	Sonderanfertigung
2	845	1110	315	ZAK082-S	40 x 10	Hager	Sonderanfertigung
2	845	1110	315	ZAK082GA	30 x 8	Hager	Standard-Produkt
1	1005	780	315	ZAK101-S	40 x 10	Hager	Sonderanfertigung
1	845	780	315	ZAK081-S	30 x 10	Hager	Sonderanfertigung
0	1005	585	315	ZAK100-S	30 x 10	Hager	Sonderanfertigung
0	845	585	315	ZAK080GA	30 x 6	Hager	Standard-Produkt
00*	845	480	315	ZAK084GA	30 x 6	Hager	Standard-Produkt



The ingoing current was evenly distributed over the supplying fuse rails:

$$I_{nA} = \sum_{i=1}^{m} I_{ngi}, \forall\, m = 1 \dots 3$$

The maximum current rating is therefore the sum of all ingoing currents. The currents must be distributed evenly.

All results are in relation to an average ambient temperature of 35 °C over a period of 24 hours.

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400 VAC Application

<table>
<tr><th rowspan="2">I_{nA} / A</th><th colspan="2">Supply</th><th rowspan="2">Busbar cross section</th><th colspan="2">Minimum Enclosure</th><th colspan="3">Outgoing</th><th rowspan="2">Comments</th></tr>
<tr><th>Fuse rail</th><th>Fuse gG / A</th><th>Size</th><th>Height / mm</th><th>Fuse rail</th><th>Fuse gG / A</th><th>I_{ng} / A</th></tr>
<tr><td>1110</td><td>4 x NH3</td><td>500</td><td rowspan="3">60 x 10</td><td rowspan="7">Gr. 2</td><td rowspan="3">1005</td><td>5 x NH2</td><td>315</td><td>252</td><td>Coupling unit NH3 open, 2 x NH3 as supply for each circuit (separate busbar system with max. I_{nA} = 625 A)</td></tr>
<tr><td>825</td><td>3 x NH3</td><td>400</td><td>3 x NH2</td><td>315</td><td>296</td><td></td></tr>
<tr><td>734</td><td>2 x NH3</td><td>500</td><td>3 x NH2</td><td>315</td><td>295</td><td></td></tr>
<tr><td>681</td><td>3 x NH2</td><td>315</td><td>40 x 10</td><td rowspan="3">845</td><td>5 x NH2</td><td>160</td><td>152</td><td></td></tr>
<tr><td>653</td><td>3 x NH2</td><td>315</td><td rowspan="2">30 x 8</td><td>5 x NH2</td><td>160</td><td>152</td><td></td></tr>
<tr><td>621</td><td>3 x NH2</td><td>315</td><td>5 x NH2</td><td>160</td><td>145</td><td>Comparison test with fuse rails by Jean Müller</td></tr>
<tr><td>610</td><td>2 x NH3</td><td>500</td><td>60 x 10</td><td>1005</td><td>3 x NH2</td><td>315</td><td>278</td><td>Coupling unit NH3 closed</td></tr>
<tr><td>564</td><td>2 x NH3</td><td>400</td><td>40 x 10</td><td rowspan="2">Gr. 1</td><td>1005</td><td>2 x NH2</td><td>315</td><td>296</td><td></td></tr>
<tr><td>514</td><td>2 x NH2</td><td>315</td><td>30 x 10</td><td>845</td><td>4 x NH2</td><td>160</td><td>149</td><td></td></tr>
<tr><td>434</td><td>2 x NH2</td><td>315</td><td>30 x 6</td><td rowspan="2">Gr. 0</td><td>845</td><td>3 x NH2</td><td>160</td><td>152</td><td></td></tr>
<tr><td>399</td><td>1 x NH3</td><td>500</td><td>30 x 10</td><td>1005</td><td>2 x NH2</td><td>315</td><td>294</td><td></td></tr>
<tr><td>303</td><td>1 x NH2</td><td>400</td><td rowspan="6">30 x 6</td><td rowspan="6">Gr. 00</td><td rowspan="6">845</td><td>2 x NH2</td><td>160</td><td>151</td><td></td></tr>
<tr><td>298</td><td>1 x NH2</td><td>315</td><td>2 x NH2</td><td>160</td><td>149</td><td></td></tr>
<tr><td rowspan="2">288</td><td rowspan="2">1 x NH2</td><td rowspan="2">315</td><td>2 x NH00</td><td>80</td><td>72</td><td rowspan="2">Two different positionings of the NH00 fuse rails were tested with similar results</td></tr>
<tr><td>1 x NH2</td><td>160</td><td>143</td></tr>
<tr><td>276</td><td>1 x NH2</td><td>315</td><td>2 x NH2</td><td>160</td><td>138</td><td>Comparison test with fuse rails by Jean Müller</td></tr>
<tr><td>274</td><td>1 x NH2</td><td>315</td><td>2 x NH2</td><td>160</td><td>138</td><td>Comparison test with fuse rails by Pronutec</td></tr>
</table>

Fuse factor $f = I_{ng} / I_N$.

On using the table above:

Depending on the needed nominal current, one must choose at least the shown ingoing set-up with the corresponding fuses. Furthermore, one must mind the minimal enclosure size that is necessary to dissipate the temperature rise inside the enclosure.

The given maximum current I_{nA} can always be handled with an enclosure that is larger in volume. A bigger cross-section of the busbars is also possible (custom solutions can be delivered if requested).

Concerning the outgoing side, one must make sure to be compliant with the given current I_{ng} for the fuse rails. Should it be necessary to choose a smaller fuse, the maximum current I_{ng} must be reduced by using the fuse factor f.

Example:

InA / A	Supply		Busbar cross section	Minimum Enclosure		Outgoing		
	Fuse rail	Fuse gG / A		Size	Height / mm	Fuse rail	Fuse gG / A	Ing / A
434	2x NH2	315	30x6	Gr. 0	1005	NH2	160	**152**

If a current of 434 A shall be distributed in a cable distribution cabinet, the supply must consist of a minimum of 2 x NH2 fuse rails with fuses of 315 A each.

To distribute this incoming current, a busbar system with a cross section of at least 30 x 6 mm^2 is needed. Thus, a compatible enclosure would be a standard cable distribution cabinet of size 0 in accordance with the German measurements standard DIN 43629-1 with a height of 1005 mm. Also, every cabinet with a higher volume can be used to distribute this current (e.g. size 0 / height: 1355 mm or size 1 / height: 1005 mm).

For the outgoing, NH2 fuse rails can be used. With fuses of 160 A, they can distribute a maximum of 152 A in this assembly configuration. Using three NH2 fuse rails to distribute the incoming current, two rails can distribute 152 A while the remaining one will still distribute 134 A. Every other load configuration of the outgoing fuse rails is also possible as long as no rail distributes more than the maximum I_{ng} shown in the table.

If a smaller fuse size is used, the fuse factor f = Ing/IN = 152 A / 160 A = 0,95 must be applied. If, for example, it is chosen to use fuses of 125 A, the I_{ng} must be reduced accordingly:

I_{ng125} = 0,95 x 125 A = 118,75 A.

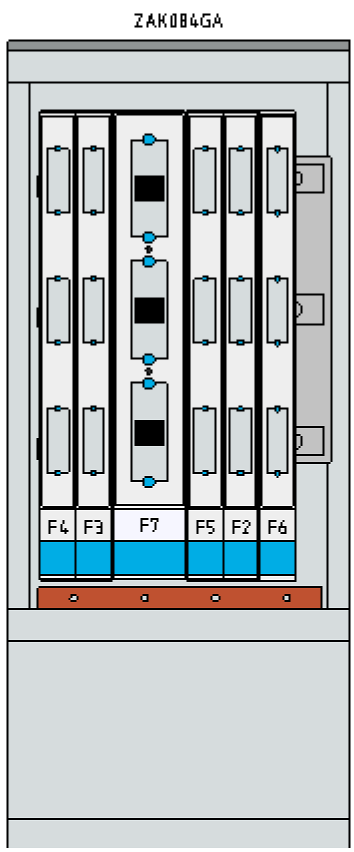
This means that no outgoing fuse rail can distribute more than 118,75 A without causing a prohibited temperature-rise inside the assembly.

800 VAC Application

I_{nA} / A	Supply		Busbar cross section	Minimum Enclosure		Outgoing			Comments
	Fuse rail	Fuse gG / A		Size	Height / mm	Fuse rail	Fuse gG / A	I_{ng} / A	
288	5 x NH00	63	30 x 6	Gr. 00	845	1 x NH3	315	288	I_{ng} reduced to 277 A if NH3 rail positioned on the edge of the busbar system.

Remark: To reach an I_{ng} = 288 A, the outgoing device must be positioned in the middle of the busbar system. A placement at the edge of the busbar system will only allow an I_{ng} = 277 A (see picture below).

Explanation: With the smallest available enclosure ZAK084GA (size 00, height: 845 mm) a nominal current of 288 A can be distributed via an outgoing device NH3 with a 315 A fuse and at least 5 x NH00 devices that are evenly loaded with 288A / 5 = 57,6 A. The current can also be distributed via more devices and a bigger enclosure can always be used.



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10.11 Verification of Short-Circuit Withstand

The test was performed as described in IEC 61439-1:2020, clause 10.11.5. The test specimens represent the most critical enclosures in the most critical configuration in accordance with table 13.

Rated values

Short-circuit values	400 VAC Application	800 VAC Application
Rated peak withstand current I_{pk}	52,5 kA	
Rated short-time withstand current I_{cw}	25 kA / 1 s	
Rated conditional short-circuit current of an ASSEMBLY I_{cc}	60 kA	30 kA

400 VAC short-circuit tests performed on all enclosure types of the smallest height:

Tested enclosures

Specimen	Size	Height / mm	Width / mm	Depth / mm	Reference	Busbars	Manufacturer
1	00	845	480	315	ZAK084GA	30 x 6 mm^2	Hager
2	0	845	585	315	ZAK080GA	30 x 6 mm^2	Hager
3	1	845	780	315	ZAK081GA	30 x 6 mm^2	Hager
4	2	845	1110	315	ZAK082GA	30 x 8 mm^2	Hager

Built-in Switching Devices and Components

- NH-fuse switch disconnectors

Type	Reference	I_n	Manufacturer
NH3	38036-0000	630 A	EFEN

- Fuse links

Type	Reference	I_n	U_n	P_V	Manufacturer
NH3	LNH3630MK	630 A	500 V	43,1 W	Hager

Overview of the test results

Specimen		Verified conditional short-circuit current I_{CC}	Verified peak withstand current I_{pk}	Verified short-time withstand current I_{cw}
1	3-pole	60,7 kA	-	-
	3-pole	-	53,0 kA	25,0 kA (1010 ms)
	1-pole	-	32,1 kA	15,4 kA (1014 ms)
2	3-pole	60,7 kA	-	-
	3-pole	-	52,8 kA	25,0 kA (1003 ms)
	1-pole	-	32,0 kA	15,4 kA (1004 ms)
3	3-pole	60,7 kA	-	-
	3-pole	-	61,9 kA	25,2 kA (1000 ms)
	1-pole	-	32,7 kA	15,5 kA (1010 ms)
4	3-pole	60,7 kA	-	-
	3-pole	-	52,6 kA	25,0 kA (1000 ms)
	1-pole	-	31,9 kA	15,4 kA (1014 ms)

800 VAC tests performed on most critical assemblies in accordance with Table 13:

Tested enclosures

Specimen	Size	Height	Width	Depth	Reference	Busbars	Manufacturer
1	00	845	480	315	ZAK084GA	30 x 6	Hager
2	1	845	780	315	ZAK081GA	30 x 6	Hager

ZAK084GA (smallest enclosure with smallest busbar cross section),
ZAK081GA (largest distance between busbar supports)

Built-in Switching Devices and Components

- NH-fuse switch disconnectors

Type	Reference	I_n	Manufacturer
NH3	LVSG3CPZ	630 A	Hager
NH00	LVSG00SPX	160 A	Hager

- Fuse links

Type	Reference	I_n	U_n	P_V	Manufacturer
NH3	N3035900	315 A	800 V	29 W	Jean Müller
NH00	N5033814	63 A	800 V	7 W	Jean Müller

Overview of the test results

Specimen	Verified conditional short-circuit current I_{CC}

1	NH3	3-pole	30,9 kA
		PEN	18,9 kA
	NH00	3-pole	30,9 kA
		PEN	18,9 kA
2	NH3	3-pole	30,9 kA
		PEN	18,9 kA
	NH00	3-pole	30,9 kA
		PEN	18,9 kA

10.12 Electromagnetic compatibility (EMC)

The assemblies are designed in accordance with IEC 61439-1:2020, Annex J.9.4.2, and fulfill the following conditions:

a) the incorporated devices and components are in compliance with the requirements for EMC for the stated environment (see J.9.4.1) as required by the relevant product or generic EMC standard.

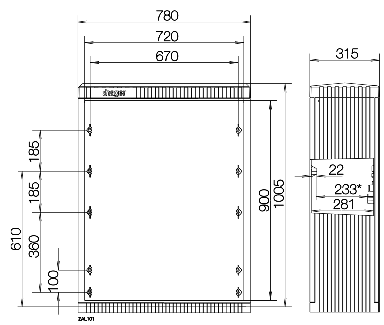
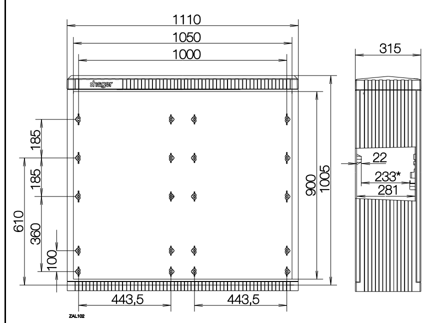
b) the internal installation and wiring is carried out in accordance with the devices and components' manufacturer's instructions (arrangement with regard to mutual influences, cable, screening, earthing, etc.).

A dedicated verification as described in J.10.12 is not necessary. The documentation of the devices' manufacturers must be considered.

10.13 Mechanical operation

After 200 mechanical cycles of the closing mechanism and the door, the protection degree of the enclosure was not affected. The force necessary for using the door did not change after the test.

Overview of series Cable Distribution Cabinets (ZAK…GA)

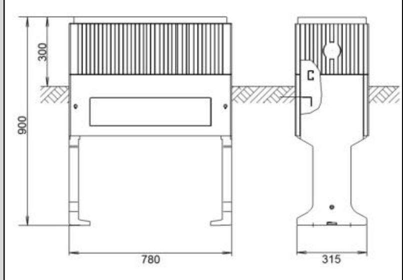
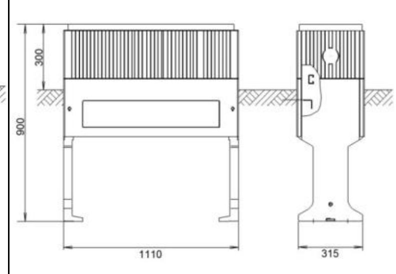
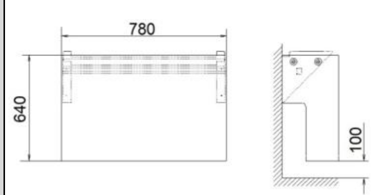
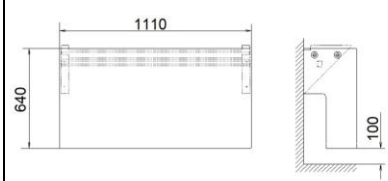
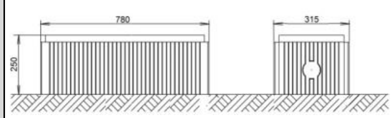
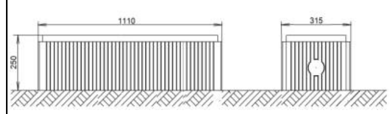
Cable Distribution Cabinets KVS (CDC)		
Size	1	2
Width in mm	780	1110
Height in mm	Depth: 315 mm	
1005		
Enclosure w/ busbar system:	**ZAK101GA**	**ZAK102GA**
Necessary Amount of ZAY95075:	**3 bags**	**4 bags**

Reference table Cable Distribution Cabinets (ZAK…GA)

Reference	**Description**
ZAK101GA	CDC, size 1/1005, w/ 4 pole busbar system 30 x 6 mm
ZAK101VAA	CDC, size 1/1005, w/ 4 pole busbar system 30 x 10 mm, with 1 x NH2, 2 x NH2
ZAK102GA	CDC, size 2/1005, w/ 4 pole busbar system 30 x 8 mm

Measurements in accordance with DIN 43629-1

Pedestals

Cable Distribution Cabinets KVS (CDC)		
Size	1	2
Width in mm	780	1110
Height in mm	Depth: 315 mm	
Necessary Amount of ZAY95075:	**3 bags**	**4 bags**
Pedestal ZAX - Standard		
900	 **ZAX006**	 **ZAX007**
Pedestal ZAX - Wall Console		
640	 **ZAX012**	 **ZAX013**
Pedestal ZAX - On-ground pedestal		
250	 **ZAX015**	 **ZAX016**

Reference table Pedestals for Cable Distribution Cabinets

Reference	Description
ZAX006	Embedded pedestal, size 1, height: 900 mm
ZAX007	Embedded pedestal, size 2, height: 900 mm
ZAX012	Wall console, size 1, height: 640 mm
ZAX013	Wall console, size 2, height: 640 mm
ZAX015	Surface-mounted base, size 1, height: 250 mm
ZAX016	Surface-mounted base, size 2, height: 250 mm

Measurements in accordance with DIN 43629-2

General characteristics

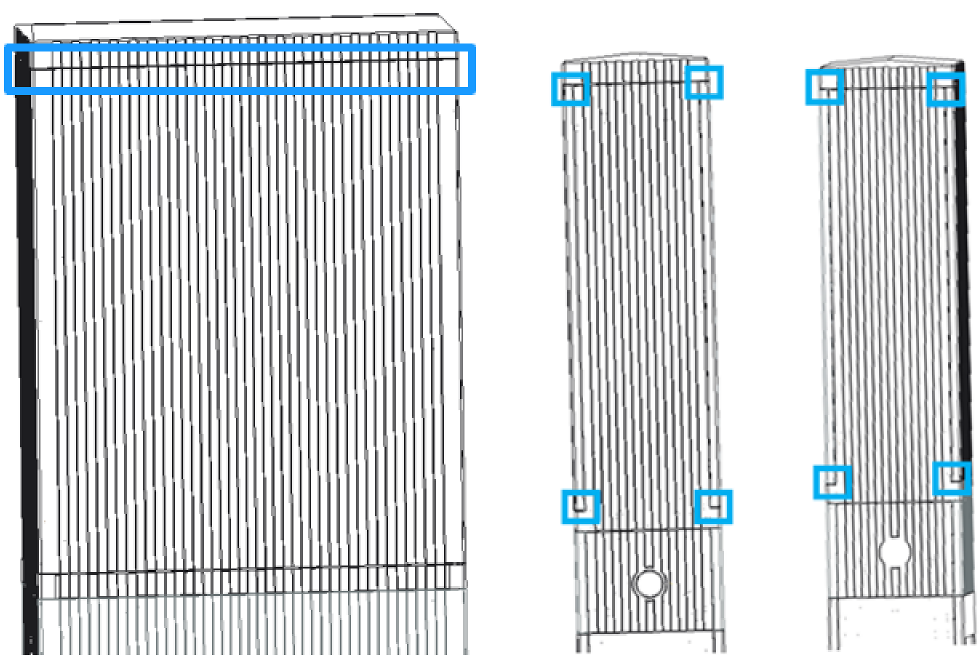
Technical Characteristic	Technical Value
Dimensional Standard	DIN 43629-1/-2/-3
Product Standards	IEC 61439-1:2020-05, EN 61439-1:2011 IEC 61439-5:2023-05, EN 61439-5:2015
Classification according to IEC 62208	
Type of Material	Insulating
Method of Fixing	Floor standing (on-ground / in-ground) / wall mounting (wall console)
Intended Location	Outdoor
Degree of Protection (IP)	general: IP44 (IEC 60529) ventilation areas: IP34D (IEC 60529)
Protection against Mechanical Impact (IK)	IK10 (IEC 62262)
Rated Insulation Voltage U_i	1,000 V AC
Enclosure Material	
Material Type	Glass-fibre reinforced polyester (EN 14598-1 UP)
Colour	RAL 7035
Material Conformity	Low-Voltage Directive 2014/35/EU RoHS Directive 2011/65/EU + RoHS 2015/863/EU (Amendment) REACH Regulation EC 1907/2006
General Characteristics	
Surface Structure	Ribbed
Surface Treatment	Untreated
Protection Class	II
Permissible Loads	See chapter *Permissible Loads*
Environmental Conditions	
Ambient temperature min./max./24 h average	-25 °C / 40 °C / 35 °C **Working temperatures for devices must be considered.**
Maximum relative humidity	100% at -25 °C to +27 °C 60 % at 35 °C 46 % at 40 °C
Pollution Degree	3
Electrical Characteristics	
Volume Resistivity	10^{14} Ohm*cm (IEC 60093)
Dielectric Strength	4 kV (EN 60598-1) 14.5 kV (IEC 61439-1:2020)
Tracking Resistance	CTI 600 (IEC 60112)
Thermal Characteristics	
Glow-wire test	960 °C (IEC 60698-2-1)
Flammability	V0 4.0 mm (UL-94)
Heat Resistance	> 140 °C (IEC 62208/ IEC 60216) > 200 °C (ISO 75-2 A)
Chemical Characteristics	
Halogen content	Halogen free
Resistance against termites	Termite resistant

UV and Corrosion Resistance	
UV resistance, mechanical	> 70 % retaining values of flexural strength (ISO 178) and Charpy impact (ISO 179)
Corrosion Resistance of Metal Parts	Damp heat cycling test (IEC 60028-2-30), Severity A, 55 °C, 6 cycles and variant 1
Further Requirements according to IEC 62208	
Axial Loads of Metal Inserts	Not applicable
Thermal Stability (9.9.1)	Dry heat IEC 60068-2-2 Test Bb / 70 °C
Resistance to Normal Heat (9.9.2)	IEC 60085
Resistance to Abnormal Heat and to Fire (9.9.3)	960 °C IEC 60695-2-10 / -11
Dielectric Strength (9.10)	1.5 times 2,200 VAC

Exceptions of IP Protection

The cabinets have an IP protection of IP44 in accordance with IEC 60529 except in the defined ventilation areas shown below. In these areas, the protection is reduced to IP34D. This means, that still no water can reach the protected space since the second numeral of the code remains identical. The first numeral is reduced to 3 with the addition of the letter "D" at the end. This means, 1 mm wire cannot enter the cabinet and reach the protected space or any live parts, but a spherical object that can run through the ventilation labyrinth might enter the enclosure.

Left: Ventilation area between back wall and roof; right: ventilation area at the edges of back wall and door to the side wall



hagergroup

Interface characteristics

In respect to IEC 61439-1:2020 & IEC 61439-5:2023

Characteristic	Standard Application	800 VAC Application
Voltage Ratings		
Rated voltage U_n	400 V AC	800 V AC
Rated operational voltage U_e	400 V AC	800 V AC
Rated insulation voltage U_i	1,000 V AC	1,000 V AC
Rated impulse withstand voltage U_{imp}	up to 12 kV **Consider the values of the devices!**	up to 8 kV **Consider the values of the devices!**
Current Ratings		
Rated current of the assembly I_{nA}	up to 653 A (standard) / 680 A (custom setup) **Consider the verification of temperature rise!**	288 A **Consider the verification of temperature rise!**
Rated current of a circuit I_{nc}	Depending on the configuration	
Rated peak withstand current I_{pk}	52,5 kA	
Rated short-time withstand current I_{cw}	25 kA / 1 s	
Rated conditional short-circuit current of an ASSEMBLY I_{cc}	60 kA	30 kA
Rated diversity factor RDF	none, consult table 101	
Rated frequency f_n	50 Hz	

Other characteristics

In respect to IEC 61439-1:2020 & IEC 61439-5:2023

a) additional requirements depending on the use of a functional unit (e.g. type of coordination, overload characteristics)
None

b) pollution degree of the macro-environment (see 3.6.10.2)
III

c) types of earthing system for which the assembly is designed
TN, TT

d) indoor and/or outdoor installation (see 3.5.1 and 3.5.2)
Outdoor installation

e) stationary or movable (see 3.5.3 and 3.5.4)
Stationary

f) degree of protection against contact with hazardous live parts, ingress of solid foreign bodies and water, IP code (See 8.2.2 of IEC 61439-1:2020)
IP44, except defined ventilation area: **IP34D** (see page 9)

g) intended for use by ordinary or authorized persons (see 3.7.16 and 3.7.17)
Authorized persons

h) electromagnetic compatibility (EMC) classification (see Annex J)

i) special service conditions, if applicable (see 7.2)
no special service conditions

j) external design (see 3.3)
enclosed assembly (IP44/IP34D)

k) degree of protection against mechanical impact, IK code, if applicable (see 8.2.1)
IK10

l) type of construction – fixed or removable parts (see 8.5.1 and 8.5.2)
Fixed parts

m) type of short-circuit protective device(s) (see 9.3.2)
NH-fuse switch disconnectors

n) measures for protection against electric shock
Protection class II

o) overall dimensions (including projections e.g handles, covers, doors), if required
Not required

p) the weight, if required
Not required

q) installation method
in-ground pedestal, on-ground pedestal, wall console (see overview)

r) external conductor type
cable

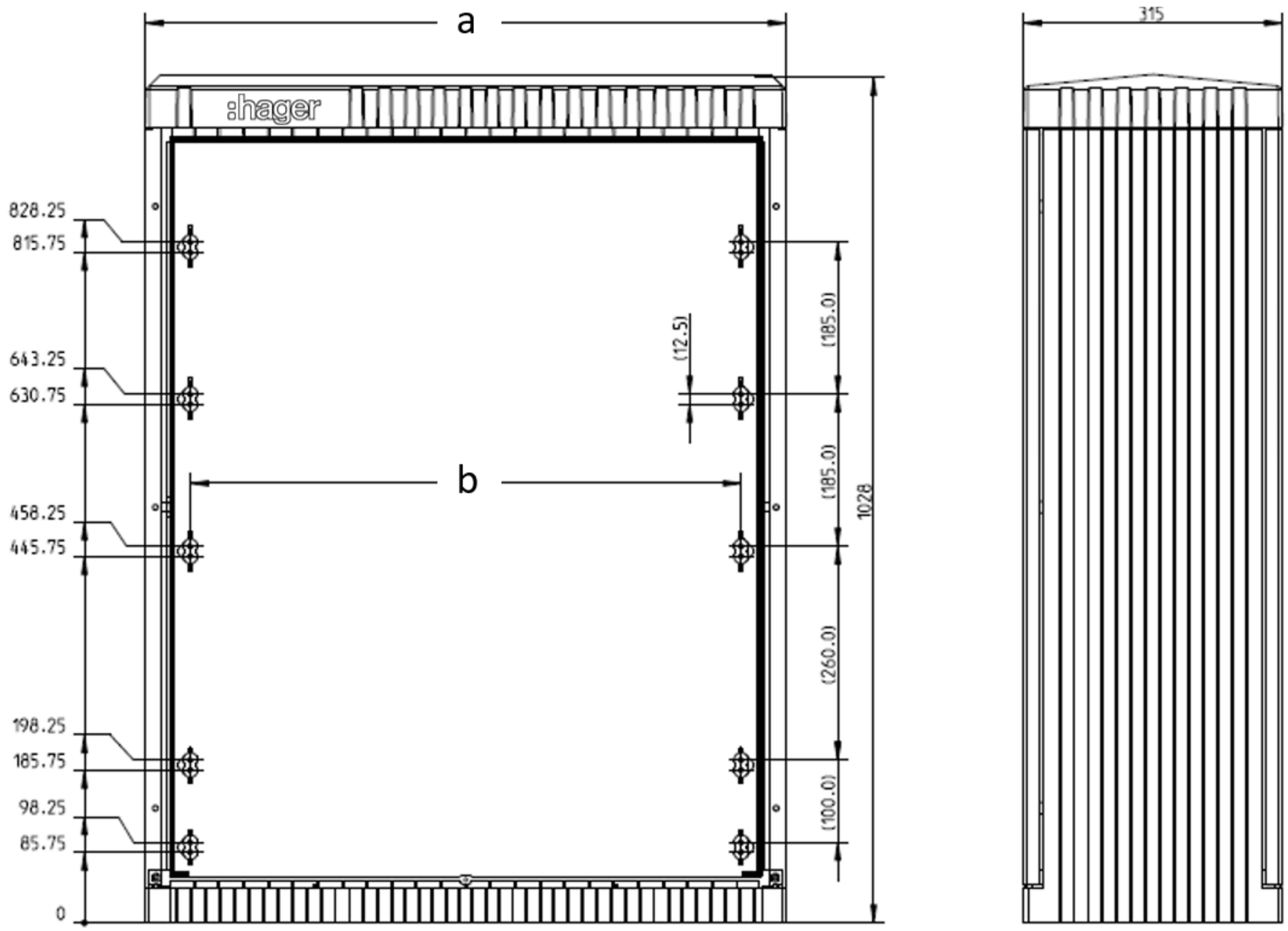
s) direction of external conductors
from below

t) external conductor material
Copper/Aluminium

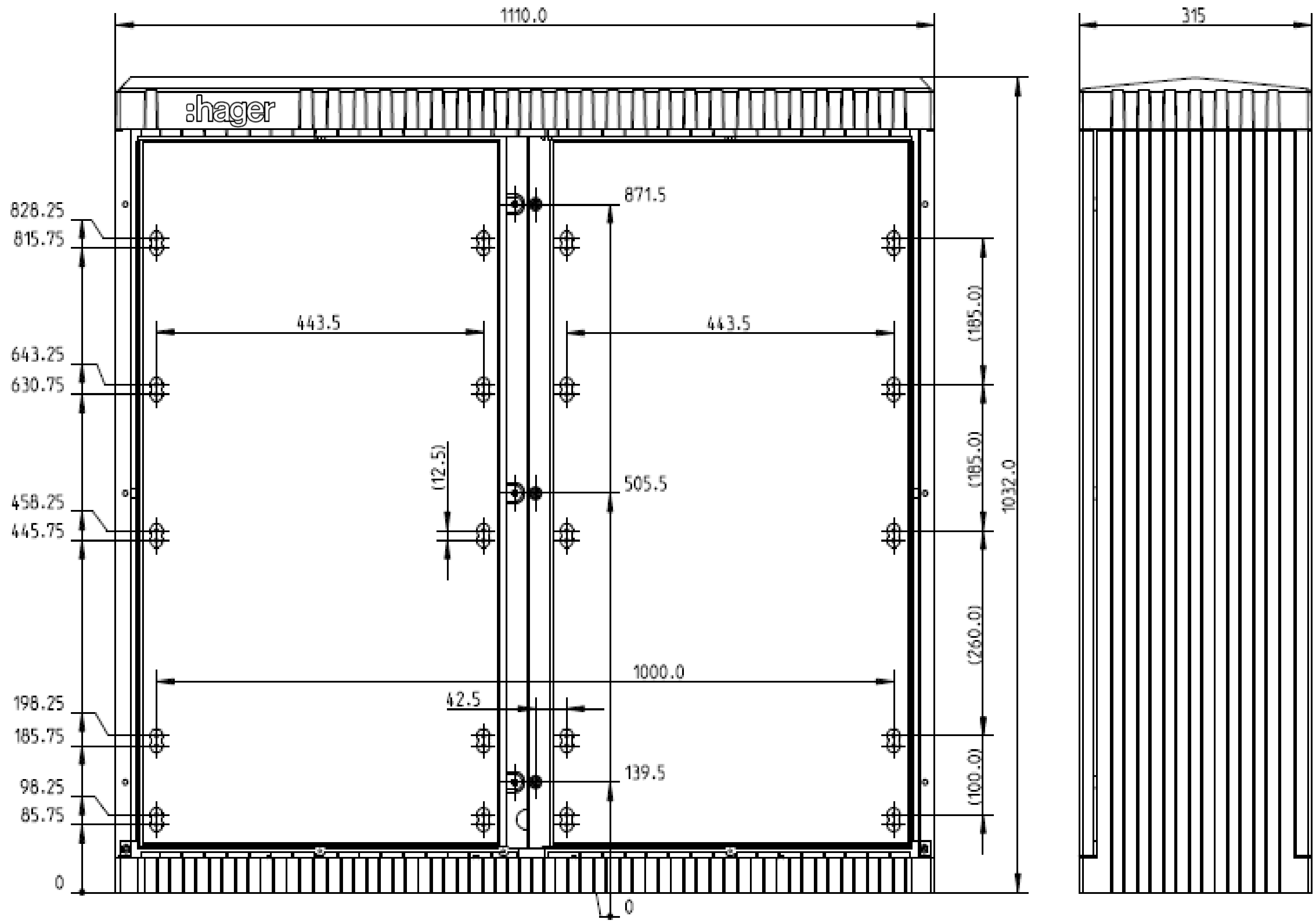
u) external phase conductor, cross sections, and terminations
according to table AA.1 for assemblies up to 630 A, termination directly on fusegear devices with screws M12 (NH2/3), M8 (NH00) or directly on busbars with screws M12

v) external PE, N, PEN conductors, cross sections, and terminations
according to table 5, IEC 61439-1, termination directly on PEN busbar with screws M12

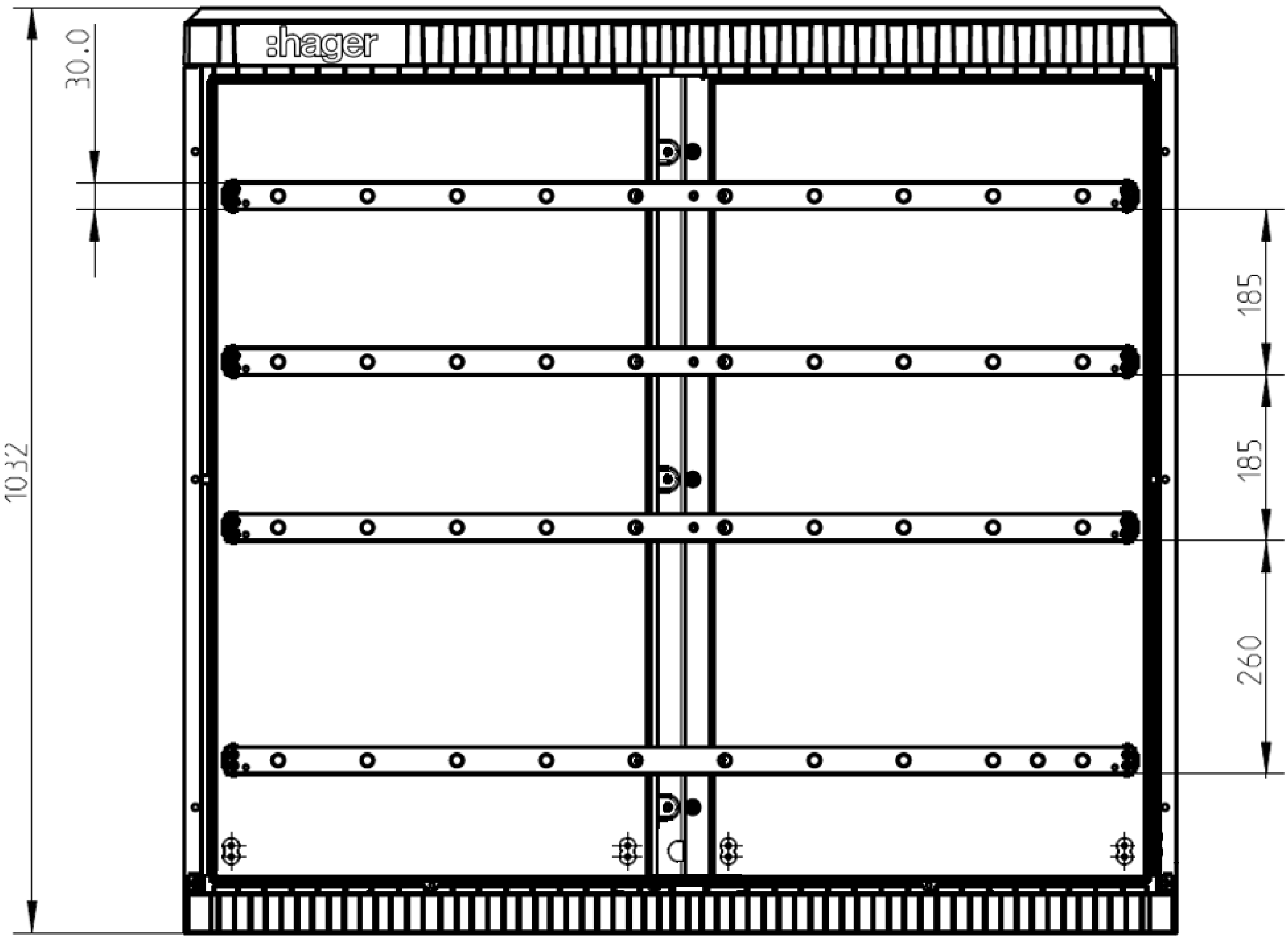
Enclosure Measurements



Measurements for ZAL101 (reference with busbars ZAK101GA)



Measurements for ZAL102 (reference with busbars ZAK102GA)



Measurements for busbar system as included in ZAK102GA

Equipment

LVSG vertical NH-fuse switch disconnectors

**devices also tested for 800 VAC application*

Type	Reference	I_n / A	Manufacturer
NH00*	LVSG00SPX	160	Hager
NH00	LVSG00RPX	160	Hager
NH00	LVSG00TRPX	160	Hager
NH00	LVSG00TSPX	160	Hager
NH1	LVSG1CPX	250	Hager
NH2	LVSG2CPX	400	Hager
NH3	LVSG3CPX	630	Hager
NH3*	LVSG3CPZ	630	Hager
NH1	LVSR1VPVK4	250	Hager
NH2	LVSR2VPVK4	400	Hager
NH3	LVSR3VPVK4	630	Hager
NH3	LVTG1000CP	1000	Hager
NH3	LVTG1000TP	1000	Hager
NH3	LVSR3TP	630	Hager
NH3	38036-0000	630	EFEN
NH3	438.53.10.XX.YY	630	Pronutec
NH2	L203100103	400	Jean Müller
NH2	9-E-EH241AAG	400	Pronutec
NH2	38864-0020	400	EFEN
NH2	38865-0200	400	EFEN

Low-voltage fuse links

**fuses for 800 VAC application*

Type	Reference	I_n / A	U_n / V	P_V / W	Manufacturer
NH00*	N5033814	63	800	7	Jean Müller
NH00	LNH0063M	63	500	5,4	Hager
NH00	LNH0080M	80	500	6,5	Hager
NH00	LNH0100M	100	500	7,5	Hager
NH00	LNH0125M	125	500	10	Hager
NH00	LNH0160M	160	500	12	Hager
NH00	LNH0063MK	63	500	5,4	Hager
NH00	LNH0080MK	80	500	6,5	Hager
NH00	LNH0100MK	100	500	7,5	Hager
NH00	LNH0125MK	125	500	10	Hager
NH00	LNH0160MK	160	500	12	Hager
NH1	LNH1160M	160	500	14,6	Hager
NH1	LNH1200M	200	500	18	Hager
NH1	LNH1224M	224	500	19	Hager
NH1	LNH1250M	250	500	20	Hager
NH1	LNH1160MK	160	500	14,6	Hager
NH1	LNH1200MK	200	500	18	Hager
NH1	LNH1224MK	224	500	19	Hager
NH1	LNH1250MK	250	500	20	Hager
NH2	LNH2160M	160	500	15	Hager
NH2	LNH2200M	200	500	18,5	Hager
NH2	LNH2224M	224	500	19,2	Hager
NH2	LNH2250M	250	500	20,6	Hager
NH2	LNH2300M	300	500	24,2	Hager

NH2	LNH2315M	315	500	25	Hager
NH2	LNH2355M	355	500	31,5	Hager
NH2	LNH2400M	400	500	28,5	Hager
NH2	LNH2160MK	160	500	15	Hager
NH2	LNH2200MK	200	500	18,5	Hager
NH2	LNH2224MK	224	500	19,2	Hager
NH2	LNH2250MK	250	500	20,6	Hager
NH2	LNH2300MK	300	500	24,2	Hager
NH2	LNH2315MK	315	500	25	Hager
NH2	LNH2355MK	355	500	31,5	Hager
NH2	LNH2400MK	400	500	28,5	Hager
NH3	LNH3400M	400	500	34	Hager
NH3	LNH3425M	425	500	39	Hager
NH3	LNH3500M	500	500	43	Hager
NH3	LNH3630M	630	500	43,1	Hager
NH3	LNH3400MK	400	500	34	Hager
NH3	LNH3425MK	425	500	39	Hager
NH3	LNH3500MK	500	500	43	Hager
NH3	LNH3630MK	630	500	43,1	Hager
NH3*	N3035900	315	800	29	Jean Müller

Accessories

Reference	Description
LVZ1230	Screws for fixation of fusegear devices
LVZ00DA185-185	Double adapter for two vertical switchgear NH00
LVZ00AL185	Cover for terminal compartment, NH00/185mm
LVZAL	Cover for terminal compartment long, NH1-3/185mm
LVZAK1	Cover for terminal compartment short, NH1-3/185mm
LVZ00AL185	Terminal clamp, 95 mm^2, NH00/185mm
LVZ001A	Terminal clamp, 150 mm^2, NH00/185mm
LVZ1230	Terminal clamp, 240 mm^2, NH1-3
ZAY95075	Base filler, 25 l