

Certificate of Conformity

No. ESY 119530 0003 Rev. 00

Holder of Certificate: **KKT KOLBE Küchentechnik GmbH & Co. KG**
Ohmstraße 17
96175 Pettstadt
GERMANY

Product: **Converter
(Hybrid Solar Inverter)**

Model(s): **HKW6-1P3, HKW8-1P3, HKW10-1P3,
HKW12-1P3, HKW15-1P3**


Parameters: See page 2

Applicable standards: VDE-AR-N 4105:2018
DIN VDE V 0124-100 (VDE V 0124-100):2020

This Certificate of Conformity confirms the compliance with the above listed standards on a voluntary basis. It refers only to the sample submitted to TÜV SÜD Product Service GmbH and does not certify the quality or safety of the serial products. It was issued according to TÜV SÜD Product Service certification program Photovoltaics and Grid Integration. For details see: www.tuvsud.com/ps-cert

Test report no.: 64290223152101

Date, 2023-02-03



(Billy Qiu)

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Parameters:

Model	HKW6-1P3	HKW8-1P3	HKW10-1P3	HKW12-1P3	HKW15-1P3
DC Link input Voltage range	1000 Vd.c.				
DC Link input maximum continuous current	2*13 Ad.c.				
DC Link input power	9000 W	12000 W	15000 W	18000 W	22500 W
Battery type	Lithium-ion				
Battery rated voltage	200 Vd.c.	250 Vd.c.	300 Vd.c.	350 Vd.c.	400 Vd.c.
Battery operating input voltage range	125~600 Vd.c.				
Max. Battery charging/discharge power	15000 W				
Max. Battery charging/discharge current	50 Ad.c.				
Maximum grid input apparent power	13200 VA	17600 VA	22000 VA	26400 VA	30000 VA
Rated grid input frequency	50 Hz				
Rated grid input voltage	230/400 Va.c., 3/N/PE				
Max. continuous grid input current	19 Aa.c.	25.5 Aa.c.	31.9 Aa.c.	38.2 Aa.c.	43.5 Aa.c.
Rated grid output active power	6000 W	8000 W	10000 W	12000 W	15000 W
Rated grid output apparent power	6600 VA	8800 VA	11000 VA	13200 VA	16500 VA
Maximum grid output apparent power	6600 VA	8800 VA	11000 VA	13200 VA	16500 VA
Max. active power P _E max	5999.1 W	7980.2 W	9987.6 W	11992.4 W	15004.9 W
Max. apparent power S _E max	6614.0 VA	8837.8 VA	11003.5 VA	13192.0 VA	16540.9 VA
Rated grid output frequency	50 Hz				
Rated grid output voltage	230/400 Va.c., 3W+N+PE				
Max. grid continuous output current	9.5 Aa.c.	12.7 Aa.c.	15.9 Aa.c.	19.1 Aa.c.	23.8 Aa.c.
Power factor	0.9 leading~0.9 lagging				
NS protection	Integrated NS protection with interface switch inside (HKW6-1P3, HKW8-1P3, HKW10-1P3, HKW12-1P3, HKW15-1P3)				

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Unit Certificate		
Manufacturer	KKT KOLBE Küchentechnik GmbH & Co. KG	
Power generation unit type	[converter]: <u>HKW6-1P3, HKW8-1P3, HKW10-1P3, HKW12-1P3, HKW15-1P3</u> Remark: certified on representative model HKW15-1P3 of family design products, results of the measurement of HKW15-1P3 can be transferred to other models based on transferability rule of measurements in DIN VDE V 0124-100 (VDE V 0124-100):2020.	
Technical data	Max. active power $P_{E_{max}}$	5999.1 W (HKW6-1P3) 7980.2 W (HKW8-1P3) 9987.6 W (HKW10-1P3) 11992.4 W (HKW12-1P3) 15004.9 W (HKW15-1P3)
	Max. apparent power $S_{E_{max}}$	6614.0 VA (HKW6-1P3) 8837.8 VA (HKW8-1P3) 11003.5 VA (HKW10-1P3) 13192.0 VA (HKW12-1P3) 16540.9 VA (HKW15-1P3)
	Rated voltage	230/400 Va.c., 3W+N+PE
	Rated current (AC) I_r	21.7 A (HKW15-1P3)
	Initial short-circuit AC current	23.8 A (HKW15-1P3)
Network connection rule	VDE-AR-N 4105 “Generators connected to the low-voltage distribution network” Technical minimum requirements for connection and parallel operation of power generation systems connected to the low-voltage network	
Test requirement	DIN VDE V 0124-100 (VDE V 0124-100) “Network integration of power generation systems – Low voltage” Test requirements for power generation units intended for connection to and parallel operation on the low-voltage network	
Test report	64.290.22.31521.01 from 28.01.2023	
The above designated power generation unit meets the requirements of VDE-AR-N 4105		
This unit certificate includes extract report information of E.5 of VDE-AR-N 4105 for the power generation unit(s)		

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Certificate of NS protection	
Manufacturer	KKT KOLBE Küchentechnik GmbH & Co. KG
Type of NS protection	Integrated NS protection
Central NS protection	No
Integrated NS protection	Yes HKW6-1P3 HKW8-1P3, HKW10-1P3, HKW12-1P3, HKW15-1P3
Network connection rule	VDE-AR-N 4105 “Generators connected to the low-voltage distribution network” Technical minimum requirements for connection and parallel operation of power generation systems connected to the low-voltage network
Test requirement	DIN VDE V 0124-100 (VDE V 0124-100) “Network integration of power generation systems – Low voltage” Test requirements for power generation units intended for connection to and parallel operation on the low-voltage network
Test report	64.290.22.31521.01 from 28.01.2023
The network and system protection designated above meets the requirements of VDE-AR-N 4105.	
This certificate of NS protection includes extract report information of E.7 of VDE-AR-N 4105 for the NS protection.	

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E.5 Test report "Network interactions " for generating units with an input current > 75 A

Extract from test report for unit certificate "Determination of electrical properties"		No. 64.290.22.31521.01
Generation unit manufacturer:	KKT KOLBE Küchentechnik GmbH & Co. KG	
Manufacturer indications:	Type of system	Hybrid Solar Inverter
	Max. active power $P_{E_{max}}$	5999.1 W (HKW6-1P3) 7980.2 W (HKW8-1P3) 9987.6 W (HKW10-1P3) 11992.4 W (HKW12-1P3) 15004.9 W (HKW15-1P3)
	Rated voltage	230/400 Va.c., 3W+N+PE
Period of measurement:	From 2022-12-09 to 2023-01-28	
Rapid voltage change (HKW15-1P3)		
Connection without provisions (regarding the primary energy carrier)	$k_i=0.50$	
Most adverse case when switching between generator levels Remark: Not applicable for PV system	$k_i=0.50$	
Connection at nominal conditions (of the primary energy carrier)	$k_i=1.00$	
Disconnection at rated power	$k_i=1.00$	
Worst case value of all switching operations	$k_{imax}=1.00$	

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Flicker – EN 61000-3-3									
		Starting			Stopping			Running	
		d _{max} (%)	d _c (%)	d _(t) (%)	d _{max} (%)	d _c (%)	d _(t) (%)	P _{st}	P _{It} 2 hours
Measured Values	L1	0.187	0.110	0	0.168	0.107	0	0.078	0.068
	L2	0.140	0.027	0	0.133	0.025	0	0.154	0.148
	L3	0.000	0.000	0	0.000	0.000	0	0.066	0.059
Limits		4%	3.3%	3.3% _{500ms}	4%	3.3%	3.3% _{500ms}	1.0	0.65

Remark: This table is applied to devices with rated current of ≤16A

Flicker – EN 61000-3-11						
Simulated network voltage (V)	L1 (P-N)	230.0	Network impedance	L1	0.24Ω+j0.15Ω	
	L2 (P-N)	230.0		L2	0.24Ω+j0.15Ω	
	L3 (P-N)	230.0		L3	0.24Ω+j0.15Ω	
	--	--		N	0.16Ω+j0.10Ω	
EZE operating current (A)	L1	21.7	EZE operating power (kVA)	L1	5000	
	L2	21.7		L2	5000	
	L3	21.7		L3	5000	
Simulated network frequency (Hz)	50		Short circuit power S _k (VA)	495000		
Plt (Maximum measured P _{st})	L1	0.078	EZE nominal power (P _n /W)	15000		
	L2	0.154				
	L3	0.067				
Maximum flicker coefficient C _{φk}	L1	2.574	--	--		
	L2	5.082				
	L3	2.211				
P _{st}	#1	#2	#3	#4	#5	#6
L1	0.075	0.076	0.078	0.078	0.070	0.064
L2	0.154	0.154	0.153	0.153	0.150	0.145
L3	0.064	0.065	0.066	0.067	0.061	0.054
P _{st}	#7	#8	#9	#10	#11	#12
L1	0.065	0.059	0.059	0.058	0.060	0.065
L2	0.147	0.143	0.143	0.141	0.143	0.148
L3	0.057	0.052	0.051	0.050	0.052	0.058

Remark: This table is applied to devices with rated current of >16A and ≤75A

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Harmonics												
Phase L1												
Harmon. Nr.	P/P _{E_{max}}											Limit (A)
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
0	0.0239	0.0038	0.0060	0.0068	0.0067	0.0062	0.0053	0.0644	0.0513	0.0446	0.0336	0.5% IR
1	0.5038	1.6536	2.9267	4.4431	5.9722	7.2822	8.8009	10.1076	11.6460	13.1659	14.4701	-
2	0.0278	0.0280	0.0141	0.0302	0.0455	0.0525	0.0590	0.0624	0.0666	0.0697	0.0737	1.08
3	0.0475	0.0431	0.0372	0.0394	0.0433	0.0398	0.0352	0.0366	0.0400	0.0357	0.0367	2.30
4	0.0063	0.0153	0.0384	0.0397	0.0249	0.0171	0.0144	0.0134	0.0142	0.0167	0.0183	0.43
5	0.0426	0.0433	0.0424	0.0391	0.0407	0.0450	0.0477	0.0442	0.0433	0.0479	0.0466	1.14
6	0.0056	0.0117	0.0102	0.0233	0.0227	0.0214	0.0176	0.0162	0.0160	0.0139	0.0127	0.30
7	0.0147	0.0260	0.0303	0.0301	0.0255	0.0256	0.0296	0.0343	0.0322	0.0300	0.0335	0.77
8	0.0030	0.0140	0.0093	0.0125	0.0188	0.0181	0.0163	0.0152	0.0137	0.0138	0.0130	0.23
9	0.0100	0.0142	0.0198	0.0217	0.0202	0.0177	0.0174	0.0198	0.0253	0.0249	0.0228	0.40
10	0.0048	0.0138	0.0118	0.0082	0.0116	0.0124	0.0122	0.0106	0.0106	0.0096	0.0104	0.18
11	0.0073	0.0127	0.0179	0.0216	0.0217	0.0197	0.0178	0.0163	0.0189	0.0242	0.0238	0.33
12	0.0074	0.0074	0.0128	0.0083	0.0116	0.0124	0.0124	0.0115	0.0091	0.0100	0.0104	0.15
13	0.0167	0.0268	0.0636	0.0288	0.0807	0.1169	0.1479	0.1643	0.1843	0.2067	0.2245	0.21
14	0.0065	0.0053	0.0087	0.0071	0.0068	0.0080	0.0075	0.0082	0.0076	0.0064	0.0070	0.13
15	0.0093	0.0209	0.0278	0.0187	0.0336	0.0589	0.0771	0.0908	0.0976	0.1052	0.1135	0.15
16	0.0062	0.0099	0.0059	0.0059	0.0064	0.0075	0.0079	0.0070	0.0074	0.0063	0.0058	0.12
17	0.0143	0.0237	0.0183	0.0153	0.0183	0.0380	0.0516	0.0634	0.0710	0.0714	0.0751	0.13
18	0.0053	0.0057	0.0036	0.0056	0.0053	0.0054	0.0051	0.0049	0.0047	0.0052	0.0046	0.10
19	0.0201	0.0193	0.0100	0.0093	0.0066	0.0192	0.0329	0.0390	0.0513	0.0549	0.0536	0.12
20	0.0042	0.0028	0.0036	0.0057	0.0038	0.0049	0.0056	0.0055	0.0052	0.0056	0.0061	0.09
21	0.0212	0.0138	0.0035	0.0098	0.0052	0.0138	0.0228	0.0286	0.0365	0.0464	0.0476	0.11
22	0.0032	0.0047	0.0042	0.0045	0.0044	0.0047	0.0041	0.0038	0.0035	0.0035	0.0039	0.08
23	0.0196	0.0178	0.0122	0.0105	0.0038	0.0115	0.0181	0.0239	0.0266	0.0347	0.0421	0.10
24	0.0026	0.0038	0.0049	0.0043	0.0033	0.0038	0.0043	0.0044	0.0041	0.0037	0.0044	0.08
25	0.0190	0.0194	0.0167	0.0105	0.0059	0.0106	0.0131	0.0164	0.0178	0.0189	0.0253	0.09
26	0.0022	0.0023	0.0037	0.0031	0.0032	0.0034	0.0034	0.0035	0.0035	0.0032	0.0035	0.07
27	0.0165	0.0121	0.0139	0.0094	0.0026	0.0084	0.0127	0.0155	0.0183	0.0185	0.0204	0.08
28	0.0017	0.0022	0.0028	0.0025	0.0029	0.0030	0.0034	0.0033	0.0036	0.0029	0.0027	0.07
29	0.0141	0.0126	0.0093	0.0083	0.0026	0.0084	0.0111	0.0126	0.0152	0.0159	0.0154	0.08
30	0.0017	0.0023	0.0020	0.0019	0.0029	0.0030	0.0033	0.0032	0.0031	0.0035	0.0028	0.06
31	0.0124	0.0137	0.0067	0.0080	0.0028	0.0084	0.0107	0.0115	0.0138	0.0133	0.0131	0.07
32	0.0016	0.0026	0.0023	0.0018	0.0025	0.0025	0.0026	0.0029	0.0027	0.0033	0.0032	0.06
33	0.0100	0.0087	0.0083	0.0075	0.0032	0.0061	0.0097	0.0114	0.0127	0.0142	0.0143	0.07
34	0.0015	0.0018	0.0029	0.0021	0.0025	0.0023	0.0029	0.0028	0.0029	0.0026	0.0033	0.05
35	0.0079	0.0063	0.0088	0.0069	0.0035	0.0053	0.0090	0.0105	0.0096	0.0128	0.0124	0.06
36	0.0016	0.0017	0.0025	0.0024	0.0026	0.0022	0.0024	0.0026	0.0027	0.0020	0.0026	0.05
37	0.0073	0.0085	0.0089	0.0079	0.0051	0.0052	0.0092	0.0107	0.0102	0.0113	0.0128	0.06
38	0.0016	0.0024	0.0019	0.0022	0.0024	0.0021	0.0021	0.0020	0.0022	0.0022	0.0019	0.05
39	0.0057	0.0058	0.0061	0.0074	0.0053	0.0033	0.0073	0.0091	0.0106	0.0088	0.0116	0.06
40	0.0013	0.0015	0.0014	0.0024	0.0026	0.0017	0.0023	0.0025	0.0027	0.0028	0.0022	0.05
THD	2.360%	0.699%	0.801%	0.715%	0.907%	1.176%	1.432%	1.067%	1.769%	1.933%	2.072%	5%
Phase L2												
Harmon. Nr.	P/P _{E_{max}}											Limit (A)
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	

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0	0.0696	0.0120	0.0189	0.0217	0.0232	0.0242	0.0251	0.0172	0.0262	0.0267	0.0271	0.5% IR
1	0.2577	1.4779	2.7720	4.3107	5.8618	7.1901	8.7268	10.0517	0.8005	13.1430	14.4615	-
2	0.0360	0.0965	0.1353	0.1389	0.1334	0.1321	0.1332	0.1368	0.0096	0.1416	0.1429	1.08
3	0.0944	0.0936	0.0883	0.0925	0.0974	0.0944	0.0887	0.0918	0.0065	0.0881	0.0910	2.30
4	0.0120	0.0600	0.0273	0.0354	0.0290	0.0228	0.0196	0.0164	0.0011	0.0153	0.0164	0.43
5	0.0635	0.0688	0.0689	0.0664	0.0692	0.0736	0.0751	0.0696	0.0048	0.0762	0.0726	1.14
6	0.0076	0.0105	0.0056	0.0241	0.0305	0.0315	0.0298	0.0285	0.0018	0.0253	0.0249	0.30
7	0.0260	0.0350	0.0423	0.0445	0.0446	0.0454	0.0513	0.0561	0.0037	0.0503	0.0554	0.77
8	0.0146	0.0294	0.0142	0.0079	0.0179	0.0209	0.0227	0.0221	0.0015	0.0227	0.0232	0.23
9	0.0187	0.0208	0.0302	0.0358	0.0367	0.0363	0.0343	0.0370	0.0029	0.0418	0.0397	0.40
10	0.0181	0.0195	0.0176	0.0064	0.0123	0.0161	0.0189	0.0185	0.0012	0.0161	0.0165	0.18
11	0.0127	0.0125	0.0156	0.0207	0.0255	0.0249	0.0250	0.0233	0.0017	0.0302	0.0304	0.33
12	0.0158	0.0060	0.0168	0.0113	0.0080	0.0134	0.0155	0.0208	0.0016	0.0222	0.0215	0.15
13	0.0194	0.0150	0.0706	0.0252	0.0440	0.0881	0.1261	0.1464	0.0119	0.1958	0.2130	0.21
14	0.0134	0.0162	0.0086	0.0097	0.0060	0.0080	0.0108	0.0096	0.0009	0.0142	0.0139	0.13
15	0.0335	0.0335	0.0420	0.0214	0.0101	0.0349	0.0597	0.0745	0.0058	0.0964	0.1056	0.15
16	0.0101	0.0151	0.0035	0.0102	0.0046	0.0072	0.0099	0.0103	0.0007	0.0131	0.0150	0.12
17	0.0379	0.0477	0.0177	0.0275	0.0056	0.0246	0.0401	0.0554	0.0042	0.0664	0.0736	0.13
18	0.0068	0.0028	0.0039	0.0076	0.0055	0.0053	0.0062	0.0074	0.0004	0.0065	0.0087	0.10
19	0.0357	0.0329	0.0096	0.0270	0.0035	0.0142	0.0249	0.0337	0.0031	0.0469	0.0491	0.12
20	0.0049	0.0064	0.0060	0.0066	0.0055	0.0043	0.0057	0.0075	0.0006	0.0072	0.0073	0.09
21	0.0309	0.0250	0.0233	0.0261	0.0026	0.0112	0.0181	0.0225	0.0022	0.0380	0.0385	0.11
22	0.0035	0.0043	0.0065	0.0051	0.0051	0.0046	0.0050	0.0060	0.0004	0.0065	0.0057	0.08
23	0.0225	0.0271	0.0245	0.0209	0.0071	0.0077	0.0164	0.0205	0.0018	0.0334	0.0370	0.10
24	0.0034	0.0049	0.0043	0.0028	0.0052	0.0037	0.0046	0.0045	0.0004	0.0064	0.0067	0.08
25	0.0196	0.0194	0.0202	0.0183	0.0085	0.0090	0.0149	0.0170	0.0012	0.0210	0.0247	0.09
26	0.0034	0.0043	0.0027	0.0022	0.0051	0.0039	0.0037	0.0038	0.0004	0.0056	0.0061	0.07
27	0.0152	0.0106	0.0092	0.0128	0.0111	0.0042	0.0115	0.0157	0.0011	0.0185	0.0216	0.08
28	0.0029	0.0033	0.0027	0.0027	0.0046	0.0036	0.0037	0.0047	0.0003	0.0062	0.0053	0.07
29	0.0121	0.0124	0.0102	0.0126	0.0126	0.0035	0.0110	0.0145	0.0010	0.0158	0.0178	0.08
30	0.0029	0.0051	0.0031	0.0033	0.0041	0.0037	0.0030	0.0038	0.0002	0.0050	0.0059	0.06
31	0.0106	0.0088	0.0142	0.0141	0.0139	0.0041	0.0107	0.0138	0.0012	0.0139	0.0155	0.07
32	0.0023	0.0020	0.0033	0.0036	0.0037	0.0036	0.0032	0.0033	0.0003	0.0034	0.0056	0.06
33	0.0094	0.0042	0.0114	0.0131	0.0126	0.0046	0.0073	0.0107	0.0010	0.0136	0.0126	0.07
34	0.0022	0.0032	0.0026	0.0035	0.0031	0.0033	0.0031	0.0032	0.0003	0.0028	0.0039	0.05
35	0.0071	0.0062	0.0068	0.0118	0.0116	0.0057	0.0058	0.0100	0.0008	0.0148	0.0120	0.06
36	0.0021	0.0025	0.0023	0.0026	0.0022	0.0033	0.0026	0.0024	0.0002	0.0036	0.0027	0.05
37	0.0067	0.0056	0.0060	0.0105	0.0112	0.0077	0.0058	0.0106	0.0008	0.0157	0.0144	0.06
38	0.0019	0.0017	0.0018	0.0023	0.0020	0.0032	0.0029	0.0026	0.0002	0.0041	0.0027	0.05
39	0.0055	0.0034	0.0071	0.0077	0.0091	0.0078	0.0036	0.0079	0.0007	0.0116	0.0138	0.06
40	0.0017	0.0032	0.0021	0.0015	0.0015	0.0032	0.0024	0.0027	0.0002	0.0042	0.0044	0.05
THD	1.383%	1.329%	1.463%	1.438%	1.410%	1.522%	1.710%	1.248%	2.036%	2.186%	2.309%	5%
Phase L3												
Harmon. Nr.	P/P _{E_{max}}											Limit (A)
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
0	0.0627	0.0147	0.0226	0.0268	0.0286	0.0295	0.0299	0.0200	0.0300	0.0303	0.0299	0.5% IR
1	0.2019	1.4238	2.7221	4.2646	5.8170	7.1462	8.6874	10.0127	11.5691	13.1088	14.4264	-
2	0.0256	0.1642	0.2213	0.2229	0.2054	0.1923	0.1795	0.1725	0.1633	0.1586	0.1605	1.08

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3	0.2096	0.2090	0.2047	0.2072	0.2110	0.2074	0.2043	0.2077	0.2106	0.2108	0.2136	2.30
4	0.0399	0.0648	0.0206	0.0546	0.0659	0.0685	0.0660	0.0638	0.0663	0.0675	0.0668	0.43
5	0.1002	0.1092	0.1069	0.1079	0.1115	0.1158	0.1176	0.1141	0.1141	0.1168	0.1146	1.14
6	0.0042	0.0176	0.0396	0.0284	0.0316	0.0332	0.0347	0.0333	0.0288	0.0279	0.0254	0.30
7	0.0491	0.0588	0.0681	0.0728	0.0735	0.0751	0.0778	0.0814	0.0790	0.0787	0.0816	0.77
8	0.0055	0.0435	0.0227	0.0220	0.0273	0.0274	0.0266	0.0242	0.0232	0.0209	0.0196	0.23
9	0.0366	0.0345	0.0460	0.0522	0.0565	0.0557	0.0559	0.0565	0.0608	0.0603	0.0596	0.40
10	0.0047	0.0236	0.0273	0.0212	0.0164	0.0174	0.0176	0.0202	0.0190	0.0201	0.0182	0.18
11	0.0224	0.0196	0.0240	0.0285	0.0347	0.0369	0.0368	0.0355	0.0354	0.0389	0.0392	0.33
12	0.0041	0.0139	0.0337	0.0232	0.0168	0.0197	0.0200	0.0205	0.0238	0.0236	0.0219	0.15
13	0.0188	0.0167	0.0741	0.0311	0.0190	0.0619	0.1072	0.1341	0.1621	0.1888	0.2090	0.21
14	0.0025	0.0189	0.0145	0.0179	0.0125	0.0113	0.0133	0.0114	0.0116	0.0133	0.0132	0.13
15	0.0344	0.0312	0.0430	0.0282	0.0050	0.0191	0.0440	0.0657	0.0781	0.0900	0.1004	0.15
16	0.0034	0.0124	0.0129	0.0137	0.0123	0.0105	0.0097	0.0096	0.0081	0.0085	0.0094	0.12
17	0.0403	0.0496	0.0168	0.0370	0.0062	0.0140	0.0316	0.0458	0.0590	0.0627	0.0678	0.13
18	0.0030	0.0087	0.0127	0.0126	0.0106	0.0080	0.0085	0.0097	0.0095	0.0088	0.0079	0.10
19	0.0370	0.0445	0.0203	0.0343	0.0071	0.0084	0.0188	0.0266	0.0402	0.0473	0.0488	0.12
20	0.0026	0.0067	0.0083	0.0100	0.0089	0.0087	0.0070	0.0079	0.0074	0.0072	0.0063	0.09
21	0.0309	0.0298	0.0310	0.0293	0.0118	0.0059	0.0138	0.0187	0.0255	0.0355	0.0395	0.11
22	0.0024	0.0048	0.0090	0.0062	0.0095	0.0071	0.0064	0.0057	0.0076	0.0080	0.0082	0.08
23	0.0217	0.0290	0.0250	0.0213	0.0164	0.0028	0.0114	0.0180	0.0222	0.0289	0.0359	0.10
24	0.0020	0.0072	0.0084	0.0053	0.0075	0.0067	0.0067	0.0056	0.0068	0.0059	0.0060	0.08
25	0.0188	0.0239	0.0176	0.0189	0.0178	0.0034	0.0117	0.0161	0.0168	0.0189	0.0220	0.09
26	0.0018	0.0044	0.0052	0.0052	0.0066	0.0064	0.0053	0.0061	0.0048	0.0064	0.0052	0.07
27	0.0156	0.0141	0.0107	0.0150	0.0173	0.0054	0.0077	0.0124	0.0153	0.0170	0.0187	0.08
28	0.0016	0.0032	0.0055	0.0052	0.0053	0.0059	0.0050	0.0049	0.0036	0.0053	0.0057	0.07
29	0.0143	0.0140	0.0111	0.0140	0.0162	0.0074	0.0059	0.0112	0.0155	0.0152	0.0167	0.08
30	0.0015	0.0044	0.0056	0.0050	0.0046	0.0054	0.0049	0.0046	0.0054	0.0039	0.0057	0.06
31	0.0142	0.0096	0.0114	0.0139	0.0159	0.0097	0.0053	0.0112	0.0155	0.0152	0.0150	0.07
32	0.0015	0.0034	0.0044	0.0045	0.0038	0.0050	0.0045	0.0040	0.0051	0.0032	0.0036	0.06
33	0.0130	0.0061	0.0083	0.0113	0.0128	0.0099	0.0032	0.0080	0.0112	0.0146	0.0133	0.07
34	0.0015	0.0024	0.0042	0.0039	0.0033	0.0042	0.0042	0.0038	0.0036	0.0042	0.0028	0.05
35	0.0113	0.0083	0.0060	0.0099	0.0111	0.0102	0.0030	0.0066	0.0098	0.0139	0.0140	0.06
36	0.0013	0.0025	0.0036	0.0031	0.0028	0.0041	0.0041	0.0040	0.0035	0.0047	0.0033	0.05
37	0.0111	0.0071	0.0054	0.0089	0.0108	0.0112	0.0047	0.0063	0.0109	0.0129	0.0157	0.06
38	0.0013	0.0020	0.0028	0.0025	0.0026	0.0038	0.0036	0.0033	0.0033	0.0044	0.0047	0.05
39	0.0091	0.0040	0.0053	0.0065	0.0086	0.0095	0.0046	0.0042	0.0088	0.0091	0.0119	0.06
40	0.0012	0.0018	0.0032	0.0018	0.0024	0.0027	0.0037	0.0037	0.0029	0.0029	0.0032	0.05
THD	1.520%	2.226%	2.442%	2.451%	2.378%	2.354%	2.403%	1.667%	2.604%	2.721%	2.834%	5%

Remark: Iref=14.5 Aa.c. Harmonics of PGU test according to IEC 61000-3-2; This table is applied to devices with rated current of ≤16A

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Harmonics												
Phase L1												
Harmon. Nr.	P/PEmax											Limit (%)
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
0	0.048%	0.143%	0.111%	0.097%	0.112%	0.111%	0.112%	0.119%	0.134%	0.125%	0.127%	0.5% IR
1	1.825%	10.562%	20.576%	30.673%	40.700%	50.806%	59.857%	69.935%	80.000%	89.991%	100.074%	-
2	0.037%	0.194%	0.244%	0.267%	0.318%	0.323%	0.346%	0.364%	0.415%	0.373%	0.401%	8.0
3	0.097%	0.166%	0.194%	0.212%	0.194%	0.212%	0.203%	0.212%	0.221%	0.226%	0.249%	-
4	0.018%	0.060%	0.041%	0.041%	0.060%	0.083%	0.097%	0.106%	0.134%	0.106%	0.138%	4.0
5	0.092%	0.111%	0.124%	0.157%	0.189%	0.166%	0.189%	0.184%	0.212%	0.221%	0.235%	10.7
6	0.014%	0.018%	0.032%	0.028%	0.051%	0.018%	0.028%	0.037%	0.051%	0.051%	0.065%	2.67
7	0.028%	0.074%	0.097%	0.088%	0.115%	0.129%	0.115%	0.129%	0.124%	0.129%	0.129%	7.2
8	0.014%	0.009%	0.014%	0.018%	0.018%	0.041%	0.028%	0.018%	0.028%	0.041%	0.041%	2.0
9	0.018%	0.051%	0.074%	0.074%	0.083%	0.106%	0.106%	0.097%	0.115%	0.106%	0.115%	-
10	0.009%	0.009%	0.018%	0.018%	0.018%	0.028%	0.023%	0.023%	0.018%	0.018%	0.023%	1.6
11	0.018%	0.051%	0.074%	0.078%	0.078%	0.074%	0.101%	0.092%	0.088%	0.101%	0.088%	3.1
12	0.009%	0.009%	0.014%	0.014%	0.023%	0.018%	0.028%	0.023%	0.028%	0.023%	0.023%	1.33
13	0.180%	0.171%	0.166%	0.364%	0.498%	0.562%	0.724%	0.839%	0.848%	0.857%	0.903%	2.0
14	0.009%	0.009%	0.009%	0.009%	0.018%	0.014%	0.023%	0.023%	0.018%	0.028%	0.018%	-
15	0.120%	0.157%	0.083%	0.203%	0.263%	0.304%	0.295%	0.373%	0.424%	0.406%	0.355%	-
16	0.005%	0.009%	0.009%	0.009%	0.009%	0.014%	0.009%	0.014%	0.018%	0.023%	0.023%	-
17	0.129%	0.124%	0.051%	0.138%	0.194%	0.240%	0.240%	0.258%	0.323%	0.373%	0.359%	-
18	0.005%	0.005%	0.005%	0.009%	0.009%	0.014%	0.009%	0.009%	0.018%	0.018%	0.018%	-
19	0.051%	0.074%	0.037%	0.097%	0.138%	0.171%	0.194%	0.194%	0.221%	0.272%	0.300%	-
20	0.005%	0.005%	0.005%	0.009%	0.014%	0.009%	0.009%	0.009%	0.009%	0.018%	0.014%	-
21	0.051%	0.046%	0.023%	0.074%	0.101%	0.124%	0.143%	0.152%	0.161%	0.184%	0.217%	-
22	0.005%	0.005%	0.005%	0.005%	0.009%	0.005%	0.009%	0.009%	0.009%	0.014%	0.018%	-
23	0.023%	0.060%	0.014%	0.065%	0.078%	0.097%	0.115%	0.129%	0.143%	0.157%	0.180%	-
24	0.005%	0.005%	0.005%	0.005%	0.009%	0.005%	0.009%	0.009%	0.009%	0.009%	0.014%	-
25	0.023%	0.069%	0.018%	0.055%	0.069%	0.078%	0.088%	0.101%	0.120%	0.129%	0.138%	-
26	0.005%	0.005%	0.005%	0.005%	0.009%	0.009%	0.005%	0.009%	0.009%	0.009%	0.009%	-
27	0.018%	0.055%	0.028%	0.051%	0.055%	0.065%	0.069%	0.083%	0.097%	0.111%	0.115%	-
28	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.009%	0.009%	0.009%	-
29	0.023%	0.032%	0.032%	0.046%	0.051%	0.055%	0.060%	0.065%	0.083%	0.097%	0.106%	-
30	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.009%	0.009%	0.009%	-
31	0.018%	0.018%	0.037%	0.037%	0.051%	0.046%	0.051%	0.055%	0.065%	0.083%	0.092%	-
32	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.009%	0.009%	-
33	0.023%	0.028%	0.041%	0.032%	0.046%	0.046%	0.046%	0.046%	0.051%	0.069%	0.078%	-
34	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.009%	-
35	0.023%	0.028%	0.041%	0.028%	0.041%	0.041%	0.037%	0.041%	0.046%	0.055%	0.074%	-
36	0.000%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.009%	0.005%	0.009%	-
37	0.018%	0.018%	0.037%	0.023%	0.041%	0.037%	0.037%	0.037%	0.041%	0.046%	0.060%	-
38	0.000%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.009%	0.005%	0.005%	-
39	0.018%	0.009%	0.032%	0.018%	0.037%	0.037%	0.032%	0.032%	0.037%	0.046%	0.051%	-
40	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.009%	0.009%	0.005%	-
THD	0.307%	0.429%	0.430%	0.623%	0.787%	0.873%	1.004%	1.131%	1.211%	1.235%	1.286%	13
PWHD	0.201%	0.251%	0.146%	0.303%	0.404%	0.476%	0.491%	0.561%	0.651%	0.704%	0.705%	22
Phase L2												
Harmon.	P/PEmax											Limit

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Nr.	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	(%)
0	0.071%	0.447%	0.529%	0.559%	0.580%	0.607%	0.617%	0.625%	0.628%	0.541%	0.537%	0.5% IR
1	0.198%	9.945%	19.949%	30.083%	40.124%	50.249%	59.304%	69.392%	79.433%	89.424%	99.507%	-
2	0.046%	0.309%	0.309%	0.318%	0.350%	0.332%	0.350%	0.364%	0.387%	0.369%	0.387%	8.0
3	0.157%	0.309%	0.355%	0.382%	0.355%	0.382%	0.369%	0.387%	0.406%	0.406%	0.429%	-
4	0.051%	0.065%	0.041%	0.037%	0.074%	0.065%	0.060%	0.083%	0.129%	0.157%	0.194%	4.0
5	0.074%	0.189%	0.207%	0.249%	0.276%	0.249%	0.281%	0.263%	0.281%	0.281%	0.276%	10.7
6	0.009%	0.014%	0.028%	0.032%	0.023%	0.060%	0.092%	0.092%	0.083%	0.051%	0.037%	2.67
7	0.092%	0.088%	0.129%	0.138%	0.175%	0.194%	0.175%	0.203%	0.194%	0.207%	0.203%	7.2
8	0.009%	0.014%	0.014%	0.018%	0.023%	0.028%	0.018%	0.051%	0.074%	0.083%	0.069%	2.0
9	0.078%	0.069%	0.111%	0.120%	0.120%	0.152%	0.161%	0.152%	0.171%	0.157%	0.161%	-
10	0.009%	0.018%	0.014%	0.018%	0.028%	0.014%	0.037%	0.023%	0.023%	0.041%	0.055%	1.6
11	0.157%	0.041%	0.065%	0.078%	0.083%	0.078%	0.106%	0.101%	0.106%	0.124%	0.106%	3.1
12	0.005%	0.018%	0.009%	0.014%	0.018%	0.032%	0.018%	0.028%	0.028%	0.028%	0.046%	1.33
13	0.078%	0.286%	0.152%	0.304%	0.442%	0.539%	0.687%	0.774%	0.797%	0.834%	0.917%	2.0
14	0.009%	0.014%	0.005%	0.009%	0.014%	0.009%	0.023%	0.014%	0.023%	0.023%	0.018%	-
15	0.060%	0.217%	0.088%	0.171%	0.235%	0.267%	0.295%	0.359%	0.387%	0.369%	0.346%	-
16	0.009%	0.009%	0.005%	0.009%	0.009%	0.009%	0.009%	0.018%	0.014%	0.014%	0.018%	-
17	0.028%	0.124%	0.051%	0.124%	0.175%	0.217%	0.230%	0.263%	0.318%	0.346%	0.336%	-
18	0.005%	0.005%	0.005%	0.005%	0.009%	0.009%	0.009%	0.009%	0.018%	0.009%	0.014%	-
19	0.028%	0.055%	0.032%	0.097%	0.124%	0.157%	0.175%	0.189%	0.221%	0.258%	0.281%	-
20	0.005%	0.005%	0.005%	0.005%	0.009%	0.005%	0.009%	0.009%	0.014%	0.009%	0.009%	-
21	0.032%	0.074%	0.046%	0.078%	0.097%	0.115%	0.129%	0.143%	0.157%	0.180%	0.207%	-
22	0.005%	0.009%	0.005%	0.005%	0.009%	0.005%	0.005%	0.009%	0.009%	0.014%	0.014%	-
23	0.028%	0.078%	0.060%	0.069%	0.083%	0.097%	0.106%	0.120%	0.134%	0.152%	0.175%	-
24	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.009%	0.009%	0.009%	-
25	0.028%	0.046%	0.069%	0.055%	0.074%	0.074%	0.088%	0.092%	0.111%	0.120%	0.138%	-
26	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.009%	0.009%	-
27	0.028%	0.014%	0.074%	0.041%	0.065%	0.065%	0.069%	0.078%	0.088%	0.097%	0.106%	-
28	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.009%	-
29	0.028%	0.023%	0.065%	0.032%	0.060%	0.065%	0.060%	0.065%	0.074%	0.088%	0.101%	-
30	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.009%	-
31	0.023%	0.028%	0.055%	0.023%	0.055%	0.055%	0.055%	0.051%	0.060%	0.074%	0.088%	-
32	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	-
33	0.023%	0.018%	0.041%	0.018%	0.051%	0.051%	0.051%	0.046%	0.046%	0.060%	0.074%	-
34	0.000%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	-
35	0.018%	0.014%	0.032%	0.018%	0.046%	0.051%	0.046%	0.041%	0.037%	0.051%	0.069%	-
36	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	-
37	0.018%	0.023%	0.023%	0.018%	0.041%	0.051%	0.041%	0.041%	0.032%	0.037%	0.055%	-
38	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	-
39	0.198%	0.023%	0.018%	0.023%	0.037%	0.046%	0.041%	0.037%	0.032%	0.032%	0.046%	-
40	0.046%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.009%	-
THD	0.365%	0.640%	0.601%	0.720%	0.850%	0.937%	1.057%	1.159%	1.231%	1.272%	1.352%	13
PWHD	0.230%	0.288%	0.196%	0.270%	0.377%	0.439%	0.476%	0.546%	0.615%	0.651%	0.671%	22
Phase L3												
Harmon. Nr.	P/PEmax											Limit (%)
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
0	0.065%	0.335%	0.445%	0.506%	0.525%	0.566%	0.593%	0.599%	0.612%	0.782%	0.806%	0.5% IR
1	1.028%	9.788%	19.857%	30.051%	40.157%	50.336%	59.433%	69.571%	79.650%	89.659%	99.751%	-

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2	0.055%	0.318%	0.359%	0.355%	0.387%	0.419%	0.452%	0.484%	0.516%	0.558%	0.576%	8.0
3	0.507%	0.594%	0.659%	0.696%	0.687%	0.719%	0.714%	0.747%	0.779%	0.806%	0.839%	-
4	0.023%	0.037%	0.069%	0.088%	0.088%	0.106%	0.092%	0.078%	0.111%	0.143%	0.180%	4.0
5	0.253%	0.281%	0.313%	0.359%	0.396%	0.369%	0.401%	0.378%	0.401%	0.401%	0.396%	10.7
6	0.028%	0.055%	0.037%	0.023%	0.023%	0.023%	0.065%	0.092%	0.078%	0.060%	0.028%	2.67
7	0.147%	0.161%	0.207%	0.221%	0.253%	0.272%	0.258%	0.281%	0.263%	0.276%	0.267%	7.2
8	0.018%	0.037%	0.032%	0.028%	0.037%	0.014%	0.032%	0.023%	0.065%	0.083%	0.092%	2.0
9	0.157%	0.120%	0.152%	0.166%	0.171%	0.198%	0.203%	0.198%	0.212%	0.198%	0.203%	-
10	0.009%	0.032%	0.018%	0.014%	0.014%	0.037%	0.028%	0.041%	0.023%	0.032%	0.055%	1.6
11	0.106%	0.088%	0.088%	0.106%	0.111%	0.111%	0.138%	0.129%	0.138%	0.147%	0.124%	3.1
12	0.009%	0.028%	0.023%	0.018%	0.018%	0.018%	0.041%	0.014%	0.041%	0.032%	0.028%	1.33
13	0.157%	0.323%	0.175%	0.281%	0.424%	0.498%	0.645%	0.797%	0.834%	0.848%	0.899%	2.0
14	0.005%	0.018%	0.018%	0.014%	0.014%	0.009%	0.014%	0.023%	0.014%	0.028%	0.032%	-
15	0.055%	0.240%	0.097%	0.161%	0.217%	0.267%	0.272%	0.332%	0.401%	0.396%	0.364%	-
16	0.005%	0.018%	0.014%	0.009%	0.014%	0.009%	0.014%	0.018%	0.023%	0.018%	0.018%	-
17	0.037%	0.124%	0.051%	0.120%	0.161%	0.207%	0.226%	0.240%	0.300%	0.350%	0.355%	-
18	0.005%	0.014%	0.014%	0.009%	0.009%	0.009%	0.009%	0.014%	0.014%	0.023%	0.014%	-
19	0.041%	0.055%	0.041%	0.097%	0.120%	0.152%	0.175%	0.184%	0.203%	0.249%	0.290%	-
20	0.005%	0.014%	0.014%	0.009%	0.009%	0.005%	0.009%	0.009%	0.014%	0.018%	0.018%	-
21	0.037%	0.069%	0.060%	0.078%	0.097%	0.111%	0.124%	0.143%	0.147%	0.166%	0.203%	-
22	0.005%	0.009%	0.009%	0.009%	0.009%	0.005%	0.009%	0.005%	0.014%	0.014%	0.014%	-
23	0.041%	0.065%	0.074%	0.065%	0.083%	0.088%	0.106%	0.120%	0.134%	0.143%	0.161%	-
24	0.005%	0.009%	0.009%	0.009%	0.009%	0.005%	0.005%	0.005%	0.009%	0.009%	0.009%	-
25	0.032%	0.032%	0.083%	0.046%	0.074%	0.074%	0.083%	0.092%	0.111%	0.120%	0.129%	-
26	0.005%	0.009%	0.009%	0.009%	0.005%	0.005%	0.005%	0.005%	0.009%	0.005%	0.009%	-
27	0.032%	0.009%	0.078%	0.032%	0.065%	0.069%	0.065%	0.074%	0.083%	0.097%	0.106%	-
28	0.005%	0.009%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.009%	-
29	0.023%	0.028%	0.069%	0.023%	0.060%	0.060%	0.060%	0.060%	0.074%	0.088%	0.101%	-
30	0.005%	0.009%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.009%	0.009%	-
31	0.023%	0.028%	0.051%	0.018%	0.051%	0.055%	0.055%	0.055%	0.055%	0.069%	0.088%	-
32	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.009%	0.009%	-
33	0.018%	0.014%	0.037%	0.018%	0.046%	0.055%	0.051%	0.046%	0.046%	0.055%	0.069%	-
34	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.009%	-
35	0.023%	0.023%	0.023%	0.023%	0.041%	0.051%	0.046%	0.046%	0.041%	0.046%	0.060%	-
36	0.000%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.009%	-
37	0.018%	0.028%	0.014%	0.028%	0.032%	0.046%	0.046%	0.041%	0.037%	0.037%	0.051%	-
38	0.000%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	-
39	0.023%	0.023%	0.014%	0.032%	0.028%	0.046%	0.041%	0.037%	0.032%	0.032%	0.041%	-
40	0.000%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	0.005%	-
THD	0.650%	0.886%	0.906%	0.992%	1.095%	1.183%	1.282%	1.410%	1.501%	1.564%	1.626%	13
PWHD	0.120%	0.302%	0.216%	0.260%	0.355%	0.430%	0.458%	0.515%	0.606%	0.660%	0.686%	22

Remark: Iref=21.7 Aa.c. Harmonics of PGU test according to IEC 61000-3-12; This table is applied to devices with rated current of >16A and ≤75A.

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E.7 Requirement for the test report for the NS protection

Extract from test report for NS protection "Determination of electrical properties"		No. <u>64.290.22.31521.01</u>	
NS protection test report			
Type of NS system:	Integrated NS protection	Other Manufacturer indications	
Firmware version & Software version:	ARM: V1.03.08, DSP: V1.02.11		
Manufacturer:	KKT KOLBE Küchentechnik GmbH & Co. KG Ohmstraße 17, 96175 Pettstadt GERMANY		
Measuring period:	From 2022-12-09 to 2023-01-28		
Inverter			
Protection function	Setting value	Tripping value	Break time NS protection
Rise-in-voltage protection $U >>$	$1.25 U_n$	L1-N/L2-N/L3-N: 288.0V L1-N: 287.8 V L2-N: 287.7 V L3-N: 287.8 V	L1-N/L2-N/L3-N: 129.0 ms L1-N: 121.2 ms L2-N: 129.2 ms L3-N: 110.4 ms
Rise-in-voltage protection $U >$	$1.10 * U_n$	1.00Un – 1.12Un 230 V – 257.6 V	L1-N/L2-N/L3-N: 498.0 s
		1.00Un – 1.08Un 230 V – 248.4 V	L1-N/L2-N/L3-N: No disconnection
		1.06Un - 1.14Un 243.8 V - 262.2 V	L1-N/L2-N/L3-N: 299.0 s
Voltage drop protection $U <$	$0.8 U_n$	L1-N/L2-N/L3-N: 183.0 V L1-N: 183.1 V L2-N: 183.0 V L3-N: 183.0 V	L1-N/L2-N/L3-N: 3030 ms L1-N: 3024 ms L2-N: 3028 ms L3-N: 3048 ms
Voltage drop protection $U <<$	$0.45 U_n$	L1-N/L2-N/L3-N: 101.1 V L1-N: 101.0 V L2-N: 101.1 V L3-N: 101.0 V	L1-N/L2-N/L3-N: 354.0 ms L1-N: 312.0 ms L2-N: 310.0 ms L3-N: 384.0 ms
Frequency decrease protection $f <$	47.5 Hz	47.50 Hz	151.0 ms
Frequency increase protection $f >$	51.5 Hz	51.51 Hz	149.0 ms
*: The above tripping time includes the entire function chain "integrated NS protection – interface switch"			
<input checked="" type="checkbox"/> as integrated NS protection			
Assigned to power generation unit type		Type 2	

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Integrated interface switch type	Series-connected relays for both the neutral conductor and the line conductor Relay type: azsr143
Response time of interface switch for integrated NS protection	Release time: Max. 10 ms
Verification of the entire functional chain “integrated NS protection – interface switch” has resulted in successful disconnection.	<input checked="" type="checkbox"/> Yes