TEST REPORT

Standard DIN VDE 0126-1-1 (VDE V 0126-1-1):2013

TÜV SÜD Test report for automatic disconnection device between a generator and the public low-voltage grid

Report reference No. ..... :	64.290.23.30956.01
Date of issue ..... :	2023-06-28
Project handler…… ..... :	Joan Wei, Jenn Huang
Testing laboratory ..... :	TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
Address ..... :	TÜV SÜD Testing Center, D1 building, No. 63 Chuangqi Road, Shilou Town, Panyu District, Guangzhou 511447, P.R. China
Testing location ..... :	as above
Client ..... :	Myenergi Ltd
Address ……..... :	Pioneer Business Park, Faraday Way Grimsby DN41 8FF UNITED KINGDOM
Client number…… ..... :	117310
Standard ..... :	This TUV SUD test report form is based on the following requirements: DIN VDE 0126-1-1:2013 (with national deviation of France: DIN VDE 0126-1-1 VFR 2019)
TRF originated by. ..... :	TÜV Product Service Co., Ltd.
Copyright blank test report ..... :	This test report is based on the content of the standard (see above). The test report considered selected clauses of the a.m. standard(s) and experience gained with product testing. It was prepared by TUV SUD Product Service GmbH. TUV SUD Group takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.
Test procedure ..... :	☐ GS, ☐ TÜV Mark, ☐ EU-Directive, ☐ without certification ☒ Type verification of conformity
Non-standard test method ..... :	N/A
National deviations ..... :	France
Number of pages (Report) ..... :	20 pages
Number of pages (Attachments) ..... :	N/A
Compiled by ..... : Joan Wei, Jenn Huang	Approved by ..... : Kennen Wang
(+ signature) Joan Wei Jenn Huang	(+ signature) Kennen Wang

Telephone : +86 20 3832 0668
Telefax : +86 20 3832 0478
http://www.tuv-sud.cn

TÜV SÜD Certification and Testing (China) Co., Ltd.
Guangzhou Branch, TÜV SÜD Group
5F, Communication Building, 163 Pingyun Rd, Huangpu Ave.
West, Guangzhou 510656, P. R. China

Test item description……..:	Hybrid inverter
Trademark ..... :	myenergi
Model and/or type reference..... :	LIBBI-HS3680, LIBBI-HS5000, LIBBI-HS6000
Rating(s) ..... :	See page 8
Manufacturer ..... :	Myenergi Ltd
Address ..... :	Pioneer Business Park, Faraday Way Grimsby DN41 8FF UNITED KINGDOM
Manufacturer number…..... :	117310
Sub-contractors/ tests (clause)..... :	--
Name ..... :	--
Order description…..... :	☒ Complete test according to TRF ☐ Partial test according to manufacturer's specifications ☐ Preliminary test ☐ Spot check ☐ Others:
Date of order…… ..... :	2021-01-15, 2021-05-10, 2023-05-22
Date of receipt of test item..... :	2021-01-15, 2021-05-10, 2023-05-23
Date(s) of performance of test..... :	2021-01-31 to 2021-04-01, 2021-05-10 to 2021-05-11, 2023-05-23 to 2023-06-27

Attachments:

N/A

General remarks:

"(see remark #)" refers to a remark appended to the report.

"(see appended table)" refers to a table appended to the report.

Throughout this report a point is used as the decimal separator.

The test results presented in this report relate only to the object tested.

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Telefax : +86 20 3832 0478

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TÜV SÜD Certification and Testing (China) Co., Ltd.
Guangzhou Branch, TÜV SÜD Group
5F, Communication Building, 163 Pingyun Rd, Huangpu Ave.
West, Guangzhou 510656, P. R. China

Summary of testing:

☐ Abweichung festgestellt / deviation(s) found

☒ keine Abweichung festgestellt / no deviations found

Tests performed (name of test and test clause):

Clause	Requirement – Test
6.1	Functional safety
6.2	Voltage monitoring (Connection condition)
6.3	Voltage monitoring
6.4	Frequency monitoring
6.5	DC current monitoring
6.6	Detection of island operation

Remark: The test methods are referred to DIN VDE V 0124-100 (VDE V 0124-100):2012

Telephone : +86 20 3832 0668
Telefax : +86 20 3832 0478

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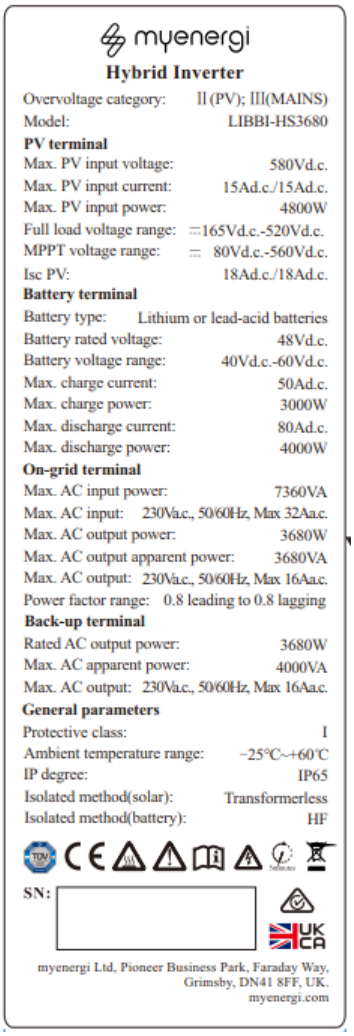
TÜV SÜD Certification and Testing (China) Co., Ltd.
Guangzhou Branch, TÜV SÜD Group
5F, Communication Building, 163 Pingyun Rd, Huangpu Ave. West, Guangzhou 510656, P. R. China

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

Below electric ratings and warnings are silk-screen on label and affixed side of enclosure.



myenergi

Hybrid Inverter

Overvoltage category:	II (PV); III(MAINS)
Model:	LIBBI-HS3680
PV terminal	
Max. PV input voltage:	580Vd.c.
Max. PV input current:	15Ad.c./15Ad.c.
Max. PV input power:	4800W
Full load voltage range:	⎓165Vd.c.-520Vd.c.
MPPT voltage range:	⎓ 80Vd.c.-560Vd.c.
Isc PV:	18Ad.c./18Ad.c.
Battery terminal	
Battery type:	Lithium or lead-acid batteries
Battery rated voltage:	48Vd.c.
Battery voltage range:	40Vd.c.-60Vd.c.
Max. charge current:	50Ad.c.
Max. charge power:	3000W
Max. discharge current:	80Ad.c.
Max. discharge power:	4000W
On-grid terminal	
Max. AC input power:	7360VA
Max. AC input:	230Va.c., 50/60Hz, Max 32Aa.c.
Max. AC output power:	3680W
Max. AC output apparent power:	3680VA
Max. AC output:	230Va.c., 50/60Hz, Max 16Aa.c.
Power factor range:	0.8 leading to 0.8 lagging
Back-up terminal	
Rated AC output power:	3680W
Max. AC apparent power:	4000VA
Max. AC output:	230Va.c., 50/60Hz, Max 16Aa.c.
General parameters	
Protective class:	I
Ambient temperature range:	-25℃~+60℃
IP degree:	IP65
Isolated method(solar):	Transformerless
Isolated method(battery):	HF

SN:

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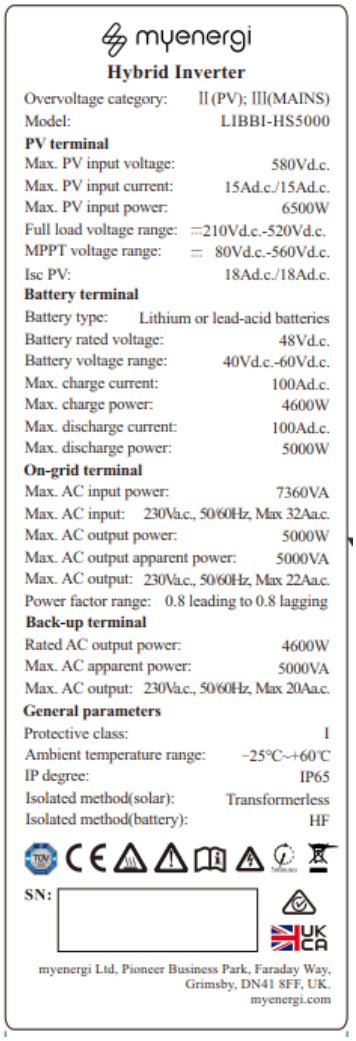
myenergi.com



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Hybrid Inverter

Overvoltage category:	II (PV); III(MAINS)
Model:	LIBBI-HS5000
PV terminal	
Max. PV input voltage:	580Vd.c.
Max. PV input current:	15Ad.c./15Ad.c.
Max. PV input power:	6500W
Full load voltage range:	⎓210Vd.c.-520Vd.c.
MPPT voltage range:	⎓ 80Vd.c.-560Vd.c.
Isc PV:	18Ad.c./18Ad.c.
Battery terminal	
Battery type:	Lithium or lead-acid batteries
Battery rated voltage:	48Vd.c.
Battery voltage range:	40Vd.c.-60Vd.c.
Max. charge current:	100Ad.c.
Max. charge power:	4600W
Max. discharge current:	100Ad.c.
Max. discharge power:	5000W
On-grid terminal	
Max. AC input power:	7360VA
Max. AC input:	230Va.c., 50/60Hz, Max 32Aa.c.
Max. AC output power:	5000W
Max. AC output apparent power:	5000VA
Max. AC output:	230Va.c., 50/60Hz, Max 22Aa.c.
Power factor range:	0.8 leading to 0.8 lagging
Back-up terminal	
Rated AC output power:	4600W
Max. AC apparent power:	5000VA
Max. AC output:	230Va.c., 50/60Hz, Max 20Aa.c.
General parameters	
Protective class:	I
Ambient temperature range:	-25℃~+60℃
IP degree:	IP65
Isolated method(solar):	Transformerless
Isolated method(battery):	HF

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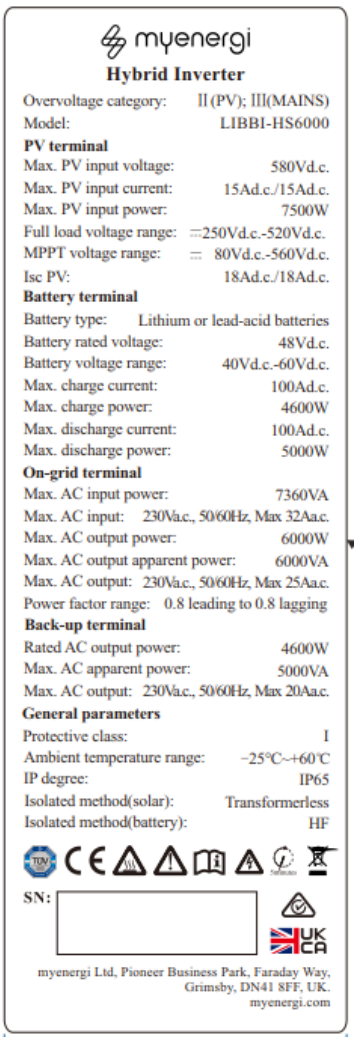

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Hybrid Inverter

Overvoltage category:	II (PV); III(MAINS)
Model:	LIBBI-HS6000
PV terminal	
Max. PV input voltage:	580Vd.c.
Max. PV input current:	15Ad.c./15Ad.c.
Max. PV input power:	7500W
Full load voltage range:	⎓250Vd.c.-520Vd.c.
MPPT voltage range:	⎓ 80Vd.c.-560Vd.c.
Isc PV:	18Ad.c./18Ad.c.
Battery terminal	
Battery type:	Lithium or lead-acid batteries
Battery rated voltage:	48Vd.c.
Battery voltage range:	40Vd.c.-60Vd.c.
Max. charge current:	100Ad.c.
Max. charge power:	4600W
Max. discharge current:	100Ad.c.
Max. discharge power:	5000W
On-grid terminal	
Max. AC input power:	7360VA
Max. AC input:	230Va.c., 50/60Hz, Max 32Aa.c.
Max. AC output power:	6000W
Max. AC output apparent power:	6000VA
Max. AC output:	230Va.c., 50/60Hz, Max 25Aa.c.
Power factor range:	0.8 leading to 0.8 lagging
Back-up terminal	
Rated AC output power:	4600W
Max. AC apparent power:	5000VA
Max. AC output:	230Va.c., 50/60Hz, Max 20Aa.c.
General parameters	
Protective class:	I
Ambient temperature range:	-25℃~+60℃
IP degree:	IP65
Isolated method(solar):	Transformerless
Isolated method(battery):	HF

SN:

myenergi Ltd, Pioneer Business Park, Faraday Way, Grimsby, DN41 8FF, UK.
myenergi.com

Telephone : +86 20 3832 0668
Telefax : +86 20 3832 0478
http://www.tuv-sud.cn

TÜV SÜD Certification and Testing (China) Co., Ltd.
Guangzhou Branch, TÜV SÜD Group
5F, Communication Building, 163 Pingyun Rd, Huangpu Ave. West, Guangzhou 510656, P. R. China

Test item particulars:	
Equipment mobility..... :	☐ movable ☐ hand-held ☒ stationary ☐ fixed ☐ transportable ☐ for building-in
Connection to the mains ..... :	☐ pluggable equipment ☐ direct plug-in ☒ permanent connection ☐ for building-in
Enviromental category ..... :	☒ outdoor ☐ indoor unconditional ☐ indoor conditional
Over voltage category Mains..... :	☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV
Over voltage category PV..... :	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV
Mains supply tolerance (%) ..... :	+/- 10%
Tested for power systems..... :	TN or TT system
IT testing, phase-phase voltage (V) ..... :	N/A
Class of equipment..... :	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Mass of equipment (kg) ..... :	30 kg (approx..)
Pollution degree..... :	PD3
IP protection class ..... :	IP65
Possible test case verdicts:	
- test case does not apply to the test object..... :	N/A (not applicable / not included in the order)
- test object does meet the requirement ..... :	P (Pass)
- test object does not meet the requirement ..... :	F (Fail)
Possible suffixes to the verdicts:	
- suffix for detailed information for the client……..:	- C (Comment)
- suffix for important information for factory inspection...:	- M (Manufacturing)

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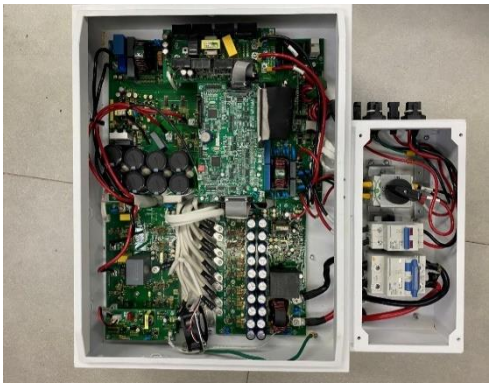
West, Guangzhou 510656, P. R. China

Picture of the product:

Over view

Bottom view

Terminal view



Internal view

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5F, Communication Building, 163 Pingyun Rd, Huangpu Ave.
West, Guangzhou 510656, P. R. China

1) The unit is non-isolated (transformerless) hybrid energy inverter for connection with public low voltage grid, for outdoor use.

2) The unit shall be used at specified ambient range. Temperature: -25 °C ~ +60 °C, Auto-derating above 45 °C; Humidity: 4% ~ 100%; Altitude: ≤ 2000 m; Overvoltage category: II (DC side), III (AC side).

3) The unit provides two relays in series on each phase between inverter output and grid terminal (L, N). The internal control is redundantly built. It contains a main DSP and a slave DSP. Both DSP can open relays independently and communicate with each other.

4) The battery side is considered as DVC-C circuit, which is with functional insulation from PV and grid side. During final installation, external battery and its wiring shall be rated for PV and grid system voltage.

5) ARM: V1.3.08, DSP: V1.3.06.

6) In order to protect user and equipment, circuit breaker shall be equipped on all input and output terminal.

7) Low voltage electrical installations shall comply with national and local regulation.

8) The grid connection protection system is evaluated according to DIN VDE 0126-1-1 (VDE V 0126-1-1):2013-08, specially with consideration of “Enedis-FOR-RES_18E - Information Collection Cards for a Connection Proposal before the file is complete and for a Connection Offer, to the Public Distribution Network managed by Enedis, of a Photovoltaic Production Installation with power greater than 36 kVA (Version 18)”. The setting of the integrated protection system of DIN VDE 0126-1-1/A1 VFR 2019 is as follows:

   Over voltage (stage 1: 10 min. mean value): 1.10 Un;

   Over voltage for phase voltage and line voltage (stage 2): 1.15 Un;

   Under voltage for phase voltage and line voltage: 0.80 Un;

   Over frequency: 51.5 Hz;

   Under frequency: 47.5 Hz.

9) The installation of this Hybrid Energy Storage Inverter in the PV plant shall further comply with “Guide Pratique XP C 15-712-3:2016, Installations photovoltaïques avec dispositif de stockage et raccordées à un réseau public de distribution” and other suitable regulations.

Telephone : +86 20 3832 0668
Telefax : +86 20 3832 0478
http://www.tuv-sud.cn

TÜV SÜD Certification and Testing (China) Co., Ltd.
Guangzhou Branch, TÜV SÜD Group
5F, Communication Building, 163 Pingyun Rd, Huangpu Ave. West, Guangzhou 510656, P. R. China

Characteristic data:

Model	LIBBI-HS3680	LIBBI-HS5000	LIBBI-HS6000
PV terminal			
Vmax. PV	580Vd.c.		
Rate Voltage	400Vd.c.		
MPPT Voltage Range	80~560Vd.c.		
MPPT Voltage Range (full load)	165 ~ 520Vd.c.	210 ~ 520Vd.c.	250 ~ 520Vd.c.
MPPT Tracker number	2		
Max. continuous PV input current per tracker	15Ad.c.		
Isc PV per tracker	18Ad.c.		
Max. continuous PV input power	4800W	6500W	7500W
Battery terminal			
Battery type	Lithium or lead-acid batteries		
Voltage range	40~60Vd.c.		
Rated voltage	48Vd.c.		
Maximum charge/discharge current	50Ad.c./80Ad.c.	100Ad.c./100Ad.c.	
Maximum charge/discharge power	3000W/4000W	4600W/5000W	
Grid terminal parameter			
Rated voltage	230Va.c.		
Rated frequency	50Hz		
Rated input Current	31Aa.c.		
Maximum continuous input current	32Aa.c.		
Maximum continuous input power	7360VA		
Rated output Current	16Aa.c.	22Aa.c.	25Aa.c.
Maximum continuous output current	16Aa.c.	22Aa.c.	25Aa.c.
Power factor (Cos phi), adjustable	0.8 leading~0.8 lagging		
Maximum continuous output power	3680VA	5000VA	6000VA
Back up load terminal parameter			
Rated voltage	230Va.c.		
Rated frequency	50Hz		
Rated output Current	16Aa.c.	20Aa.c.	
Maximum continuous output current	16Aa.c.	20Aa.c.	
Rated continuous output power	3680W	4600W	
Maximum output apparent power	4000VA	5000VA	

Model difference:

All model have the same PCB layout circuit, except the quantity of bus capacitor and power rating. Detail please refer to characteristic data.

Telephone : +86 20 3832 0668
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5F, Communication Building, 163 Pingyun Rd, Huangpu Ave.
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DIN VDE 0126-1-1 (VDE V 0126-1-1):2013			
Clause	Requirement – Test	Result – Remark	Verdict

4	**Requirements**		P
	The following requirements applied to integrated and separated safety disconnect device.		P
	The disconnection device must disconnect the generator unit from the grid on the AC side with two switches in series due to:		P
	- Voltage-and/or frequency change of low voltage network,		P
	- DC current feed-in into the low voltage network,		P
	- Unintended island operation and		P
	- Intended island operation with standby network generator.		P
4.1	Functional safety		P
	The safety of the functions of automatic disconnection device defined in 4.3 to 4.6 and 4.8, if applicable, shall be ensured under all operation conditions. It can be installed as independent device or integrated parts of generation system and must be disconnect in single fault condition and indicate the fault condition.		P
4.1.1	Single fault safety		P
	The disconnection device must fulfill the requirement of single fault safety according to VDE-AR-N 4105: 2011-08, A.6		P
4.1.2	Disconnection device		P
	The disconnection device must comply with DIN EN 62109-2 (VDE 0126-14-2): 2012-04, 4.4.4.15.2 in case of integration in a PV converter and VDE-AR-N 4105: 2011-08, 6.4 in other cases.		P
4.2	Connection condition		P
	The connection, which reconnect after a network fault and reconnect after short interruption, shall comply with VDE-AR-N 4105: 2011-08, 8.3.1.		P
4.3	Voltage monitoring		P
4.3.1	Voltage decrease U<		P
	The disconnection due to a voltage decrease		P

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Guangzhou Branch, TÜV SÜD Group
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DIN VDE 0126-1-1 (VDE V 0126-1-1):2013			
Clause	Requirement – Test	Result – Remark	Verdict
	must comply with VDE-AR-N 4105: 2011-08, 6.5.1 and 6.5.2		
4.3.2	Voltage increase U>>		P
	The disconnection due to a voltage increase must comply with VDE-AR-N 4105: 2011-08, 6.5.1 and 6.5.2		P
4.3.3	Slow voltage increase U>		P
	The disconnection due to a slow voltage increase (10-minute-mean-value) must comply with VDE-AR-N 4105: 2011-08, 6.5.1 and 6.5.2		P
4.4	Frequency monitoring	Enedis-FOR-RES_18E setting consider	P
	The disconnection due to a frequency decrease or a frequency increase must comply with VDE-AR-N 4105: 2011-08, 6.5.1 und 6.5.2	Protection frenquency setting: 47.5 Hz for under frequency, 51.50 Hz for over frequency.	P
4.5	DC current monitoring		P
	A DC current feed into the low voltage network due to a disorder system operation must activate the disconnection within 0.2s. For this, the disorder itself or a measured DC component of current of more than 1A can be regarded as disconnection criterion.		P
4.6	Detection of islanding operation	Refer to IEC 62116	P
	The disconnection due to the detection of a unintended islanding operation must comply with VDE-AR-N 4105: 2011-08, 6.5.1 and 6.5.3		
4.7	Marking		P
	A generation with automatic disconnection device must include with visible specification “VDE 0126-1-1”. It can be done through:		P
	- Rating plate or		P
	- Issue on the brochure of disconnection or		N/A
	- A separate labelling		N/A
4.8	Requirement for the integrated disconnection device in photovoltaic converter		P
	The requirement of DIN EN 62109-2 (VDE 0126-14-2): 2012-04, 4.8 for the residual current monitoring and for the isolation monitoring of PV generators must be complied.	Refer to safety report: 64.290.22.30751.01	P
5	**General requirements**		P

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DIN VDE 0126-1-1 (VDE V 0126-1-1):2013			
Clause	Requirement – Test	Result – Remark	Verdict
	The limits of radio interference shall comply with DIN EN 61000-6-3 (VDE 0839-6-3). The interference immunity are tested according to DIN EN 61000-6-2 (VDE 0839-6-2)	Declared by manufacturer	P
6	**Type test**		P
6.0	General		P
	I If not specified in other cases, the following tests are applied for integrated and separated disconnection device. A separate disconnection device is tested together with a suitable input feeder Here it is to ensure, that the disconnection signal generate not from input feeder but from the disconnection device.		P
6.1	Functional safety		P
	The test on single fault safety and fault detection with followed disconnection shall comply with VDE 0124-100, 5.4.5.2.	See appende table	P
6.2	Voltage monitoring		P
	The tests of connection are re-connection shall comply with DIN V DIN VDE V 0124-100 (VDE V 0124-100):2012-07, 5.5.1 and 5.5.2.	See appende table	P
6.3	Voltage monitoring		P
	The test of voltage monitoring shall comply with DIN VDE V 0124-100 (VDE V 0124-100):2012-07, 5.4.5.3	See appende table	P
6.4	Frequency monitoring		P
	The test of frequency monitoring shall comply with DIN VDE V 0124-100 (VDE V 0124-100):2012-07, 5.4.5.4	See appende table	P
6.5	DC current monitoring		P
	The test of disconnection due to DC current feed in is done optionally according to a) or b):	See appende table	P
	a) In the measurement device of disconnection device (e.g. current transducer, resistor), a DC current of 1A is impressed. The disconnection must be done within 0.2s.		P
	b) Through fault simulation and by means of measurement, it is determined whether a disordered system operation with a DC component of feed in current of more than 1 A will lead to disconnection within 0.2 s.		P
6.6	Detection of island operation		P

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DIN VDE 0126-1-1 (VDE V 0126-1-1):2013			
Clause	Requirement – Test	Result – Remark	Verdict
	The test on disconnection due to unintended islanding operation shall comply with DIN VDE V 0124-100 (VDE V 0124-100):2012-07, 5.4.6.	Consider with IEC 62116	P
7	**Production test**		N/A
	Before shipment of automatic disconnection device, each manufacturer shall undertake the production test in sense of safety related parameter.	Declared by manufacturer	N/A
8	**Installation specifications**		N/A
	Initial and repeated test of automatic disconnection device besides the production test can be waived. If the automatic disconnection device is installed as independent device, it shall not used in TN-C system. It is accepted for TN-C-S system in the case.	Integrated in the PV inverter.	N/A

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6.1	TABLE: Functional safety					P
Ambient temperature (°C) ……..... :						26
Relative humidity……:						55%
No.	component	Fault	Input (Vdc)	Output (Vac, kW)	Test duration	Observation
Below component single fault applied on the batsps board						
1.	Transformer TX1, secondary winding	S-C	400Vdc	230Vac/5KW	10 min	Operating as normal, no damage, no hazard.
2.	Transformer TX1, primary winding	S-C	400Vdc	230Vac/5KW	10 min	Operating as normal, no damage, no hazard.
Discharge board						
3.	IGBT, Q3 pin d-s	S-C	400Vdc	230Vac/5KW	10 min	Unit shut down immediately, Q1 damaged and non-resettable, no damage, no hazard.
4.	Bus Capacitor, C77	S-C	400Vdc	230Vac/5KW	10 min	D3, R31, R43 damaged, then LCD show “Bat Loss”, no damage, no hazard.
5.	Transformer TX2, secondary winding VCCA2	S-C	400Vdc	230Vac/5KW	10 min	LCD show “Soft Time Out”, then inverter shut down, and the unit can be recoverable after fault removed, no damage, no hazard.
6.	Transformer TX2, primary winding	S-C	400Vdc	230Vac/5KW	10 min	LCD show “Soft Time Out”, then inverter shut down, and the unit can be recoverable after fault removed, no damage, no hazard.
PSDR, AC board						
7.	Transformer TX3, secondary winding 15V	S-C	400Vdc	230Vac/5KW	10 min	Unit shutdown immediately and can be recoverable after fault removed, no damage. No hazards.
8.	Transformer TX3, primary winding	S-C	400Vdc	230Vac/5KW	10 min	Unit shutdown immediately and can be recoverable after fault removed, no damage, no hazard.
9.	Transformer TX3, secondary winding 12V	S-C	400Vdc	230Vac/5KW	10 min	Unit shutdown immediately and can be recoverable after fault removed, no damage, no hazard.
10.	Resistor, R182	S-C	400Vdc	230Vac/5KW	10 min	Operating as normal, no damage, no hazard.
11.	Resistor, R33	S-C	400Vdc	230Vac/5KW	10 min	Operating as normal, no damage, no hazard.
12.	Bus Capacitor, C169	S-C	400Vdc	230Vac/5KW	10 min	Operating as normal, no damage, no hazard. But PV1 voltage shows zero.

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Telefax : +86 20 3832 0478
http://www.tuv-sud.cn
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Guangzhou Branch, TÜV SÜD Group
5F, Communication Building, 163 Pingyun Rd, Huangpu Ave.
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13.	Current sensor, HCt4 pin1-pin2	S-C	400Vdc	230Vac/5KW	10 min	Operating as normal, no damage, no hazard. But PV1 current shows zero.
14.	Bus Capacitor, C69	S-C	400Vdc	230Vac/5KW	10 min	LCD show “Bus Short Fail”, then inverter shut down, and the unit can be recoverable after fault removed, no damage, no hazard.
15.	Resistor, R108	S-C	400Vdc	230Vac/5KW	10 min	LCD show “Bus Volt High”, then inverter shut down, and the unit can be recoverable after fault removed, no damage, no hazard.
16.	IGBT, Q18	S-C	400Vdc	230Vac/5KW	10 min	Unit shut down immediately, Q18, Q19, Q20 damaged and non-resettable, no hazard.
17.	Current sensor K9 pin1-pin3	S-C	400Vdc	230Vac/5KW	10 min	Unit shut down immediately, Q18, Q19, Q20, Q21, Q22, Q23 damaged and non-resettable, no hazard.
18.	Resistor, R22	S-C	400Vdc	230Vac/5KW	10 min	Operating as normal, no damage, no hazard.
19.	Transformer T2, secondary winding 5V	S-C	400Vdc	230Vac/5KW	10 min	Unit shutdown immediately and can be recoverable after fault removed, no damage, no hazard.
20.	Transformer T2, secondary winding 5V	O-L	400Vdc	230Vac/5KW	10 min	105% resistive load, the unit operates normally, temperature: winding: 45.5°C, core 46.1°C, 110% resistive load, temperature: winding: 35.1°C, core 34.0°C, Unit shutdown immediately, no damage, no hazard.
Charge board						
21.	Mosfet Q9 d-s	S-C	400Vdc	230Vac/5KW	10 min	Unit shut down immediately, Q9, Q13 damaged and non-resettable, no hazard.
22.	Current sensor HCT4 R134	O-S	400Vdc	230Vac/5KW	10 min	Unit shut down, LCD show “Chg Curr Ove”, no damage, no hazard.
23.	Mosfet Q19 d-s	S-C	400Vdc	230Vac/5KW	10 min	LCD show “Soft Time Out”, then inverter shut down, and the unit can be recoverable after fault removed, no damage, no hazard.
24.	Transformer T3, primary winding	S-C	400Vdc	230Vac/5KW	10 min	Unit shutdown immediately and can be recoverable after fault removed, no damage, no hazard.
25.	Transformer T3, secondary	S-C	400Vdc	230Vac/5KW	10 min	Unit shutdown immediately and can be

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	winding					recoverable after fault removed, no damage, no hazard.
Fault-tolerance of residual current monitoring						
26.	RCMU U34 Pin1-pin2	S-C	400 Vdc	230Vac/5KW	10 minutes	The fault applied before the unit operation. After applied the fault, unit does not start and reports ” GFCI sensor unusual”.
27.	RCMU U34, R265	S-C	400 Vdc	230Vac/5KW	10 minutes	The fault applied before the unit operation. After applied the fault, unit does not start and reports ” GFCI sensor unusual”.
28.	RCMU U34 Pin6-pin7	S-C	400 Vdc	230Vac/5KW	10 minutes	The fault applied before the unit operation. After applied the fault, unit does not start and reports ” GFCI sensor unusual”.
29.	RCMU U34 Pin7-pin8	S-C	400 Vdc	230Vac/5KW	10 minutes	The fault applied before the unit operation. After applied the fault, unit does not start and reports ” GFCI sensor unusual”.
Fault-tolerance of automatic disconnecting means						
30.	Bypass grid relay K11, relay board	S-C	400 Vdc	230Vac/5KW	10min	The fault applied before unit operate. After applied the fault, unit does not start and report "F19, Backup Relay Fail".
31.	Bypass grid relay K12, relay board	S-C	400 Vdc	230Vac/5KW	10min	Same as above
32.	Bypass grid relay K13, relay board	S-C	400 Vdc	230Vac/5KW	10min	Same as above
33.	Bypass grid relay K14, relay board	S-C	400 Vdc	230Vac/5KW	10min	Same as above
34.	Load relay K5 and K8, relay board	S-C	400 Vdc	230Vac/5KW	10min	Same as above
35.	Load relay K9 and K10, relay board	S-C	400 Vdc	230Vac/5KW	10min	Same as above
36.	Grid relay K3 and K2, AC board(PSDR)	S-C	400 Vdc	230Vac/5KW	10min	The fault applied before unit operate. After applied the fault, unit does not start and report "F14, Grid Relay Fail".
37.	Grid relay K4 and K8, AC board(PSDR)	S-C	400 Vdc	230Vac/5KW	10min	Same as above
Check that the relays fulfil the basic insulation or simple separation based on the PV circuit working voltage.						Yes L distance: 1.8mm*2=3.6mm N distance: 1.8mm*2=3.6mm
Each active phase can be switched. (L and N)						Yes
supplementary information: S-C: short circuit, O-C: open circuit, O-L: overload, R: reversed						

6.2	TABLE: Connection condition and synchronization		P
Model	LIBBI-HS5000	Reconnection time (s)	--

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Test procedure	a) f=47.45Hz, no reconnection allowed	--	Pass
	b) f=47.55Hz, reconnection allowed	76.8	Pass
	c) f=50.10Hz, no reconnection allowed	--	Pass
	d) f=50.00Hz, reconnection allowed	76.8	Pass
	e) U=84% Un, no reconnection allowed	--	Pass
	f) U=86% Un, reconnection allowed	76.6	Pass
	g) U=111% Un, no reconnection allowed	--	Pass
	h) U=109% Un, reconnection allowed	76.8	Pass
	i) U reduced to 77%Un for 2 s and afterwards recovered to normal condition, after 5s, the reconnection allowed.	19.9	Pass
	j) U reduced to 77%Un for 4 s and afterwards recovered to normal condition, after 60s, the reconnection allowed.	72.5	Pass
Supplementary information: (1) The test method are referred to DIN VDE 0124-100 (VDE V 0124-100): 2012-07, Clause 5.5.1. (2) For test i) and j), the PGU reconnection after 60 s, it also comply with the requirements.			

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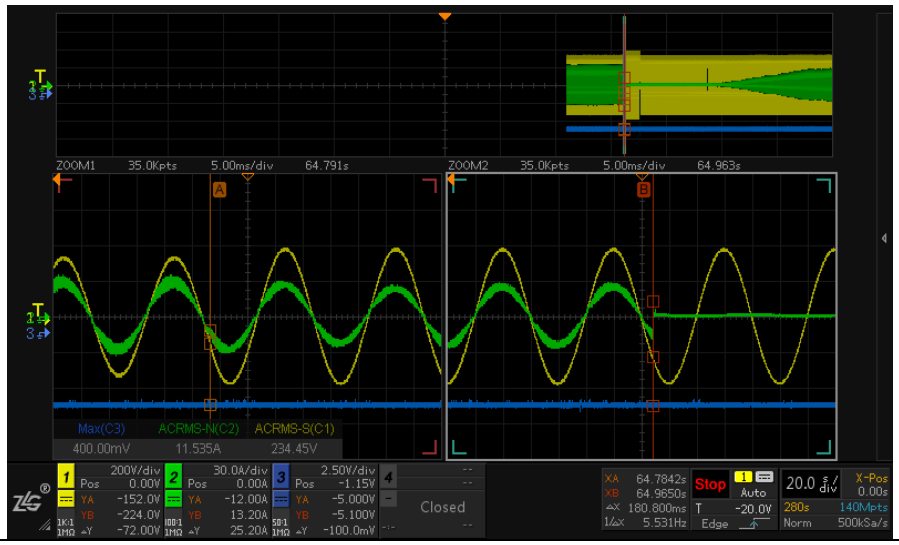
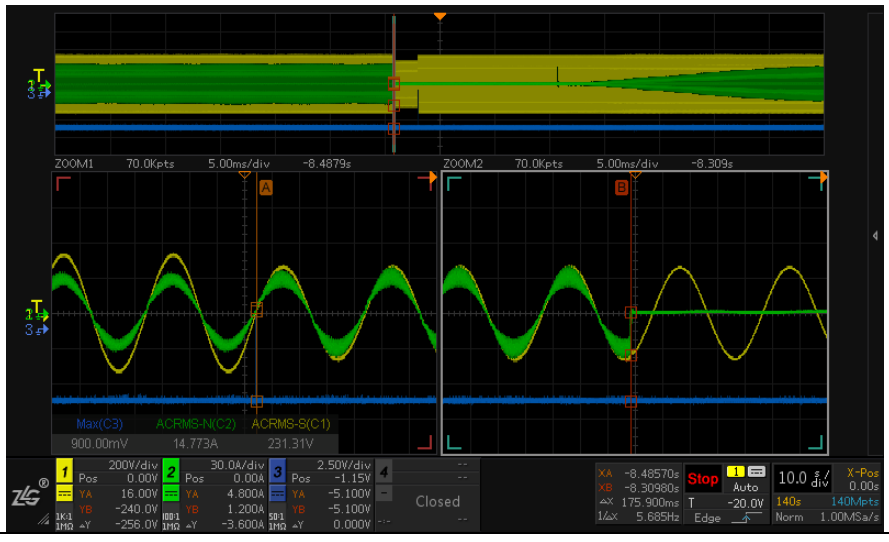
6.3 #1	TABLE: Voltage monitoring (integrated protection and interface switch)						P
Test procedure (for U>>, U<)	For line-line voltage protection, the phase angle is change that a line-line voltage reach its limit value. In this test, the phase voltage for the test of over voltage protection is set as 110% Un and under voltage protection is set as 90% Un. For phase voltage protection, one of the phase voltage is changed, 118% Un for over voltage protection, and 77% Un for under voltage protection. All tests are repeated for three times. The disconnection value shall not be deviated from the setting value for more than 1% Un. Disconnection time shall not be more than 200 ms						
		1		2		3	
		Value (V)	Time (ms)	Value (V)	Time (ms)	Value (V)	Time (ms)
Phase voltage	U>> 264.5V	264.89	181	264.9	182	264.62	184
	U< 184.0V	183.12	176	182.91	194	182.95	182

Overvoltage, U>>



Undervoltage, U<



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6.3 #2	TABLE: Voltage monitoring for 10-min-mean-value	P
Test procedure (for U>)	a) The voltage is maintained at 100% Un for 600s, afterwards the voltage is raise to 112%, the switch off must be within 600s; b) The voltage is maintained at Un for 600s, afterwards the voltage is raised to 108% . The switch off should not be activated. c) The voltage is maintained at 106% Un for 600s, afterwards the voltage is raised to 114%. The switch off should be within 225s-375s.	

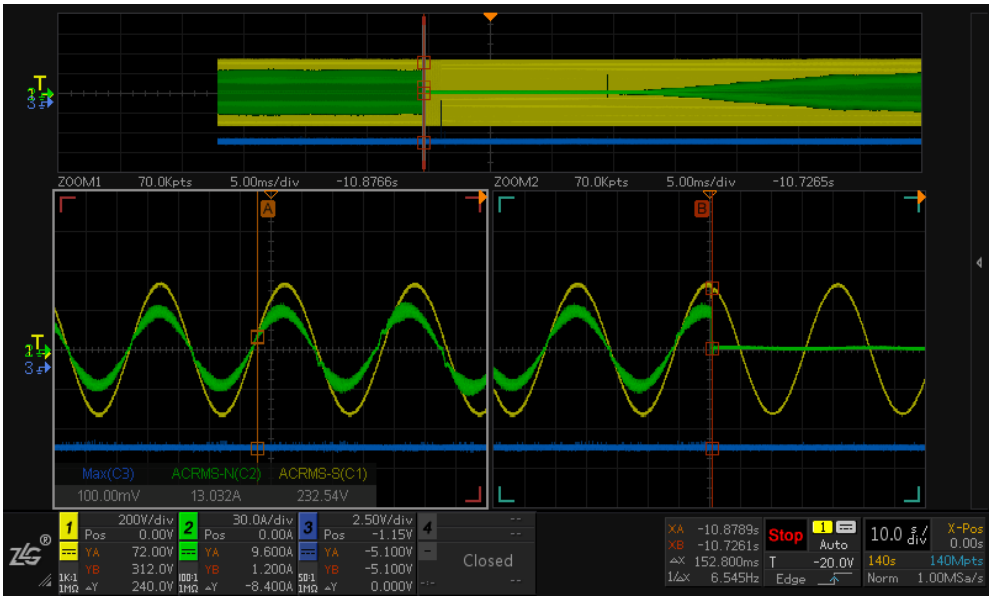
	a		b		c	
Iteration	Switch off (Yes/No)	Time (s)	Switch off (Yes/No)	Time (s)	Switch off (Yes/No)	Time (s)
L-N	Yes	534	No	720	Yes	345

Supplementary information:

The test method are referred to DIN VDE 0124-100 (VDE V 0124-100): 2012-07, Clause 5.4.5.3.3.

6.4	TABLE: Frequency monitoring						P
Test procedure (for f>, f<)	For frequency protection, the frequency is changed with a speed of 1Hz/s. All tests are repeated for three times. The disconnection value shall not be deviated from the setting value for more than 0.1% fn. Disconnection time shall not be more than 200ms						
	Trip frequency settings (Hz)	1		2		3	
		Value (Hz)	Time (ms)	Value (Hz)	Time (ms)	Value (Hz)	Time (ms)
f>	51.5 Hz (VFR 2019)	51.544	153	51.547	142	51.542	151
f<	47.50 Hz	47.499	142	47.495	170	47.499	143

Overfrequency, f>



Underfrequency, f>

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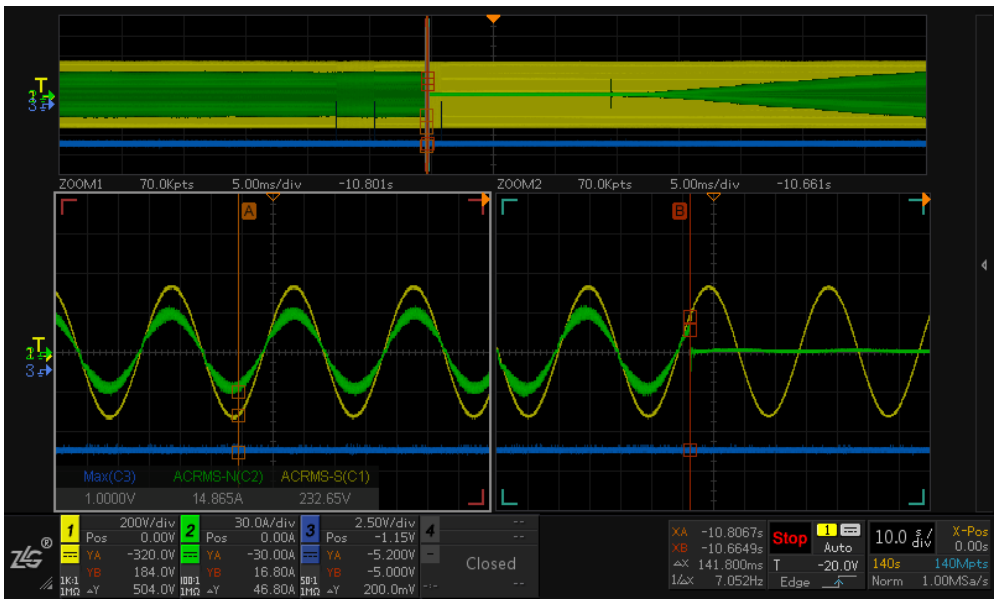

Supplementary information:

The test method are referred to DIN VDE 0124-100 (VDE V 0124-100): 2012-07, Clause 5.4.5.4.

6.5	**DC current monitoring**				P
Test procedure	The test of disconnection due to DC current feed in is done optionally according to a) or b): a) In the measurement device of disconnection device (e.g. current transducer, resistor), a DC current of 1A is impressed. The disconnection must be done within 0.2s. b) Through fault simulation and by means of measurement, it is determined whether a disordered system operation with a DC component of feed in current of more than 1A will lead to disconnection within 0.2s				
Method used	Test Condition	Measured DC current (mA)	Applied DC component (A)	Measured disconnected time (ms)	Limit time
b	10% P_n	47.6	1A	197	200 ms
b	50% P_n	49.4	1A	191	200 ms
b	100% P_n	52.9	1A	192	200 ms

6.6	**TABLE: Islanding detection**						P
Rated Frequency = (Hz)		50 Hz		Rated Voltage = (Vac)		230/400 V	
EUT rated output power (VA)		6000 VA		Phase		Single phase	
Test method is refer to IEC 62116:2014							
No	P_{EUT} (% of EUT rating)	Reactive Load (% of Q_L)	P_{AC} (% of nominal)	Q_{AC} (% of nominal)	Run on time (ms)	P_{EUT} (kW)	Actual Q_f	V_{DC}
1	100	100	0	0	481.0	5.97	0.99	442
2	66	66	0	0	421.2	3.96	1.00	335
3	33	33	0	0	235.5	1.98	0.98	206

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4	100	100	-5	-5	419.2	5.97	1.02	442
5	100	100	-5	0	453.2	5.97	1.04	442
6	100	100	-5	5	467.2	5.97	1.06	442
7	100	100	0	-5	459.2	5.97	0.97	442
8	100	100	0	5	359.2	5.97	1.01	442
9	100	100	5	-5	435.2	5.97	0.92	442
10	100	100	5	0	441.2	5.97	0.94	442
11	100	100	5	5	461.2	5.97	0.96	442
12	66	66	0	-5	376.0	3.96	0.96	335
13	66	66	0	-4	486.0	3.96	0.96	335
14	66	66	0	-3	364.0	3.96	0.97	335
15	66	66	0	-2	478.0	3.96	0.98	335
16	66	66	0	-1	386.0	3.96	0.98	335
17	66	66	0	1	490.0	3.96	0.99	335
18	66	66	0	2	428.0	3.96	0.99	335
19	66	66	0	3	447.6	3.96	1.00	335
20	66	66	0	4	471.6	3.96	1.00	335
21	66	66	0	5	409.6	3.96	1.00	335
22	33	33	0	-5	267.5	1.98	0.99	206
23	33	33	0	-4	299.0	1.98	0.99	206
24	33	33	0	-3	292.0	1.98	1.00	206
25	33	33	0	-2	340.0	1.98	1.00	206
26	33	33	0	-1	331.0	1.98	1.00	206
27	33	33	0	1	392.0	1.98	1.01	206
28	33	33	0	2	365.0	1.98	1.01	206
29	33	33	0	3	381.0	1.98	1.01	206
30	33	33	0	4	310.0	1.98	1.02	206
31	33	33	0	5	270.0	1.98	1.02	206

Supplementary information:

According to the test procedure of IEC 62116 Clause 6.1 g), the shaded portion of Table 6 are tested and with shorter run-on time than the balance condition. Thus, non-shaded parameter combinations are not required for testing and this part of the test sequence of Table 6 is deemed to be completed;

……End of test report……

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Telefax : +86 20 3832 0478

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Guangzhou Branch, TÜV SÜD Group
5F, Communication Building, 163 Pingyun Rd, Huangpu Ave. West, Guangzhou 510656, P. R. China