TÜVNORD

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Evaluation report

Report No. 35411423 of 23. 01. 2026

Manufacturer:	Guangzhou Felicity Solar Technology Co., Ltd. (Airport Baiyun)No.2, 4, 6, 8, 10 and 12 Donghua Huaye Road, Renhe Town, Baiyun District, Guangzhou, Guangdong, P. R. China				
Type of power unit:	Hybrid Inverter (Type 2)				
Designation of the power unit:	IVGM50KHP3G2, IVGM40KHP3G2, IVGM30KHP3G2, IVGM29K9HP3G2, IVGM25KHP3G2				
Technical data:	Rated effective power:	P_{rE}	=	25000-50000	W
	Rated voltage:	U_n	=	400	V
	Nominal frequency:	f_r	=	50	Hz
Basis of assessment:	VDE-AR-N 4105:2018-11 DIN VDE V0124-100:2020-06				
Order date:	12. 11. 2025				
Order number:	8003092430				
Processor:	Iris Zheng				
Version number:	Version 1.0				

This report comprises 29 Pages

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This document has been approved according to CERT-401-VA-007. Details are available from the QM-Department.

Version index

Version	Date	Creator	Changes
1.0	23. 01. 2026	Iris Zheng	Original

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General

In its letter of 2025.06.23, the above-mentioned manufacturer commissioned TÜV NORD (Hangzhou) Co., Ltd. to carry out a test in accordance with the guidelines listed below for the generating units (EZE) listed in Table 5. If the test is positive, it serves as the basis for the issuing of a unit certificate by the certification body TÜV NORD CERT GmbH.

1.1. Test basis

Table 1: Test basis

VDE-AR-N 4105	VDE-AR-N 4105: 2018-11	Power plants on the low-voltage grid- Minimum technical requirement for connection and parallel operation of power plants on the low-voltage grid
DIN VDE V 0124-100	DIN VDE V0124-100:2020-06	Grid integration of generating plants - Low voltage - Test requirement for generating units intended for connection and parallel operation on the low voltage grid
VDE-AR-N 4100	VDE-AR-N 4100: 2019-04	Technical rules for the connection and operation of customer installations to the low voltage network (TAR low voltage)

1.2. Scope of certification

TÜV NORD CERT GmbH has carried out the verification of the generation unit properties on the basis of the documents submitted in accordance with the directives and ordinances listed in chapter 1.1 and documented in the present report. This report is only valid for the listing in table 2 and is not transferable to other generation units. The unit certification to be carried out is a family certification. The transferability of the test reports (measurement reports) to the other generation units of the family is assessed in chapter 4.1. In each chapter, the requirements from the regulations are first checked for conformity on the basis of the measured generation units, followed by a statement on transferability.

The certification body shall be informed immediately in writing of any design changes to the generation unit and of any changes to the hardware used which affect the assessed properties, and the further procedure shall be agreed. In the event of failure to do so, the client shall be liable for all damages and claims arising from the further use of the report and the certificate based on it.

A consideration of cyber security is not required by the assessment basis VDE 4105 and was not the subject of this test. Due to the existing communication interfaces of the generation units and their components, an additional consideration of a possible manipulation of the safety functions (security for safety) is recommended.

2. REFERENCED DOCUMENTS

Table 2: Measurement reports used

Ref.	Content / Title	Date
/U1/	Dongguan BALUN Testing Technology Co., Ltd. Test report for IVGM50KHP3G2, IVGM40KHP3G2, IVGM30KHP3G2, IVGM29K9HP3G2, IVGM25KHP3G2 Report number: BL-DG2560064-205	12.12.2025

Table 3: Excerpts from test report

Ref.	Content / Title		Measured generating units /Type	Date
/U2/	BL-DG2560064-205 A1	E.7 Requirements for the Test report for NA protection	IVGM50KHP3G2, IVGM40KHP3G2, IVGM30KHP3G2, IVGM29K9HP3G2, IVGM25KHP3G2	12.12.2025
/U3/	BL-DG2560064-205 A2	E.5 Test report "Network perturbations for generating units with an input current < 75 A	IVGM50KHP3G2, IVGM40KHP3G2, IVGM30KHP3G2, IVGM29K9HP3G2, IVGM25KHP3G2	12.12.2025

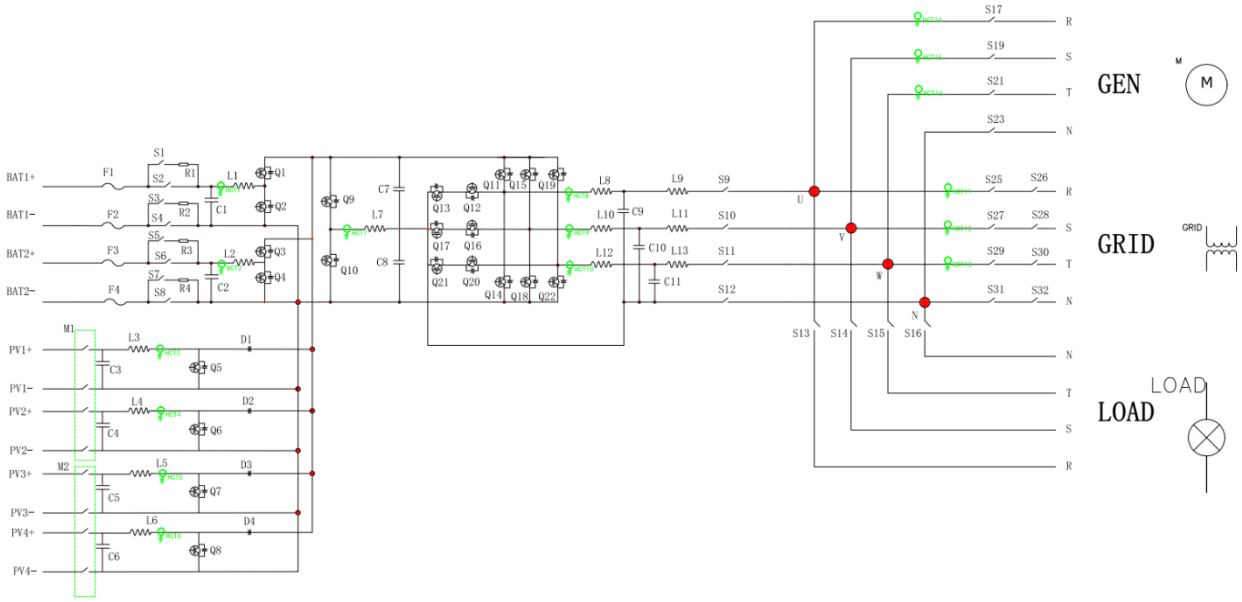
Table 4: Documents used

Ref.	Content / Title	Date
/U4/	Guangzhou Felicity Solar Technology Co., Ltd. Manufacturer declaration for IVGM50KHP3G2 series	20.12.2025
/U5/	User Manual – IVGM50KHP3G2 series	30.10.2025
/U6/	Guangzhou Felicity Solar Technology Co., Ltd. ISO-9001 certificate (Reg. Nr. 2070023Q10167R1M) issued by Guangdong Zhongzhijian Certification Co., Ltd.	23.01.2025
/U7/	China national accreditation service for conformity assessment ISO 17025 Scope of Dongguan BALUN Testing Technology Co., Ltd.- Accreditation certificate (Reg. Nr. CNAS L14701)	15.07.2025
/U8/	Fsolar Operating Instructions	V3.0

3. TECHNICAL DATA

3.1. Schematic structure of the units

Figure 1: Schematic structure



3.2. Technical data of the units

Table 5: Technical data of unit

General			
Type of EZE	Type 2 / Hybrid Inverter		
Designation	IVGM25KHP3G2	IVGM29K9HP3G2	IVGM30KHP3G2
Rated apparent power S_{rE}	25000VA 27500VA(max)	29900VA 29900VA(max)	30000VA 33000VA(max)
Rated effective power P_{rE}	25000W 27500W(max)	29900W 29900W(max)	30000W 33000W(max)
Max. effective power P_{Emax}	27488.09W (0.999 P_{Emax})	29899.91W (0.999 P_{Emax})	32999.31W (0.999 P_{Emax})
Max. apparent power S_{Emax}	27803.09VA (1.011 S_{Emax})	29899.98VA (0.999 S_{Emax})	32999.99VA (0.999 S_{Emax})
Rated voltage U_r	230/400, 3W+N+PE		
Rated current I_r	36.3A	43.4A	43.5A
Initial short-circuit alternating current I''_k	43.6A	52.1A	52.2A

Reactive power adjustment range cos φ	0.8 leading to 0.8 lagging	
Rated frequency f_n	50/60Hz	
PV – Input Variables		
Min. MPP voltage	150V	
Max. MPP voltage	850V	
Max. DC input voltage	1000V	
Number of MPPT	2	3
Max. input current	36.0A +36.0A	36.0A +36.0A +36.0A
Isc PV	55.0A+55.0A	55.0A +55.0A +55.0A
DC – Input variables		
Type /IGBT module	IKW50N120CH7, IKW75N65EH5, IKW75N120CH7	
Quantity DC Link Capacitor	34	
Clock frequency	15.6kHz	
Type of power control	SPWM	
Max. Output current (only for IGBT)	80A	
Software versions	Master: V201, Slave: V101	
Generation unit Control		
Manufacturer	Guangzhou Felicity Solar Technology Co., Ltd.	
Software version	Master: V201, Slave: V101	
Protection device		
Manufacturer	Churfod Electronics Co., Ltd.	
Type	Integrated guard	
Switch-off unit (AC)	CHAR-112A2000	
Software versions	Master: V201, Slave: V101	

General		
Type of EZE	Type 2 / Hybrid Inverter	
Designation	IVGM40KHP3G2	IVGM50KHP3G2
Rated apparent power S_{rE}	40000VA 44000VA(max)	50000VA 55000VA(max)

Rated effective power P_{rE}	40000W 44000W(max)	50000W 55000W(max)
Max. effective power P_{Emax}	43965.05W (0.999 P_{Emax})	55070.20W (1.001 P_{Emax})
Max. apparent power S_{Emax}	43997.95VA (0.999 S_{Emax})	55070.57VA (1.001 S_{Emax})
Rated voltage U_r	230/400, 3W+N+PE	
Rated current I_r	58.0A	72.5A
Initial short-circuit alternating current I''_k	69.6A	87.0A
Reactive power adjustment range cos φ	0.8 leading to 0.8 lagging	
Rated frequency f_n	50/60 Hz	
PV – Input Variables		
Min. MPP voltage	150 V	
Max. MPP voltage	850 V	
Max. DC input voltage	1000 V	
Number of MPPT	4	
Max. input current	36.0A +36.0A +36.0A +36.0A	
Isc PV	55.0A +55.0A +55.0A +55.0A	
DC – Input variables		
Type /IGBT module	IKW50N120CH7, IKW75N65EH5, IKW75N120CH7	
Quantity DC Link Capacitor	34	
Clock frequency	15.6kHz	
Type of power control	SPWM	
Max. Output current (only for IGBT)	80A	
Software versions	Master: V201, Slave: V101	
Generation unit Control		
Manufacturer	Guangzhou Felicity Solar Technology Co., Ltd.	
Software version	Master: V201, Slave: V101	
Protection device		
Manufacturer	Churfod Electronics Co., Ltd.	
Type	Integrated guard	

Switch-off unit (AC)	CHAR-112A2000
Software versions	Master: V201, Slave: V101

4. VERIFICATION

The required measurements were carried out at model IVGM50KHP3G2(cover IVGM40KHP3G2, IVGM30KHP3G2, IVGM29K9HP3G2, IVGM25KHP3G2) in accordance with DIN VDE V 0124-100 (comment Jun 2020) in the period from 29.05.2024 to 23.09.2024, and retested on model IVGM50KHP3G2 (cover IVGM40KHP3G2, IVGM30KHP3G2, IVGM29K9HP3G2, IVGM25KHP3G2) according to clause 5.2.3, 5.2.4.1 a, 5.2.4.1 b, 5.2.6, 5.5.2.1 and 5.5.7.5 of DIN VDE V 0124-100 (comment Jun 2020) in the period from 25.06 .2025 to 10.11.2025 (detail see test report /U1/) by the ISO/IEC 17025:2017 accredited measurement institute Dongguan BALUN Testing Technology Co., Ltd. (CNAS Certificate No. L14701 /U7/). The measurement results are summarized in the test report BL-DG2560064-205 /U1/.

The assessment was based on DIN VDE V 0124-100:2020-06.

4.1. Transferability of the test reports

According to DIN VDE V 0124-100 Chapter 6.2, a transfer of test reports is permissible to other Type 2 generation units under the following boundary conditions.

Evaluation criteria	Evaluation	Source
The results are available for the smallest and largest power variant or, alternatively, the rated apparent power of the generation unit to be certified is between 1/√10 times and 2 times the rated apparent power of the measured generation unit.	Conformity The dynamic and quasi-stationary measurement was performed on the generator unit IVGM50KHP3G2 with S_{rE} = 50000VA. And the test results of model IVGM50KHP3G2 can technically equivalent cover model IVGM40KHP3G2, IVGM30KHP3G2, IVGM29K9HP3G2, IVGM25KHP3G2 and according to models difference of /U4/ which declared by manufacture. All generation units mentioned in table 5 are in this range.	/U1/ /U4/
The design and the control technology decisive for the electrical properties including the software used in the generation unit are technically equivalent.	Conformity The manufacturer has confirmed the equivalence of all generation units mentioned in table 5 and explained in models difference of /U4/. The regulation and control logic are the same for all generator units.	/U1/ /U4/

Evaluation criteria	Evaluation	Source
Inverter generation unit	Conformity The manufacturer has confirmed the equivalence of the IGBT modules except the value of output current used for all models in the Table 2 in /U4/.	/U4/
Generation unit control	Conformity The same generation unit control logic is used for all model listed in Table 5.	/U4/
Hardware	Conformity technically equivalent hardware for all models listed in table 5	/U4/
Software	Conformity The software is identical for all generation models listed in Table 5	/U4/

Table 6: Technical difference of hardware between the generation unit types in Table 3 (/U4/)

Model	IVGM25KHP3G2	IVGM29K9HP3G2, IVGM30KHP3G2	IVGM50KHP3G2, IVGM40KHP3G2
MPPT numbers	2	3	4

All models have the same topology, construction, hardware and software. The difference is the number of MPPT trackers, IVGM50KHP3G2 and IVGM40KHP3G2 have four groups of MPPT trackers, IVGM30KHP3G2 and IVGM29K9HP3G2 have three groups of MPPT trackers, and IVGM25KHP3G2 has two groups of MPPT trackers, and the output power, voltage, current and input power are different and adjusted by software.

So, both Software and Hardware changes have no influence on technical equivalence. In terms of technical evaluation, the model IVGM50KHP3G2 can cover other models which list in table 5.

According to DIN VDE V 0124-100 chapter 6.2 non-FRT results can be transferred directly as relative value without modifications, if they are related to the rated power P_{rE} or the rated current I_n respectively. If the results are available as physical values for current or power, then a transfer by linear conversion using the nominal values of the non-measured family member and the measured generation unit is possible.

• Current

$$I_{\text{Family member}} = I_{\text{N Family member}} \frac{\text{I}_{\text{Test item}}}{I_{\text{N Test item}}}$$

• Power

$$S_{\text{Family member}} = P_{\text{rE Family member}} \frac{S_{\text{Test item}}}{P_{\text{rE Test item}}}$$

$$P_{\text{Family member}} = P_{\text{rE Family member}} \frac{P_{\text{Test item}}}{P_{\text{rE Test item}}}$$

$$Q_{\text{Family member}} = P_{\text{rE Family member}} \frac{Q_{\text{Test item}}}{P_{\text{rE Test item}}}$$

Based on the above evaluation, a transfer of the test reports according to DIN VDE V 0124-100 is permissible for the generation unit listed in Table 5.

4.2. Operating range

VDE-AR-N 4105 chapter 5.7.1 specifies the requirements for the quasi-stationary operation of a generation unit. The manufacturer approves the following operating ranges of table 7. These cover the required operating range according to VDE-AR-N 4105 chapter 5.7.1 (Figure 4).

Table 7: Quasi-stationary operating ranges

	Area	Time
Voltage (continuous operation)	80% to 110% Un	Unlimited
Voltage	≤ 80% Un	2.0 s
Voltage	≥ 115%Un	2.0 s
Frequency (continuous operation)	47.5Hz to 51.5 Hz	Unlimited
Frequency	≤ 47.5 or ≥ 51.5 Hz	2.0 s

Evaluation criteria	Evaluation	Source
Continuous operation in the voltage range from 90 to 110 % U_n and in the frequency range 49.0 to 51.0 Hz is possible.	Conformity See page 7 of manufacturer declarations /U4/	/U4/
In the voltage range from 85 to 90 % U_n or from 110 to 115 % U_n operation is possible for 60 s	Conformity See page 7 of manufacturer declarations /U4/	/U4/
In the frequency range of 47.5 to 49.0 Hz or 51.0 to 51.5 Hz, operation is possible for 30 min.	Conformity See page 7 of manufacturer declarations /U4/	/U4/
The DCS can undergo fast frequency changes without disconnection from the grid. At least the following averaged rates of frequency change (RoCoF) apply: • ±2.00 Hz/s in sliding 0.5 s time window • ±1.50 Hz/s in sliding 1.0 s time window • 1.25 Hz/s in sliding 2.0 s time window	Conformity According to the manufacturer's declaration, the generation unit separates at a frequency change of ±2.00 Hz/s doesn't disconnect from the mains. See page 12 of manufacturer declarations /U4/	/U4/

4.3. Mains feedback

In accordance with the underlying guidelines, the system perturbations, such as flicker, voltage changes due to switching on and off of the generation unit and harmonics are measured in accordance with DIN VDE V 0124-100 Chapter 5.2. The results of the measurement of the system perturbations can be found in the measurement report /U1/ BL-DG2560064-205. The requirements for flicker and harmonics for individual devices according to the specifications of VDE-AR-N 4100 Chapter 5.4.2. are complied with.

Rapid voltage changes

Evaluation criteria	Evaluation	Source
For power units and storage tanks with a rated current ≤ 16 A: The requirements of DIN EN 61000-3-3 (VDE 0838-3) are met.	Not applicable	--
For power units and storage units with a rated current > 16 A and ≤ 75 A: The requirements of DIN EN 61000-3-11 (VDE 0838-11) are met.	The test carried on all models at the individual grid connection point. See cl. 5.2.2 of test report/U1/ on page 14 to 18.	/U1/
For power units and storage units with a rated current > 75 A: The measurement results are -shown in the extract from the test report in accordance with the specifications of VDEAR-N -4105 Annex E.5. A valuation can only be made at the asset level.	Not applicable	--

Flicker

Evaluation criteria	Evaluation	Source
For power units and storage tanks with a rated current ≤ 16 A: The requirements of DIN EN 61000-3-3 (VDE 0838-3) are met.	Not applicable	--
For power units and storage units with a rated current > 16 A and ≤ 75 A: The requirements of DIN EN 61000-3-11 (VDE 0838-11) are met.	The test was carried on model IVGM50KHP3G2 at the individual grid connection point. See cl. 5.2.3 of test report/U1/ on page 19.	/U1/
For power units and storage units with a rated current > 75 A: The measurement results are -shown in the extract from the test report in accordance with the specifications of VDEAR-N -4105 Annex E.5. A valuation can only be made at the asset level.	Not applicable	--

Harmonics and interharmonics

Evaluation criteria	Evaluation	Source
For power units and storage tanks with a rated current ≤ 16 A: The requirements of DIN EN 61000-3-2 (VDE 0838-2) are met.	Not applicable	--
For power units and storage units with a rated current > 16 A and ≤ 75 A: The requirements of DIN EN 61000-3-12 (VDE 0838-12) are met.	The test carried on model: IVGM50KHP3G2. The evaluation is carried out separately for each network connection point separately. The required measurement results Refer to the attached excerpt /U3/ from the test report page 5 to 9.	/U1/ /U3/
For power units and storage units with a rated current > 75 A: The measurement results are -shown in the extract from the test report in accordance with the specifications of VDEAR-N -4105 Annex E.5.	Not applicable	--

Commutation dips

Evaluation criteria	Evaluation	Source
The requirements of DIN EN 61000-3-12 (VDE 0838-12) are complied with.	Not applicable	--

Feeding direct currents

Evaluation criteria	Evaluation	Source
The requirements of DIN EN 61000-3-12 (VDE 0838-12) are complied with.	The evaluation is carried out on model IVGM50KHP3G2 and IVGM25KHP3G2, the required measurement results can be taken from the test report /U1/ on page 27 and 28.	/U1/

According to the specifications of VDE- AR-N 4105 chapter 5.4, the network operator must determine the network perturbations of a generating plant. The results from the test report /U1/ or the excerpt from the test report /U3/ can be used to evaluate the system perturbations at the grid connection point.

For the non-measured DCIs, the values from the excerpt from the test report can be used directly, as these are given in relation to the nominal power.

4.4. Proof of the behaviour of the generating unit on the grid

According to the underlying guidelines, the symmetry behavior of inverters is measured in accordance with DIN VDE V 0124-100 chapter 5.3.2.

Evaluation criteria	Evaluation	Source
The maximum value of unbalance does not exceed 5% S_{Emax}.	The evaluation is carried out on model IVGM50KHP3G2, the maximum asymmetry is 100.58VA (0.20% S_{Emax}) the required measurement results can be taken from the test report /U1/ on page 31 to 32.	/U1/

4.4.1. Active and reactive power ranges

According to the underlying guidelines, the active and reactive power ranges are measured in accordance with DIN VDE V 0124-100 Chapter 5.4.2.

Evaluation criteria	Evaluation	Source
The cos(φ) values determined at least cover the range required according to VDE-AR-N 4105:2018-11 Chapter 5.7.2.2.2 to 5.7.2.2.4 depending on the type of generation unit.	Conformity the test value of Cos(φ) within the required range ±0.90	/U1/
The measured values for S_{Emax} and P_{Emax} do not exceed the manufacturer's specifications by more than 2 %.	Conformity The maximum asymmetry is 1.10% S_{Emax}. See test report /U1/ on page 40. The maximum asymmetry is 0.13% P_{Emax}. See test report /U1/ on page 36.	/U1/

4.4.2. Active power reduction through setpoint specification

Chapter 5.7.4.1 of VDE-AR-N 4105 sets requirements for the setpoint specification and chapter 5.7.4.2 for the network security management (NSM). The metrological verification is carried out in accordance with DIN VDE V 0124-100 chapter 5.4.3.

Evaluation criteria	Evaluation	Source
The generation unit has an interface for setpoint input by third parties.	Conformity The setpoint is specified by the associated control software. According to the manufacturer's declaration the setpoint setting can be carried out with the following interface can be performed: - RS485 - WLAN/GPRS See page 7 of manufacture declaration /U4/	/U1/ /U4/
The power unit has an interface for setpoint input for the NSM.	Conformity The setpoint specification can be carried out by the digital inputs. See test report /U1/ on page 44.	/U1/
Each reduction request of the grid operator must be traceable for the grid operator via the metering concept or via a telecontrol connection.	Conformity	/U1/
The power reduction must be possible in every operating condition and from every operating point.	Conformity	/U1/
Behaviour at setpoint values below the technical minimum continuous power.	Not applicable.	--
Measurement assessment		
No mains disconnections occur during the measurements.	Conformity	/U1/
The measured active power does not deviate from the setpoint by more than ± 5 % P_{rE}	Conformity The maximum deviation is 0.21% P_{rE} with a setpoint value specification of 50%P_{rE}. See page 41 of test report /U1/	/U1/
The determined power gradient does not fall below 0.33 % P_{rE} /s and does not exceed 0.66 % P_{rE} /s.	Conformity The following performance gradients are demonstrated by the measurement on IVGM50KHP3G2: Power increase: 0.44% P_{rE} /s Power reduction: 0.44% P_{rE} /s See page 42 to 43 of test report /U1/	/U1/
When measuring the priority of the interfaces, the lowest setpoint is always approached or the setpoint at the interface programmed for the NSM is never exceeded.	Conformity The lowest setpoint is always given priority. See page 44 of test report /U1/	/U1/

Evaluation criteria	Evaluation	Source
When testing the logical interface (input port), the active power feed-in of the DCU is completely terminated within a maximum of 5 s after the change of state of the logical signal.	Conformity The test value is 0.247 s and stop feed-in active power with a maximum of 5s See page 44 of test report /U1/	/U1/

4.4.3. Active power feed-in from power unit at over- and underfrequency

Chapter 5.7.4.3 of VDE-AR-N 4105 specifies requirements for active power control at overfrequency and underfrequency. The metrological verification is carried out according to DIN VDE V 0124-100 chapter 5.4.4 and 5.4.5.

Evaluation criteria	Evaluation	Source
The accuracy of the frequency measurement in steady state must be at least ±10 mHz.	Conformity	/U4/
For generating units, the frequency value for the start of this frequency-dependent active power feed-in must be adjustable between 50.2 Hz to 50.5 Hz.	Conformity According to the parameter table in /U4/ the parameter "Over frequency threshold" can be set between 50.0 Hz to 55.0 Hz in steps of 0.01 Hz can be set. See Manufacture declarations /U4/ on page 13.	/U4/
The statics of the frequency-dependent active power feed-in must be adjustable from 2 % to 12 %.	Conformity 5% was selected according to the manufacturer's declaration /U4/ See Manufacture declarations /U4/ on page 13.	/U4/
At grid frequencies f > 51.5 Hz, the generating units and storage facilities must disconnect from the grid when energy is delivered.	Conformity When the protection parameter "OF stage 1 trip value" (default setting: 51.5 Hz) is exceeded, the generating units is disconnected from the mains. See Manufacture declarations /U4/ on page 15.	/U4/
At frequencies below 49.8 Hz, all generating units must increase the currently generated active power P_{mom} with a gradient of 40 % P_{Emax} per hertz (s = 5 %) up to their technically possible maximum value. For storage units, a gradient of 100 % P_{Emax} per hertz (s = 2 %) applies.	Conformity	/U4/

Evaluation criteria	Evaluation	Source
Power reductions that serve to protect equipment are also permissible at underfrequency.	Conformity Power reduction in the event of underfrequency didn't not occur when generation unit normal operation. See Manufacture declarations /U4/ on page 13.	/U4/
At grid frequencies f < 47.5 Hz, the power units and storage units must disconnect from the grid:	Conformity When the protection parameter "UF stage 1 trip value" (default setting: 47.5 Hz) is exceeded, the generating units is disconnected from the mains. See Manufacture declarations /U4/ on page 15.	/U4/
The initial time delay is T_V ≤ 2 s.	The max initial time delay is 0.13s for over-frequency and 0.11s for under-frequency. See cl.5.4.5 of test report/U1/ on page 46 and cl.5.4.7 of test report/U1/ on page 49	/U1/
For the temporal course of the frequency-dependent adaptation of the active power, the following conditions must be met with regard to the initial time delay T_V and the transient time *Tan_90* %: • After T_V + 0.1 (*Tan_90* %-TV) has elapsed, at least 9 % of the required power adjustment ΔP has been achieved. • 90 % of the power adjustment *P has been* achieved after the transient time *Tan_90* % has elapsed.	Conformity Maximum T_V: 0.13s Active power at $T_{9\%soll}$ is 26405W, Active power at $T_{ta90\%}$ is 29700 W	/U1/
Conditionally controllable DCIs can be regulated in their control range according to the characteristic curve. Outside the controllable range, the switch-off then takes place according to the evenly distributed switch-off limit.	Not applicable The generation unit is not a conditionally controllable type.	--
Measurement assessment		
The active power reduction takes place after settling with a deviation≤ ±10 % P_{Emax}	Conformity	/U1/
After the frequency increase to > 51.5 Hz, no active power may be delivered. The active power may only be increased again when the frequency is reduced below 50.2 Hz. The delay time is at least 60 s and the power must then be increased with a gradient of≤ 10 % P_{Emax} /min.	Conformity The max active power gradient after reconnection is 7.91% P_{rE}/min. The max reconnection time is 66.4s. See test report /U1/ on page 45.	/U1/

Evaluation criteria	Evaluation	Source
After the frequency has been reduced to < 47.5 Hz, no active power may be output. The active power may only be increased again after a frequency increase > 49.8 Hz. The delay time is at least 60 s and the power must then be increased with a gradient of≤ 10 % P_{Emax} /min.	Conformity The max active power gradient after reconnection is 7.96% P_{rE}/min. The max reconnection time is 79.2 s. See test report /U1/ on page 48.	/U1/
The initial time delay T_V of the frequency-dependent adjustment of the active power output is ≤ 2 s.	Conformity The maximum initial time delay is 0.13s. See cl.5.4.7 of test report/U1/ on page 46.	/U1/
For Type 2 units (with the exception of Type 2 units with rotating machines) are the build-up time Tan_90% and the settling time Tein of the strain the active power output is less than 2 s and 20s.	Conformity The generation unit is Type 2 See cl.5.4.5 of test report/U1/ on page 45.	/U1/
In the case of DCIs with VKM or gas turbines, the power gradient of the active power output is at least 66 % P_{Emax} per min (corresponds to 1.11 % P_{Emax} pers). In this case, the criteria for transient time and settling time are not evaluated.	Conformity See cl.5.4.5 of test report/U1/ on page 45 and 46.	/U1/
In the event of overfrequency outside the controllable range, conditionally controllable DCIs keep the power fed in when leaving the control range constant until it is switched off.	Not applicable. The generation unit is not a conditionally controllable type. See Manufacture declarations /U4/ on page 13.	/U4/
In the case of conditionally controllable DCIs, there is no switch-off at underfrequency between 49.8 Hz and 47.5 Hz.	Not applicable. The generation unit is not a conditionally controllable type. See Manufacture declarations /U4/ on page 13.	/U4/

4.4.4. Static voltage maintenance / reactive power provision

According to VDE-AR-N 4105 chapter 5.7.2.2.3, the following requirements for the provision of reactive power are placed on power unit. The metrological verification is carried out in accordance with DIN VDE V 0124-100 Chapter 5.4.8.

Reactive power capacity of the power unit:

Evaluation criteria	Evaluation	Source
The power unit has a voltage-dependent reactive power capacity according to Fig. 4 of VDE AR-N 4105	Conformity	/U4/
The power unit has a reactive power capacity below P_{Emax} according to Fig. 5 and Fig. 6 of VDE AR-N 4105.	Conformity When requesting the maximum reactive power provision of	/U1/ /U4/

	0.4843 S_{rE}, the generation unit can increase the active power to a maximum of 100% P_{rE} limit in favor of the reactive power provision. See test report /U1/ on page 51.	
Conditionally controllable DCIs must be able to control the reactive power up to the technical minimum power.	Not applicable. The generation unit is not a conditionally controllable type.	--
The control deviation of the reactive power may be a maximum of ± 4 % in relation to P_{Emax}	Conformity	/U1/
Measurement assessment		
The determined 60 s average value for reactive power is in the range ± 4 % P_{Emax}	Conformity The maximum tolerance 0.33% stated in test report /U1/ on page 51.	/U1/

Procedure for the provision of reactive power:

According to VDE-AR-N 4105 chapter 5.7.2., the following requirements for the provision of reactive power are placed on power unit. The metrological verification is carried out in accordance with DIN VDE V 0124-100 Chapter 5.7.2.4.

Evaluation criteria	Evaluation	Source
None of the predefined reactive power procedures is preset in the delivery state. This must only be activated during commissioning according to the grid operator's specifications.	Conformity None of the specified reactive power procedures is preset when the device is delivered. This must only be activated during commissioning according to the specifications of the network operator.	/U4/
Without setting the reactive power control, the power unit cannot feed in.	Conformity See page 8 to 9 of manufacture declarations /U4/	/U4/
The power unit has the following reactive power control modes: a) Reactive power-voltage characteristic $Q(U)$ or b) Displacement factor/active power characteristic cos φ (P) c) fixed displacement factor cos φ	Conformity See page 8 to 9 of manufacture declarations /U4/	/U4/
The control behaviour corresponds to the PT-1 behaviour shown in Fig. 10 of VDE-AR-N 4105.	Conformity See page 9 of manufacture declarations /U4/	/U4/
The setting time for the reactive power is adjustable between 6 s and 60 s (for type 1 between 10 s and 60 s)	Conformity See page 9 of manufacture declarations /U4/	/U4/

Evaluation criteria	Evaluation	Source
By default, the setting time for the reactive power is set to 10 s	Conformity See page 9 of manufacture declarations /U4/	/U4/
Reactive power voltage characteristic *Q*(*U*)		
In the standard settings, the *Q*(*U*) characteristic corresponds to the characteristic according to Fig. 7 of VDE-ARN-N 4105. It must be specified whether this can be parameterized.	Conformity See test report /U1/ on page 59 to 67.	/U1/
The voltage measurement is carried out with a maximum measuring error of 1 % in relation to the nominal value.	Conformity See test report /U1/ on page 59 to 67.	/U1/
All reactive power values determined for the respective voltages at the generator terminals are ± 4 % P_{Emax}	Conformity See test report /U1/ on page 59 to 67.	/U1/
The control behaviour corresponds to the PT-1 behaviour shown in Fig. 10 of VDE-AR-N 4105 and does not violate the tolerance bands.	Conformity See test report /U1/ on page 59 to 67.	/U1/
Displacement factor/active power characteristic cos φ (*P*)		
In the standard settings, the *cos φ (P)* characteristic curve corresponds to the characteristic curve according to Fig. 8 or Fig. 9 of VDE-AR-N 4105. It must be specified whether this can be parameterised.	Conformity See page 53 to 58 of test report /U1/ See page 9 of manufacture declarations /U4/	/U1/ /U4/
Tests 1 and 3 according to chapter 5.4.8.3 of DIN VDE V 0124-100 are passed if for all calculated reactive power values the maximum deviation between the reactive power setpoint and the actual value at the generator terminals is 4.0 % P_{Emax} at the most.	Conformity See page 53 of test report /U1/	/U1/
Test 2 in accordance with chapter 5.4.8.3 of DIN VDE V 0124-100 is passed if the power unit demonstrably complies with the power gradient requirements in accordance with VDE-AR-N 4105:2018-11, 5.7.4.2.	Conformity See page 53 of test report /U1/	/U1/
Test 4 according to chapter 5.4.8.3 of DIN VDE V 0124-100 is passed if • test steps c) and e) has PT1 behaviour according to Figure 10 of VDE-AR-N 4105:2018-11 • Test step d) optionally the power gradient lies between the limits defined in VDE-AR-N 4105:2018-11, 5.7.4.1 or the step response of the reactive power also exhibits PT1 behaviour according to VDE-AR-N 4105:2018-11, 5.7.2.5.	Conformity See page 54 of test report /U1/	/U1/
Displacement factor cos φ		
The displacement factor can be set in steps Δcos φ= 0.01	Conformity See page 9 of manufacture declarations /U4/	/U4/

Evaluation criteria	Evaluation	Source
The control deviation of the reactive power may be a maximum of ± 4 % in relation to P_{Emax}	Conformity See page 51 to 52 of test report /U1/	/U1/

4.5. Proof of NA protection

4.5.1. General requirements

VDE-AR-N 4105 chapter 6.1 describes the general requirements for protective devices.

Evaluation criterion	Evaluation	Source
For power unit with an apparent power > 30 kVA, a central NA protection shall be provided. Exception: In the case of combined heat and power plants, integrated NA protection is also permissible for power systems > 30 kVA.	Conformity The NA protection of the generation unit which list in table 5 were an integrated NA protection. See page 15 of manufacture declarations /U4/.	/U4/
For generation unit with an apparent power ⩽ 30 kVA, NA protection or integrated protection must be provided.	Not applicable The NA protection of the generation unit is an integrated NA protection. Central NA protection to be implemented at the level of the generating plant.	--

4.5.2. Fault detection from NA protection

According to VDE-AR-N 4105 chapter 6.1, protective functions must be maintained even in the event of a fault in the system control. A single fault must not result in the loss of the protective function of the mains and system protection. The metrological verification is carried out in accordance with DIN VDE V 0124-100 chapter 5.5.2.

Evaluation criteria	Evaluation	Source
Errors performed	Conformity All faults required in VDE V 0124-100, See clause 5.5.2 in test report /U1/ on page 72 to 78.	/U1/
Measurement assessment		
If any of the above faults are detected, shutdown must occur within 10 seconds of fault detection. In case of failure of the auxiliary voltage, the switch-off command must be given without delay.	Conformity If the faults are detected according to VDE V 0124-100, chapter 5.5.2, the generation unit disconnects immediately from the mains. See page 69 to 71 of test report /U1/	/U1/

4.5.3. Central tie switch

The requirements for central tie switches are described in VDE-AR-N 4105 chapter 6.4.1 and 6.4.2. The metrological verification is carried out according to DIN VDE V 0124-100 chapter 5.5.6.2.

The generation unit have an integrated tie switch and no central tie switch /U4/. The specifications of VDE-AR-N 4105 for central NA protection in combinations with central or integrated tie switches must be observed and implemented at the level of the generating plant.

4.5.4. Integrated tie switch

The requirements for the coupling switches are described in VDE-AR-N 4105 chapter 6.4. The metrological verification is carried out according to DIN VDE V 0124-100 chapter 5.5.6.3.
The generation unit have an integrated tie switch (/U1/ and /U4/).

Table 8: Information on the design of the coupling switch

	Breaking capacity of the coupling switch		Own time Open coupling switch max.	Pre-fuse selective line protection or NH fuse	Initial short-circuit current I_k
	I_e	Switch-off capacity			
CHAR-112A2000	200A	220A	35ms operate time 30ms release time	No back-up fuse, as there is no central tie switch. The integrated relay is redundant in the generation unit, so that the selectivity can be guaranteed	IVGM50KHP3G2: 87.0A, IVGM40KHP3G2: 69.6A, IVGM30KHP3G2: 52.2A, IVGM29K9HP3G2: 52.1A, IVGM25KHP3G2: 43.6A

Evaluation criteria	Evaluation	Source
The bus tie breaker must be designed for the conditional rated short-circuit current, taking into account the required protective devices, and must be capable of instantaneous tripping.	Conformity Same integrated tie switch model CHAR-112A2000 used for IVGM50KHP3G2, IVGM40KHP3G2, IVGM30KHP3G2, IVGM29K9HP3G2, IVGM25KHP3G2. See page 16 to 18 of manufacture declarations /U4/	/U4/
The switching capacity of the coupling switch shall be rated according to the higher of the rated current of the upstream fuse or the maximum	Conformity	/U4/

initial short-circuit AC contribution of the Generation unit.	I_K: IVGM50KHP3G2:43.6A, IVGM40KHP3G2:52.1A, IVGM30KHP3G2:52.2A, IVGM29K9HP3G2:69.6A, IVGM25KHP3G2:87.0A See page 3 of manufacture declarations /U4/	
A function check of the coupling switch according to VDE-AR-N 4105 chapter 6.4 must be realised.	Conformity According to the manufacturer declaration, the tie switch has a control voltage which disconnects the generation unit from the mains when it is interrupted. The coupling switch used complies with the requirement of IEC 62109. See page 15 of manufacture declarations /U4/	/U4/
The tie switch must switch all phase conductors.	Conformity The unit have two relays on each L line and N line in the AC side as auto switch device. See page 15 of manufacture declarations /U4/	/U4/
The intrinsic time of the coupling switch shall be specified in the manufacturer's documentation.	Conformity The unit has two couples of relays integrated in the output line. See page 15 of manufacture declarations /U4/	/U4/
Evaluation of the measurement results		
The disconnection of the control voltage must lead to the undelayed disconnection of the coupling switch.	Conformity An interruption of the control voltage leads to an instantaneous switch-off of the generation unit. (Chap. 5.5.2.1 of the test report on page 71).	/U1/
A simulated defect during switch-on must be detected without delay and the power unit must not feed in and must not switch on again.	Conformity See page 83 in test report /U1/	/U1/
A simulated defect during operational switch-off must be detected without delay and the power unit must not feed in and must not switch on again.	Conformity See page 83 in test report /U1/	/U1/
A simulated malfunction of the coupling switch when tripped by the NA protection must be detected without delay and the power unit must not feed in and must not switch on again.	Conformity If a malfunction of the tie switch is detected, the generation unit switches off without delay.	/U1/

	See page 69 in test report /U1/ (Chap. 5.5.2.1 of the test report)	
The switch-off time of the total chain of action must not exceed 200 ms.	Conformity The maximum switch-off time of the total action chain is 149 ms for U>> function with setting of 200 ms trip time. (cl 5.5.7.4 of test report on page 101)	/U1/

4.5.5. Protective devices and protective settings

The requirements for the protective function are described in VDE-AR-N 4105 Chapters 6.5.1 and 6.5.2. The metrological verification is carried out in accordance with DIN VDE V 0124-100 Chapters 5.5.7 to 5.5.10. The results of the measurement are summarized in the extract from the measurement report /U3/.

Evaluation criteria	Evaluation	Source
The following functions of the NA protection are to be realised: • Voltage protection *U* >>, *U* >, U <, *U* << • Frequency protection *f* <, *f* > • Island network detection. Voltage protection devices should evaluate the effective value. Here, the evaluation of the 50- Hz fundamental is sufficient.	Conformity See page 15 of manufacture declaration /U4/	/U1/ /U3/ /U4/
The voltage rise protection *U* > is to be designed as a sliding 10-minute mean value protection that prevents the upper voltage limit according to DIN EN 50160 from being exceeded (monitoring of the voltage quality). It is sufficient if a new 10-minute average value is formed every 3 s at the latest, which is to be compared with the set value for *U* >.	Conformity See page 107 to 113 of test report /U1/	/U1/ /U2/
Voltage protection devices must be designed to monitor the incoming phase conductors. For generating plants < 30 kVA, the voltage(s) (per phase conductor into which the power is fed) between the phase conductors and the neutral conductor must be measured.	Not applicable	--
For power systems > 30 kVA, the voltage protection devices must be designed as three-phase devices. For this purpose, the three voltages between the phase conductors and the neutral conductor must be measured. The three interlinked phase-to-phase voltages must either be calculated from the three phase-to-neutral voltages or measured separately. Thus, 2 x 3 voltage values are to be recorded here.	Conformity See page 86 to 113 of test report /U1/	/U1/
The voltage values are to be logically ORed.	Conformity	/U1/

Frequency protection devices can be single-phase.	Conformity	/U1/
The setting values of the protection functions and the last five dated error messages must be readable on the NA protection. Supply interruptions of 3 s must not lead to a loss of the error messages.	Conformity The last five error messages can be read in the generation unit control. See page 116 of test report /U1/	/U1/
The NA protection shall be provided with protection against unauthorised access	Conformity The settings of the NA protection are protected by password.	/U1/ /U4/
The voltage rise protection $U >$ must be adjustable in the NA protection.	Conformity set the parameters according to page 53-54 of User Manual/ U5/ Grid Setting/IP Protection/ “HV1”	/U1/ /U5/
For directly coupled synchronous and asynchronous generators with $P_n > 50$ kW, the time delay of the voltage drop protection $U <$ and $U <<$ in the NA protection must be adjustable.	Not applicable	--
All other protective functions described in VDE-AR-N 4105:2018-11, 6.5 are either fixed or protected against unauthorized access by additional, separate protection.	Conformity See page 15 of manufacture declarations /U4/	/U1/ /U4/
Evaluation of the measurement results		
Test steps 1.1 to 1.7, 4.1 to 4.7, 6.1 to 6.7 according to DIN VDE V 0124-100: The switch-off values may have a maximum deviation of ±1 % from U_n	Conformity See page 86 of test report/U1/	/U1/
Test steps 8.1 and 10.1 according to DIN VDE V 0124-100: The permissible tolerance between the set value and the trigger value is a maximum of 0.1 % f_n for the frequency.	Conformity See page 114 of test report/U1/	/U1/
Test steps 2.1 to 2.7, 5.1 to 5.7, 9.1 and 11.1 according to DIN VDE V 0124-100: The determined switch-off times must be smaller than the values specified in Table 2 of VDE-AR-N 4105. If the control signal of the coupling switch is used for evaluation, the maximum intrinsic time of the coupling switch must be taken into account.	Conformity The setting of the protection functions f< and f<< has been set to 100 ms. The maximum switch-off time is 157 ms. See page 114 of test report/U1/	/U1/
Test steps 3.1 to 3.3 according to DIN VDE V 0124-100: • Test 3.1 The shutdown takes place in the range between 450 s - 550 s. • Test 3.2 There is no shutdown. • Test 3.2 The shutdown occurs in the range between 225 s - 375 s.	Conformity The following tripping times could be verified by the measurement according to Tab. 39 in VDE V0124-100: Test step 3.1: The maximum trip time is 593 s,	/U1/

	Test step 3.2: No triggering, Test step 3.3: The maximum trip time is 293 s. See page 107 of test report /U1/	
Test steps 5.1 to 5.7 according to DIN VDE V 0124-100: The test is passed for Stirling generators, fuel cells and synchronous or asynchronous generators ≤ 50 kW if the shutdown has occurred within 200 ms after application of the jump. For directly coupled synchronous or asynchronous generators > 50 kW, the test is passed if the shutdown occurred within a range between 1.0 s and 1.1 s. For inverters, the test is passed if the shutdown occurred within a range between 3.0 s and 3.1 s.	Conformity See page 83 of test report /U1/	/U1/
Test steps 7.1 to 7.7 according to DIN VDE V 0124-100: The test is passed if the switch-off after application of the jump has occurred within between 300 ms and 400 ms.	For 0.45Un. The maximum switch-off time is 362 ms. See page 98 of test report /U1/	/U1/

4.6. Connection conditions and synchronisation

VDE-AR-N 4105 chapter 8.3 describes the requirements for connection and synchronisation. The metrological verification is carried out according to DIN VDE V 0124-100 chapter 5.6.

Evaluation criteria	Evaluation	Source
The connection may only be made in the voltage range from 85 % U_n to 110 % U_n and in the frequency band 47.5 Hz to 50.1 Hz.	Conformity See page 126 of test report /U1/	/U1/
The switch-on delay time is at least 60 s.	Conformity See page 126 of test report /U1/ See page 13 of manufacture declarations /U4/	/U1/ /U4/
The delay time is adjustable.	Not applicable The delay time of the connection cannot be set in the generation unit.	--
After triggering of the NA protective device or the $P_{AV,E}$ monitoring, the active power delivered to the grid of the grid operator by controllable power plants and storage facilities must not exceed the gradient of 10 % of the P_{Amax} per minute.	Conformity See page 13 of manufacture declarations /U4/	/U4/
Non-regulatable power units and storage tanks can switch on after 1 min to 10 min (random generator) or later.	Not applicable	--
Connection of synchronous generators		

The following synchronisation conditions are adjustable and preset as follows: • = 10°; • f = 500 mHz; • U = 10 % U_n	Not applicable	--
Connection of asynchronous generators		
Asynchronous generators which are started up by a drive unit may be connected at a speed between 95 % and 105 % of the synchronous speed.	Not applicable The generation unit is Type 2	--
For asynchronous generators that are not connected without voltage, the connection conditions for Synchronous generators to be complied with.	Not applicable The generation unit is Type 2	--
Evaluation of the measurement results		
A connection is made at > 85 % U_n	Conformity See page 126 of test report /U1/	/U1/
A connection is made at < 110 % U_n	Conformity See page 126 of test report /U1/	/U1/
Switching takes place at > 47.5 Hz	Conformity See page 126 of test report /U1/	/U1/
Switching takes place at < 50.1 Hz	Conformity See page 126 of test report /U1/	/U1/
The active power gradient after protective tripping is 10 % of P_{Amax} per minute. The verification is carried out during the measurement according to chapters 5.4.4 to 5.4.7 of DIN VDE V 0124-100.	Conformity See page 126 of test report /U1/	/U1/

4.7. Proof of $P_{AV,E}$ monitoring

According to the manufacturer's specifications, the $P_{AV,E}$ monitoring is not part of the unit. It is a separate piece of equipment.

In accordance with the manufacturer's specifications, $P_{AV,E}$ monitoring is implemented in the generation unit controller. The function can be implemented in a stand-alone device i accordance with the specifications of VDE-AR-N 4105 cl. 5.5.2.

The requirements for $P_{AV,E}$ monitoring are described in VDE-AR-N 4105 Chapter 5.5.2. The metrological verification is carried out in accordance with DIN VDE V 0124-100 cl.5.7

Evaluation criteria	Evaluation	Source
If the $P_{AV,E}$ monitoring is not part of the generation unit is not built as a unit, the entire chain of effects checked.	Conformity $P_{AV,E}$ monitoring shall cover all line conductors. See page 19 of manufacture declarations /U4/	/U4/
The accuracy of the transducer when measuring corresponds to class 1 or better	Conformity See page 243 of test report /U1/	/U1/

$P_{AV,E}$ Monitoring as a control function Evaluation Source		
The following measurements are for $P_{AV,E}$ monitoring carried out • Loss of load • Jump in primary energy supply	Conformity See page 130 of test report /U1/	/U1/
The generation unit meets the requirements of the limit curve in VDE-AR-N 4105, Figure 1.	Conformity See page 130 of test report /U1/	/U1/
$P_{AV,E}$ Monitoring as a switch-off function		
No disconnection occurs for an active power of 0.98 $P_{AV,E}$ and for the ranges: • 1.02 $P_{AV,E}$ to 1.067 $P_{AV,E}$ • 1.067 $P_{AV,E}$ to 1.670 $P_{AV,E}$ • 1.690 P $P_{AV,E}$ If the shutdown occurs within the specified time.	Not applicable	--

4.8. Proof of dynamic network support

The FRT capability and the dynamic grid support were measured on the Inverter system and evaluated in the following with regard to compliance with the regulations. The manufacturer has stated in his manufacturer's declaration /U4/ that the following voltage-time characteristic is shown:

Table 9 Voltage-time characteristic of the UVRT

Time [s]	U [p.u.]
0.15	0.15
0.25	0.25
1.5	0.50
2	0.60
60	0.85~0.90

Table 10 Voltage-time characteristic of the OVRT

Time [s]	U [p.u.]
60	1.10~1.15
5	1.15~1.20
0,1	1.20~1.25

Evaluation criteria	Evaluation	Source
The required UVRT and OVRT tests were carried out completely and successfully in accordance with DIN VDE V 0124-100. The power unit did not disconnect from the mains during any UVRT and OVRT tests	Conformity See page 133 of test report /U1/ See page 14 to 15 of manufacture declarations /U4/	/U1/ /U4/
The capacity of the power unit corresponds at least to the required limit curves from VDE4105 Chapter 5.7.3	Conformity See page 133 of test report /U1/ See page 14 to 15 of	/U1/ /U4/

Evaluation criteria	Evaluation	Source
	manufacture declarations /U4/	
A voltage-time characteristic (assets of the power unit) is available.	Conformity See page 133 of test report /U1/ See page 14 to 15 of manufacture declarations /U4/	/U1/ /U4/
The power unit's self-protection does not conflict with the required dynamic grid support	Conformity See page 133 of test report /U1/ See page 14 to 15 of manufacture declarations /U4/	/U1/ /U4/
The DC unit is capable of cycling through successive mains faults. The proof that a type 1 DC unit is capable of cycling through multiple consecutive voltage dips is provided if the generator is verifiably designed according to DIN EN 60034-1 (VDE 0530-1), chapter 9.3.2.	Not applicable The generation unit is a Type 2 unit.	--
Evaluation of the measurement results		
During the collapse, the power unit does not disconnect from the grid.	Conformity for all function See page 133 of test report /U1/	/U1/
Type 1 units support the mains voltage during a mains fault by feeding in a suitable active and reactive current. Due to the reactive current feed-in, the voltage increase during and after a mains fault must not lead to the overvoltage limit curve (see VDE-AR-N 4105:2018-11) being violated.	Not applicable The generation unit is a Type 2 unit.	--
Asynchronous generators must remain connected to the mains within the tests shown and are allowed to supply active and reactive current on principle.	Not applicable The generation unit is a Type 2 unit.	--
Type 2 units and storage units must not feed in active or reactive current during a mains fault and a voltage at the terminals of the power unit below 0.8 Un and above 1.15 Un.	Conformity for all function See page 135 to 238 of test report /U1/	/U1/
The power unit does not disconnect from the mains within 60 s after the end of the fault.	Conformity for all function See page 135 to 238 of test report /U1/	/U1/
After the end of the fault, type 1 units and asynchronous machines have a transient time of the active power of max. 6 s and a transient time of the reactive power of as fast as possible.	Not applicable The generation unit is a Type 2 unit.	--
After the end of the fault, type 2 units and storage tanks have a transient time of max. 1 s for active power, transient time of reactive power according to PT1 behaviour with 3 Tau = 10 s according to VDE-AR-N 4105:2018-11, 5.7.2.5.	Conformity for all function See page 135 to 238 of test report /U1/	/U1/

5. QUALITY MANAGEMENT SYSTEM

The manufacturer has demonstrated certification of its quality management system to ISO 9001 for the manufacturing facility (Business Operation Address: (Airport Baiyun)No.2, 4, 6, 8, 10 and 12 Donghua Huaye Road, Renhe Town, Baiyun District, Guangzhou, Guangdong, P. R. China) of the generating units listed in Table 5 and, according to a manufacturer's declaration /U4/, will maintain this for the duration and validity of this unit certification. It is recommended that the Unit Certificate be issued with the following additions.

6. SUMMARY

The generating units listed in Table 5 meet the requirements for generation from VDE-AR-N 4105:2018-11 with the comments and restrictions listed below.
It is recommended that the Unit Certificate be issued with the following additions.

Comments	The generation units have an integrated tie switch and no central tie switch. The specifications of the VDE-AR-N 4105 for central NA protection in combinations with central or integrated tie switches must be observed and implemented at the level of the generating plant. None of the specified reactive power procedures is preset when the device is delivered. This must only be activated during commissioning according to the specifications of the network operator. This assessment report replaces the initial report 35386027 version V1.0, and the associated initial certificate no. 44 798 23053426 Rev.1.0 void. According to the declaring by client, the following updates of the EUT have been made: 1. Update the applicant, manufacturer and factory, from “Guangdong Felicity New Energy Co., Ltd” to “Guangzhou Felicity Solar Technology Co., Ltd.” 2. Update the applicant address, manufacturer address, factory address from” (KongGangBaiYun)No. 2, Donghua Huaye Road, Renhe Town, Baiyun Area, Guangzhou, Guangdong, P.R. CHINA” to “(Airport Baiyun)No.2, 4, 6, 8, 10 and 12 Donghua Huaye Road, Renhe Town, Baiyun District, Guangzhou, Guangdong, P. R. China” 3. Update the label, model name from” T-REX-50KHP3G01, T-REX-40KHP3G01, T-REX-30KHP3G01, T-REX-29K9HP3G01, T-REX-25KHP3G01” to “IVGM50KHP3G2, IVGM40KHP3G2, IVGM30KHP3G2, IVGM29K9HP3G2, IVGM25KHP3G2” 4. Updated some inductor components, filtering common mode inductors. 5. Adjustment of component positions on PCB boards, only the layout has been adjusted. After evaluation, all the test data can originate from the initial assessment report no. 35386027 version V1.0 except for clause 5.2.3, 5.2.4.1 a, 5.2.4.1 b, 5.2.6, 5.5.2.1 and 5.5.7.5 of DIN VDE V 0124-100 (comment Jun 2020)
Restrictions	None

Digitally signed by Owen Gu Date: 2026.01.23 14:55:10 +08'00'

Digitally signed by Harvey Wang Date: 2026.01.26 11:01:43 +08'00'

Owen Gu & Harvey Wang

Reviewer

Digitally signed by Iris Zheng Date: 2026.01.23 12:52:33 +08'00'

Iris Zheng

Evaluator