

EQUIPMENT CERTIFICATE

Certificate No.:
TC-GCC-DNV-SE-0124-08254-1

Issued:
2023-11-02

Valid until:
Unlimited

GCC class
TC_i

Issued for:

PV Inverters HYBRID [5K-20K]TL-3PH/3PH A (PPM Type A)

With specifications and software version as listed in Annex 2

Issued to:

Shenzhen SOFARSOLAR Co., Ltd.

11/F., Gaoxinqi Technology Building, No.67 Area, Xingdong Community, Xin'an Sub-district,
Bao'an District, Shenzhen City, China

According to:

DNV-SE-0124, 2021-10: Certification of Grid Code Compliance

**PTPIREE, 2021-04: Conditions and procedures for using certificates in the process
of connecting power generating modules to power networks**

32016R0631, 2016-04: Requirements for Generators (NC RfG)

**PSE, 2018-12: Requirements of general application resulting from Commission
Regulation (EU) 2016/631 of 14 April 2016**

detailed in Annex 1

Based on the document:

CR-GCC-DNV-SE-0124-08254-A072-1

Network Code Requirements for a PGU of Type A -
Poland, Certification Report, dated 2023-11-02

Further assessment information, including scope and conditions, is found in Annex 1. Description
of the PV inverters and type tests performed is found in Annex 2 and Annex 3 respectively.
Annexes are an explicit and inseparable part of the certificate. The certificate shall only be
distributed with all annexes.

Hamburg, 2023-11-02

For DNV Renewables Certification



Bente Vestergaard
Service Line Leader for Type Certification



By DAKKS according DIN EN IEC/ISO 17065
accredited Certification Body for products. The
accreditation is valid for the fields of certification
listed in the certificate.

Hamburg, 2023-11-02

For DNV Renewables Certification



Rui Cai
Project Manager

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Conditions, assessment criteria and scope of assessment

Provided that the conditions listed in section 1 are considered at project level, the PV inverters as further specified in Annex 2 comply with the requirements within scope of this certification, as specified in section 3.

1 Conditions

- Changes of the system design, hardware or the software of the certified PV inverters are to be approved by DNV.
- Inverter settings must finally be agreed and checked at project level to ensure grid code compliance, based on the requirements of relevant System Operator (SO). For the functionalities within scope of this certification, more information about the settings assessed is found in Control Settings in section 4.2 as well as the corresponding assessment sections 5.1-5.4 of the certification report CR-GCC-DNV-SE-0124-08254-A072-1.
- The capability of remote control has been shown on unit level but must finally be ensured at project level, considering any further requirements of relevant System Operator (SO) and the full communication network. For the functionalities within scope of this certification, this concerns remote cessation of active power and remote blocking and control of LFSM-O, as further described in section 5.3 and 5.4 of the certification report CR-GCC-DNV-SE-0124-08254-A072-1.

2 Assessment criteria and normative references for this certificate:

- /A/ Service Specification DNV-SE-0124: Certification of Grid Code Compliance, DNV, October 2021
- /B/ Conditions and procedures for using certificates in the process of connecting power generating modules to power networks, Warunki i procedury wykorzystania certyfikatów w procesie przyłączenia modułów wytwarzania energii do sieci elektroenergetycznych, version 1.2, PTPIREE, dated 2021-04-28, (in the following: PTPIREE 2021-04)
- /C/ Requirements of general application resulting from Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators (NC RfG) – as approved by the decision of the President of the Energy Regulatory Office DRE.WOSE.7128.550.2.2018.ZJ dated January 2nd 2019, Wymogi ogólnego stosowania wynikające z Rozporządzenia Komisji (UE) 2016/631 z dnia 14 kwietnia 2016 r. ustanawiającego kodeks sieci dotyczący wymogów w zakresie przyłączenia jednostek wytwórczych do sieci (NC RfG), PSE S.A., dated 2018-12-18 zatwierdzone Decyzją Prezesa Urzędu Regulacji Energetyki DRE.WOSE.7128.550.2.2018.ZJ z dnia 2 stycznia 2019 r, (in the following: PSE 2018-12)
- /D/ Commission Regulation (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators, published in the Official Journal of the European Union L112/1, The European Commission, 27/04/2016. Document 32016R0631, (in the following: NC RfG)

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3 Scope of assessment and results

The following functionalities have been assessed based on the rules for the use of equipment certificates for Power Park Modules (PPMs), as specified in chapter 7 and 9 of the PTPIREE 2021-04 /B/. The functions denoted “Not Applicable” in the table of chapter 7 has not been included.

Capability	NC RfG /D/	PSE 2018-12 /C/	Type A	Assessment result (*)
Frequency range	13.1(a)	13.1(a)(i)	x	Compliant
Rate of Change of Frequency (RoCoF) withstand capability, df/dt	13.1(b)	13.1(b)	x	Compliant
Remote cessation of active power	13.6	13.6	x	Compliant
Limited Frequency Sensitive Mode – Over Frequency (LFSM-O)	13.2	13.2(a), (b), (f)	x	Compliant

(*) Please note also the corresponding conditions for compliance, as stated in section 1

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Schematic description and technical data of the generating units

1 Schematic description of the generating unit

The SOFARSOLAR solar inverter family Hybrid [5K-20K]TL-3PH, consisting of: HYD 5KTL-3PH, HYD 6KTL-3PH, HYD 8KTL-3PH, HYD 10KTL-3PH, HYD 10KTL-3PH-A, HYD 15KTL-3PH, HYD 20KTL-3PH convert electrical energy generated by photovoltaic modules (DC) to three-phase alternating current (AC).

They run at 400 V rated output voltage with a rated active power output of 5 kW to 20 kW. All variants share the same hardware and software, except minor rating differences of some components and type of cooling system of the inverter. These will have no influence on the electrical behavior tested and certified, as confirmed by the manufacturer. The different output power variants are achieved through derating via software. There is no further difference in the hardware or software used.

The electrical data of the generating unit is summarized in the following section.

2 Technical data of main components

According to the documents provided by the manufacturer, the following components are used.

2.1 General Specifications

Generating Unit	HYD 5KTL-3PH	HYD 6KTL-3PH	HYD 8KTL-3PH
No. of phases	3	3	3
Rated apparent power	5500 VA	6600 VA	8800 VA
Rated active power	5000 W	6000 W	8000 W
Rated AC-voltage (phase to phase)	400 Vac	400 Vac	400 Vac
Rated frequency	50 Hz	50 Hz	50 Hz
Generating Unit	HYD 10KTL-3PH	HYD 10KTL-3PH-A	HYD 15KTL-3PH
No. of phases	3	3	3
Rated apparent power	11000 VA	10000 VA	16500 VA
Rated active power	10000 W	10000 W	15000 W
Rated AC-voltage (phase to phase)	400 Vac	400 Vac	400 Vac
Rated frequency	50 Hz	50 Hz	50 Hz
Generating Unit	HYD 20KTL-3PH		
No. of phases	3		
Rated apparent power	22000 VA		
Rated active power	20000 W		
Rated AC-voltage (phase to phase)	400 Vac		
Rated frequency	50 Hz		

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2.2 DC Input

Generating Units	HYD 5KTL-3PH HYD 6KTL-3PH HYD 8KTL-3PH	HYD 10KTL-3PH HYD 10KTL-3PH-A HYD 15KTL-3PH HYD 20KTL-3PH
Min. MPPT voltage	180 V	180 V
Max. MPPT voltage	960 V	960 V
Max. DC input voltage	1000 V	1000 V
Max. DC input current	16 A / 16 A	32 A / 32 A

2.3 Software Version

Software version	V000001
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2.4 Unit transformer

The transformer is not part of the generating unit and consequently has not been part of the assessment.

2.5 Grid Protection

The protection is not part of certification scope

2.6 Control settings

The control interface allows for the selection of different parameter sets via the “Safety Parameters” field, which provide default settings based on specific grid codes and national requirements. This can be set either directly on the inverter, using USB plug-in and inverter display, or remotely via RS485. For this certification the parameter set called “012 000” (for Poland) at the display interface, was assessed for the functionalities within scope of this certification.

It should be noted that compliance can be achieved also with other parameter sets and control settings, but that changes to control settings will affect the inverter control behavior which can thus affect compliance. It should be noted the final settings must be agreed on project level in agreement with relevant system operator.

Protection settings has not been part of the assessment. Since these could intervene with and affect the compliance of the assessed functionalities, this must be further assessed at project level.

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Type tests

1 Type tests

Tests were performed between 2021-11-01 and 2021-11-10 in the SOFARSOLAR lab in Shenzhen in P.R. China. All tests were performed under ISO-17025 accreditation and they were performed on the HYD 15KTL-3PH unit.

The results used for assessment are documented in the measurement report(s) as specified below:

Scope	Reference
Frequency range	3.1 of /1/
Rate of Change of Frequency (RoCoF) withstand capability, df/dt	3.2 of /1/
Remote cessation of active power	3.3 of /1/
Limited Frequency Sensitive Mode – over frequency (LFSM-O)	3.4 of /1/

Test report(s)	Document number	Content
/1/	10305241-SHA-TR-07-A	Measurement of power control characteristics of a PV inverter of the type HYD 15KTL-3PH according to FGW TG3 Rev. 25 and Polish Grid Code

The tests results have been assessed against the requirements of PSE 2018-12 /C/ and NC RfG /D/. Further details are described in the corresponding certification report CR-GCC-DNV-SE-0124-08254-A072-1.