EQUIPMENT CERTIFICATE

Certificate No.:	Issued:	Valid until:	GCC class
TC-GCC-DNVGL-SE-0124-07916-2	2022-06-08	Unlimited	TC_I

Issued for:

PV Inverters GW[5-10]K(N)-ET/BT (PPM Type A)

With specifications and software version as listed in Annex 2

Issued to:

Goodwe Technologies Co., Ltd.

No.90 Zijin Road, New District, Suzhou, 215011, China

According to:

DNVGL-SE-0124, 2016-03: 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-DNVGL-SE-0124-07916-A072-2 Network Code Requirements for a PGU of Type A - Poland, Certification Report, dated 2022-06-08

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.

Hamburg, 2022-06-08

For DNV Renewables Certification

Bente Vestergaard
Director and Service Line Leader Type and Component Certification

DAkkS Deutsche Akkreditierungsstelle D-ZE-11053-01-00

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, 2022-06-08

For DNV Renewables Certification

Aleksandra Voss
Project Manager

EQUIPMENT CERTIFICATE – ANNEX 1

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 withing 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-DNVGL-SE-0124-07916-A072-2.
- 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-DNVGL-SE-0124-07916-A072-2.

2 Assessment criteria and normative references for this certificate:

/A/ Service Specification DNVGL-SE-0124: Certification of Grid Code Compliance, DNV GL, March 2016

/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 Comission, 27/04/2016. Document 32016R0631, (in the following: NC RfG)

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

EQUIPMENT CERTIFICATE – ANNEX 2

Schematic description and technical data of the generating units

1 Schematic description of the generating unit

The GOODWE inverter family consists of hybrid and battery inverter GW[5-10]K(N)-ET/BT, consisting of: GW5K-ET, GW6.5K-ET, GW8K-ET, GW10K-ET, GW5K-BT, GW6K-BT, GW8K-BT, GW10K-BT, GW5KN-ET, GW6.5KN-ET, GW8KN-ET, GW10KN-ET variants 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 10 kW. The “-ET” variants can be connected with both PV and battery input, while the” -BT” variants only have battery connection. The “N” units are units with the higher input current. It should be noted that the “charging mode” of the inverter has not been considered during assessment, since this is not covered by Polish regulations /C/ or NC RfG /D/.

All variants share the same hardware and software, except minor rating differences of some components on the input side of the inverter, but these will have no influence on the electrical behavior tested and certified, as explained by the manufacturer. The different power ratings are realized via minor hardware modifications on the control boards, also adapting the power rating in the software control.

The inverter software was updated with an additional grid country in DSP. It was concluded that software update does not affect responses of tested functionality.

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	**GW5K-ET**	**GW6.5K-ET**	**GW8K-ET**	**GW10K-ET**
No. of phases	3	3	3	3
Rated apparent power	5000 VA	6500 VA	8000 VA	10000 VA
Rated active power	5000 W	6500 W	8000 W	10000 W
Rated AC-voltage	400 Vac	400 Vac	400 Vac	400 Vac
Rated frequency	50 Hz	50 Hz	50 Hz	50 Hz
Generating Unit	**GW5K-BT**	**GW6K-BT**	**GW8K-BT**	**GW10K-BT**
No. of phases	3	3	3	3
Rated apparent power	5000 VA	6000 VA	8000 VA	10000 VA
Rated active power	5000 W	6000 W	8000 W	10000 W
Rated AC-voltage	400 Vac	400 Vac	400 Vac	400 Vac
Rated frequency	50 Hz	50 Hz	50 Hz	50 Hz
Generating Unit	**GW5KN-ET**	**GW6.5KN-ET**	**GW8KN-ET**	**GW10KN-ET**
No. of phases	3	3	3	3
Rated apparent power	5000 VA	6500 VA	8000 VA	10000 VA
Rated active power	5000 W	6500 W	8000 W	10000 W
Rated AC-voltage	400 Vac	400 Vac	400 Vac	400 Vac
Rated frequency	50 Hz	50 Hz	50 Hz	50 Hz

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2.2 DC Input

Generating Unit	GW[5-10]K-ET	GW[5-10]K -BT	GW[5-10]KN -ET
Min. MPPT voltage	200 V	NA	200 V
Max. MPPT voltage	850 V	NA	850 V
Min. battery voltage	180 V	180 V	180 V
Max. battery voltage	600 V	600 V	600 V
Max. DC input voltage	1000 V	600 V	1000 V
Max. DC input current	12.5 / 12.5 A	25 A	16 / 16 A

2.3 Software Version

Generating Unit	GW[5-10]K-ET, GW[5-10]K -BT, GW[5-10]KN -ET
Firmware version	290-10268
Software version	090922

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 interface supplied by mobile application “PV master” allows to select different safety settings via the “Safety Code” at the “Basic Settings” tap of “PV master” application, which provide default parameter sets based on specific grid codes and requirements for countries or regions. For this certification report the parameter set called “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 behaviour 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.

EQUIPMENT CERTIFICATE – ANNEX 3

Type tests

1 Type tests

Tests were performed between 2021-10-26 and 2021-11-12 in the Goodwe lab in Suzhou in P.R. China. All tests were performed under ISO-17025 accreditation and they were performed on the GW10K-ET 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/	*10304652-SHA-TR-03-A*	Measurement of power control characteristics of a PV inverter of the type GW10K-ET 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-DNVGL-SE-0124-07916-A072-2.