

EQUIPMENT CERTIFICATE

Certificate No.:	Issued:	Valid until:	GCC class
TC-GCC-DNVGL-SE-0124-07790-0	2021-11-09	Unlimited	TC _i

Issued for:

PV Inverters GW100K-HT, GW110K-HT, GW120K-HT, GW136K-HTH (PPM Type A, B, C, D)

With specifications and software version as listed in Annex 2

Issued to:

GoodWe Technologies Co., Ltd.

No.90 Zijin Rd., 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-0124-07790-A072-0 Network Code Requirements for a PGM of Type A, B, C, D - Poland, Certification Report, dated 2021-11-09

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, 2021-11-09
For DNV Renewables Certification

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Dr. Bente Vestergaard
Director and Service Line Leader Type
and Component Certification

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

Dr. Liselotte Ulvgård
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 5.1-5.9 of the certification report CR-GCC-DNVGL-SE-0124-07790 -A072-0.
- 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 especially concerns:
 - Remote cessation of active power
 - Remote set-point control of active power
 - Remote blocking and control of LFSM-O
 - Remote blocking of LFSM-OAs further described in section 5.3-5.6 of the certification report CR-GCC-DNVGL-SE-0124-07790 -A072-0.
- For fast fault reactive current control, it should be noted that the value of the k-factor cannot be set in the user interface. In order to change the k-factor, the inverter control settings must instead be accessed via RS485/MODBUS control, which will require supplementary equipment and software. The procedures and responsibilities to change these settings must be further agreed between plant owner, system operator and GoodWe at project level.

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 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	Type B	Type C	Type D	Assessment result (**)
Frequency range	13.1(a)	13.1 (a)(i)	x	x	x	x	Compliant
Rate of Change of Frequency (RoCoF) withstand capability, df/dt	13.1 (b)	13.1 (b)	x	x	x	x	Compliant
Remote cessation of active power	13.6	13.6	x	x			Compliant
Remote control of active power	14.2	14.2 (b)		x			Compliant
Limited Frequency Sensitive Mode – over frequency (LFSM-O)	13.2 (*)	13.2 (a), (b), (f)	x	x	x	x	Compliant
Limited Frequency Sensitive Mode – under frequency (LFSM-U)	15.2 (c)	15.2 (c)(i)			x	x	Compliant
Capability to withstand voltage dips for connection below 110 kV	14.3	14.3 (a)(i), (b)		x	x	x	Compliant
Capability to withstand voltage dips for connection above 110 kV	16.3	16.3 (a)(i), (c)				x	Compliant
Fast fault current injection, symmetric and asymmetric faults	20.2 (b), (c), 21.3 (e)	20.2 (b), (c), 21.3 (e)		x	x	x	Compliant
Active power recovery after fault clearance	20.3	20.3 (a)		x	x	x	Compliant

(*) Article 13.2(b) only applicable for type A PPMs according to NC RfG.

(**) 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 GoodWe solar inverter family GW100K-HT to GW136K-HTH, consisting of: GW100K-HT, GW110K-HT, GW120K-HT, GW136K-HTH convert electrical energy generated by photovoltaic modules (DC) to three-phase alternating current (AC). They run at 400/500 V rated output voltage with a rated active power output of 100-136 kW.

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	GW100K-HT	GW110K-HT	GW120K-HT	GW136K-HTH
No. of phases	3	3	3	3
Rated apparent power	100 kVA	110 kVA	120 kVA	136 kVA
Max apparent power	110 kVA	121 kVA	132 kVA	150 kVA
Rated active power	100 kW	110 kW	120 kW	136 kW
Rated AC-voltage (phase to phase)	400V,3L/N/PE	400V,3L/N/PE	400V,3L/N/PE	500V,3L/PE
Rated frequency	50Hz	50Hz	50Hz	50Hz

2.2 DC Input

Generating unit	GW100K-HT	GW110K-HT, GW120K-HT, GW136K-HTH
Min. MPPT voltage	180V	180V
Max. MPPT voltage	1000V	1000V
Max. DC input voltage	1100V	1100V
Max. DC input current	10*30A	12*30A

2.3 Software Version

Firmware version	290-10170
Software version	V1.05.05

2.4 Unit transformer

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

2.6 Grid Protection

The protection is not part of certification scope

2.7 Control settings

The control interface allows for the selection of different parameter sets via the "Safety Option" field, which provide default settings based on specific grid codes and national requirements. For this certification report the parameter set called "Poland" in the interface, was assessed for the functionalities within scope of this certification. The settings are by default set to and match type D requirements, which will make them compliant also to the requirements of type A, B and C. 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.

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. Final settings must be agreed on project level in agreement with relevant system operator.

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Type tests

1 Type tests

Tests were performed between 2021-04-19 and 2021-09-10 in the GoodWe lab, Suzhou (P.R. China), based on a customized test plan, resulting in test report /1/ and /2/. In addition, test report /3/ performed according to VDE-AR-N 4105/11.18 was taken into consideration for remote cessation and control of active power. All tests were performed under ISO-17025 accreditation and they were performed on the GW136K-HTH unit, with some complementary tests on the GW120K-HT.

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

Test	Test report
Frequency range	Section 5.1 of /1/
Rate of Change of Frequency (RoCoF) withstand capability, df/dt	Section 5.2 of /1/
Remote cessation of active power	Section 5.3 of /1/, Section 5.4.3(d) of /3/
Remote control of active power	Section 5.4 of /1/, Section 5.4. of /3/
Limited Frequency Sensitive Mode – over frequency (LFSM-O)	Section 5.5 of /1/, Section 5.1. of /2/
Limited Frequency Sensitive Mode – under frequency (LFSM-U)	Section 5.6 of /1/
Fault Ride Through (FRT)	Section 4 of /1/, Section 4. of /2/
Fast fault current injection, symmetric and asymmetric faults	Section 4 of /1/, Section 4. of /2/
Active power recovery after fault clearance	Section 4 of /1//

Test report(s)	Document number	Content
/1/	10289930-A-3-A	Test report: Power Quality tests on a PV inverter of the type Goodwe GW136K-HTH according to FGW TG3 Rev. 25 and Polish requirement
/2/	10289930-SHA-TR-04-A	Test report: Power Quality tests on a PV inverter of the type Goodwe GW136K-HTH according to FGW TG3 Rev. 25 and Polish requirement.
/3/	CN215U1Y 001	Test report for certification according to VDE-AR-N 4105/11.18

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-0124-07790-A072-0.