

# EQUIPMENT CERTIFICATE

Certificate No.:	Issued:	Valid until:	GCC class
TC-GCC-DNVGL-SE-0124-08503-1	2023-03-06	Unlimited	TC <sub>i</sub>

Issued for:

## PV Inverters BNT[003-025]KTL (PPM Type A)

With specifications and software version as listed in Annex 2

Issued to:

## Afore New Energy Technology (Shanghai) Co., Ltd.

Building 7, No.333 Wanfang Rd, Minhang District, Shanghai, China. 201112

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-0124-08503-A072-1 Network Code Requirements for a PGU of Type A - Poland, Certification Report, dated 2023-03-06

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, 2023-03-06  
For DNV Renewables Certification

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**Bente Vestergaard**  
Director and Service Line Leader Type  
and Component 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.

**Sofien Ben Saad**  
Project Manager

# EQUIPMENT CERTIFICATE – ANNEX 1

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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-DNVGL-SE-0124-08503-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-DNVGL-SE-0124-08503-A072-1.

### 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)

### 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 AFORE solar inverter family BNT[003-025]KTL, consisting of: BNT003KTL, BNT004KTL, BNT005KTL, BNT006KTL, BNT008KTL, BNT010KTL, BNT012KTL, BNT013KTL, BNT015KTL, BNT017KTL, BNT020KTL, BNT025KTL. 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 3 kW to 25 kW. The different output power variants are achieved through derating via software. Models BNT003KTL, BNT004KTL, BNT005KTL, BNT006KTL, BNT008KTL, BNT010KTL, BNT012KTL and BNT013KTL have 2 PV input strings, BNT015KTL have 3 PV input strings, BNT017KTL, BNT020KTL and BNT025KTL have 4 PV input strings. There are no further differences in the hardware or firmware used, as stated by the manufacturer.

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	BNT003KTL	BNT004KTL	BNT005KTL	BNT006KTL
No. of phases	3	3	3	3
Rated apparent power	3000VA	4000VA	5000VA	6000VA
Rated active power	3000W	4000W	5000W	6000W
Rated AC-voltage (phase to phase)	400 Vac	400 Vac	400 Vac	400 Vac
Rated frequency	50 Hz	50 Hz	50 Hz	50 Hz
Generating Unit	BNT008KTL	BNT010KTL	BNT012KTL	BNT013KTL
No. of phases	3	3	3	3
Rated apparent power	8000VA	10000VA	12000VA	13000VA
Rated active power	8000W	10000W	12000W	13000W
Rated AC-voltage (phase to phase)	400 Vac	400 Vac	400 Vac	400 Vac
Rated frequency	50 Hz	50 Hz	50 Hz	50 Hz
Generating Unit	BNT015KTL	BNT017KTL	BNT020KTL	BNT025KTL
No. of phases	3	3	3	3
Rated apparent power	15000VA	17000VA	20000VA	25000VA
Rated active power	15000W	17000W	20000W	25000W
Rated AC-voltage (phase to phase)	400 Vac	400 Vac	400 Vac	400 Vac
Rated frequency	50 Hz	50 Hz	50 Hz	50 Hz

#### 2.2 DC Input

	BNT003KTL - BNT013KTL	BNT015KTL	BNT017KTL - BNT025KTL
Min. MPPT voltage	150V	150V	150V
Max. MPPT voltage	1000V	1000V	1000V
Max. DC input voltage	1100V	1100V	1100V
Max. DC input current	15A/15A	20A/32A	32A/32A

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## 2.3 Software Version

Firmware version	1.05
Software version	1.14

## 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” field, which provide default settings based on specific grid codes and national requirements. For this certification report the parameter set called “Poland” in 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 2021-12-27 and 2021-12-28 in the Afore lab, Shanghai in P.R. China. All tests were performed under ISO-17025 accreditation and they were performed on the BNT003KTL and BNT025KTL units.

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/	0304979-SHA-TR-01-A	Measurement of power control characteristics of a PV inverter of the type BNT025KTL 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-0124-08503-A072-1.