TYPE CERTIFICATE

Certificate No.:	Issued:	Valid until:
TC-GCC-TR8-09334-0	2023-09-29	2028-09-28

Issued for:

SUN2000-12KTL-M5, SUN2000-15KTL-M5, SUN2000-17KTL-M5, SUN2000-20KTL-M5, SUN2000-25KTL-M5, SUN2000-12K-MB0, SUN2000-15K-MB0, SUN2000-17K-MB0, SUN2000-20K-MB0, SUN2000-25K-MB0

With specifications and software version as listed in Annex 2

Issued to:

Huawei Technologies Co., Ltd.

Bantian, Longgang District, Shenzhen 518129, P.R. China

According to:

VDE-AR-N 4110:2023-09, Technical requirements for the connection and operation of customer installations to the medium and high voltage network

FGW TG8:2019-02 Technical Guidelines for Power Generating Units, Systems and Storage Systems as well as for their Components, Part 8

detailed in Annex 1

Based on the documents:

CR-GCC-TR8-09334-A065-0	Certification report: Model validation GCC, dated 2023-09-26
CR-GCC-TR8-09334-A066-0	Certification report: Fault ride-through, dated 2023-09-22
CR-GCC-TR8-09334-A067-0	Certification report: Control behaviour and other grid code requirements, dated 2023-09-29

The generating units of the inverter family SUN2000-[12-25]KTL-M5 and SUN2000-[12-25]K-MB0 as specified in Annex 2 comply with the requirements of VDE-AR-N 4110:2023-09 and the complementary documents stated in Annex 1 provided the conditions of Annex 1 are considered at project level. The simulation model and the measurement reports of the type tests are cited in Annex 3.

Hamburg, 2023-09-29

For DNV Renewables Certification

Dr. Bente Vestergaard
Service Line Leader Type Certification

DAkkS Deutsche Akkreditierungsstelle D-ZE-22290-01-00

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, 2023-09-29

For DNV Renewables Certification

i.A. S. Ben Saad

Sofien Ben Saad
Project Manager

Conditions and assessment criteria

1 Conditions

- Changes to the system design, software or the manufacturer's quality system are to be approved by DNV.
- In case PT1-behaviour for reactive power set point changes is requested on project level, this needs to be implemented by a plant controller providing the corresponding set-points to the generating unit.
- The PGU has one interface to handle active power set points. Consequently, prioritization of control input signals from different actors (such as grid operators and direct sellers) is not possible. To have this feature implemented a plant controller is needed in order to comply with A.1.2.5.1.1 No. 3 in FGW TG8 /C/ on project level.
- The display to check the protection settings is missing, as well as the test terminals used to enable protection tests without disconnecting any wires. This is not in agreement with the requirements of the VDE-AR-N 4110 /A/. Therefore, the following shall be taken into account:
    - With regard to the missing display, the operator of the PV-plant is responsible to provide a proper solution for checking the settings of the generating unit. If requested by the grid operator, it might therefore be necessary to provide such device (e.g. tablet or smartphone) with a corresponding application, which is either to be stored on site or need to be provided on demand.
    - With regard to the missing test terminals, the consequences need to be investigated on project level. Depending on the requirements of the corresponding grid operator, an additional "intermediate" protective disconnection device on the low-voltage side of the transformer might be necessary.
- The parameters of the generation unit are summarized in the parameter list provided by the manufacturer. The specified "default values" do not automatically meet the requirements according to the guidelines mentioned in Annex 1 section 2. If necessary, the settings must be adjusted and checked on a project level.
- In general, it needs to be investigated on project level whether a permanent reduction of the rated active power is necessary to meet the reactive power requirement at the grid connection point.
- If a reactive power provision by the functionality "Q(U) control" or by "Q with voltage limiting function" is required on project level the use of a plant control having these functions implemented is mandatory.
- The inverter don't prioritize any external active power setpoint over the active power calculated based on the P(f) characteristic. If this is not desired on project level in the way it is implemented, the use of a plant control having these functions implemented is mandatory.
- For assessments related to project certification, the simulation model shall only be used in the certified version. For clear identification, a checksum (MD5) was assigned to the model (see Annex 3, Section 2).

TYPE CERTIFICATE – ANNEX 1

2 Assessment criteria and normative references for this certificate:

/A/ VDE-AR-N 4110:2023-09, Technische Regeln für den Anschluss von Kundenanlagen an das Mittelspannungsnetz und deren Betrieb (TAR Mittelspannung), VDE Verband der Elektrotechnik Elektronik Informationstechnik e.V., vom September 2023

(VDE-AR-N 4110 Technical requirements for the connection and operation of customer installations to the medium-voltage network (TAR medium voltage), in the following: VDE-AR-N 4110)

/B/ Technische Richtlinie für Erzeugungseinheiten und -anlagen, Teil 3: Bestimmung der elektrischen Eigenschaften von Erzeugungseinheiten und -anlagen am Mittel-, Hoch- und Höchstspannungsnetz, Fördergesellschaft Windenergie und andere Erneuerbare Energien (FGW), Revision 25, vom 01.03.2016
(FGW Technical Guidelines, Part 3, rev. 25: Determination of the electrical behaviour of generating units, in the following: FGW TG3 rev. 24)

/C/ Technische Richtlinie für Erzeugungseinheiten und -anlagen, Teil 3: Bestimmung der elektrischen Eigenschaften von Erzeugungseinheiten und -anlagen, Speicher sowie für deren Komponenten am Mittel-, Hoch- und Höchstspannungsnetz, Fördergesellschaft Windenergie und andere Dezentrale Energien (FGW), Revision 25, vom 01.09.2018
(FGW Technical Guidelines, Part 8: Certification of the electrical behaviour of generating units, Systems and Storage as well as their Components on the grid, in the following: FGW TG8)

/D/ FGW TG4: Technische Richtlinie für Erzeugungseinheiten und -anlagen, Teil 4: Anforderungen an Modellierung und Validierung von Simulationsmodellen der elektrischen Eigenschaften von Erzeugungseinheiten und -anlagen, Speicher sowie deren Komponenten, Fördergesellschaft Windenergie und andere Erneuerbare Energien (FGW), Revision 9, vom 01.02.2019
(FGW Technical Guidelines, Part 4: Demands on modelling and validation of simulation models of generating units and systems as well as their components)

Schematic description and technical data of the generating units

1 Schematic description of the generating unit

The Huawei solar inverter family SUN2000-[12-25]KTL-M5 and SUN2000-[12-25]K-MB0, consisting of: SUN2000-12KTL-M5, SUN2000-15KTL-M5, SUN2000-17KTL-M5, SUN2000-20KTL-M5, SUN2000-25KTL-M5, SUN2000-12K-MB0, SUN2000-15K-MB0, SUN2000-17K-MB0, SUN2000-20K-MB0, SUN2000-25K-MB0 convert electrical energy generated by photovoltaic modules (DC) to three-phase alternating current (AC).

The inverter type SUN2000-25KTL-M5 running at 400 V was tested for the default rated active power of 25 kW, but the maximum active power limit can be increased up to the apparent power limit of 27.5 kVA when the ambient temperature is below 35 degrees Celsius.

Compared to SUN2000-[12-25]KTL-M5, SUN2000-[12-25]K-MB0 have one more pair of additional DC input terminals which allows them to connect to more primary side energy. The different power variants are realized via adapting the current in the software control. There is no further difference in the hardware or software used, as confirmed by the manufacturer's information.

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

2 Technical data of main components

2.1 General Specifications

Generating Unit	SUN2000-12KTL-M5	SUN2000-15KTL-M5	SUN2000-17KTL-M5
No. of phases	3	3	3
Max. apparent power	13.2 kVA	16.5 kVA	18.7 kVA
Rated active power	12 kW	15 kW	17 kW
Rated AC-voltage (phase to phase)	400 V	400 V	400 V
Rated frequency	50 Hz	50 Hz	50 Hz
Contribution to short circuit current	47.7 A	47.7 A	47.7 A

Generating Unit	SUN2000-20KTL-M5	SUN2000-25KTL-M5
No. of phases	3	3
Max. AC power	22 kVA	27.5 kVA
Rated active power	20 kW	25 kW
Rated AC-voltage (phase to phase)	400 V	400 V
Rated frequency	50 Hz	50 Hz
Contribution to short circuit current	47.7 A	47.7 A

Generating Unit	SUN2000-12K-MB0	SUN2000-15K-MB0	SUN2000-17K-MB0
No. of phases	3	3	3
Max. apparent power	13.2 kVA	16.5 kVA	18.7 kVA
Rated active power	12 kW	15 kW	17 kW
Rated AC-voltage (phase to phase)	400 V	400 V	400 V
Rated frequency	50 Hz	50 Hz	50 Hz
Contribution to short circuit current	47.7 A	47.7 A	47.7 A
Generating Unit	**SUN2000-20K-MB0**	**SUN2000-25K-MB0**	
No. of phases	3	3	
Max. AC power	22 kVA	27.5 kVA	
Rated active power	20 kW	25 kW	
Rated AC-voltage (phase to phase)	400 V	400 V	
Rated frequency	50 Hz	50 Hz	
Contribution to short circuit current	47.7 A	47.7 A	

2.2 DC input

Generating Unit	SUN2000-12KTL-M5, SUN2000-15KTL-M5, SUN2000-17KTL-M5, SUN2000-20KTL-M5, SUN2000-25KTL-M5, SUN2000-12K-MB0, SUN2000-15K-MB0, SUN2000-17K-MB0, SUN2000-20K-MB0, SUN2000-25K-MB0
Min. MPPT voltage	200 V
Max. MPPT voltage	1000 V
Max. DC input voltage	1100 V
Max. DC input current	30 A × 2

2.3 Inverter-Power section

Generating Unit	SUN2000-12KTL-M5, SUN2000-15KTL-M5, SUN2000-17KTL-M5, SUN2000-20KTL-M5, SUN2000-25KTL-M5, SUN2000-12K-MB0, SUN2000-15K-MB0, SUN2000-17K-MB0, SUN2000-20K-MB0, SUN2000-25K-MB0
Generic type	Transformerless
Pulse rate of inverter	20.5 kHz
Software version	SUN2000MB V200R022C10

2.4 Software version

Firmware version	V200R022C10
Software version	V200R022C10SPC100

2.5 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 grid protection is integrated into the control of the generating unit.

2.7 Disconnection device

Manufacturer	HongFa
Type name	HF161F

TYPE CERTIFICATE – ANNEX 3

Type tests and validated Simulation Model

1 Type tests

The measurements were performed on a SUN2000-12KTL-M5, SUN2000-15KTL-M5, SUN2000-17KTL-M5, SUN2000-20KTL-M5 and SUN2000-25KTL-M5 inverter of Huawei Technologies Co., Ltd. at customer facilities in Shanghai. The components and the software versions are described in Annex 2 of this certificate.

The measurement results are documented in the following measurement reports. Specific results can be found in the corresponding extracts as well as the certification reports CR-GCC-TR8-09334-A066-0 and CR-GCC-TR8-09334-A067-0 also providing details on the assessment.

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

No. test reports	Extract No.	Content
10332709-SHA-TR-10-B		Fault ride-through tests
10332709-SHA-TR-14-A	10332709-SHA-TS-08-A	power quality and power control characteristics
10332709-SHA-TR-15-A	10332709-SHA-TS-09-A	power quality

All tests according to FGW TG3 /B/ were assessed according to FGW TG8 /C/ and in compliance with VDE-AR-N 4110 /A/.

2 Validated Simulation Model

The validated simulation model of the generating unit is contained in the following table. In order to identify the simulation model clearly the corresponding file names and check sums are specified below.

File name	MD5-Checksum
HW-SUN2000-25KTL-M5-VDE4110-ENCV1_0.rar	A97F733A4FB582EC379FBEF75FA174DB

The simulation model has been validated against FGW TG4 /E/. Further details are written in the corresponding certification report CR-GCC-TR8-09334-A065-0.