## TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch D-PL-19065-01-00 according to ISO/IEC 17025:2017



#### Tests in the fields: Photovoltaic Inverters and Wind Converters, ESS-Converters

The testing laboratory is permitted, without being required to inform and obtain prior approval from DAkkS, to use standards or equivalent testing methods listed in the annex to the Accreditation Certificate D-PL-19065-01-00 according to ISO/IEC 17025:2017 with different issue dates.

The current status of any given scope of accreditation may be found respectively in the database of accredited bodies of Deutsche Akkreditierungsstelle GmbH <u>https://www.dakks.de/en/content/accredited-bodies-dakks</u>

Existing scope	Flexible scope (Category III)	Description	Update date of flexible scope
Australia:			
AS/NZS 4777.2:2020+ Amd 1:2021	AS 4777.2:2015 AS 4777.2: 2020 AS/NZS	Grid connection of energy systems via inverters, Part 2: Inverter requirements	2023-08-03 2024-11-19
	4777.2:2020+Amd 2:2024		
AS 4777.3:2005		Grid connection of energy systems via inverters, Part 3: Grid protection requirements	
Austria:			
OVE E 8001-4- 712/A2:2016		Erection of electrical installations with rated voltages up to AC 1000 V and DC 1500 V - Part 4-712: Photovoltaic power-systems - Erection and safety requirements systems	
TOR D4: 2016		Technical and organizational rules for operators and users of networks Part D: Special technical rules	
OVE-Richtlinie R 25:2020		Test requirements for generator units to be connected to and operated in parallel with low- voltage distribution networks	
TOR Erzeuger type A V1.2	TOR Erzeuger type A V1.3	Connection and parallel operation of type A power generation systems and microgeneration systems. (maximum capacity < 250kW and nominal voltage <110 kV)	2024-11-19
TOR Erzeuger type B V1.2	TOR Erzeuger type B V1.3	Connection and parallel operation of type B power generation systems (maximum capacity > 250 kW and < 35MW and nominal voltage <110 kV)	2024-11-19
TOR Erzeuger type C V1.2	TOR Erzeuger type C V1.3	Connection and parallel operation of type C power generation systems (maximum capacity > 35 MW and <50 MW and nominal voltage <110 kV)	2024-11-19

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TOR Erzeuger	TOR Erzeuger type	Connection and parallel operation of type D	2024-11-19
type D V1.2	D V1.3	power generation systems (maximum capacity > MW 50 or rated voltage > kV110)	
RKS-AT Type B:	RKS-AT Type B:	Guideline for the conformity of generation 2024-1	
2022	2024	system in Austria (maximum capacity > 250 kW and < 35MW and nominal voltage <110 kV)	
RKS-AT Type	RKS-AT Type C:	Guideline for the conformity of generation	2024-11-19
C: 2022	2024	system in Austria (maximum capacity > 35 MW	
	RKS-AT Type D:	and <50 MW and nominal voltage <110 kV) Guideline for the conformity of generation	2024-11-19
RKS-AT Type D: 2022	2024	system in Austria (maximum capacity > MW 50	2024-11-19
D. 2022	2024	or rated voltage > kV110)	
Belgium:			
C10/11:2021	C10/11:2012	SPECIFIC TECHNICAL PRESCRIPTIONS	
	C10/11:2019	REGARDING POWER-GENERATING PLANTS	
		OPERATING IN PARALLEL TO THE	
Deserile		DISTRIBUTION NETWORK	
Brazil:	Γ		T
ABNT NBR		Photovoltaic (PV) systems – Characteristics of	
16149: 2013		the utility interface	
ABNT NBR 16150: 2013		Photovoltaic (PV) systems – Characteristics of	
INMETRO		the utility interface – Conformity test procedure Photovoltaic Power Generation Equipment	
ORDINANCE		INMETRO ORDINANCE nº16/2021	
n°16/2021			
INMETRO	INMETRO	Photovoltaic Power Generation Equipment	2024-11-19
ORDINANCE	ORDINANCE	INMETRO ORDINANCE nº140/2022	
n°140/2022	n°515/2023		
Chile:			-
NTCO-	NTCO-PMGD:2024	Technical standard for the connection and	2024-11-19
PMGD:2019		operation of PMGD in medium voltage medium	
NTOVOO		voltage installations (Chile)	
NTSyCS 2020-09		Safety and quality of service technical standard (Chile)	
Cyprus:			1
Technical Guide		Technical provisions, requirements and	
SM10:2020		conditions for the interconnection and parallel	
		operation of a photovoltaic system with the low	
		voltage distribution network (Cyprus)	

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SAAH: 2023		Technical provisions, requirements and conditions for interconnection and parallel operation of a system for the production of electricity from renewable energy sources the distribution network of the distribution system operator (Cyprus)	
Czech Republic:	1		
PPDS:2022		Rules for parallel operation of products and accumulation equipment networking by distribution system operators	
Denmark:			
Technical Regulation 3.2.1:2016	Technical Regulation 3.2.1:2017	Technical regulation 3.2.1 for power plants up to and including 11 kW	2024-11-19
Technical Regulation 3.3.1:2023	Technical Regulation 3.3.1:2024	Technical regulation for battery plants	2024-11-19
DANSK ENERGI LV:2019	DANSK ENERGI LV:2022	Technical requirements for connection of power- generating plants to the low-voltage grid (≤1kV) Type A and B (Denmark)	2024-11-19
DANSK ENERGI MV HV:2019	DANSK ENERGI LV:2022	Technical requirements for connection of power- generating plants to the medium and high- voltage grid (>1kV) Type B, C and D (Denmark)	2024-11-19
Dubai:			
DEWA DRRG: 2016	DEWA DRRG: 2023	Standards for distributed renewable resources generators connected to the distribution network.	2024-11-19
Egypt:			
ssPV:2014		Technical Requirements for Connecting Small Scale PV (ssPV) Systems to Low Voltage Distribution Networks (Egypt)	
Solar Energy Plants Grid Connection Code:2017		Solar Energy Plants Grid Connection Code In addition to the Egyptian Transmission Grid Code and The Egyptian Distribution Network (Egypt)	
Europe:			
EN 50438: 2013		Requirements for the connection of micro- generators in parallel with public low-voltage distribution networks	
COMMISSION REGULATION (EU) 2016/631		COMMISSION REGULATION (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators	

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EN 50549-	EN 50549-	Requirements for generating plants to be	2022-09-01
1:2019	1:2019/AC:2019	connected in parallel with distribution networks -	
	EN 50549-	Part 1: Connection to a LV distribution network	2024-11-19
	1:2019+A1:2023	above 16 A	
EN 50549-	EN 50549-	Requirements for generating plants to be	2022-09-01
2:2019	2:2019/AC:2019	connected in parallel with distribution networks -	
	EN 50549-	Part 2: Connection to a MV distribution network	2024-11-19
	2:2019+A1:2023		
EN 50549-		Requirements for generating plants to be	
10:2022		connected in parallel with distribution networks.	
		Part 10: Tests for conformity assessment of generating units.	
Finland:			
		Orid Cade Crecifications for Deven Constitution	T
VJV 2018		Grid Code Specifications for Power Generating Facilities (Finland)	
SJV 2019		Grid Code Specifications for Grid Energy	
		Storage Systems (Finland)	
France:			
UTE C 15-712-	UTE C15-712-	LOW-VOLTAGE ELECTRICAL	2023-08-03
1: 2010	1:2013	INSTALLATIONS: Photovoltaic installations	
		connected to the public distribution network	
Arrêté du		French Republic Official JOURNAL of the Laws	
2020-06-09		and decrees	
		(Only for Title 1: Technical design and operating	
		specifications for connection of an electricity	
		generating installation to the public electricity	
Germany:		network)	
		Originate provider of non-context plants	0000 00 04
DIN V VDE V 0124-100:2020	DIN V VDE V 0124- 100:2012	Grid integration of generator plants - Generator units - Test requirements for	2023-03-31
0124-100.2020	100.2012	generation units to be connected and operated	
		parallel with the low-voltage distribution	
		networks	
DIN VDE V		Automatic disconnection device between a	
0126-1-1:2013		generator and the public low-voltage grid	
VDE-AR-N		Generators connected to the low-voltage	
4105: 2018		distribution network - Technical requirements for	
		the connection to and parallel operation with	
		low-voltage distribution networks	
VDE-AR-E	VDE-AR-E 2510-2:	Stationary electrical energy storage systems	2024-11-19
2510-2: 2021	2015	intended for connection to the low voltage grid	
VDE-AR-N	VDE-AR-N	Technical rules for the connection and operation	2023-3-31
4100:2019	4100:2017	of customer installations to the low voltage	
		network (TAR low voltage)	

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VDE-AR-N	VDE-AR-N 4110:	Technical requirements for the connection and	2024-11-19
4110: 2023	2018	operation of customer installations to the	2024-11-13
	VDE-AR-N	medium voltage network (TAR medium voltage)	2023-08-03
	4110/A1:2022		
VDE-AR-N	VDE-AR-N	Technical requirements for the connection and	2024-11-19
4120: 2018	4120/A1:2023	operation of customer installations to the high	
		voltage network (TAR high voltage)	
VDE-AR-N		Technical requirements for the connection and	
4130: 2018		operation of customer installations to the extra	
BDEW:2008+		high voltage network (TCR extra high voltage)	
		Technical Guideline Generating Plants Connected to the Medium-	
Supplement 1/2009		Voltage Network	
7/2010		Guideline for generating plants' connection to	
2/2011		and parallel operation with the medium-voltage	
1/2013		network	
FGW TR3	FGW TR3 Rev.23	Technical Guidelines for Power Generating	2023-08-03
Rev.26	FGW TR3 Rev.24	Units	
	FGW TR3 Rev.25	Part 3 Determination of electrical characteristics	
		of power generating units connected to MV, HV	
		and EHV grids	
FGW TR4	FGW TR4 Rev.6	Technical Guidelines for Power Generating	2023-08-03
Rev.10	FGW TR4 Rev.7	Units	
	FGW TR4 Rev.8	Part 4 Demands on Modelling and Validating	
	FGW TR4 Rev.9	Simulation Models of the Electrical	
		Characteristics of Power Generating Units and Systems	
FGW TR8 Rev.9	FGW TR8 Rev.6	Technical Guidelines for Power Generating	2023-08-03
	FGW TR8 Rev.7	Units	
	FGW TR8 Rev.8	Part 8 Certification of the electrical	
		characteristics of power generating units and	
		systems in the medium-, high- and highest-	
		voltage grids	
FNN Hinweis:	FNN Hinweis: 2016	Connection and operation of storage system to	2023-03-31
2022	FNN Hinweis: 2024	low voltage network	2024-04-08
	FNN Hinweis: 2019	(Anschluss und Betrieb von Speichern am	2024-11-19
BVES 2.0		Niederspannungsnetz) Efficiency guideline for PV storage systems	
Global:			
		Test propodure of jolanding provention	T
IEC 62116:2014		Test procedure of islanding prevention measures for utility-interconnected photovoltaic	
		inverters	
EN 62116:2014		Test procedure of islanding prevention	
2.102110.2014		measures for utility-interconnected photovoltaic	
		inverters	

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IEC 61727:2004		Photovoltaic (PV) systems - Characteristics of the utility interface	
IEEE 1547:2018	IEEE 1547:2003	IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources	2023-03-31
	IEEE 1547a™- 2020	with Associated Electric Power Systems Interfaces	2024-04-08
IEEE 1547.1:2020	IEEE 1547.1:2005	IEEE Standard Conformance Test Procedures f or Equipment Interconnecting Distributed Energy Resources with Electric Power Systems and As sociated Interfaces	2023-03-31
IEC 61400-21- 1:2019		Wind energy generation systems – Part 21-1: Measurement and assessment of electrical characteristics – Wind turbines (Only Grid Connection in laboratory tests)	
IEC 61400-27- 2:2020		Wind energy generation systems - Part 27-1: Electrical simulation models - Generic models	
EN 50530:2010	EN 50530/A1:2013	Overall efficiency of grid connected photovoltaic inverters	2024-11-19
IEC 61683:1999		Photovoltaic systems - Power conditioners - Procedure for measuring efficiency	
IEC TS 63217:2021		Utility-interconnected photovoltaic (PV) inverters - Test procedure of over-voltage ride-through measurements	
IEC TS 62910:2020	IEC TS 62910:2015	Utility-interconnected photovoltaic inverters – Test procedure for low voltage ride-through measurements	2023-03-31
Greece:			•
Decision RAE 1165/2020		Determination of maximum power thresholds applicable to power plants and parameters of general application of Regulation (EU) 2016/631 (Greece)	
Hungary:			
Hungary grid code		Parameters for the Essential requirements in accordance with COMMISSION REGULATION (EU) 2016/631 of 14 April 2016 establishing a network code on requirements for grid connection of generators (RfG regulation)	
India:	•		
CEA:2019		Central Electricity Authority (Technical standard for connectivity to the grid)	

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Ireland:			
DTIS-230206- BRL:2018		Conditions Governing the Connection and Operation of Micro-Generation (Ireland)	
DTIS-250701- BDW:2019		Connections Governing Connection to the Distribution System at Medium Voltage (Ireland)	
Distribution Code Version 8		Distribution Code for connected to ESB Networks (Ireland)	
Italy:			
CEI 0-21:2022 +V1:2022+V2:2 024	CEI 0-21:2014 + V1:2014 CEI 0-21:2019 CEI 0- 21:2019+V1:2020	Reference technical rules for the connection of active and passive users to the LV electrical Utilities	2023-08-03
CEI 0-16:2022 +V1:2022+V2:2 023+ V3:2024	CEI 0-16:2014 + V1:2014 CEI 0-16: 2019 CEI 0-16;V2 (2023- 05) CEI 0- 16:2019+V1:2020	Reference technical rules for the connection of active and passive consumers to the HV and MV electrical networks of distribution Company	2023-08-03
Jordan:			
IRR-TIC:2015		Intermittent Renewable Resources (IRR) Transmission Interconnection Code (TIC)	
IRR-DCC- MV:2015	IRR-DCC- MV:2016(Version 2)	Intermittent Renewable Resources (Wind and PV) Distribution Connection Code (DCC) At Medium Voltage (MV)	2024-11-19
Netherland:			
Netcode elektriciteit:2023	Netcode elektriciteit:2022	Electricity Network Code issued by ACM Netherland	2024-11-19
Norway:			
NVF 2023		National guide for functional requirements in the power system	
Poland:			•

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NC RFG:2018		Poland: Proposal for general application requirements under Commission Regulation (EU) 2016/631 of April 14, 2016 establishing a network code on the requirements for connecting generating units to the grid (NC RfG) General Application Requirements resulting from the EU Commission Regulation 2016/631 of 14 April 2016 establishing the Network Code on the requirements for connecting generating units to the grid - approved by the Decision of the President of the Energy Regulatory Office DRE. WOSE.7128.550.2.2018.ZJ of 2 January 2019	
PTPiREE: 2021	PTPIREE: 2024	Conditions and procedures for the use of certificates in the process of connecting modules in power generation to electricity grids	2024-11-19
Portugal:		·	
Ordinance No. 73/2020		Non-exhaustive requirements for connecting the generating modules to the Public Service Electrical Network (RESP) (Portugal)	
Romania:			
ANRE Order 208:2018		Technical norm on the technical requirements to connect power-generating modules, power plants modules and offshore power park modules to public electrical grids	
South Africa:		1	
NRS 097-2- 1:2024	NRS 097-2-1:2017	Grid interconnection of embedded generation Part 2: Small-scale embedded generation	2024-04-08
RPPs:2022	RPPs:2019	Grid connection code for renewable power plants (RPPs) connected to the electricity transmission system (TS) or the distribution system (DS) in South Africa	2024-11-19
Spain:			
RD 1663:2000		Royal Decree 1663/2000, Connection of photovoltaic system to the low- voltage grid network	
RD 661:2007		Royal Decree 661/2007, About the generation of electric energy	
RD 1699: 2011		Royal Decree 1699/2011, the connection of generation system for electric energy with small power	

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RD 413:2014		Royal Decree 413/2014, of June 6, which	
		regulates the activity of electricity production from renewable energy sources, cogeneration	
		and waste.	
RD 244:2019		Zero injection for inverters and other generation units	
UNE 206006: 2011		Performance tests for islanding detection of multiple grid-connected photovoltaic inverters in parallel	
UNE 206007-1: 2013		Requirements for connecting to the power system. Part1: Grid-connected inverters	
UNE 206007-2 IN:2014		Requirements for connecting to the power system. Part 2: Requirements concerning system security for installations containing inverters.	
P.O.12.2:2018		Generation and demand facilities: minimum design, equipment, operation, service and security requirements	
P.O. 12.3 :2006		Requirements for responding to voltage gaps in wind installations	
NTS V2.1:2021- 07	NTS V1.0:2019-07 NTS V2.0:2020-11	Technical standard for monitoring the conformity of the electricity generation modules according to EU Regulation 2016/631	2024-04-08
NTS SENP V1.1:2021-07		Technical standard for monitoring the compliance of power generating modules according to P.O. 12.2 SENP	
UNE 217001:2020		Requirements and tests for systems that avoid the discharge of energy to the distribution network	
UNE 217002:2020		Inverters for connection to the distribution network Testing of DC injection requirements to the grid, surge generation and island operation detection system	
PVVC:2018		Procedures for verification, validation and certification of the requirements of po 12.3 on the response of the wind and photovoltaic facilities to the voltage holes	
TED/749:2020		Order TED/749/2020, of July 16, establishing the technical requirements for connection to the network necessary for the implementation of the connection network codes.	
Sweden:	1		1

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EIFS 2018:2		The Energy Market Inspectorate's Regulations	
LII 0 2010.2		on the determination of generally applicable	
		requirements for network connection of	
		generators	
Switzerland:			1
NA/EEA-NE7 -		Network connection for energy generation	
CH 2020		systems to the low-voltage network - Technical	
		requirements for connection and parallel	
		operation in NE7	
Thailand:			
MEA Guideline		Regulation for an Inverter Used in Grid-	
2015		connected Power Generating System of the	
		Metropolitan Electricity Authority (MEA)	
PEA Guideline		The Requirements on Grid Connection of	
2016		Provincial Electricity Authority(PEA) for VSPP	
United Kingdom:			
ER G83	G83 Issue 2	Recommendations for the Connection of Type	2023-08-03
issue2:2012	Amendment	Tested Small-scale Embedded Generators (Up	
	3 :2019	to 16A per Phase) in Parallel with Low-Voltage	
		Distribution Systems	
ER G59	G59/3/7 Issue	Recommendations for the connection of	2023-08-03
issue2:2011	3:2019	generating plant to the distribution systems of	
ER G59		licensed distribution network operators	
issue3:2013			
ER G59 issue3-			
3:2018		Dequirements for the connection of Fully time	
ER G98 Issue 1	ER G98 issue1-	Requirements for the connection of Fully type	2023-08-03
- Amendment	1:2018	tested micro-generators (up to and including	
7 :2022		16A per phase) in parallel with public low voltage distribution networks	
ER G99 Issue 1	ER G99 issue1-	Requirements for the connection of generation	2024-04-08
-Amendment	1:2018	equipment in parallel with public distribution	
9:2022	ER G99 issue1-	networks	
	8:2021		
	ER G99 issue1-		2024-11-19

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Test and simulation of product types according to the standards NTS SENP and NTS of Spain Grid Code are listed below:

Product type	Standard	Test/simulation clause and details	Remark
Electricity Generation Units (UGE) and Energy Storage System to be installed in Electricity Generation Modules (MGE) of the Electrical Park Module (MPE) type. Photovoltaic inverters and other power converters. Battery Storage System	NTS SENP V1.1:2021-07 NTS V2.1:2021-07	<ul> <li>5.1: Limited frequency sensitive mode - overfrequency (LFSM-O)</li> <li>5.2: Limited frequency sensitive mode - underfrequency (LFSM-U)</li> <li>5.3: Frequency sensitive mode (FSM)</li> <li>5.5: Active power control range and remote controllability</li> <li>5.7: Reactive power capability at maximum capacity and below maximum capacity</li> <li>5.8: Reactive Power Control in PPM</li> <li>5.11: Robustness requirements: Active power recovery after a fault, Fault ride Through Capability, and Fast Fault Current Injection Capability</li> </ul>	Technical Standard for monitoring the conformity of electricity generating modules under EU Regulation 2016/631 (NTS) Technical standard for monitoring the compliance of power generating modules according to P.O. 12.2 SENP (NTS SENP)

Table 1

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#### Table 1 (Continued#1)

Table 1 (Continued	#1)		
Additional Components of the Electricity Generation Modules (CAMGE) to be installed in Electric Park Modules (MPE). Power Plant Controller (PPC), STATCOM and Battery Storage Systems PPC: Section 4.6.1. "Power Plant Controller". STATCOM: Section 4.6.2. "Reactive power provision active static compensation system"	NTS SENP V1.1:2021-07 NTS V2.1:2021-07	<ul> <li>STATCOM (4.6.1):</li> <li>4.6.1: Measurement of reactive power capacity exchanged by a STATCOM.</li> <li>4.6.1: Measurement of the dynamics of response of a STATCOM in the face of a change of power/current setpoint</li> <li>PPC tests according to:</li> <li>5.1: Limited frequency sensitive mode - overfrequency (LFSM-O)</li> <li>5.2: Limited frequency sensitive mode - underfrequency (LFSM-U)</li> <li>5.3: Frequency sensitive mode (FSM)</li> <li>5.5: Active power control range and remote controllability</li> <li>5.7: Reactive power capability at maximum capacity and below maximum capacity</li> <li>5.8: Reactive Power Control in PPM</li> <li>5.11: Robustness requirements: Active power recovery after a fault, Fault ride Through Capability, and Fast Fault Current Injection Capability</li> </ul>	Technical Standard for monitoring the conformity of electricity generating modules under EU Regulation 2016/631 (NTS) Technical standard for monitoring the compliance of power generating modules according to P.O. 12.2 SENP (NTS SENP)
Models of Electricity Generation Units (UGE) and Energy Storage System to be installed in Electricity Generation Modules (MGE) of the Electrical Park Module (MPE) type. Photovoltaic inverters and other power converters. Battery Storage System	NTS SENP V1.1:2021-07 NTS V2.1:2021-07	Simulations for the validation of the UGE model, according to section 6.2 of the NTS	Technical Standard for monitoring the conformity of electricity generating modules under EU Regulation 2016/631 (NTS) Technical standard for monitoring the compliance of power generating modules according to P.O. 12.2 SENP (NTS SENP)

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#### Table 1 (Continued#2)

Table 1 (Continued	#2)		
Models of Additional Components of Power Generation Modules (CAMGE) to be installed in Electric Park Modules (MPE).	NTS SENP V1.1:2021-07 NTS V2.1:2021-07	Simulations for model validation of CAMGE, according to section 6.3 of the NTS	Technical Standard for monitoring the conformity of electricity generating modules under EU Regulation 2016/631 (NTS) Technical standard for monitoring the
Power Plant Controller (PPC), PPC: Power Park controllers STATCOM			compliance of power generating modules according to P.O. 12.2 SENP (NTS SENP)
Models of Electricity Generation Units (UGE) Photovoltaic inverters and other power converters. Battery Storage System	NTS SENP V1.1:2021-07 NTS V2.1:2021-07	Simulations: 5.1: Limited frequency sensitive mode - overfrequency (LFSM-O) 5.2: Limited frequency sensitive mode - underfrequency (LFSM-U) 5.3: Frequency sensitive mode (FSM)	Technical Standard for monitoring the conformity of electricity generating modules under EU Regulation 2016/631 (NTS) Technical standard for monitoring the compliance of power generating modules according to P.O. 12.2 SENP (NTS SENP)
Models of Additional Components of Power Generation Modules (CAMGE) to be installed in Electric Park Modules (MPE). Power Plant Controller (PPC), PPC: Power Park controllers STATCOM	NTS SENP V1.1:2021-07 NTS V2.1:2021-07	Simulations: 5.1: Limited frequency sensitive mode - overfrequency (LFSM-O) 5.2: Limited frequency sensitive mode - underfrequency (LFSM-U) 5.3: Frequency sensitive mode (FSM)	Technical Standard for monitoring the conformity of electricity generating modules under EU Regulation 2016/631 (NTS) Technical standard for monitoring the compliance of power generating modules according to P.O. 12.2 SENP (NTS SENP)
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