Preliminary prototype confirmation

Manufacturer / Applicant	**Jiangsu Koyoe Energy Technology Co., Ltd.** **Building 3, Industrial Zone C, No.588 Wutaishan Road** **New District, Suzhou, Jiangsu** **P.R. China**		
Product type	**Battery storage system with bidirectional inverter**		
Model		**KY-PCS100KH-A**	**KY-PCS125KH-A**
Specifications	Nominal apparent power	110 kVA	137 kVA
	Nominal active power	100 kW	125 kW
	Nominal voltage	380/400V,3L/N/PE	380/400V,3L/N/PE
	Nominal frequency	50/60 Hz	50/60 Hz

Description

Storage system with power electronic converter for feeding power generated by battery modules into the public AC grid (discharging operation mode, PGU) or draw energy from the public AC grid to charge the battery (charging operation mode, Load).

Standards

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

VDE-AR-N 4120:2018-11 + A1:2024-04
Technical requirements for the connection and operation of customer installations to the high voltage network (TAR high voltage)

FGW TG8 Rev. 9:2019-02
Certification of the Electrical Characteristics of Power Generating Units, Systems and Storage Systems as well as their Components on the Grid

This preliminary prototype certificate confirms that the above-mentioned PGUs are prototypes according to VDE-AR-N 4110/VDE AR-N 4120 and FGW TG 8 Rev.9: The PGU are characterized by major technical developments or innovations (see Annex 1 and Annex 3).

It is also confirmed that the general ability of the PGU to fulfil the requirements of the VDE-AR-N 4110/VDE AR-N 4120, based on manufacturer data of the electrical properties of the PGUs (see Annex 2). It is expected that in the scope of a certification the requirements of Annex A of the FGW TG8 will be fulfilled.

Restriction

A test terminal strip must be installed separately if necessary.

Commission of the first power generating unit prototype in Germany Date of commission not confirmed

"This Document is an English translation of the original certificate in German language with number U25-0499"

Project number:	**25TH0255**	**Certification program:**	**NSOP-0032-DEU-ZE-V10**
Confirmation number:	**U25-0499**	**Date of issue:**	**2025-05-22**

Certification body

Georg LORITZ
Lab Supervisor Energy Systems

Accreditation

DAkkS Deutsche Akkreditierungsstelle D-ZE-12024-01-00

Description of the revisioning of the preliminary prototype confirmation U25-0499	
Rev. 0	First issue

Annex 1	
This certificate confirms that the mentioned power generating unit (PGU) according to FGW TR 8 is a prototype. For this purpose, the PGU is described below, and the main technical developments or innovations are presented. After commissioning the first unit of the specified type, the certification body must be notified of the commissioning date. The preliminary prototype confirmation is then replaced by a prototype confirmation, which is valid for 2 years after the notified commissioning date. After that, the unit must have a valid unit certificate.	
FGW TG 8 (Rev. 9)	
Requirements	**Comment / Verdict**
2.11 Equipment prototypes	
2.11.1 Prototype regulation	
A prototype is the first piece of equipment of a type displaying fundamental technical developments or innovations, and all additional pieces of equipment of this type commissioned within two years of commissioning the first piece of equipment of this type	Considered (see Annex 3).
The regulation and periods for equipment prototypes in a PGS can be found in the GCR.	Considered. according to VDE-AR-N 4110/VDE AR-N 4120 applies: for production plants with production units of the same prototype, the plant certificate and the declaration of conformity must be submitted within one year after the first prototype has received a unit certificate
2.11.2 Prototype declaration	
The prerequisite for a certification body issuing a prototype confirmation is a manufacturer's declaration regarding the following points:	
• statement on the partial or complete conformity with one or more GCR;	Considered (see Annex 3)
• declaration that this relates to a substantial technical development or innovation	Considered (see Annex 3)
• the identification of differences to any existing and previously certified equipment;	Considered (see Annex 3).
• additional technical data corresponding to the requirements or the relevant GCR.	Considered (see Annex 3).
Substantial technical developments and innovations are usually present if components or software versions have been modified such that the electrical behaviour of the generation unit on the grid has significantly changed or an equivalent electrical behaviour has been achieved through a different technical development and innovation.	Since the product is intended to achieve unit certification in accordance with VDE-AR- N 4110/VDE AR-N 4120 and no certification has yet been obtained, the software version used is a significant technical development/innovation.
Based on the manufacturer's declarations submitted regarding the prototype, the certification body will assess whether this is a technical development and certifies this in the form of a prototype confirmation.	Considered (see Annex 3)
The certification body must clearly identify in the prototype confirmation that the prototype would fundamentally be able to meet the requirements of the relevant GCR in terms of electrical characteristics and functions of the operating equipment. The requirements of the GCR for the test scope for the prototype confirmation must be taken into account (to the extent present).	Considered (see Annex 3)

Annex 2

This certificate confirms that the named generating unit (PGU) is able to meet the requirements for the electrical properties of a generating unit according to VDE-AR-N 4110/VDE AR-N 4120. For this purpose, the conformity of the electrical properties of the PGU with the requirements of the VDE-AR-N 4110/VDE AR-N 4120 is verified as described below:

Type of equipment	EZE			Component		
	Photovoltaic (PV)	Storage	ORC	EZA-Regler	Component circuits	Interface protection
	☐	☒	☐	☐	☐	☐
Note	The following points 1), 2) and 4) are to be applied			The following points 1), 2), 3) and 4) are to be applied		

VDE-AR-N 4110		
BV-No	**Requirements**	**Comment / Verdict**
12 Regulation for prototypes		
1)	A prototype is the first power generating unit of a type presenting substantial technological developments or innovations and all other power generating units of this type put into operation within two years after the commissioning of the first power generating unit of this type. NOTE 1 This definition corresponds to the term's definition given in SDLWindV [1]. There is no relation to the term "pilot wind turbine" (de: Pilotwindenergieanlage) used in the EEG [6]. Technological developments and innovations are generally considered to be substantial where components or software versions are changed so that the electrical behaviour of the power generating unit at the network changes significantly and a unit certification of this new type is required.	Considered (see Annex 3).
2)	For the prototype of a power generating unit the requirements of this VDE application guide apply. For these prototypes, a prototype confirmation, in which the certification body confirms a substantial technological development or innovation based on a manufacturer declaration, is sufficient, instead of the unit certificate, for a period of two years after commissioning of the first power generating unit prototype in Germany. The certification body shall also check and set out reproducibly in the prototype confirmation, whether the prototype is generally capable of meeting the requirements of this VDE application guide for the electrical properties of the power generating unit. This is based on an electrical properties data sheet prepared by the manufacturer of the power generating unit. For prototypes commissioned before 2019-04-27, the above-mentioned period starts 2019-04-27.	Considered.
3)	For components within the power generating plant, for which a component certificate is required, the prototype regulation can be applied in analogy	Not applicable.

Annex 2		
BV-No	**Anforderungen**	**Comment / Verdict**
4)	In order to allow the certification body to carry out the required plausibility test, the data sheet of the power generating unit shall contain at least the following information: - electrical data (nominal and rated quantities); - schematic overview circuit diagram of the power generating unit with all relevant components; - operating ranges of the power generating unit: • limits in quasi-steady-state operation, • reactive power adjustment range, • FRT limit curve (U/t diagram); - protection functions with setting ranges: • decoupling protection, • self-protection; - active power control: • power/frequency behaviour, • active power gradient; - reactive power control: - dynamic reactive current feed-in: • basic functionality; - declaration of the manufacturer stating that the power generating unit has been designed so that the requirements of this application guide for the power generating unit can be complied with At the latest after expiry of the above-mentioned period, a unit certificate is required. NOTE 2 If the unit certificate is available prior to expiry of the two-year term after commissioning the first power generating unit of this type, it can still be a prototype.	Considered. Data from the manufacturer are available (see Annex 3). Results of the plausibility check see the following table.
Plausibility test		
a)	Electrical data (nominal and rated quantities)	Fulfilled (see Annex 3)
b)	schematic overview circuit diagram of the power generating unit with all relevant components;	Fulfilled (see Annex 3)
c)	operating ranges of the power generating unit: • limits in quasi-steady-state operation, • reactive power adjustment range, • FRT limit curve (U/t diagram);	Fulfilled (see Annex 3)
d)	protection functions with setting ranges: • decoupling protection, • self-protection	Fulfilled (see Annex 3) under the following condition: The PGU does not provide a test terminal for on-site testing. A test terminal must be installed on plant level.
e)	active power control: • power/frequency behaviour, • active power gradient;	Fulfilled (see Annex 3)
f)	Reactive power control	Fulfilled (see Annex 3)
g)	dynamic reactive current feed-in: • basic functionality	Fulfilled (see Annex 3)
h)	Declaration of the manufacturer stating that the power generating unit has been designed so that the requirements of this application guide for the power generating unit can be complied with	Fulfilled (see Annex 3)

Annex 3

Manufacturer's declaration on the prototype / Description of functions / Electrical data

Herstellererklärung

Manufacturer's Declaration

Jiangsu Koyoe Energy Technology Co., Ltd. Stromumwandlungssystem

Version	1.0	Autor
For Jiangsu Koyoe	13.05.2025	Mr. Weirong Zhang (张卫荣)
For Zertification	13.05.2025	Dr. Frank Wieland

Die Stromerzeugungseinheiten KY-PCSl00KH-A und KY-PCS125KH-A können die Anforderungen der VDE-AR-N 4110/4120 an die elektrischen Eigenschaften der Stromerzeugungseinheiten erfüllen.

The power generation units KY-PCSl00KH-A and KY-PCS125KH-A are capable of meeting the electrical property requirements of the VDE-AR-N 4110/4120 standards. This means they comply with the relevant regulations for grid connection and operation.

1. **Beschreibung:**

   Description

Es handelt es sich um ein Notstromversorgungsprojekt, das an das Stromnetz angeschlossen oder netzunabhängig betrieben werden kann. Das Projekt nutzt zwei mobile Energiespeicher-Systemcontainer von Jiangsu Koyoe mit einer Gesamteingangs- und -ausgangsleistung von 2,5 MW und einer Speichersystemkapazität von 5,2 MWh. Es kann aufgeladen werden, wenn ausreichend Strom vorhanden ist, und als Notstromversorgung verwendet werden, wenn Strom benötigt wird, um wirtschaftliche Verluste durch Stromprobleme zu vermeiden.

Die Systemarchitektur ist wie folgt.

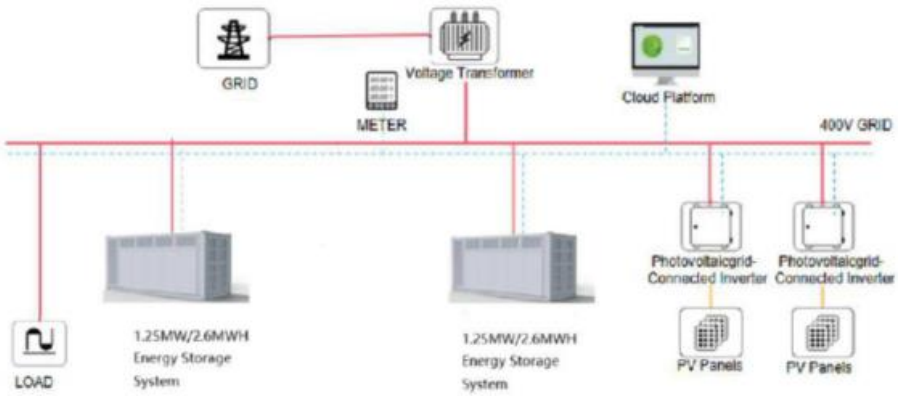
Bei dieser Lösung handelt es sich um ein integriertes AC/DC-Containersystem zur Energiespeicherung von Jiangsu Koyoe Energy Technology Co., Ltd. Das Produkt verfügt über ein begehbares Flüssigkeitskühlungsdesign mit einem hohen Grad an Systemintegration und erfüllt die Anforderungen für einen sicheren, zuverlässigen und langfristigen Betrieb des Energiespeichersystems. Das integrierte System weist eine höhere Gesamtstabilität auf, ist bequem zu bauen und zu installieren und kann direkt an den Netzpunkt oder das Booster-System angeschlossen werden.

Annex 3

The system uses two mobile energy storage containers from Jiangsu Koyoe, with a total input and output capacity of 2.5 MW and a storage capacity of 5.2 MWh. It can be charged when there is sufficient electricity and used as an emergency power source to prevent economic losses caused by power outages.

The architecture features an integrated AC/DC container system designed by Jiangsu Koyoe Energy Technology Co., Ltd. It includes a walk-in liquid cooling design, high system integration, and meets safety, reliability, and long-term operation standards. The integrated system offers higher overall stability, is easy to build and install, and can be directly connected to the grid point or booster system.

Fig: Blockbild



2. **Typen der Stromwandler siehe Anhang 1**

   See attachment 1 for the types of current transformers

Annex 3

3. Typenschilder: Nameplates

KOYOE	
Name:	Power Conversion System
Model:	KY-PCS100KH-A
Serial Number	
AC Data	
Nominal Voltage(V)	400/380, 3L/N/PE
Nominal Frequency(Hz)	50/60
Nominal Output Power(W)	100000
DC Data	
Voltage Range(V)	700-950
Max. DC Current(A)	200
Max. DC Power(W)	125000
General Data	
Dimension(W*H*D)	512*300*800mm
Protective Class	Class I
Ingress Protection Rating	IP65
Operating Temperature Range (℃)	-25 to 60℃(>45℃ derating)

DRM0 X DRM1 X DRM2 X
DRM3 X DRM4 X DRM5 X
DRM6 X DRM7 X DRM8 X

Global Support Hotline:+86 400-900-9536 Web: www.koyoe.com
Business Cooperation: info@koyoe.com
After Sales Service: service@koyoe.com
Add: Building 3, Industrial Zone C, No.588 Wutaishan Road, New District, Suzhou, Jiangsu P.R. China

KOYOE	
Name:	Power Conversion System
Model:	KY-PCS125KH-A
Serial Number	
AC Data	
Nominal Voltage(V)	400/380, 3L/N/PE
Nominal Frequency(Hz)	50/60
Nominal Output Power(W)	125000
DC Data	
Voltage Range(V)	700-950
Max. DC Current(A)	200
Max. DC Power(W)	150000
General Data	
Dimension(W*H*D)	512*300*800mm
Protective Class	Class I
Ingress Protection Rating	IP65
Operating Temperature Range (℃)	-25 to 60℃(>45℃ derating)

DRM0 X DRM1 X DRM2 X
DRM3 X DRM4 X DRM5 X
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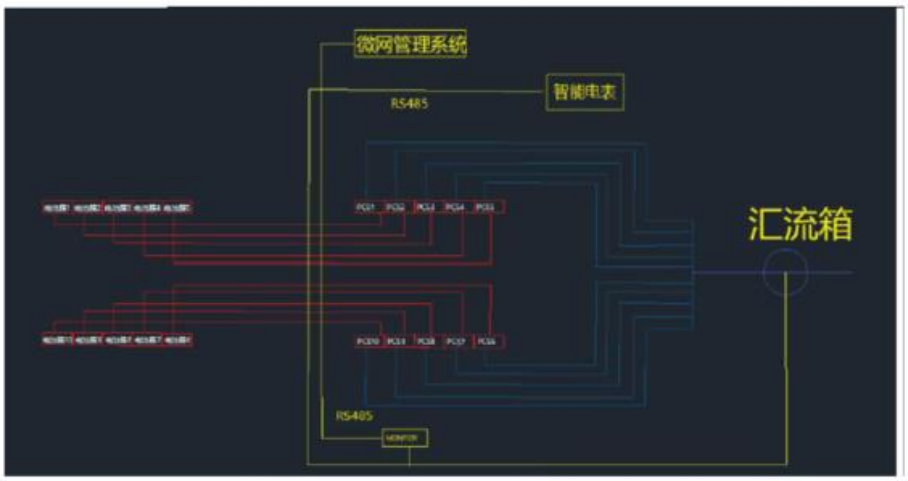
Dies sind die Typenschilder am Produkt, das Modell, die technischen Spezifikationen und Warnhinweise enthalten.

These are the nameplates on the product, which contains the model, technical specifications and warning information.

Fig: Aufbau

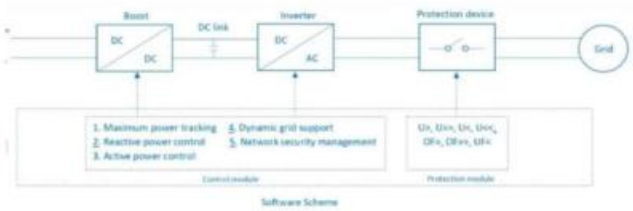


Annex 3

4. **Schutzparameter: Die Koyoe-Produkte erfüllen die folgenden Anforderungen**

   Protection Parameter: The Koyoe products meet the following requirements

Interface protection settings:			
Parameter	Setting range	Setting step	Default value
OV1 protection value *OV-G-V1*	1.00Un...1.30Un	0.001Un	1.10Un
OV1 protection time *OVGV1-T*	0.01s...180s	0.01s	100ms
OV2 protection value *OV-G-V2*	1.00Un...1.30Un	0.001Un	1.25Un
OV2 protection time *OVGV2-T*	10ms...100ms	0.01s	100ms
UV1 protection value *UN-G-V1*	0.10Un...1.00Un	0.001Un	0.80Un
UV1 protection time *UNGV1-T*	0.01s ...2.4s	0.01s	1.0s
UV2 protection value *UN-G-V2*	0.10Un...1.00Un	0.001Un	0.45Un
UV2 protection time *UNGV2-T*	10ms ...800ms	0.01s	300ms
OF1 protection value *OV-G-F1*	50.0Hz...55.0Hz	0.01Hz	51.5Hz
OF1 protection time *OVGF1T*	0.01s ...5s	0.01s	100ms
OF2 protection value *OV-G-F2*	50.0Hz...55.0Hz	0.01Hz	52.5Hz
OF2 protection time *OVGF2T*	10ms...100ms	0.01s	100ms
UF1 protection value *UN-G-F1*	45.0Hz...50.0Hz	0.01Hz	47.5Hz
UF1 protection time *UNGF1T*	10ms...100ms	0.01s	100ms



Software Scheme

Annex 3

5.PQ diagram:

KY-PCS125KH-A								
P {p.u.}	Direction	Qmax {p.u.}						
		85 % Un	90 % Un	95 % Un	100 % Un	105 % Un	110 % Un	115 % Un
0	Underexcited	-0.600	-0.600	-0.600	-0.600	-0.600	-0.600	-0.600
	Overexcited	0.600	0.600	0.600	0.600	0.600	0.600	0.600
0.1	Underexcited	-0.600	-0.600	-0.600	-0.600	-0.600	-0.600	-0.600
	Overexcited	0.600	0.600	0.600	0.600	0.600	0.600	0.600
0.2	Underexcited	-0.600	-0.600	-0.600	-0.600	-0.600	-0.600	-0.600
	Overexcited	0.600	0.600	0.600	0.600	0.600	0.600	0.600
0.3	Underexcited	-0.600	-0.600	-0.600	-0.600	-0.600	-0.600	-0.600
	Overexcited	0.600	0.600	0.600	0.600	0.600	0.600	0.600
0.4	Underexcited	-0.600	-0.600	-0.600	-0.600	-0.600	-0.600	-0.600
	Overexcited	0.600	0.600	0.600	0.600	0.600	0.600	0.600
0.5	Underexcited	-0.600	-0.600	-0.600	-0.600	-0.600	-0.600	-0.600
	Overexcited	0.600	0.600	0.600	0.600	0.600	0.600	0.600
0.6	Underexcited	-0.600	-0.600	-0.600	-0.600	-0.600	-0.600	-0.600
	Overexcited	0.600	0.600	0.600	0.600	0.600	0.600	0.600
0.7	Underexcited	-0.482	-0.566	-0.600	-0.600	-0.600	-0.600	-0.600
	Overexcited	0.482	0.566	0.600	0.600	0.600	0.600	0.600
0.8	Underexcited	-0.287	-0.412	-0.512	-0.600	-0.600	-0.600	-0.600
	Overexcited	0.287	0.412	0.512	0.600	0.600	0.600	0.600
0.9	Underexcited	0.000	0.000	-0.304	-0.436	-0.436	-0.436	-0.436
	Overexcited	0.000	0.000	0.304	0.436	0.436	0.436	0.436
1	Underexcited	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Overexcited	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1.1	Underexcited	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Overexcited	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Die Berechnung basiert auf 1,0-fache der Nennleistung. Die Produkte von Koyoe erfüllen unter diesen Bedingungen die Anforderungen

We calculate based on 1.0 times the rated power, It meets the requirements of Koyoe products

6. Kommunikationsfunktion des bidirektionalen Energiespeicherkonverters *Communication function of the bidirectional energy storage converter*

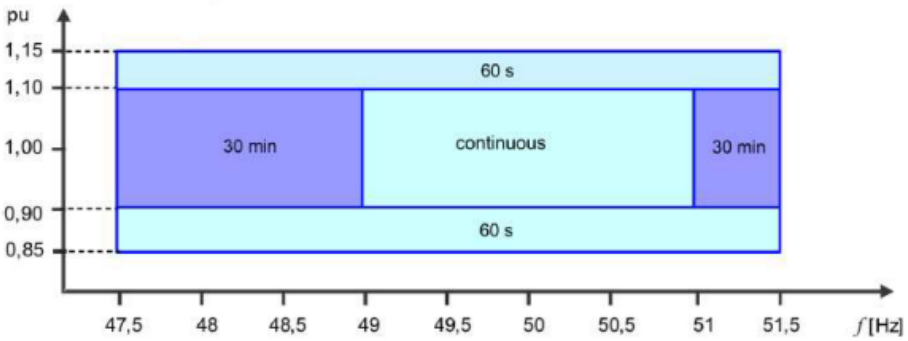
Der bidirektionale Energiespeicher-Wechselrichter verfügt über mindestens eine unabhängige RS485-Kommunikationsschnittstelle und eine unabhängige CAN-Kommunikations-schnittstelle zur Kommunikation mit dem BMS. Der bidirektionale Energiespeicher-Wechselrichter (PCS) tauscht hauptsächlich Informationen mit dem lokalen Überwachungssystem aus. Der bidirektionale Energiespeicher-Wechselrichter sendet seinen eigenen Betriebsstatus an das lokale Überwachungssystem und den Überwachungshinter-grund und kann vom Hintergrund ausgegebene Befehle und Sollwerte empfangen. Gleichzeitig kann es BMS-Systeminformationen zum Schutz der Batterie empfangen.

The bidirectional energy storage inverter is equipped with at least one independent RS485 communication interface and one independent CAN communication interface to communicate with the Battery Management System (BMS). Its main function is to exchange information with the local monitoring system. The inverter sends its operational status and background information to the monitoring system, and it can also receive commands and setpoints issued by the system to adjust its operation accordingly. Additionally, it can receive BMS system information to help protect the battery. This communication capability ensures that the energy storage system operates efficiently and safely.

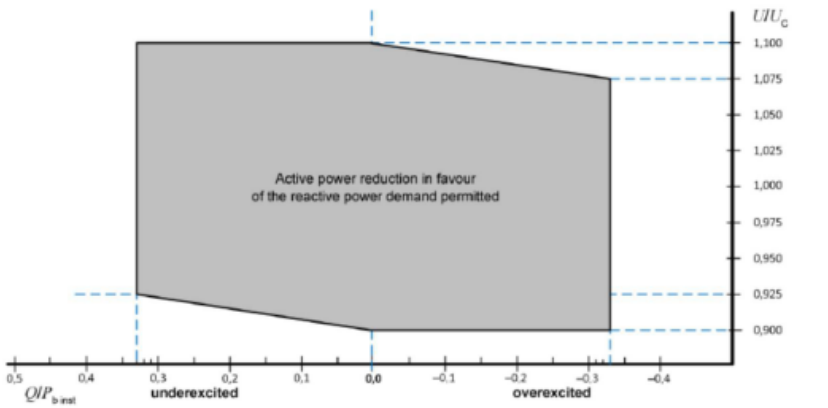
Annex 3

7. **Die folgenden Kurven und Vorgaben der VDE-AR-N4110 und VDE-AR-N4120 werden eingehalten**

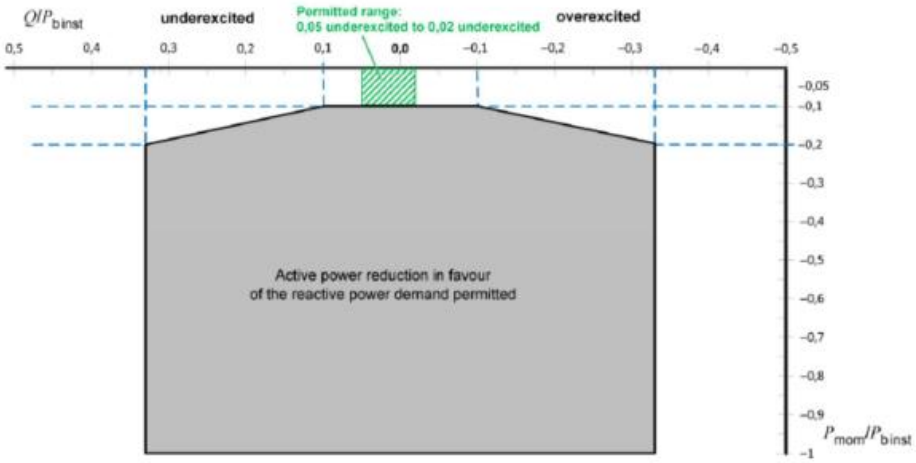
   The following curves and specifications of VDE-AR-N 4110 and VDE-AR-N4120 are adhered to.



VDE-AR-N 4110:2023-09 (en)



Annex 3



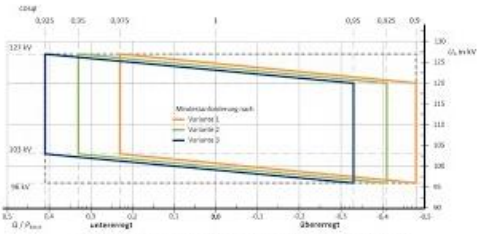


Bild 4 – Varianten der Anforderungen an Erzeugungsanlagen an die Blindleistungsbereitstellung am Netzanschlusspunkt

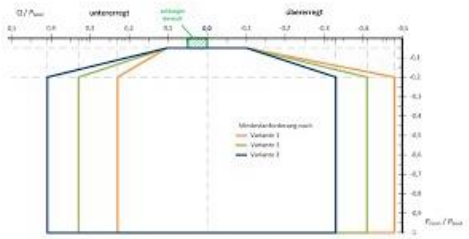
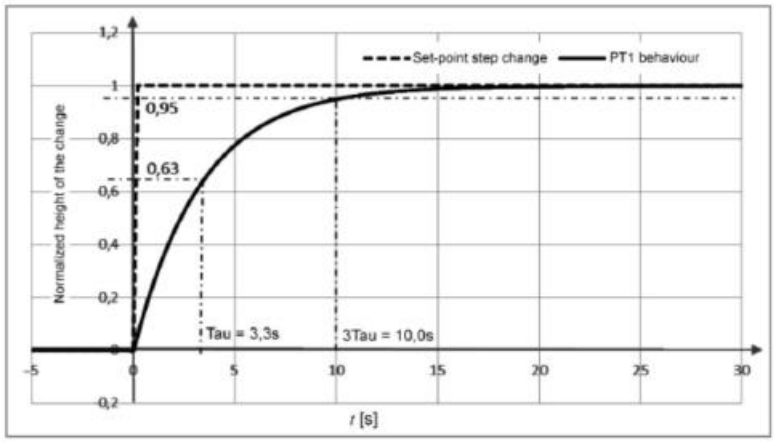
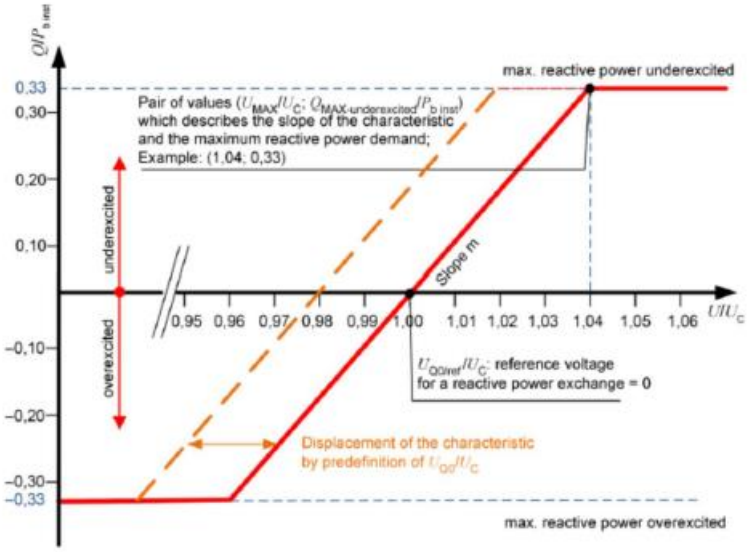


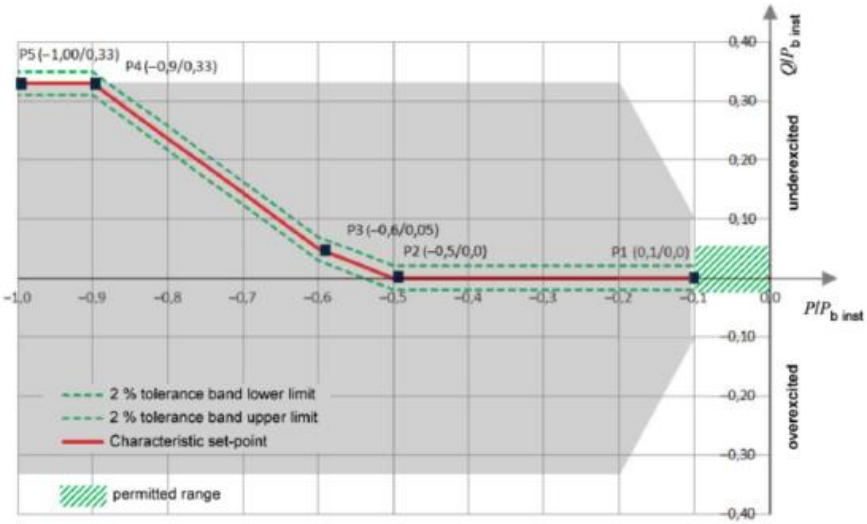
Bild 5 – Varianten der PQ-Diagramme der Erzeugungsanlage am Netzanschlusspunkt im Verbraucherzählpfeilsystem

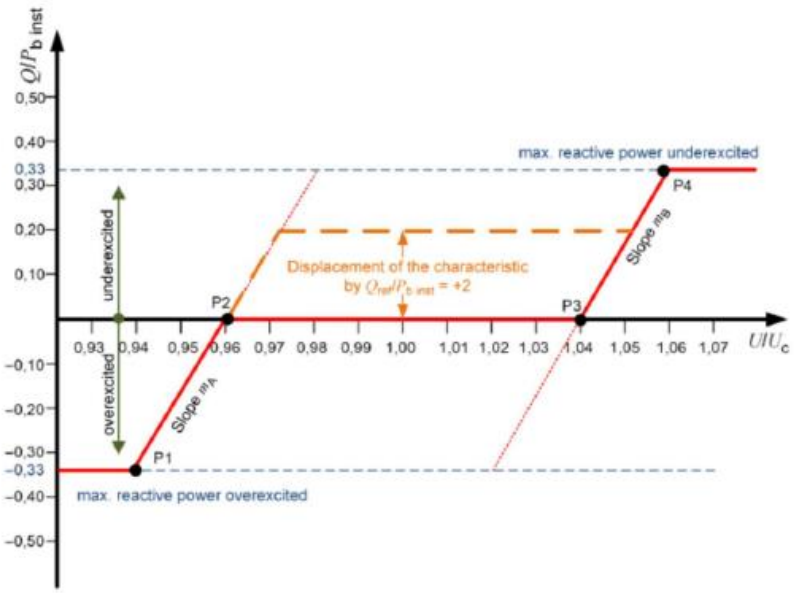
Annex 3


Set-point step change
PT1 behaviour
Normalized height of the change
0,95
0,63
Tau = 3,3s
3Tau = 10,0s
t [s]

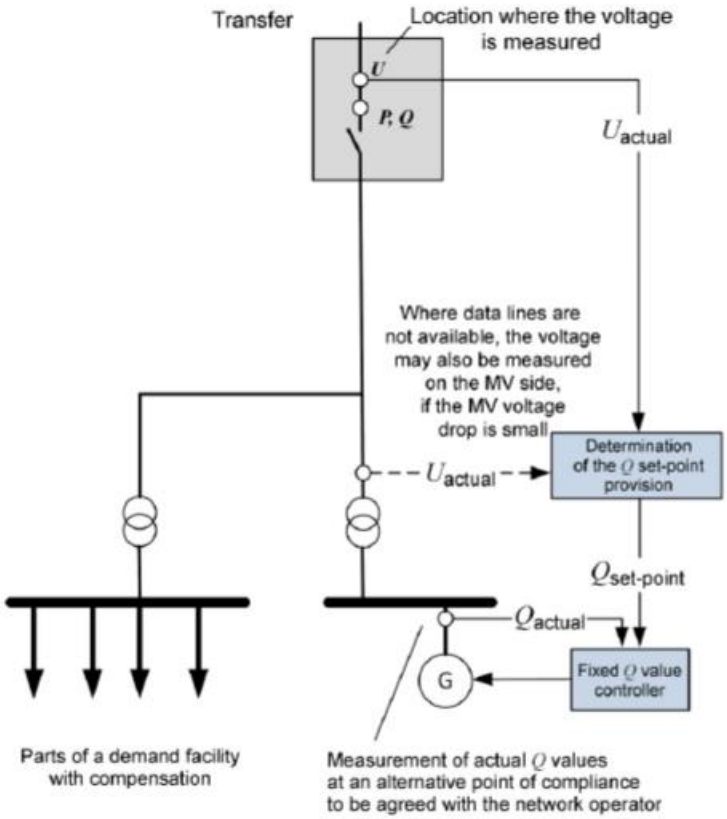

max. reactive power underexcited
Pair of values (U_MAX/U_C; Q_MAX-underexcited/P_b inst)
which describes the slope of the characteristic
and the maximum reactive power demand;
Example: (1,04; 0,33)
underexcited
overexcited
Slope m
U_QDirect/U_C: reference voltage
for a reactive power exchange = 0
Displacement of the characteristic
by predefinition of U_QD/U_C
max. reactive power overexcited

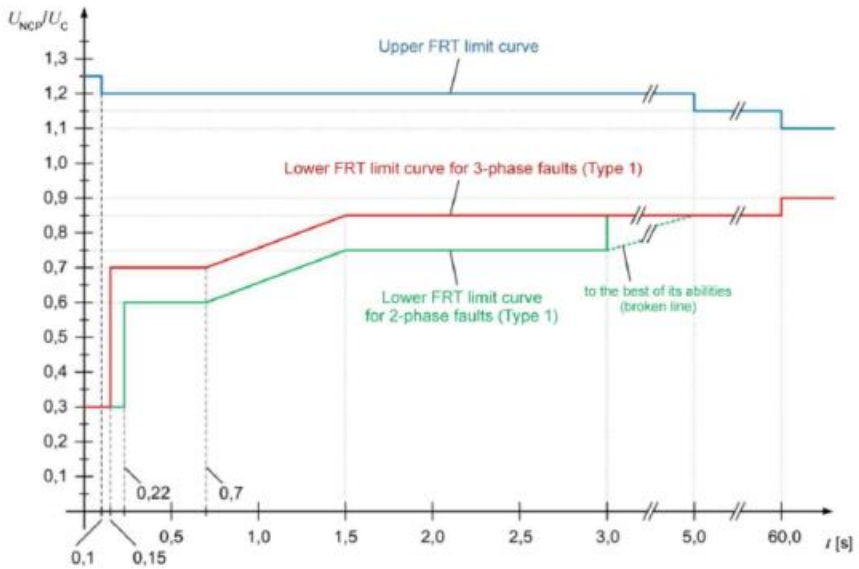
Annex 3


P5 (–1,00/0,33)
P4 (–0,9/0,33)
P3 (–0,6/0,05)
P2 (–0,5/0,0)
P1 (0,1/0,0)
Q/P b inst
P/P b inst
underexcited
overexcited
2 % tolerance band lower limit
2 % tolerance band upper limit
Characteristic set-point
permitted range


Q/P b inst
max. reactive power underexcited
max. reactive power overexcited
underexcited
overexcited
Displacement of the characteristic
by Q_ref/P_b inst = +2
Slope inA
Slope inB
P1
P2
P3
P4
U/U_c

Annex 3


Transfer
Location where the voltage is measured
U
P, Q
U actual
Where data lines are not available, the voltage may also be measured on the MV side, if the MV voltage drop is small
U actual
Determination of the Q set-point provision
Q set-point
Q actual
G
Fixed Q value controller
Parts of a demand facility with compensation
Measurement of actual Q values at an alternative point of compliance to be agreed with the network operator


U_NCP/U_C
1,3
1,2
1,1
1,0
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
Upper FRT limit curve
Lower FRT limit curve for 3-phase faults (Type 1)
Lower FRT limit curve for 2-phase faults (Type 1)
to the best of its abilities (broken line)
0,22
0,7
0,1
0,15
0,5
1,0
1,5
2,0
2,5
3,0
5,0
60,0
t [s]

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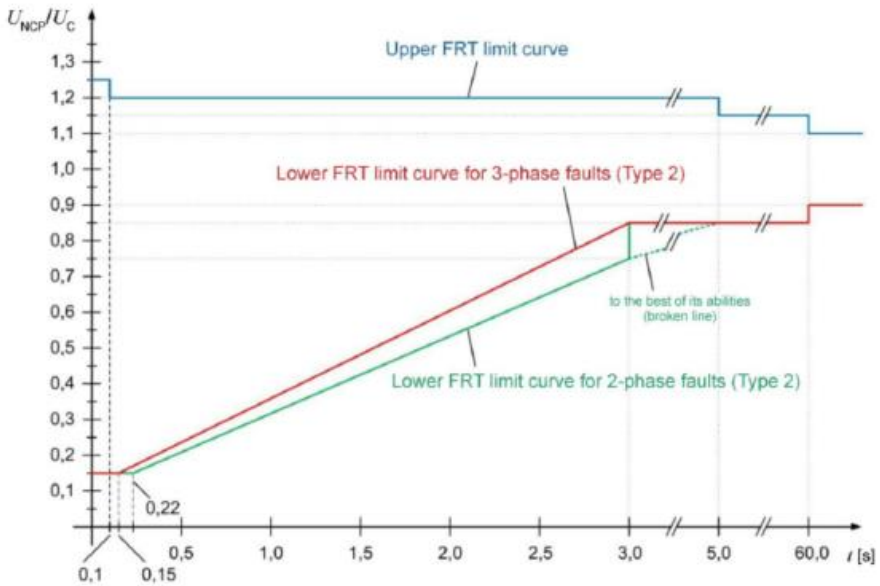
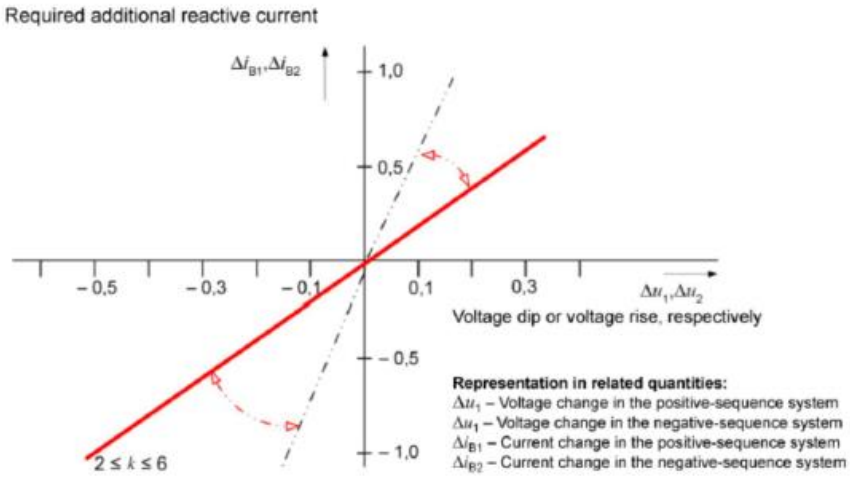
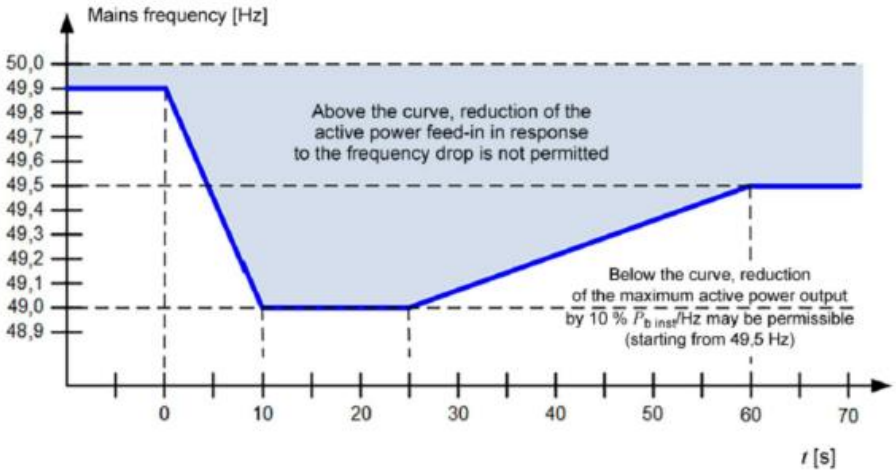

U_{NCP}/U_C
1,3
1,2
1,1
1,0
0,9
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
Upper FRT limit curve
Lower FRT limit curve for 3-phase faults (Type 2)
to the best of its abilities
(broken line)
Lower FRT limit curve for 2-phase faults (Type 2)
0,22
0,1
0,15
0,5
1,0
1,5
2,0
2,5
3,0
5,0
60,0
t [s]


Required additional reactive current
$\Delta i_{B1}, \Delta i_{B2}$
1,0
0,5
– 0,5
– 1,0
– 0,5
– 0,3
– 0,1
0,1
0,3
$\Delta u_1, \Delta u_2$
Voltage dip or voltage rise, respectively
$2 \le k \le 6$
Representation in related quantities:
Δu_1 – Voltage change in the positive-sequence system
Δu_1 – Voltage change in the negative-sequence system
Δi_{B1} – Current change in the positive-sequence system
Δi_{B2} – Current change in the negative-sequence system

Annex 3



		Type 1	Type 2	
		Power generating plants, storage units, and controllable appliances	Power generating plants and controllable appliances	Storage units
Uprating	Step response time in the event of a frequency reduction in the range of 49,8 Hz to 47,5 Hz	≤ 5 min for a $\Delta P \leq 20$ % of $P_{b\,inst}$	≤ 10 s for a $\Delta P \leq 50$ % of $P_{b\,inst}$	≤ 1 s for a $\Delta P \leq 100$ % of $P_{b\,inst}$
	Step response time in the event of a frequency reduction in the range of 51,5 Hz to 50,2 Hz	≤ 5 min for a $\Delta P \leq 20$ % of $P_{b\,inst}$ [a]		
	Settling time	≤ 6 min	≤ 30 s	≤ 10 s
Power reduction	Step response time in the event of a frequency rise in the range of 50,2 Hz to 51,5 Hz	≤ 8 s for a $\Delta P \leq 45$ % of $P_{b\,inst}$	≤ 2 s for a $\Delta P \leq 50$ % of $P_{b\,inst}$	≤ 1 s for a $\Delta P \leq 100$ % of $P_{b\,inst}$
	Step response time in the event of a frequency rise in the range of 47,5 Hz to 49,8 Hz			
	Settling time	≤ 30 s	≤ 20 s	≤ 10 s

[a] If the power has previously been reduced for overfrequency without adjusting the primary process (e.g. combustion capacity), then the subsequent uprating has to be done considerably quicker.

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Response the reactive current fulfill:
a) Anschwingzeit: $T_{an\_90\,\%} \leq 30$ ms;
b) Einschwingzeit: $T_{ein\ \Delta x} \leq 60$ ms.

Dynamic network support			
Parameter	Setting range	Setting step	Default value
Operation Mode	Full support / Zero current	--	Full support
K factor *VRT_K1, VRT_K2*	2 ...6	0.5	4
Entry threshold *StaticVL, StaticVH*	Upper bond: 0.8...1.0Un *StaticVH* Lower bond: 1.0...1.2Un *StaticVL*	0.01Un	Upper bond: 1.1Un *StaticVH* Lower bond: 0.9Un *StaticVL*

Function	Protection setting range	Recommended protection set values	
Rise-in-voltage protection $U>>$	1,00 to 1,30 u_n	1,20 U_c	300 ms
Rise-in-voltage protection $U>$	1,00 to 1,30 u_n	1,10 U_c [a]	180 s
Voltage reduction protection $U<$	0,10 to 1,00 u_n	0,80 U_c	2,7 s
QU protection ($Q \rightarrow$ and $U<$)	0,70 to 1,00 u_n	0,85 U_c	500 ms
[a] With a view to compliance with the voltage quality, values in excess of 1,1 U_c should not be set.			

Network event	Residual voltage in relation to U_{1min}	Duration [ms]	Interruption time
Double fault	≤ 0,3	140 ms to 160 ms	0,3 s to 2 s
	≤ 0,3	550 ms to 600 ms	20 s to 30 s
Standard fault	≤ 0,3	950 ms to 1 050 ms	20 s to 30 s
Double fault	≤ 0,3	140 ms to 160 ms	0,3 s to 2 s
	≤ 0,3	950 ms to 1 050 ms	

Die Vorgaben der VDE-AR-N 4110 und VDE-AR-N 4120 werden vollständig von den Produkten von Koyoe erfüllt.

The requirements of VDE-AR-N 4110 and VDE-AR-N 4120 are fully met by the products of Koyoe

8. quasi-stationären Betrieb
quasi-steady-state operation

Während des quasi-stationären Betriebs sollen die Kraftwerke in der Lage sein, sich mit dem Verteilnetz zu verbinden und dort gemäß den Vorgaben in Abbildung 4 zu arbeiten. Das gilt für den gesamten Frequenzbereich von 47,5 Hz bis 51,5 Hz sowie für Spannungen im Bereich von 85 % bis 115 % der Nennspannung (Uc) auf der Netzanschlusspunkts. Der quasi-stationäre Betrieb ist dabei definiert durch eine Spannungsänderung von weniger als 5 % Uc pro Minute und eine Frequenzänderung von weniger als 0,5 % der Nennfrequenz (fn) pro Minute.

During quasi-steady-state operation, the power generating plants shall be able to operate linked to the distribution network in compliance with the minimum time requirements given in Figure 4 over the full frequency range of 47,5 Hz to 51,5 Hz and for voltages in the range of 85 % Uc to 115 % Uc (r.m.s. values of the phase-to-phase voltage) at the network connection

Annex 3

point. The quasi-steady-state operation is defined by a voltage gradient of 5 % Uc/min and a frequency gradient of 0,5 % fn/min.

9. Q(U) Kennlinie

Q(U) characteristic

Reactive power-voltage character curve Q(U)			
Parameter	Setting range	Setting step	Default value
Reactive power node *(Q1-Q4)*	Q1: 0…0.6Pn Q2: -0.6Pn...0.6Pn Q3: -0.6Pn...0.6Pn Q4: -0.6Pn...0	0.01Pn	Q1: 0.44Pn Q2: 0 Q3: 0 Q4: -0.44Pn
Voltage node *(Voltage1-Voltage4)*	Voltage1: 0.93Un…1.00Un Voltage2: 0.95Un…1.00Un Voltage3: 1.00Un…1.05Un Voltage4: 1.00Un…1.07Un	0.01Un	Voltage1: 0.96Un Voltage2: 1.00Un Voltage3: 1.00Un Voltage4: 1.04Un
Settling time *3Tau*	6s…60s	1s	10s

Die Anforderungen werden durch die Koyoe-Produkte erfüllt.

It meets the requirements of Koyoe products.

10. Q(P) Kennlinie

Q(P) characteristic

Character curve Q(P)			
Parameter	Setting range	Setting step	Default value
Reactive Power Node (Q1-Q5)	Q1: -0.6Pn...0.6Pn Q2: -0.6Pn...0.6Pn Q3: -0.6Pn...0.6Pn Q4: -0.6Pn...0.6Pn Q5: -0.6Pn...0.6Pn	0.01Pn	Q1: 0 Q2: 0 Q3: -0.05Pn Q4: -0.33Pn Q5: -0.33Pn
Active Power Node (P1-P5)	P1: 0...1.0Pn P2: 0...1.0Pn P3: 0...1.0Pn P4: 0...1.0Pn P5: 0...1.0Pn	0.1Pn	P1: 0 P2: 0.5Pn P3: 0.6Pn P4: 0.9Pn P5: 1.0Pn
Settling time 3Tau	6s…60s	1s	10s

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c. Fixed Q

Fixed Q			
Parameter	Setting range	Setting step	Default value
Reactive power Q *React. Power*	-0.6Pn...0.6Pn	0.01Pn	Q=0
Reactive power Q in com loss condition	--	--	last set-point received
Settling time *3Tau*	6s...60s	1s	10s

If communication with plant controller or network operator interrupted over 1min, the reactive power maintain the last set-point received.

d. Fixed cosφ

Fixed cosφ			
Parameter	Setting range	Setting step	Default value
Displacement factor *Power Factor*	0.80ue...0.80oe	0.005	1.00
Displacement factor in com loss condition	--	--	last set-point received
Settling time *3Tau*	6s...60s	1s	10s

If communication with plant controller or network operator interrupted over 1min, the reactive power maintain the last set-point received.

Die Anforderungen werden durch die Koyoe-Produkte erfüllt.

It meets the requirements of Koyoe products.

11. PGU

Das PGU wurde so ausgelegt, dass die Anforderungen der VDE-AR-N 4110 und VDE-AR-N 4120 für die Erzeugungseinheit erfüllt werden können. Der Prototyp stellt eine wesentliche technische Weiterentwicklung bzw. Innovation dar.

The PGU have been designed so that the requirements of VDE-AR-N 4110 and VDE-AR-N 4120 for the power generating unit can be complied with. The prototype is an essential technical advancement or innovation.

Jiangsu Koyoe Energy Technology Co., Ltd.

Dr. Frank Wieland

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Annex 3

Declaration

Jiangsu Koyoe Energy Technology Co., Ltd. Power Conversion System The KY-PCS100KH-A and KY-PCS125KH-A power generation units can meet th e requirements of VDE-AR-N 4110/4120 for the electrical characteristics of the power generation units.

The technical parameters are as follows:

Model	KY-PCS100KH-A	KY-PCS125KH-A
Battery Data		
Operating Voltage Range[V]	700~950	
Number of battery	1	
Max. Charge/Discharge Current[A]	200/200	
Max. Charge/Discharge Power[A]	120000	150000
Battery type	Li-ion/Lead-acid	
AC Data(on-grid)		
Nominal Output Power[W]	100000	125000
Max. Apparent Power [VA]	110000	137000
Max Input Power[W]	110000	137000
Nominal Output Voltage[Vac]	380/400V,3L/N/PE	
Nominal Output Frequency[Hz]	50/60	
Max. Output Current[A]	160	200
Max. Three-phase Unbalanced Output Current[A]	160	200

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Power Factor	~1 (0.8 lead to 0.8 lag can be set)	
Total Harmonic Distortion[%]	<3	
AC Data(off-grid)		
Nominal Output Power[W]	100000	125000
Max. Apparent Power [VA]	110000	137000
Nominal Output Voltage[Vac]	380/400V,3L/N/PE	
Nominal Output Frequency[Hz]	50/60	
Max. Three-phase Unbalanced Output Current[A]	160	200
Max. Output Single-phase Apparent Power[VA]	37000	45000
Peak Output Apparent Power[VA](60s)	140000	140000
Peak Output Apparent Power[VA](10s)	150000	150000

We confirm that the above mentioned Power Conversion System are considered as Prototypes in accordance with the VDE-AR-N 4110/4120

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