TEST REPORT

UNE 217001

Tests for systems intended to avoid the energy transmission to the distribution network

Report reference number ..... :	**PVES2408WDG0290-2**
Date of issue ..... :	2024-11-01
Total number of pages ..... :	46
Testing laboratory name ..... :	**Bureau Veritas Consumer Products Services Germany GmbH**
Address ..... :	Businesspark A96, 86842 Türkheim, Germany
Accreditation ..... :	ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12024-03-00
Applicant's name ..... :	**Guangdong Felicity New Energy Co., Ltd.**
Address ..... :	(KongGangBaiYun)No. 2, Donghua Huaye Road, Renhe Town, Baiyun Area Guangzhou Guangdong P.R. China
Test specification	
Standard ..... :	UNE 217001:2020 Requirements and tests for systems intended to avoid the energy transmission to the distribution network
Test procedure ..... :	**Certificate of compliance**
Test report form number. ..... :	UNE217001
Master TRF ..... :	Bureau Veritas Consumer Products Services Germany GmbH
Test item description ..... :	**Photovoltaic (PV) and battery inverter**
Trademark ..... :	FelicityESS
Model / Type ..... :	T-REX-25KHP3G01, T-REX-29K9HP3G01, T-REX-30KHP3G01, T-REX-40KHP3G01, T-REX-50KHP3G01

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Ratings ..... :	**T-REX-25KHP3G01**	**T-REX-29K9HP3G01**	**T-REX-30KHP3G01**
Max. input DC voltage [V].....:	1000		
MPP DC voltage range [V] .....:	200-850		
Max. Input DC current [A].....:	36/36	36/36/36	36/36/36
Output AC voltage .....:	230Vac, 50Hz, 3L/N/PE		
Nominal. Output AC current [A].....:	36,3	43,4	43,5
Max. Output AC current [A] .....:	39,9	43,4	47,8
Rated Output power [kW].....:	25,0	29,9	30,0
Max. Output power [kVA].....:	27,5	29,9	33,0
Battery Voltage Range[V] .....:	160-800		
Max. Battery Current[A] .....:	50/50		

Ratings ..... :	**T-REX-40KHP3G01**	**T-REX-50KHP3G01**
Max. input DC voltage [V].....:	1000	
MPP DC voltage range [V] .....:	200-850	
Max. Input DC current [A].....:	36/36/36/36	
Output AC voltage .....:	230Vac, 50Hz, 3L/N/PE	
Nominal. Output AC current [A].....:	58,0	72,5
Max. Output AC current [A] .....:	63,8	79,7
Rated Output power [kW].....:	40,0	50,0
Max. Output power [kVA].....:	44,0	55,0
Battery Voltage Range[V] .....:	160-800	
Max. Battery Current[A] .....:	50/50	

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Testing Location .....:	**Guangdong Felicity New Energy Co., Ltd.**
Address.....:	(KongGangBaiYun)No. 2, Donghua Huaye Road, Renhe Town, Baiyun Area Guangzhou Guangdong P.R. China
Tested by (name and signature) .....:	Chason Ye **Chason Ye** PV Project Engineer Digitally signed by Chason Ye DN: cn=Chason Ye, o=Bureau Veritas Shenzhen Co., Ltd. Dongguan Branch, ou=New Energy, email=chason.ye@bureauveritas.com, c=CN Date: 2024.11.01 09:15:22 +08'00'
Approved by (name and signature) .....:	
Manufacturer's name .....:	**Guangdong Felicity New Energy Co., Ltd.**
Manufacturer address.....:	(KongGangBaiYun)No. 2, Donghua Huaye Road, Renhe Town, Baiyun Area Guangzhou Guangdong P.R. China
Factory name .....:	**Guangdong Felicity New Energy Co., Ltd.**
Factory address.....	(KongGangBaiYun)No. 2, Donghua Huaye Road, Renhe Town, Baiyun Area Guangzhou Guangdong P.R. China

Document History

Date	Internal reference	Modification / Change / Status	Revision
2024-11-01	Chason Ye	Initial report was written	0

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Test item particulars	
Equipment mobility ..... :	Permanent connection
Operating condition ..... :	Continuous
Class of equipment ..... :	Class I
Protection against ingress of water ..... :	IP65 according to EN 60529
Mass of equipment [kg] ..... :	Approx. 85,6kg

Possible test case verdicts	
- test case does not apply to the test object ..... :	N/A
- test object does meet the requirement ..... :	P (Pass)
- test object does not meet the requirement ..... :	F (Fail)

Testing	
Date of receipt of test item ..... :	2024-08-26
Date (s) of performance of tests ..... :	2024-08-26 to 2024-10-31

General remarks

The test results presented in this report relate only to the object(**s**) tested.

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"(see Annex #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.

Throughout this report a ☒ comma / ☐ point is used as the decimal separator.

This report consists of the following documents and/or enclosures

1. Test Report
2. Pictures of the unit – Annex No. 1
3. Test equipment list – Annex No. 2

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Copy of marking plate

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

FelicityESS™

T-REX-25KHP3G01	
Product Type	Hybrid Inverter
Protection Degree	IP65
Overvoltage-category	DC II; AC III
Ambient Temperture	–25°C~60°C,>50°C Derating
Warranty	5 years
Battery Input Data	
Battery Voltage Range	160~800Vd.c.
Max. Charging Current	50+50(A)
Max. Discharging Current	50+50(A)
PV String Input Data	
Max. DC Input Power	32.5 kW
Max. DC Input Voltage	1000Vd.c.
Min. DC Input Voltage	150Vd.c.
MPPT Range	200~850Vd.c.
Full Load DC Voltage Range	450~850Vd.c.
PV Input Current	36+36(A)
Max. PV Isc	55+55(A)
AC Output Data	
Rated AC Output Power	25 kW
Max. AC Output Power	27.5 kW
AC Output Rated Current	36.3 A
Max. AC Current	39.9 A
Rated AC Voltage	220/380,230/400 Vac(-20%~+15%)
AC Wiring Mode	L1/L2/L3/N/PE
Rated AC Frequency	50 /60 Hz(45~55Hz/55~65Hz)
Power Factor	0.8(leading) to 0.8(lagging)
Efficiency	
Max. Efficiency	97.60%
Euro Efficiency	97.00%
MPPT Efficiency	99.90%

RoHS

CAUTION:
- High Voltage,warning electric shock
- Keep the equipment well ventilated
- The capacitors store hazardous energy Do not touch while working!

Manufacturer:
Guangdong Felicity New Energy Co., Ltd
Address:
(KongGangBaiYun)No. 2, Donghua Huaye Road, Renhe Town, Baiyun Area, Guangzhou, Guangdong, P. R. CHINA

FelicityESS™

T-REX-29K9HP3G01	
Product Type	Hybrid Inverter
Protection Degree	IP65
Overvoltage-category	DC II; AC III
Ambient Temperture	–25°C~60°C,>50°C Derating
Warranty	5 years
Battery Input Data	
Battery Voltage Range	160~800Vd.c.
Max. Charging Current	50+50(A)
Max. Discharging Current	50+50(A)
PV String Input Data	
Max. DC Input Power	38.87 kW
Max. DC Input Voltage	1000Vd.c.
Min. DC Input Voltage	150Vd.c.
MPPT Range	200~850Vd.c.
Full Load DC Voltage Range	360~850Vd.c.
PV Input Current	36+36+36(A)
Max. PV Isc	55+55+55(A)
AC Output Data	
Rated AC Output Power	29.9 kW
Max. AC Output Power	29.9 kW
AC Output Rated Current	43.4 A
Max. AC Current	43.4 A
Rated AC Voltage	220/380,230/400 Vac(-20%~+15%)
AC Wiring Mode	L1/L2/L3/N/PE
Rated AC Frequency	50 /60 Hz(45~55Hz/55~65Hz)
Power Factor	0.8(leading) to 0.8(lagging)
Efficiency	
Max. Efficiency	97.60%
Euro Efficiency	97.00%
MPPT Efficiency	99.90%

RoHS

CAUTION:
- High Voltage,warning electric shock
- Keep the equipment well ventilated
- The capacitors store hazardous energy Do not touch while working!

Manufacturer:
Guangdong Felicity New Energy Co., Ltd
Address:
(KongGangBaiYun)No. 2, Donghua Huaye Road, Renhe Town, Baiyun Area, Guangzhou, Guangdong, P. R. CHINA

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FelicityESS™

T-REX-30KHP3G01

Product Type	Hybrid Inverter
Protection Degree	IP65
Overvoltage-category	DC II; AC III
Ambient Temperture	–25°C~60°C,>50°C Derating
Warranty	5 years
Battery Input Data	
Battery Voltage Range	160~800Vd.c.
Max. Charging Current	50+50(A)
Max. Discharging Current	50+50(A)
PV String Input Data	
Max. DC Input Power	39 kW
Max. DC Input Voltage	1000Vd.c.
Min. DC Input Voltage	150Vd.c.
MPPT Range	200~850Vd.c.
Full Load DC Voltage Range	360~850Vd.c.
PV Input Current	36+36+36(A)
Max. PV Isc	55+55+55(A)
AC Output Data	
Rated AC Output Power	30 kW
Max. AC Output Power	33 kW
AC Output Rated Current	43.5 A
Max. AC Current	47.9 A
Rated AC Voltage	220/380,230/400 Vac(-20%~+15%)
AC Wiring Mode	L1/L2/L3/N/PE
Rated AC Frequency	50 /60 Hz(45~55Hz/55~65Hz)
Power Factor	0.8(leading) to 0.8(lagging)
Efficiency	
Max. Efficiency	97.60%
Euro Efficiency	97.00%
MPPT Efficiency	99.90%

RoHS

CAUTION:
- High Voltage,warning electric shock
- Keep the equipment well ventilated
- The capacitors store hazardous energy Do not touch while working!

Manufacturer:
Guangdong Felicity New Energy Co., Ltd
Address:
(KongGangBaiYun)No. 2, Donghua Huaye Road, Renhe Town, Baiyun Area, Guangzhou, Guangdong, P. R. CHINA

FelicityESS™

T-REX-40KHP3G01

Product Type	Hybrid Inverter
Protection Degree	IP65
Overvoltage-category	DC II; AC III
Ambient Temperture	–25°C~60°C,>50°C Derating
Warranty	5 years
Battery Input Data	
Battery Voltage Range	160~800Vd.c.
Max. Charging Current	50+50(A)
Max. Discharging Current	50+50(A)
PV String Input Data	
Max. DC Input Power	52 kW
Max. DC Input Voltage	1000Vd.c.
Min. DC Input Voltage	150Vd.c.
MPPT Range	200~850Vd.c.
Full Load DC Voltage Range	360~850Vd.c.
PV Input Current	36+36+36+36(A)
Max. PV Isc	55+55+55+55(A)
AC Output Data	
Rated AC Output Power	40 kW
Max. AC Output Power	44 kW
AC Output Rated Current	58 A
Max. AC Current	63.8 A
Rated AC Voltage	220/380,230/400 Vac(-20%~+15%)
AC Wiring Mode	L1/L2/L3/N/PE
Rated AC Frequency	50 /60 Hz(45~55Hz/55~65Hz)
Power Factor	0.8(leading) to 0.8(lagging)
Efficiency	
Max. Efficiency	97.60%
Euro Efficiency	97.00%
MPPT Efficiency	99.90%

RoHS

CAUTION:
- High Voltage,warning electric shock
- Keep the equipment well ventilated
- The capacitors store hazardous energy Do not touch while working!

Manufacturer:
Guangdong Felicity New Energy Co., Ltd
Address:
(KongGangBaiYun)No. 2, Donghua Huaye Road, Renhe Town, Baiyun Area, Guangzhou, Guangdong, P. R. CHINA

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FelicityESS™

T-REX-50KHP3G01

Product Type	Hybrid Inverter
Protection Degree	IP65
Overvoltage-category	DC II; AC III
Ambient Temperture	–25°C~60°C,>50°C Derating
Warranty	5 years
Battery Input Data	
Battery Voltage Range	160~800Vd.c.
Max. Charging Current	50+50(A)
Max. Discharging Current	50+50(A)
PV String Input Data	
Max. DC Input Power	65 kW
Max. DC Input Voltage	1000Vd.c.
Min. DC Input Voltage	150Vd.c.
MPPT Range	200~850Vd.c.
Full Load DC Voltage Range	450~850Vd.c.
PV Input Current	36+36+36+36(A)
Max. PV Isc	55+55+55+55(A)
AC Output Data	
Rated AC Output Power	50 kW
Max. AC Output Power	55 kW
AC Output Rated Current	72.5 A
Max. AC Current	79.7 A
Rated AC Voltage	220/380,230/400 Vac(-20%~+15%)
AC Wiring Mode	L1/L2/L3/N/PE
Rated AC Frequency	50 /60 Hz(45~55Hz/55~65Hz)
Power Factor	0.8(leading) to 0.8(lagging)
Efficiency	
Max. Efficiency	97.60%
Euro Efficiency	97.00%
MPPT Efficiency	99.90%

RoHS

CAUTION:

- High Voltage,warning electric shock
- Keep the equipment well ventilated
- The capacitors store hazardous energy Do not touch while working!

Manufacturer:
Guangdong Felicity New Energy Co., Ltd

Address:
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Current Transducer



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General product information:

Hybrid inverter

358-S010005-02

FelicityESS™

USER GUIDE

T-REX-50KHP3G01
T-REX-40KHP3G01
T-REX-30KHP3G01
T-REX-29K9HP3G01
T-REX-25KHP3G01



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General product information:

Hybrid inverter

Appendix

Model	T-REX -50KHP3G01	T-REX -40KHP3G01	T-REX -30KHP3G01	T-REX -29K9HP3G01	T-REX -25KHP3G01
Battery Input Data					
Battery Type	LFP (LiFePO4)				
Battery Voltage Range	160~800Vd.c.				
Max. Charging Current	50+50(A)				
Max. Discharging Current	50+50(A)				
Number of battery input	2				
PV String Input Data					
Max. DC Input Power	65 kW	52 kW	39 kW	38. 87 kW	32. 5 kW
Max. DC Input Voltage	1000Vd.c.				
Min. DC Input Voltage	150Vd.c.				
Start-up Voltage	250Vd.c.				
Rated DC Input Voltage	600Vd.c.				
MPPT Range	200~850Vd.c.				
Full Load DC Voltage Range	450~850Vd.c.	360~850Vd.c.	360~850Vd.c.	360~850Vd.c.	450~850Vd.c.
PV Input Current	36+36+36+36(A)		36+36+36(A)		36+36(A)
Max. PV Isc	55+55+55+55(A)		55+55+55(A)		55+55(A)
No.of MPP Trackers	4		3		2
No.of Strings per MPP Tracker	2		2		2
AC Output Data					
Rated AC Output Power	50 kW	40 kW	30 kW	29. 9 kW	25 kW
Max. AC Output Power	55 kW	44 kW	33 kW	29. 9 kW	27. 5 kW
AC Output Rated Current	72.5 A	58 A	43. 5 A	43. 4 A	36.3 A
Max. AC Current	79.7 A	63.8 A	47. 9A	43. 4 A	39.9 A
Rated AC Voltage	220/380,230/400 Vac (-20%~+15%)				
AC Wiring Mode	3W+N+PE				
Rated AC Frequency	50 /60 Hz (45~55Hz/55~65Hz)				
THDI	<3% (At Rated Power)				
Power Factor	0.8(leading) to 0.8(lagging)				
Efficiency					
Max. Efficiency	97.60%				
Euro Efficiency	97.00%				
MPPT Efficiency	99.90%				

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Hybrid inverter

Protection	
PV Input Lightning Protection	Integrated
PV String Input Reverse Polarity Protection	Integrated
Battery Input Lightning Protection	Integrated
Battery Input Reverse Polarity Protection	Integrated
Insulation Resistor Detection	Integrated
Residual Current Monitoring Unit	Integrated
Output Over Current Protection	Integrated
Output Shorted Protection	Integrated
Output Over Voltage Protection	Integrated
Anti-islanding Protection	Integrated
AC Output Lightning Protection	Integrated
Certification and Standards	
Grid Regulation	NRS 097-2-1,VDE4105,EN50549-1,AS 4777.2, G99/1,CEI 0-21,NC.RFG
Safety EMC / Standard	IEC/EN 61000-6-1/2/3/4,IEC/EN 62109-1,IEC/EN 62109-2
General Data	
Net Weight	85.6KG
Gross Weight	98.4KG
Product Dimension	940*582*340mm
Package Dimension	1110*770*463mm
Protection Degree	IP65
Operating Temperature Range	-25 to 60 ℃ (> 50 ℃ derating)
Humidity	0 ~ 95 % (No condensation)
Cooling	Smart cooling
Altitude	3000 m (> 2000 m derating)
Communication with BMS	RS485,CAN
Monitor module	WiFi/GPRS
Installation Style	Wall-mounted
Warranty[1]	10 years
[1]Conditions apply, refer to FelicityESS Warranty policy.	

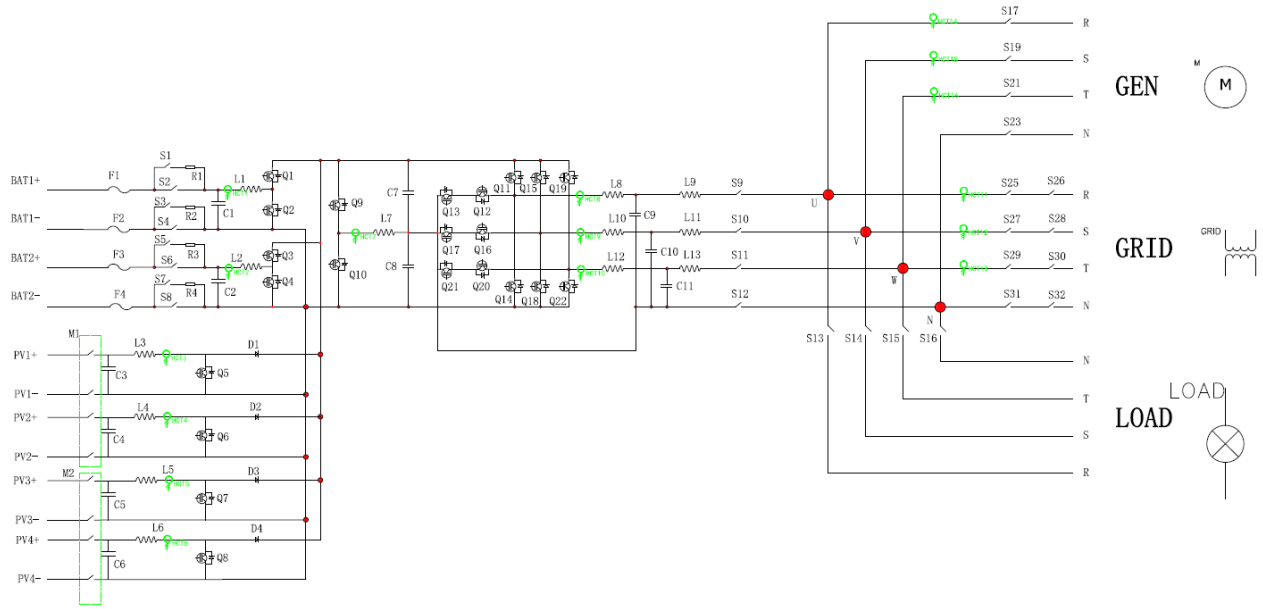


Figure 1 – Block diagram

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Description of the differences of the models within a series:

The PGUs including model T-REX-25KHP3G01, T-REX-29K9HP3G01, T-REX-30KHP3G01, T-REX-40KHP3G01 and T-REX-50KHP3G01. All the models use the same control unit, control system, software, and similar hardware platform. The different powers are realized by software derating. The model T-REX-25KHP3G01 is equipped with two DC inputs and with two MPP trackers. The models T-REX-29K9HP3G01 and T-REX-30KHP3G01 are equipped with two DC inputs and with three MPP trackers. The models T-REX- 40KHP3G01 and T-REX-50KHP3G01 are equipped with two DC inputs and with four MPP trackers.

The product was tested on:

Model:	T-REX-50KHP3G01	Serial number:	10020200824350074



Hardware version: V100

Master DSP Software (FW) version: V201
Slave DSP Software (FW) version: V101
All tests were performed on photovoltaic (PV) and battery inverter T-REX-50KHP3G01 with the current sensor H012 AKH-0.66/K-36. Tests of the EUT of T-REX-50KHP3G01 not applicable for the models T-REX-25KHP3G01, T-REX-29K9HP3G01, T-REX-30KHP3G01 and T-REX- 40KHP3G01 were performed on the concerned models and a statement is given at the relevant test.

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1) Basic outline of the system	Informative

Application Scenarios

Scheme of Single machine photovoltaic power generation system: Photovoltaic (PV) and battery inverter + Current Transducer

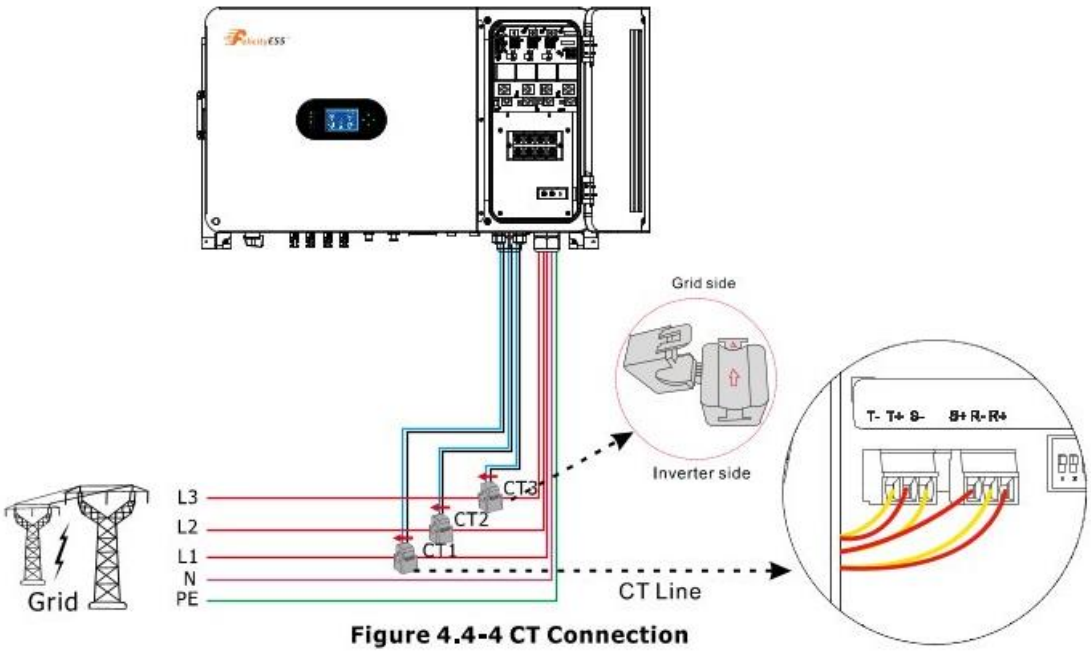


Figure 4.4-4 CT Connection

Note: CT Description
1. The default transformation ratio for CT is 3000:1
2. The default range of CT is 300A

Figure 2 –Scheme of Single machine photovoltaic power generation system (CT Connection)

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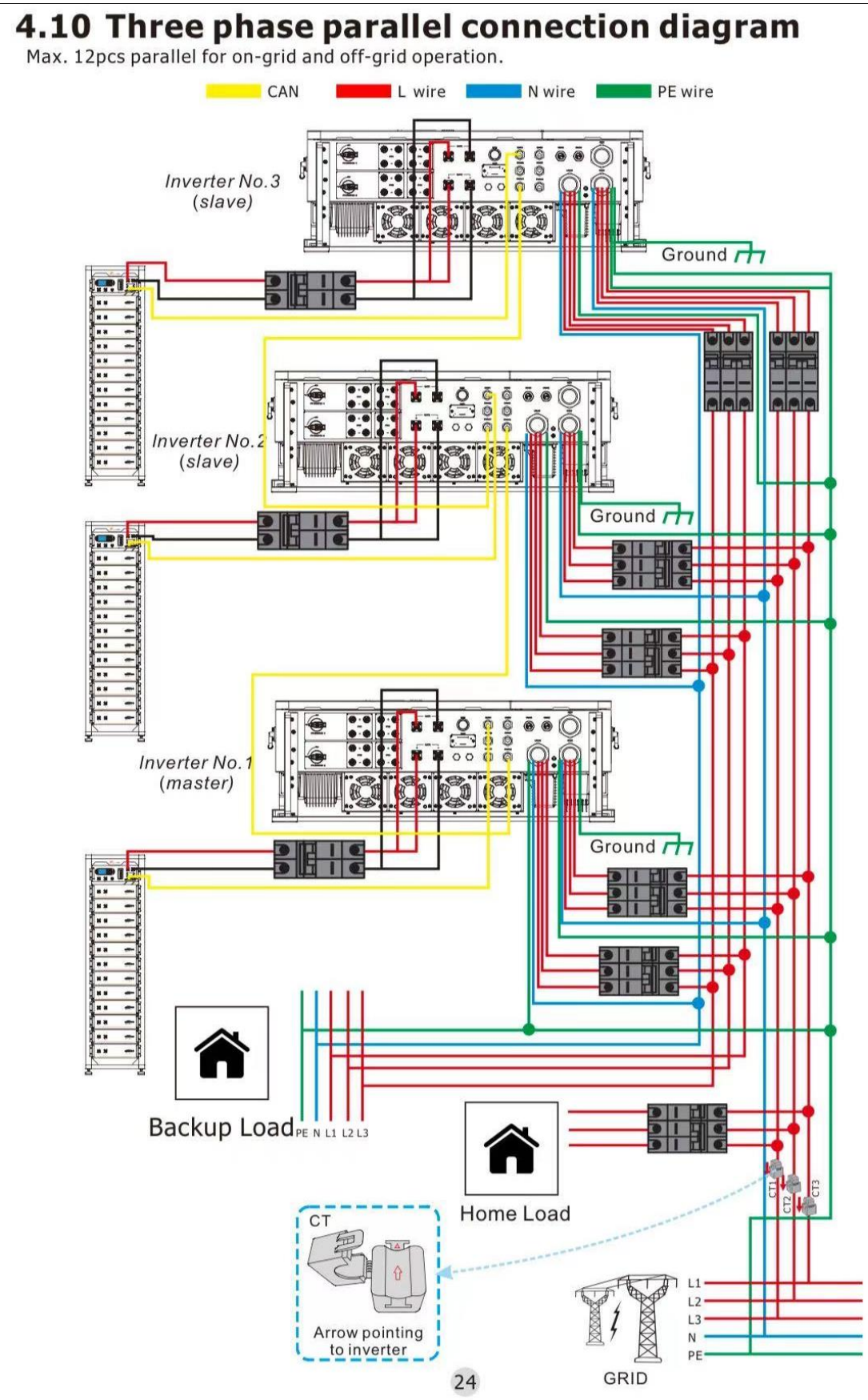


Figure 3 -Scheme of parallel photovoltaic power generation system

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2) Power analyzer and class of measurement transformers for power measurement.		**Informative**
Current Transducer		
Model:		AKH-0.66/K-Φ50-FLS
Primary nominal rms current	:	300A
Output current @Ipn	:	100mA
Accuracy level	:	0,5
AC withstand voltage	:	3000V/1min 50Hz
Connecting wires of secondary winding	:	Red and black wire 2C*22AWG
Working Voltage	:	AC 660V 50-60Hz
Working altitude	:	≤3000m
Working temperature	:	-30°C ~+70°C

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3) Control element.	Informative

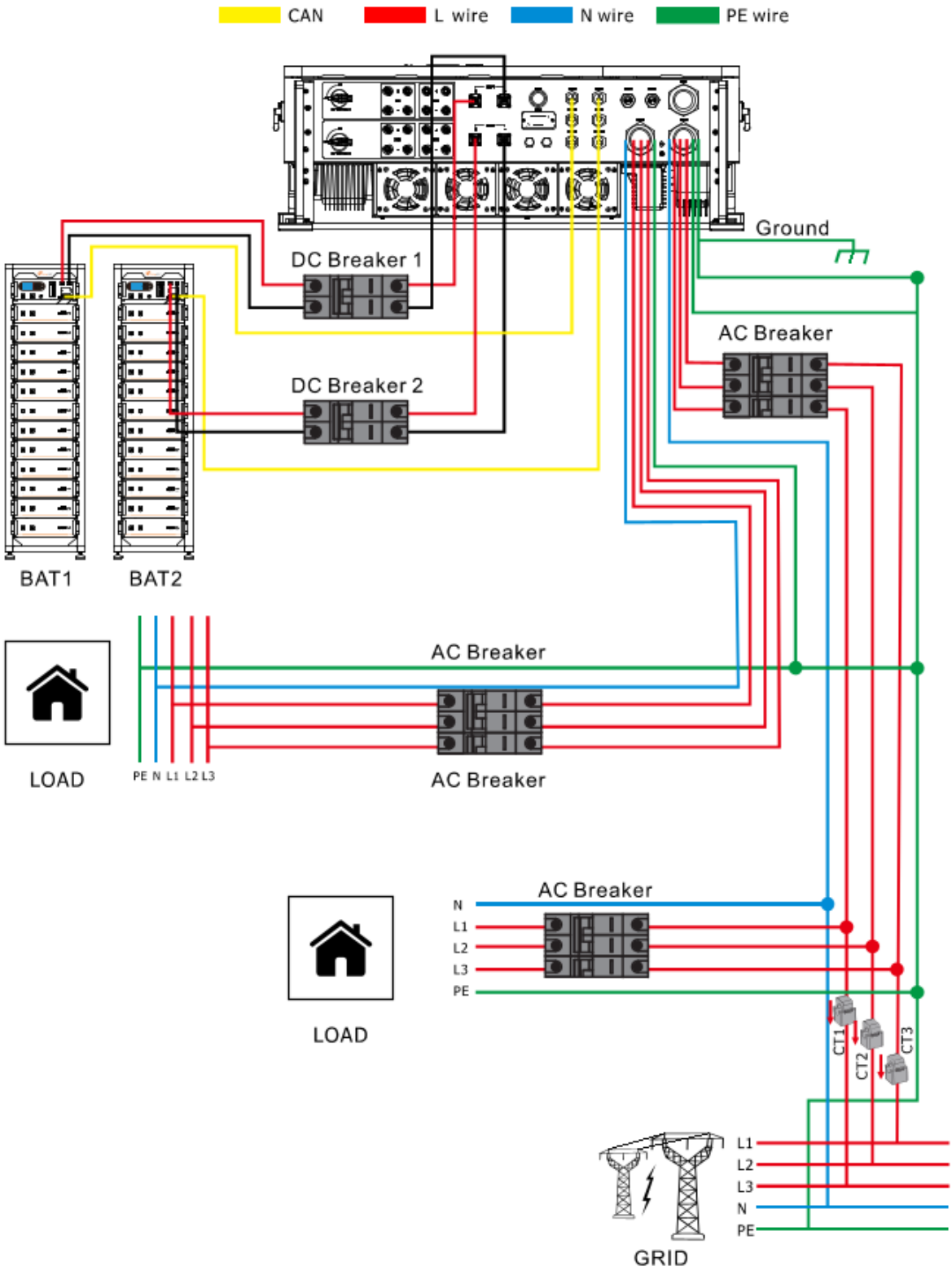


Figure 4 – Scheme of typical installation

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4) Type of communications used between the different elements.	**Informative**
Inverter and Current Transducer	
Inverter:	T-REX-50KHP3G01
Current sensor:	AKH-0.66/K-Φ50-FLS

5) Type generators for which the system is valid.	**Informative**
Following Generators are Valid for the System:	
Inverter: T-REX-25KHP3G01, T-REX-29K9HP3G01, T-REX-30KHP3G01, T-REX-40KHP3G01, T-REX-50KHP3G01	
Comment: The test have been Performed on the T-REX-50KHP3G01.	

6) Power of the type generator tested and generators / analyser's assimilated.	**Informative**
Note: The power rating of the generators can be found on page 2. The technical data of the current transducer can be found on page 14.	

7) Control algorithm	**Informative**

The control algorithm of the system is described as follows:

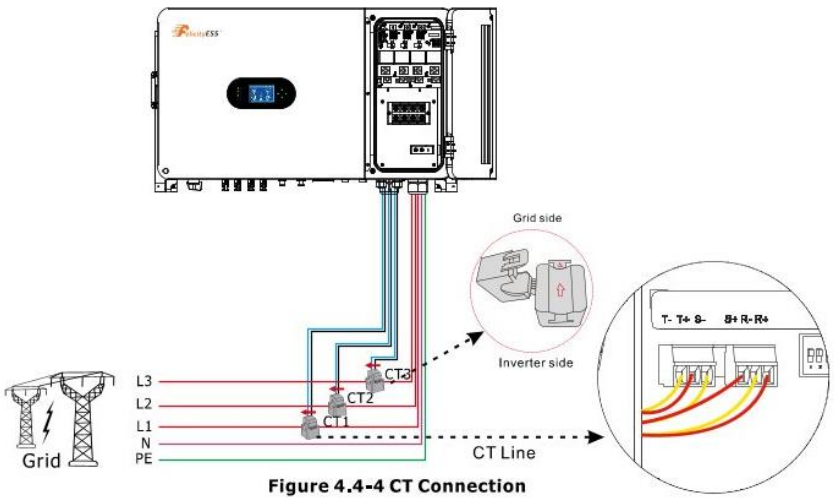


Figure 4.4-4 CT Connection

Note: CT Description
1. The default transformation ratio for CT is 3000:1
2. The default range of CT is 300A

The inverter provides following operation modes:

- Unlimited operation

  No power supply limitation. The inverter products power depending on available primary energy.
- Limited power operation

  Output power of the inverter is controlled:

  power injection to the grid lower ≤ defined power set point at the interconnection point
- Zero power injection

  Output power of the inverter is controlled. Energy generation and consumption balance at the interconnection point can be achieved. No power injection into grid.

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8) Electric characteristics of the generator	**Informative**
Note: The electric characteristics of the generators can be found on page 2.	
9) Maximum number of generators to be connected	**Informative**
Note: The maximum number of generators is based on the test result tr and local installation requirements.	

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4. Test	P
4.1 Tolerance in permanent mode	P

a) Test 1 (Scheme of Single machine photovoltaic power generation system, see Figure 3)

Connection scheme:	Phase 1	Phase 2	Phase 3	Test 1	Test 2	Test 3	Result
Three Phase	P_{inv}%	P_{inv}%	P_{inv}%	P_{Grid} [kW]	P_{Grid} [kW]	P_{Grid} [kW]	
	90-100	90-100	90-100	-0,056	-0,141	-0,112	P
	10-20	10-20	10-20	-0,112	-0,114	-0,112	P
	0	0	0	-0,123	-0,124	-0,123	P
	90-100	60-70	60-70	-5,019	-4,922	-5,047	P
	60-70	60-70	60-70	-0,080	-0,111	-0,102	P
	30-40	60-70	60-70	-10,020	-10,035	-10,028	P
	0	60-70	60-70	-21,674	-21,680	-21,679	P

Test procedure:

The test must be repeated with the different type generators that are going to be approved for the system, each of them being able to be tested separately.

To verify this condition, the following test is carried out, following the scheme shown in the different figures:

1 Connect the generator to an energy source capable of supplying a power equal to or greater than the power of the generator to be tested.

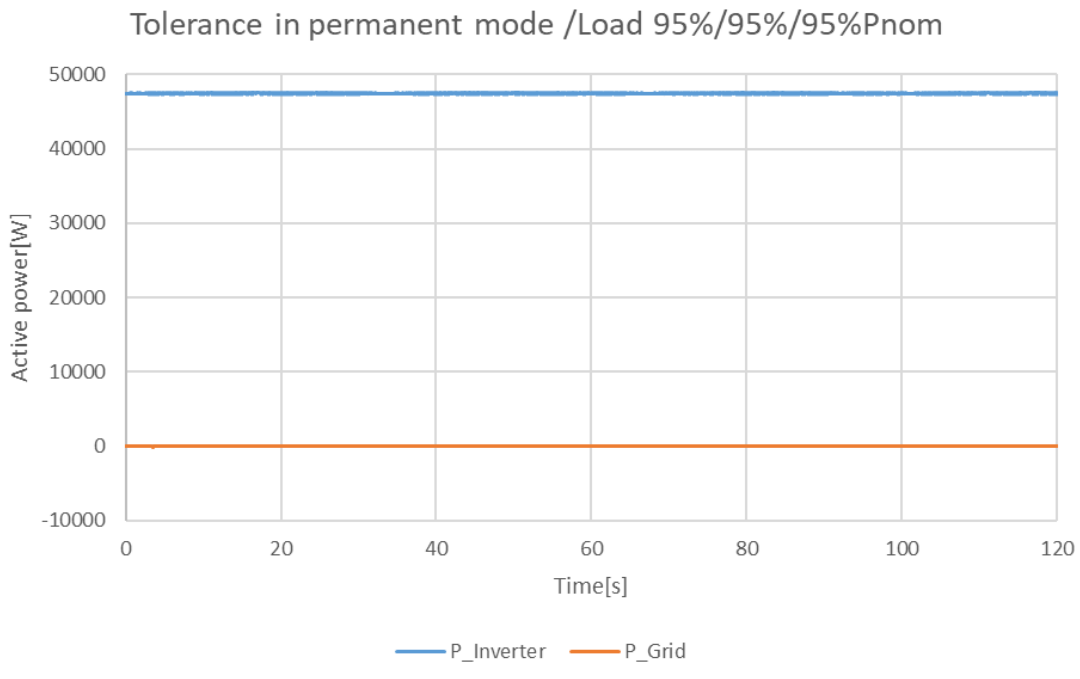
2 Connect the generator to the grid to be tested.

3 Set the load value according to the values indicated in Table 1.

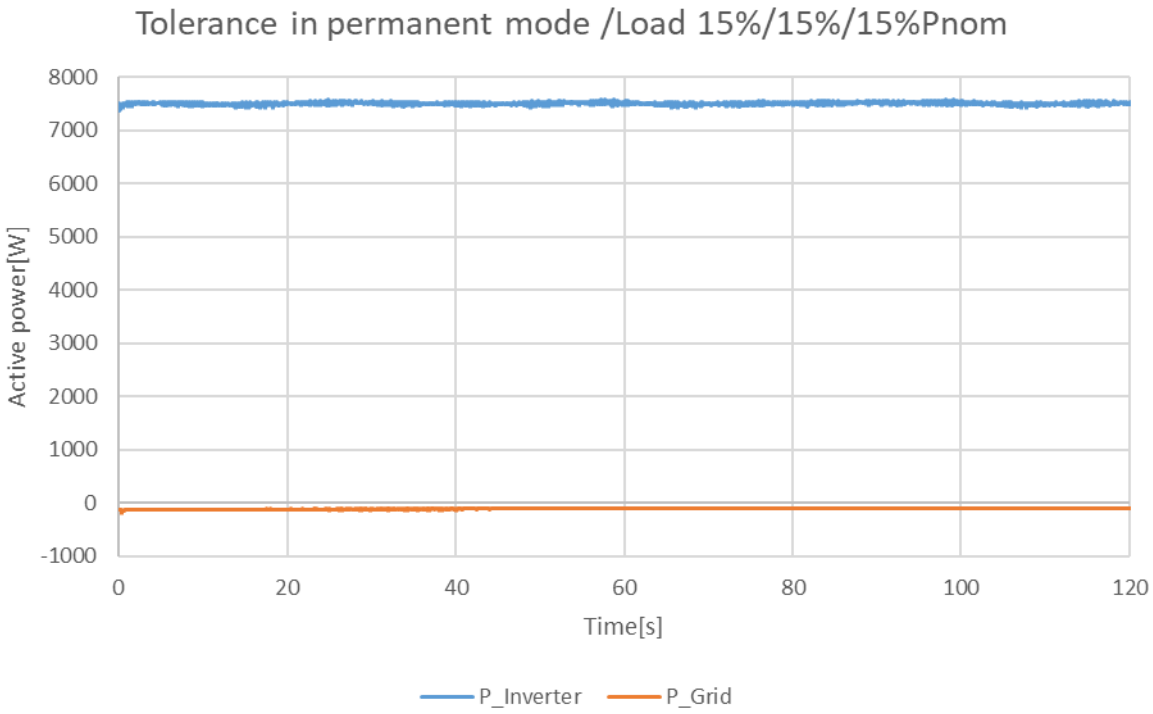
4 Wait a time of at least two seconds before starting the measurement.

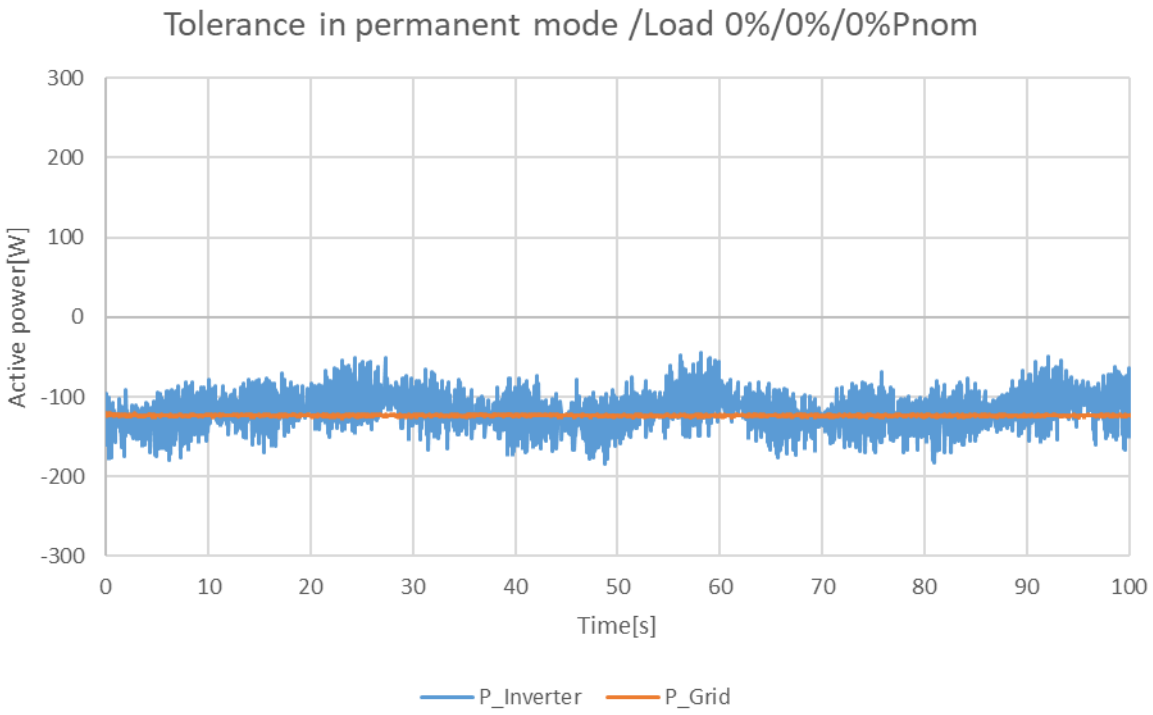
5 Measure the power exchanged at the test point, with an uncertainty better than or equal to 0.5% + 25 W, making measurements every 50 ms.

Graph of power gradient:

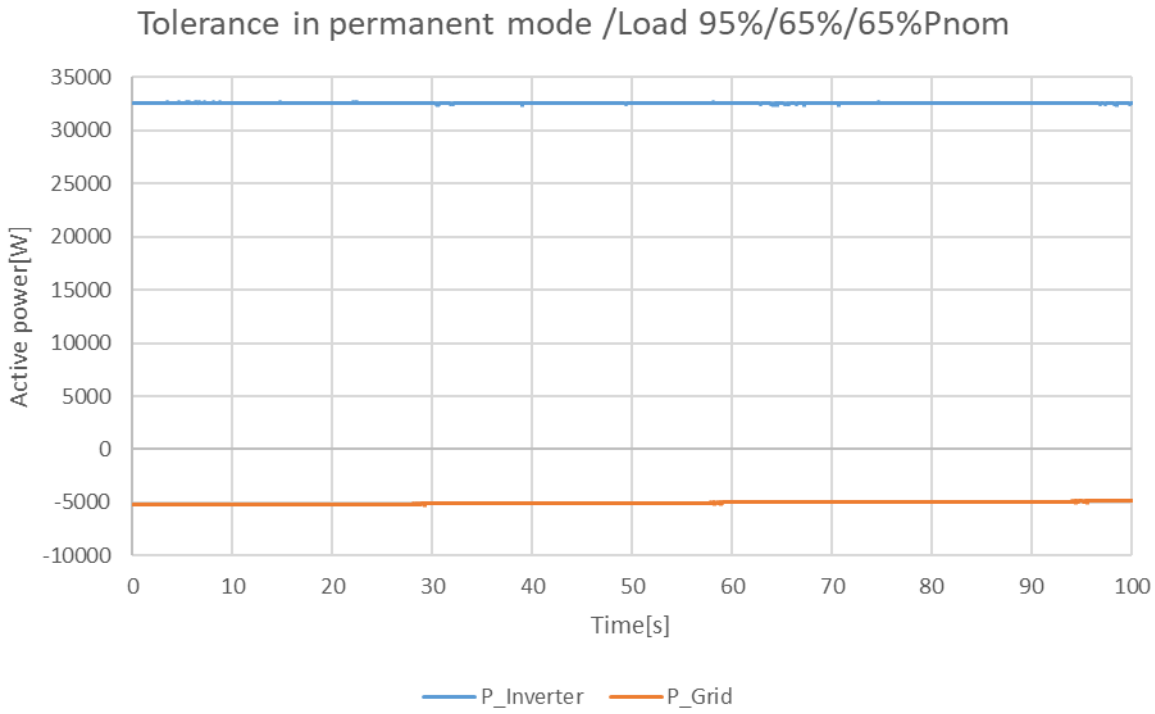


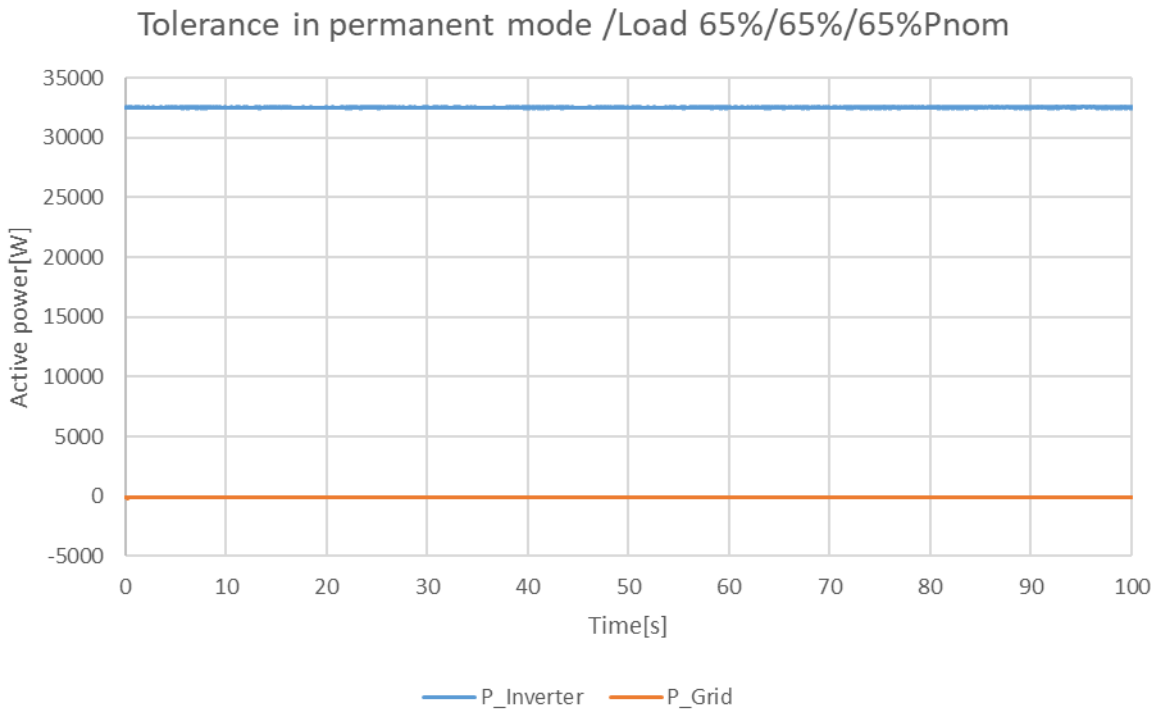
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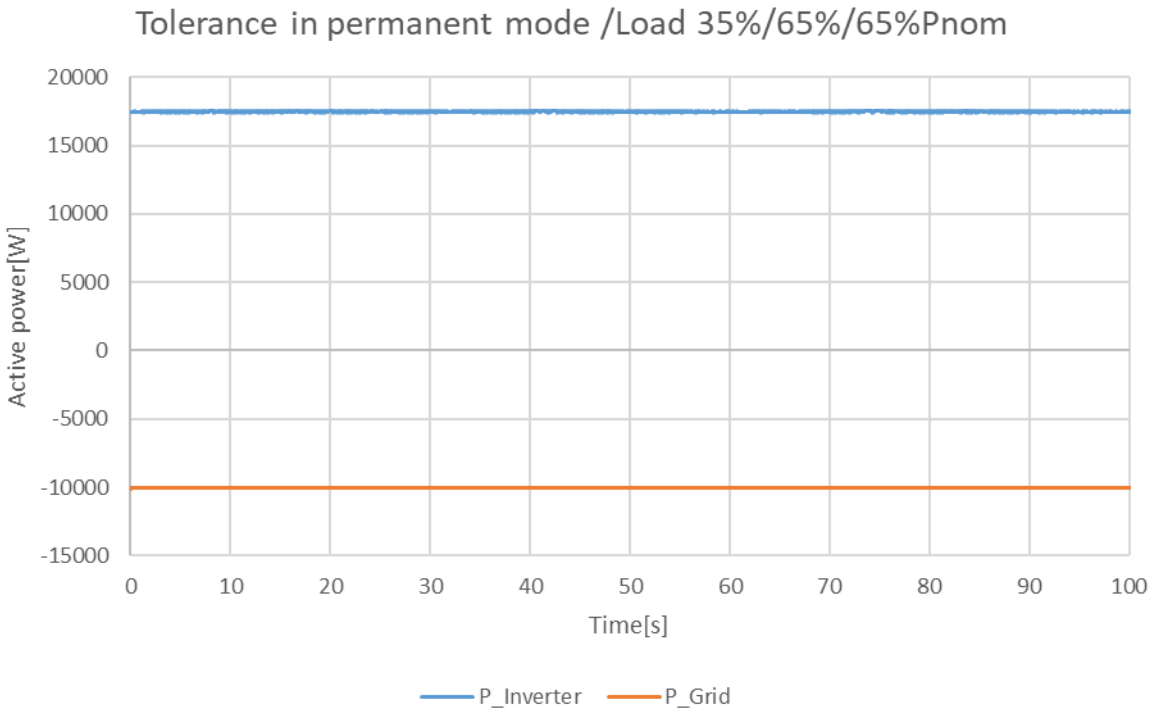


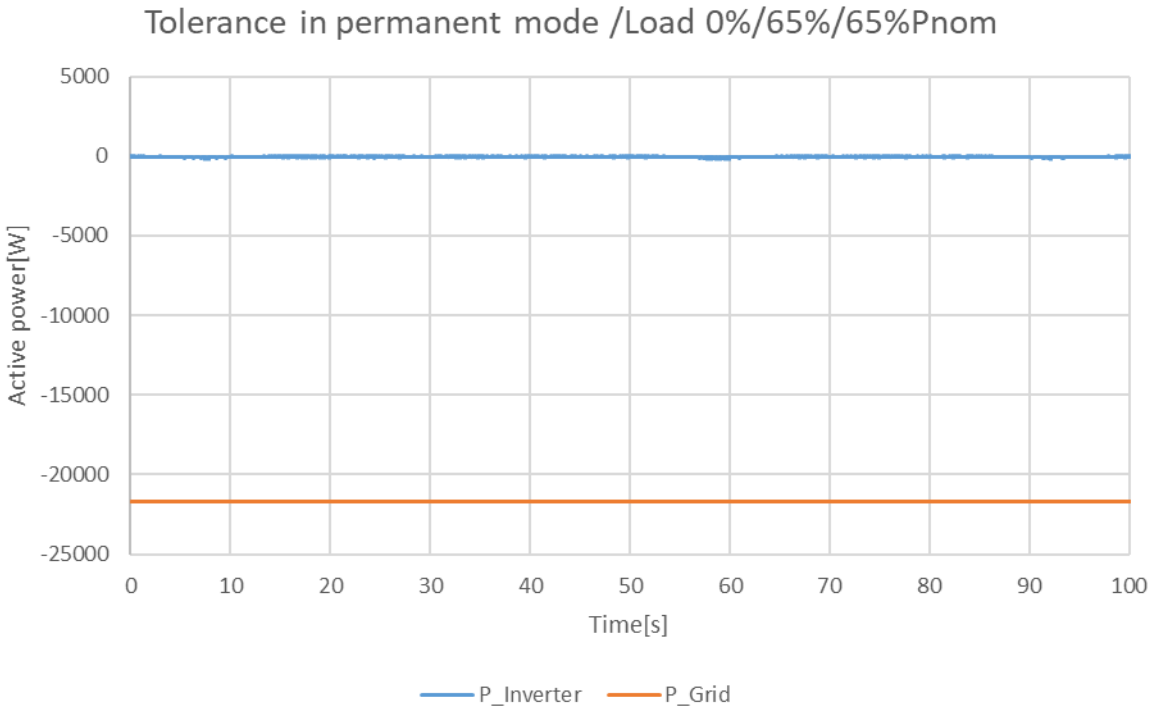
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b) Test 2 (Parallel operation with two inverters, see Figure 4)

Connection scheme:	Phase 1	Phase 2	Phase 3	Test 1	Test 2	Test 3	Result
Three Phase	P_{inv}%	P_{inv}%	P_{inv}%	P_{Grid} [kW]	P_{Grid} [kW]	P_{Grid} [kW]	
	90-100	90-100	90-100	-0,056	-0,084	-0,065	P
	10-20	10-20	10-20	-0,144	-0,131	-0,134	P
	0	0	0	-0,136	-0,135	-0,135	P

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	90-100	60-70	60-70	-5,098	-5,055	-4,933	P
	60-70	60-70	60-70	-0,134	-0,063	-0,205	P
	30-40	60-70	60-70	-10,012	-10,028	-9,728	P
	0	60-70	60-70	-21,743	-21,738	-21,730	P

Test procedure:

The test must be repeated with the different type generators that are going to be approved for the system, each of them being able to be tested separately.

To verify this condition, the following test is carried out, following the scheme shown in the different figures:

1 Connect the generator to an energy source capable of supplying a power equal to or greater than the power of the generator to be tested.

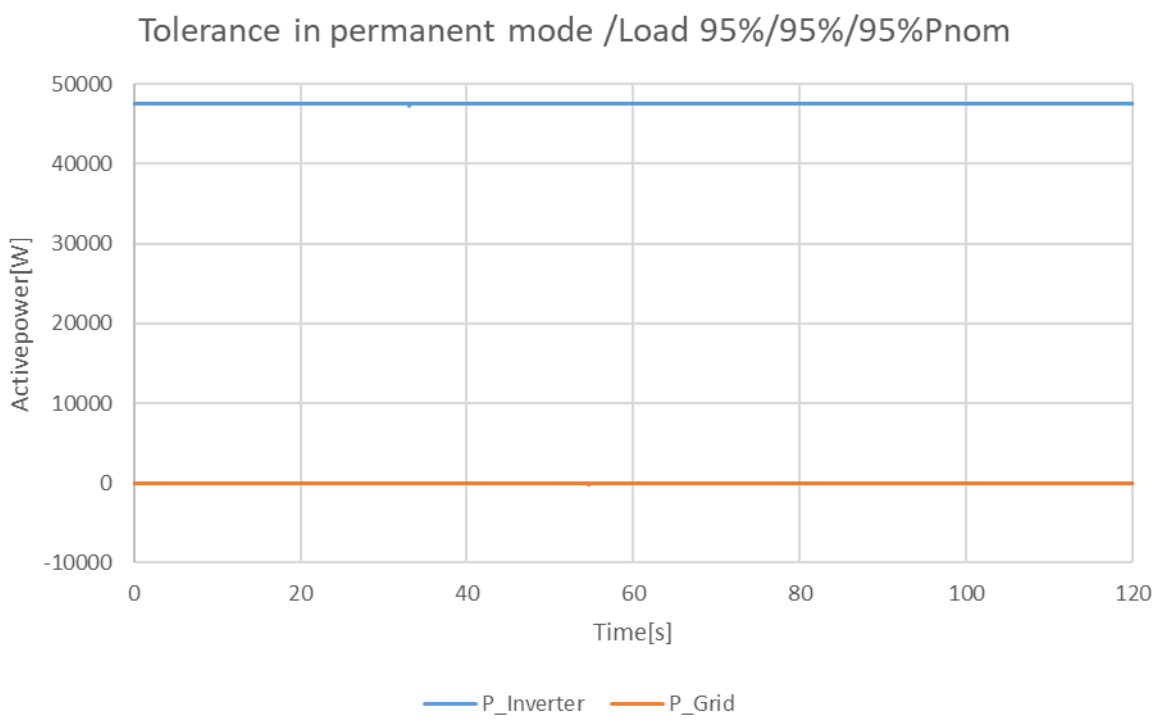
2 Connect the generator to the grid to be tested.

3 Set the load value according to the values indicated in Table 1.

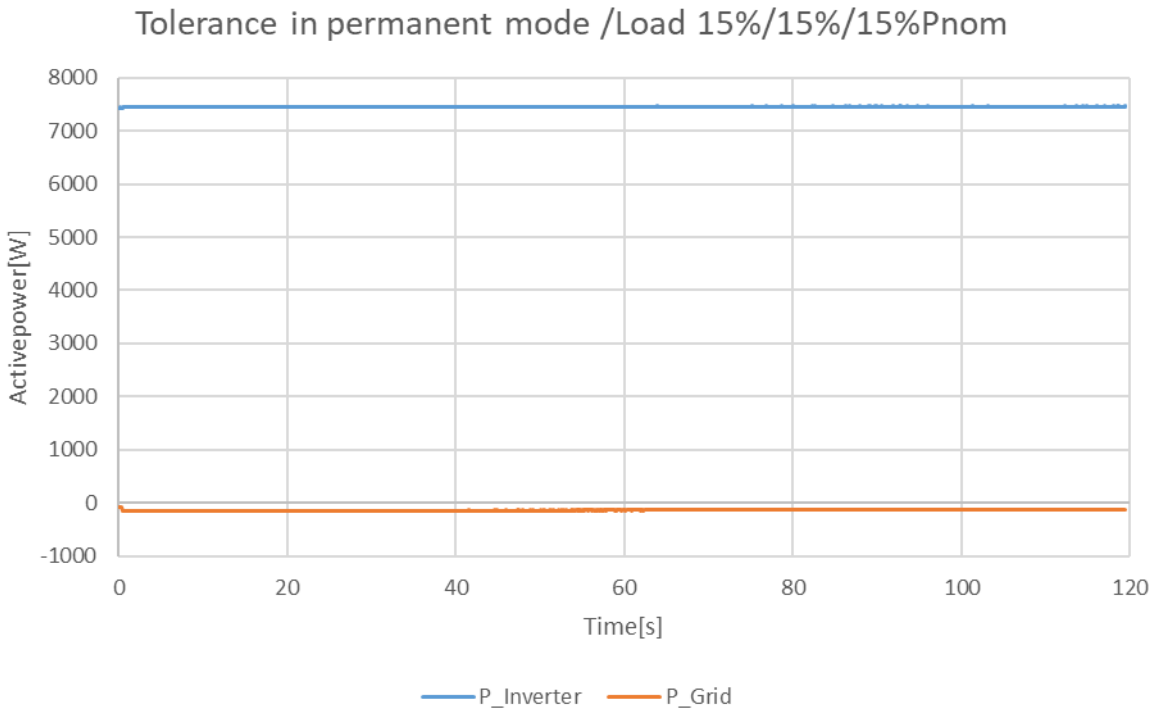
4 Wait a time of at least two seconds before starting the measurement.

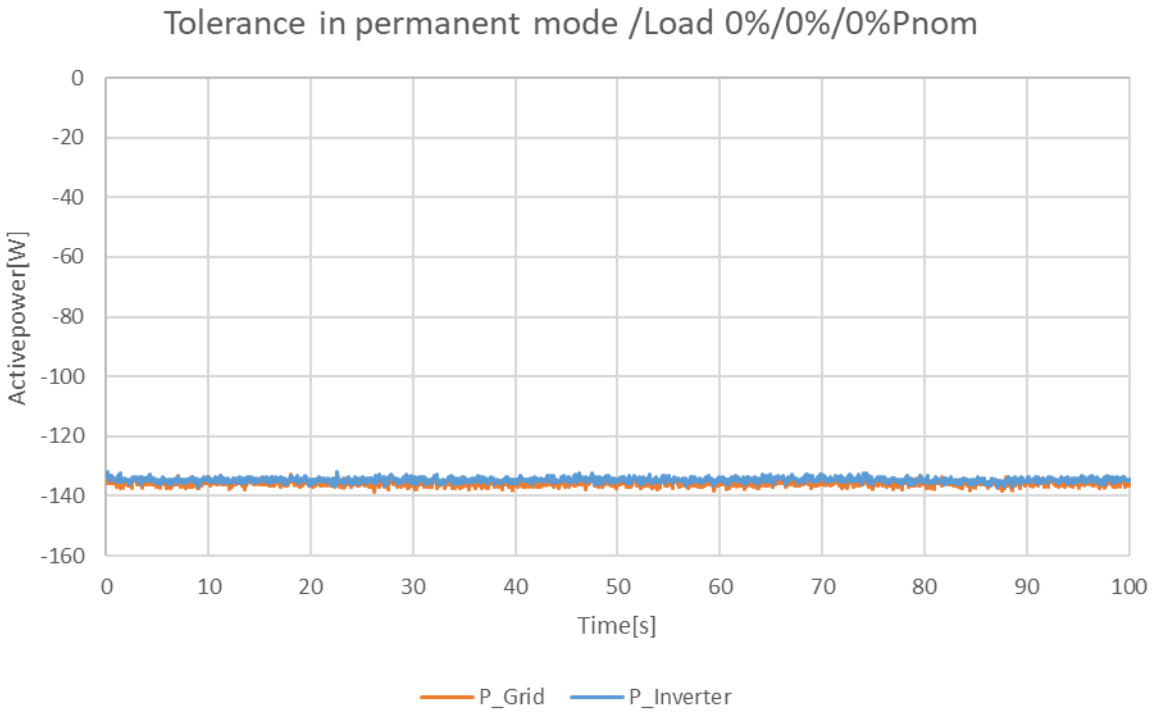
5 Measure the power exchanged at the test point, with an uncertainty better than or equal to 0.5% + 25 W, making measurements every 50 ms.

Graph of power gradient:

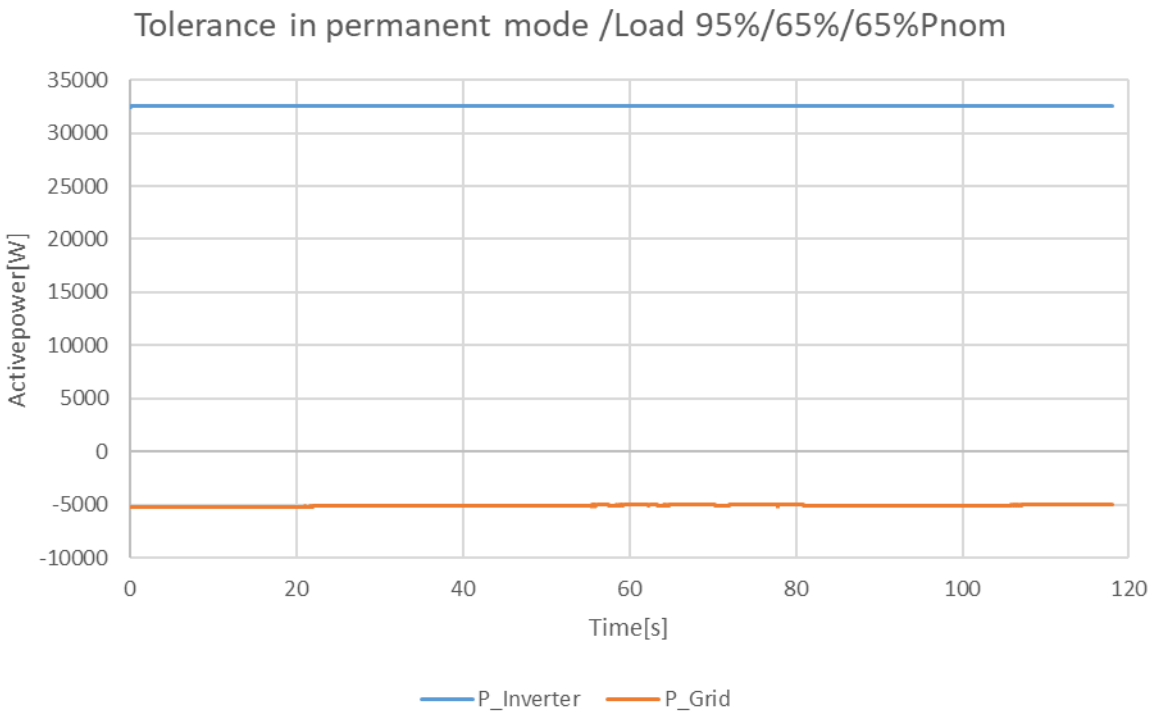


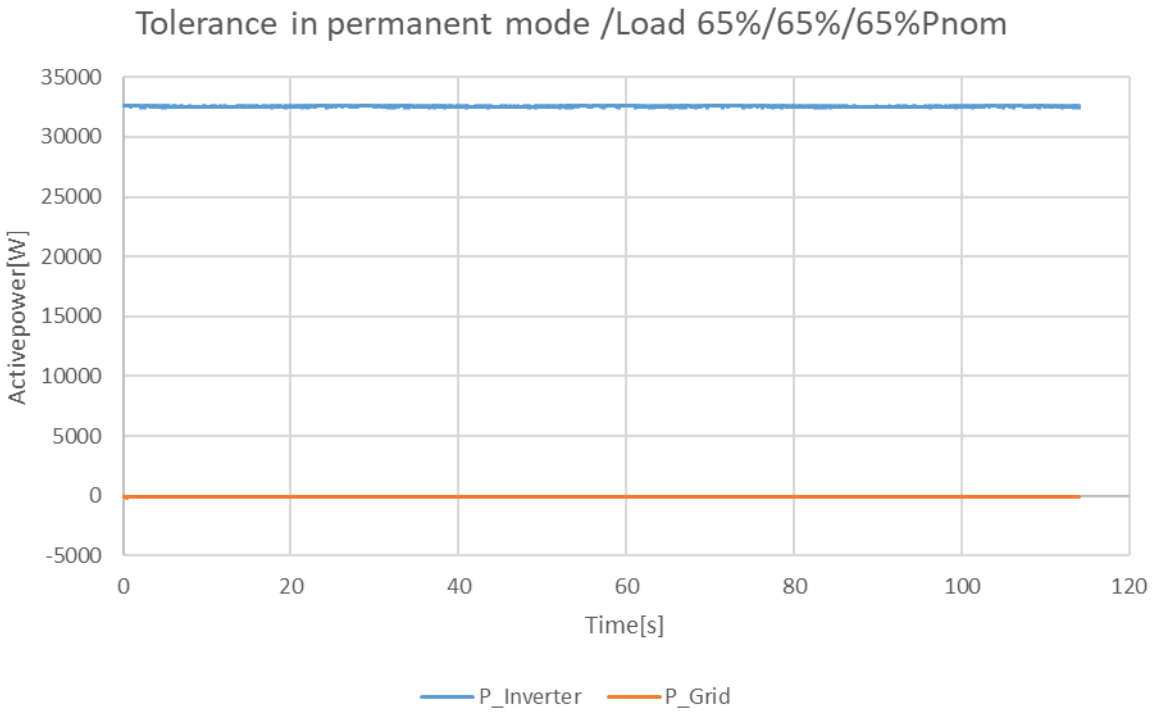
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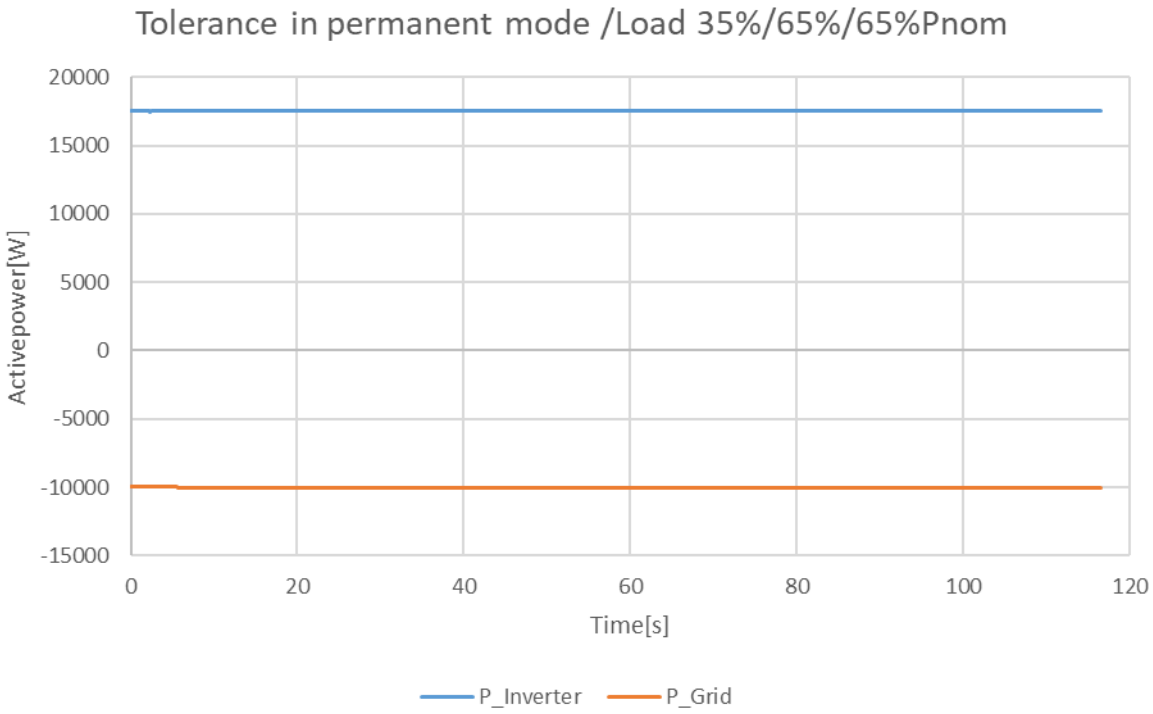


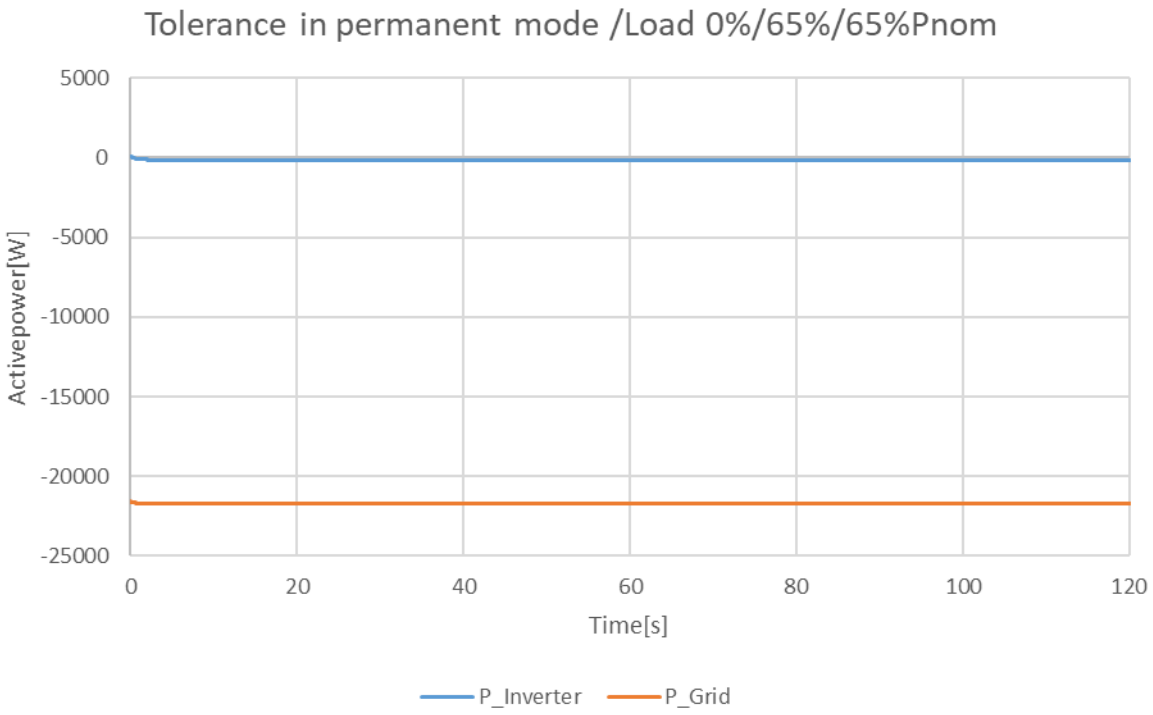
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Assessment criterion:

For adjustable PGUs:

The power limitation system must guarantee that before a load disconnection, the generator readjusts its production, reaching the permanent regime again in less than t_a(the required time of action).

Note:

The tests had been performed on the T-REX-50KHP3G01 are valid for the T-REX-25KHP3G01, T-REX-29K9HP3G01, T-REX-30KHP3G01 and T-REX-40KHP3G01 since it is almost same as in hardware and just power derated by software.

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4.2 Response to load disconnections						P
a) Test 1 (Scheme of Single machine photovoltaic power generation system, see Figure 3)						
TEST	Initial load	Final load	Test 1	Test 2	Test 3	Result
	P_{inv}%	P_{inv}%	Response time in sec.	Response time in sec.	Response time in sec.	
1	90-100%	60-70%	0,95	0,95	1,00	P
2	90-100%	30-40%	1,50	1,35	1,45	P
3	90-100%	0-5%	1,55	1,60	1,50	P
4	60-70%	30-40%	1,20	1,05	1,05	P
5	60-70%	0-5%	1,45	1,55	1,60	P
6	30-40%	0-5%	1,45	1,15	1,25	P

Test procedure:

The test must be repeated with the different type generators that are going to be approved for the system, each of them being able to be tested separately.

To verify this condition, the following test is performed with the following sequence:

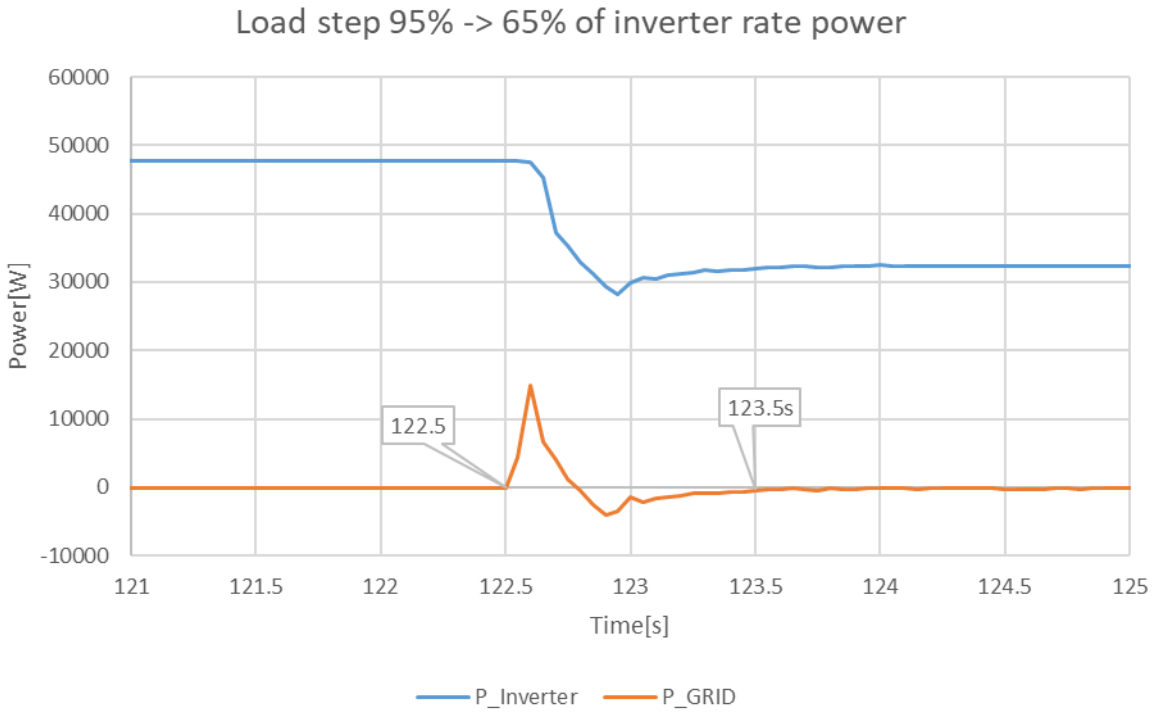
1 Connect the generator to a power source that feeds the generator and that is capable of supplying a power equal to or greater than the power of the generator to be tested.

2 Connect the generator to the grid to be tested.

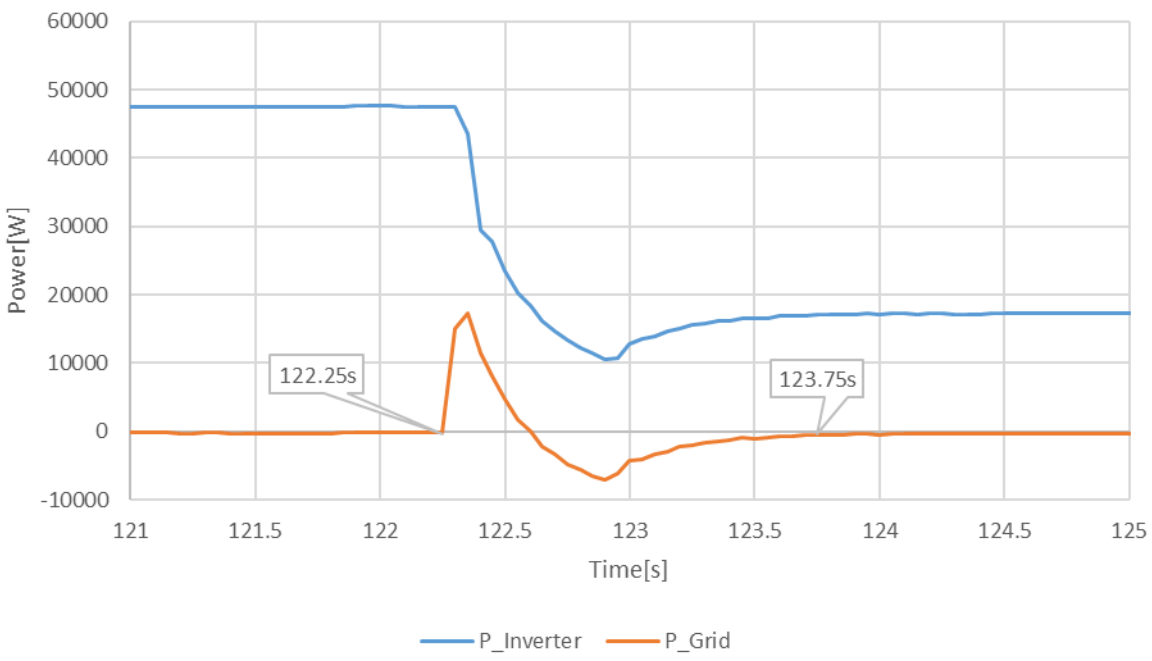
3 Perform the load disconnections proposed in Table 2.

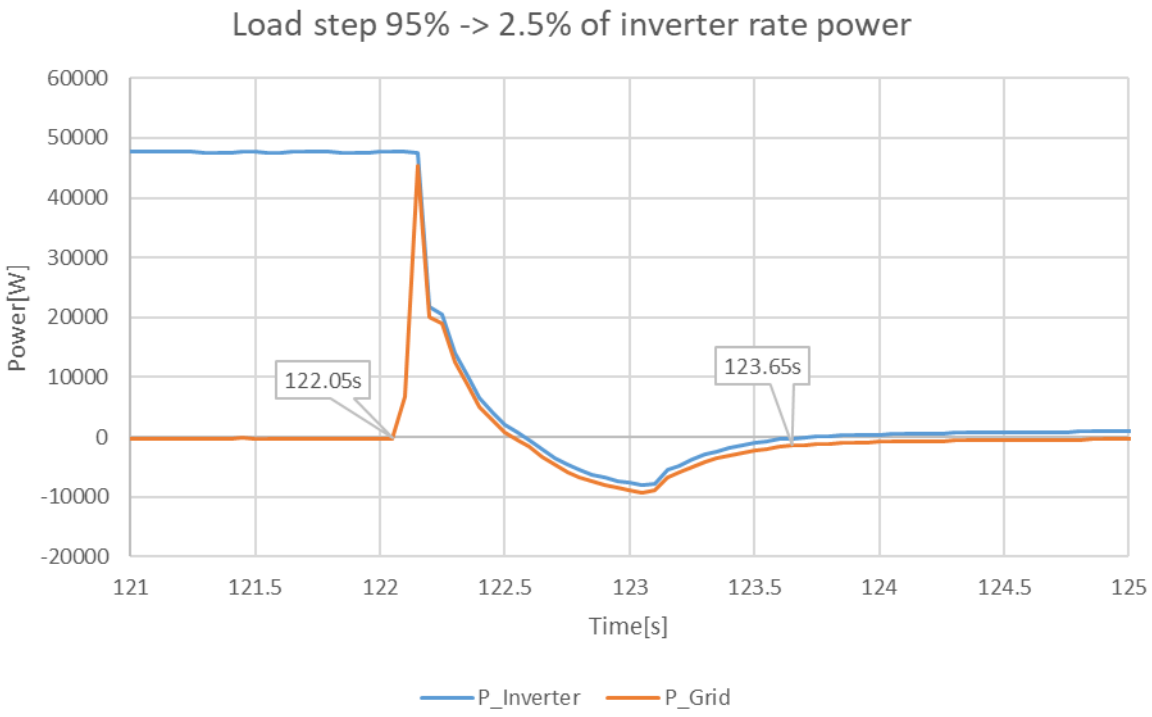
4 Measure the power exchanged with the network, with an uncertainty better than or equal to 0.5% + 25 W, making measurements of 50 ms in a time window of 2 min comprising at least one minute before and after the load disconnection.

Graph of power gradient:

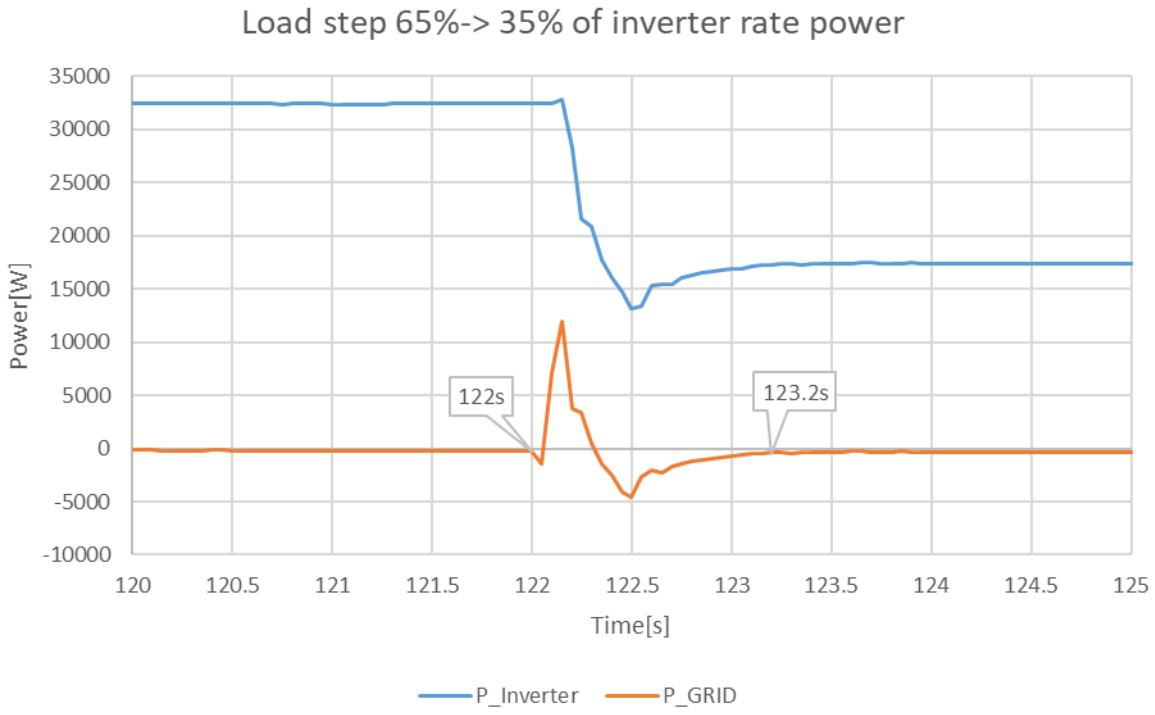


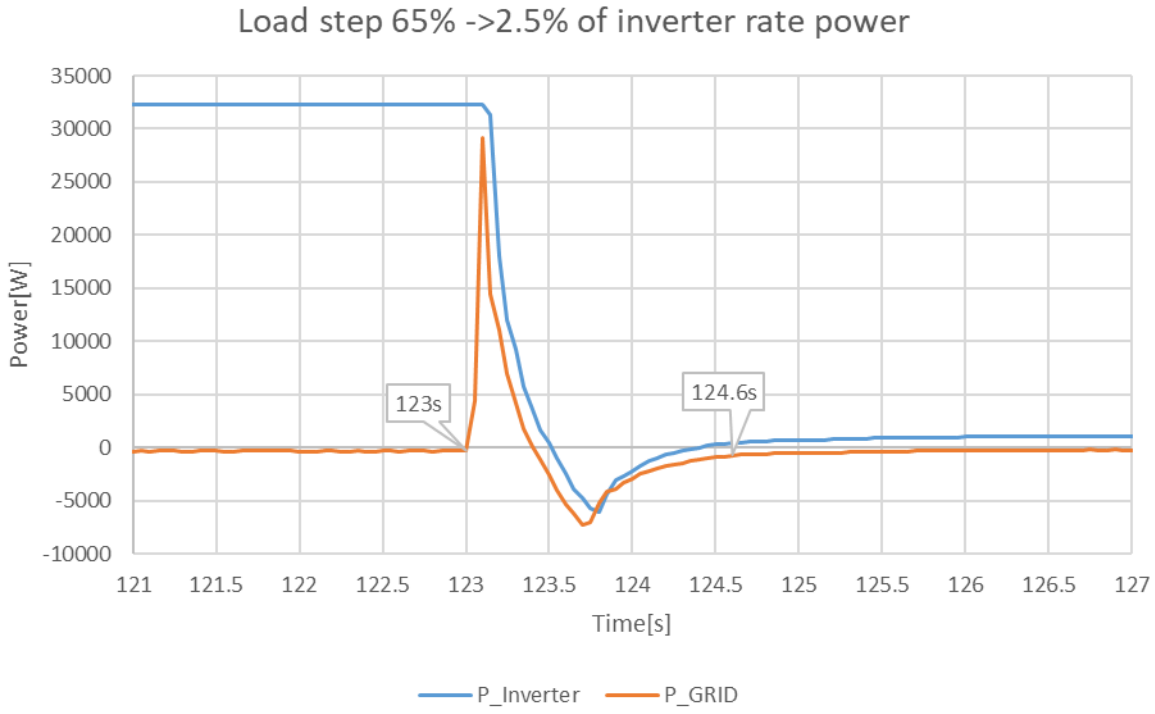
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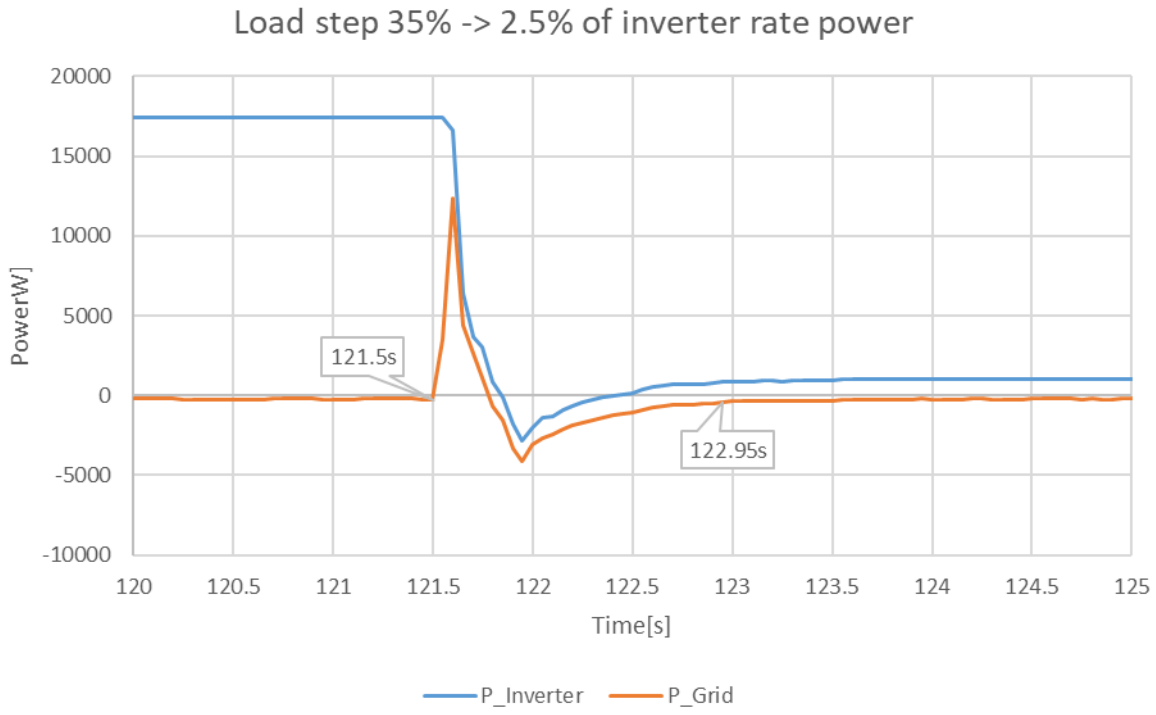


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b) Test 2 (Parallel operation with two inverters, see Figure 4)

TEST	Initial load	Final load	Test 1	Test 2	Test 3	Result
	P_{inv}%	P_{inv}%	Response time in sec.	Response time in sec.	Response time in sec.	
1	90-100%	60-70%	0,70	1,00	0,95	P
2	90-100%	30-40%	1,35	1,20	1,15	P
3	90-100%	0-5%	1,65	1,55	1,50	P
4	60-70%	30-40%	1,10	0,75	0,75	P
5	60-70%	0-5%	1,75	1,30	1,20	P
6	30-40%	0-5%	1,45	1,15	1,30	P

Test procedure:

The test must be repeated with the different type generators that are going to be approved for the system, each of them being able to be tested separately.

To verify this condition, the following test is performed with the following sequence:

1 Connect the generator to a power source that feeds the generator and that is capable of supplying a power equal to or greater than the power of the generator to be tested.

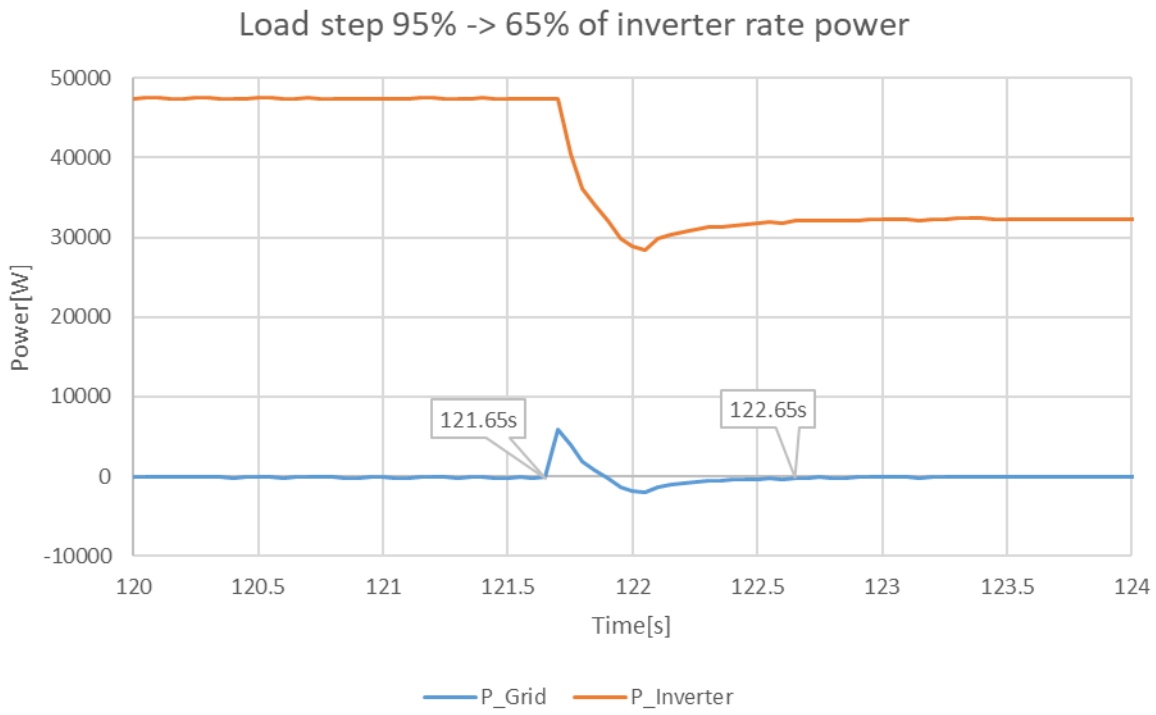
2 Connect the generator to the grid to be tested.

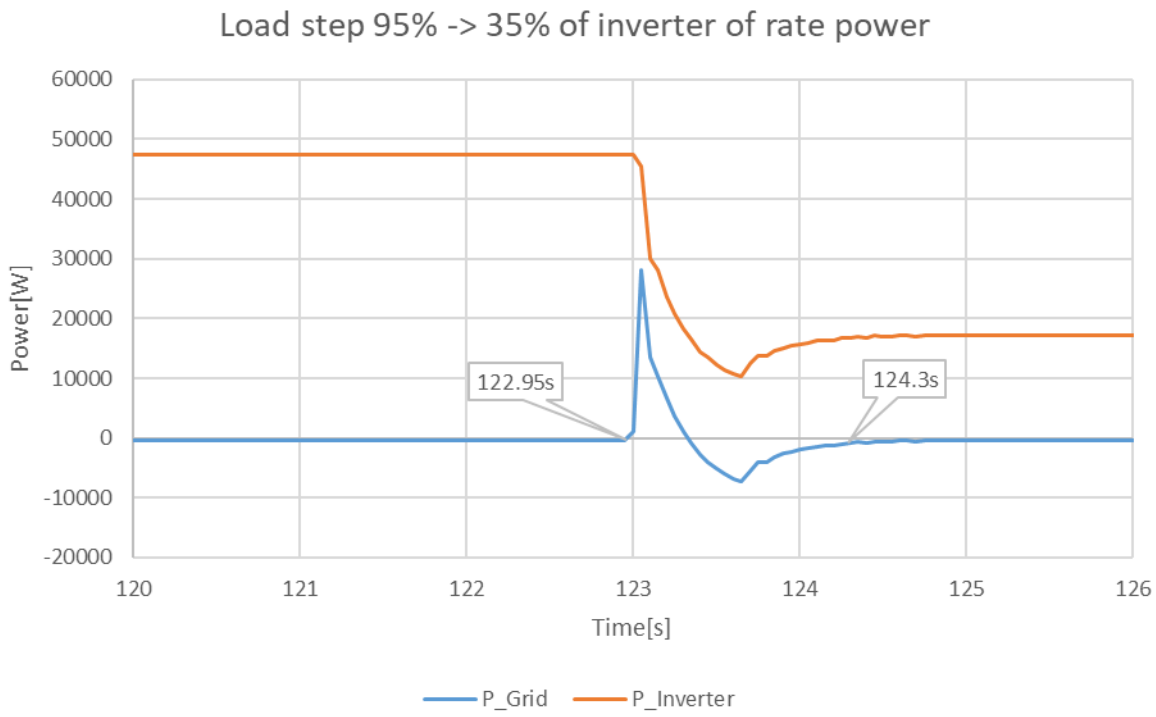
3 Perform the load disconnections proposed in Table 2.

4 Measure the power exchanged with the network, with an uncertainty better than or equal to 0.5% + 25 W, making measurements of 50 ms in a time window of 2 min comprising at least one minute before and after the load disconnection.

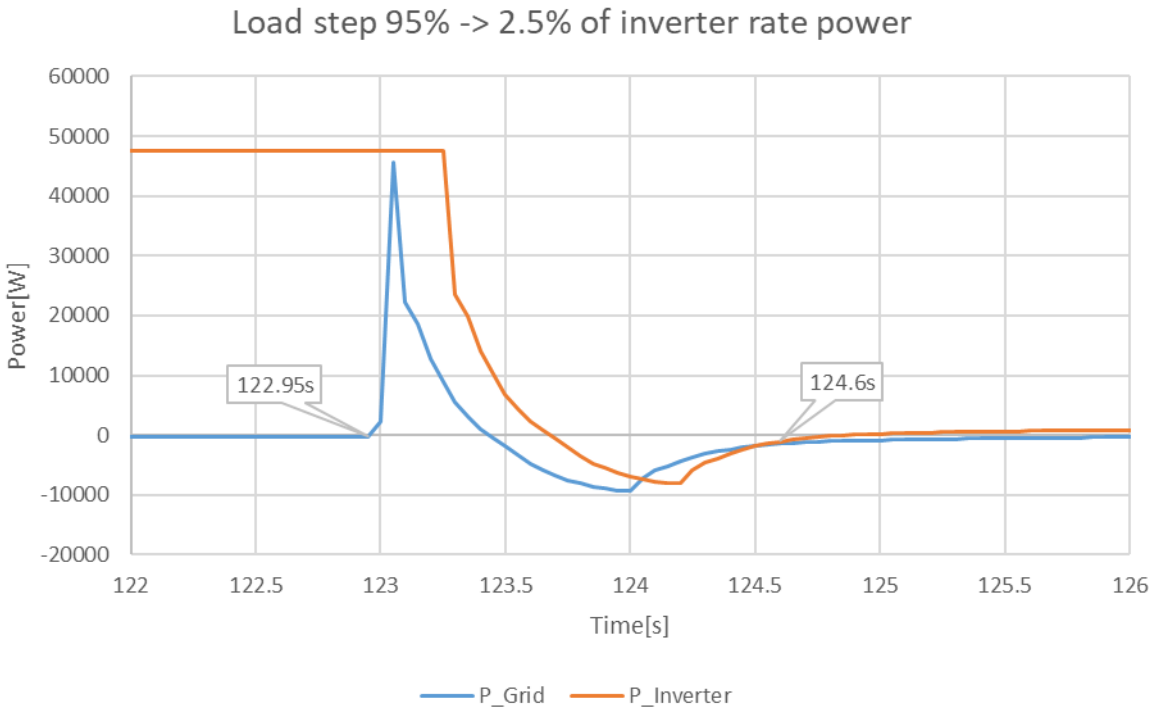
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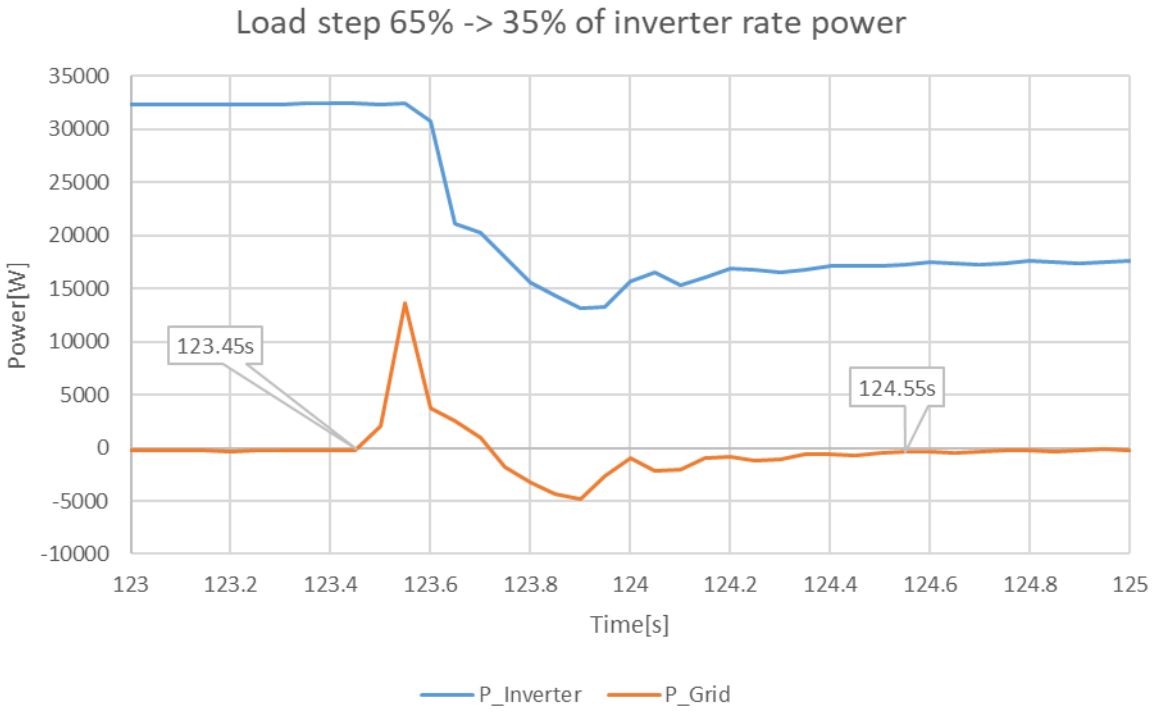
Graph of power gradient:



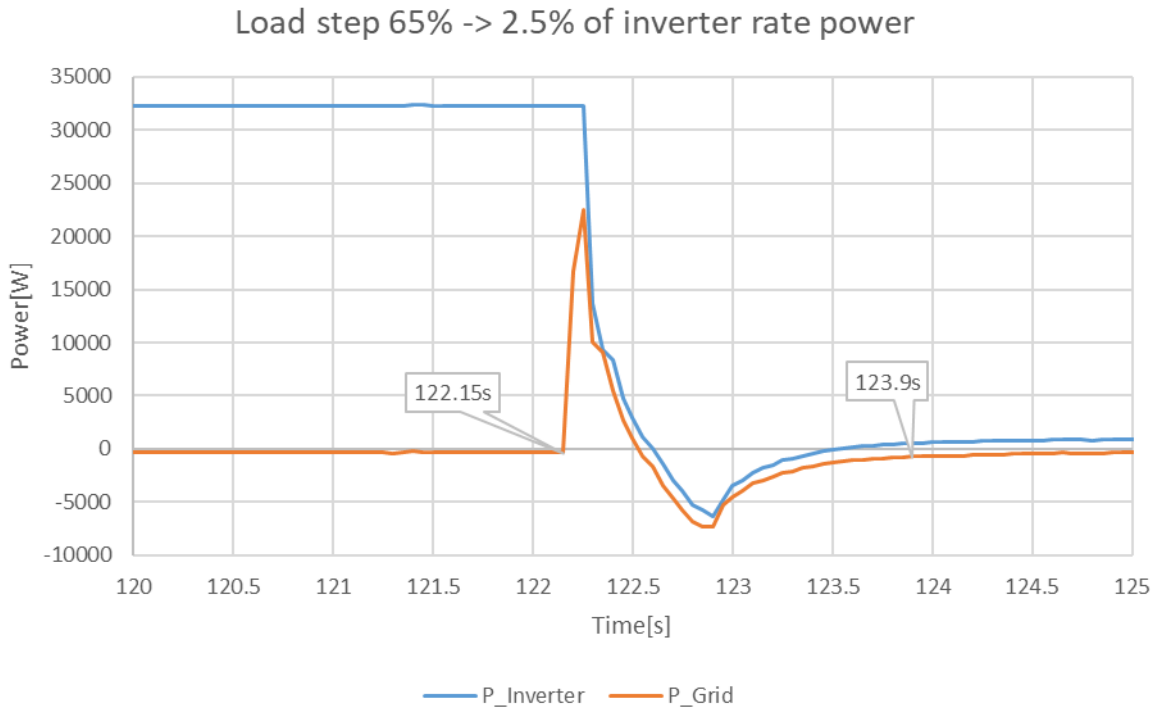


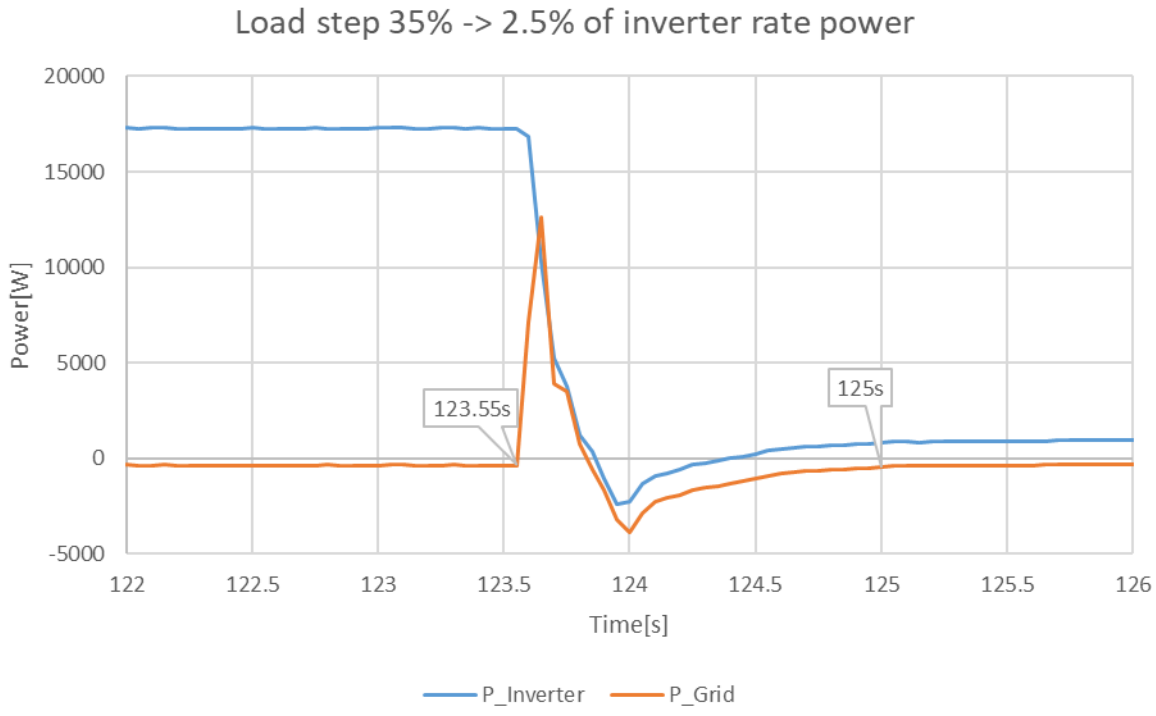
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Assessment criterion:

For adjustable PGUs:

The power limitation system must guarantee that before a load disconnection, the generator readjusts its production, reaching the permanent regime again in less than t_a(the required time of action).

Note:

The tests had been performed on the T-REX-50KHP3G01 are valid for the T-REX-25KHP3G01, T-REX-29K9HP3G01, T-REX-30KHP3G01 and T-REX-40KHP3G01 since it is almost same as in hardware and just power derated by software.

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4.3 Response to power increases in the primary energy source						P
a) Test 1 (Scheme of Single machine photovoltaic power generation system, see Figure 3)						
Step	AC load	Power DC source	Test 1	Test 2	Test 3	Result
	P_{inv}%	P_{inv}%	Response time in sec.	Response time in sec.	Response time in sec.	
1	60-70%	40-50%	0,75	0,25	0,15	P
2	60-70%	90-100%				

Test procedure:

The test must be repeated with the different type generators that are going to be approved for the system, each of them being able to be tested separately.

To verify this condition, the test is performed with the following sequence of operations:

1 Connect the generator to a power source that feeds the generator and is capable of supplying between 40% and 50% of the power of the generator to be tested.

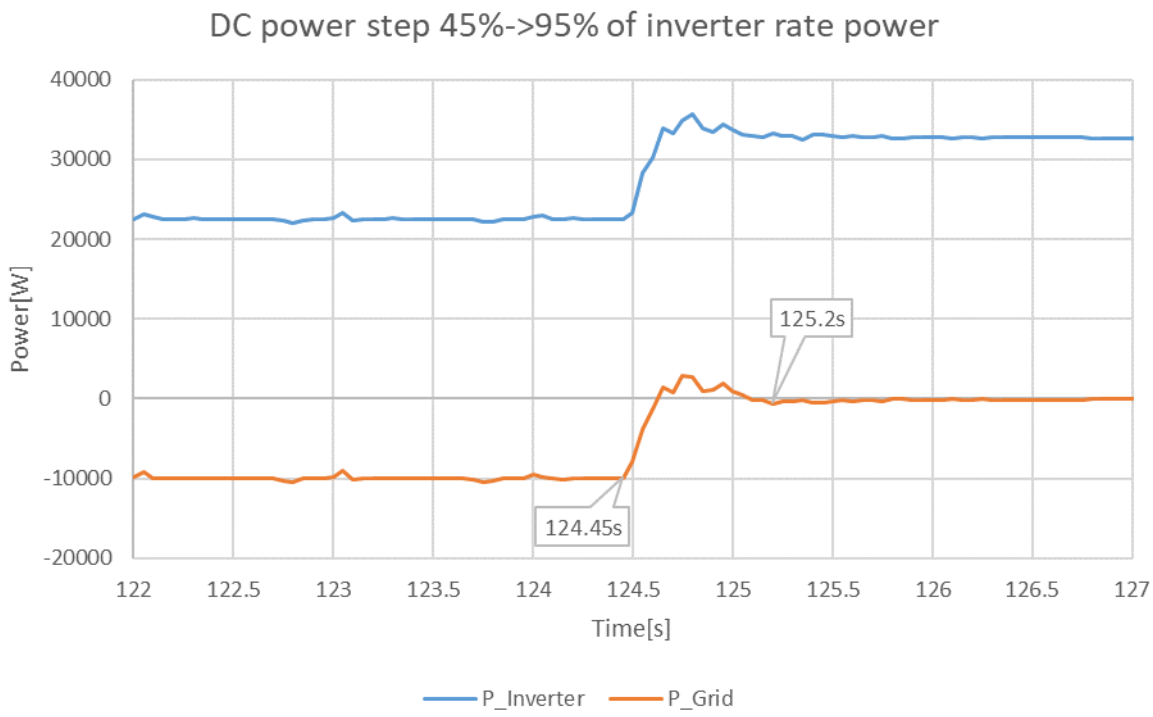
2 Connect the generator to the grid to be tested.

3 Connect a load that consumes between 60% and 70% of the power of the generator to be tested.

4 Increase by a step the power available in the energy source above 90% of the nominal power of the generator to be tested.

5 Measure the power exchanged with the grid, with an uncertainty better than or equal to 0.5% + 25 W, making measurements every 50 ms in a time window of 2 min comprising at least one minute before and after the increase in the power of the generator.

Repeat each of the tests three times.



b) Test 2 (Parallel operation with two inverters, see Figure 4)

Step	AC load	Power DC source	Test 1	Test 2	Test 3	Result

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	P_{inv}%	P_{inv}%	Response time in sec.	Response time in sec.	Response time in sec.	
1	60-70%	40-50%	0,15	0,15	0,20	P
2	60-70%	90-100%				

Test procedure:

The test must be repeated with the different type generators that are going to be approved for the system, each of them being able to be tested separately.

To verify this condition, the test is performed with the following sequence of operations:

1 Connect the generator to a power source that feeds the generator and is capable of supplying between 40% and 50% of the power of the generator to be tested.

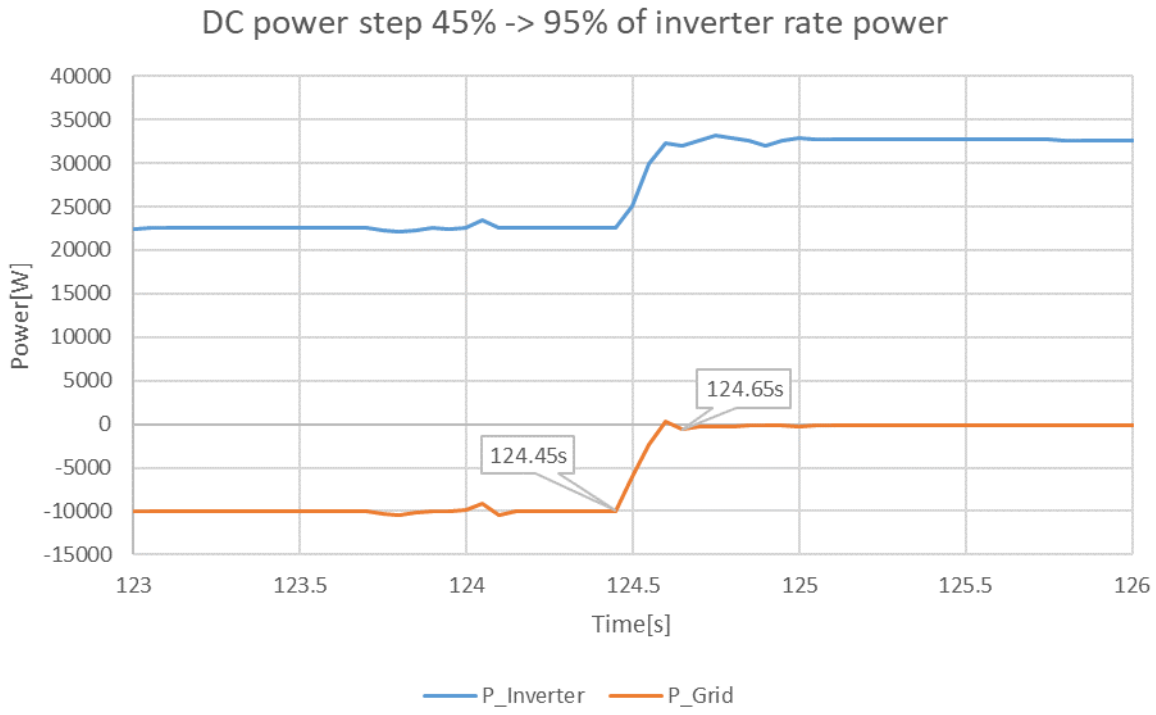
2 Connect the generator to the grid to be tested.

3 Connect a load that consumes between 60% and 70% of the power of the generator to be tested.

4 Increase by a step the power available in the energy source above 90% of the nominal power of the generator to be tested.

5 Measure the power exchanged with the grid, with an uncertainty better than or equal to 0.5% + 25 W, making measurements every 50 ms in a time window of 2 min comprising at least one minute before and after the increase in the power of the generator.

Repeat each of the tests three times.



Assessment criterion:

For adjustable PGUs:

The power limitation system must guarantee that before a load disconnection, the generator readjusts its production, reaching the permanent regime again in less than t_a(the required time of action).

Note:

The tests had been performed on the T-REX-50KHP3G01 are valid for the T-REX-25KHP3G01, T-REX-29K9HP3G01, T-REX-30KHP3G01 and T-REX-40KHP3G01 since it is almost same as in hardware and just power derated by software.

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4.4 Action in case of loss of communications							P
a) Test 1 (Scheme of Single machine photovoltaic power generation system, see Figure 3)							
Step	AC load	Power DC source	Communication between energy meter and generator	Test 1	Test 2	Test 3	Result
	P_{inv}%	P_{inv}%		Response time in sec.	Response time in sec.	Response time in sec.	
1	60-70%	90-100%	Yes	0,012	0,012	0,012	P
2	60-70%	90-100%	No				

Test procedure:

The generator must stop generating in case of loss of communication between the different elements of the system in a time less than the required action time. If the control element is integrated into one of the required devices (power measuring equipment or generator) it will not be necessary to check the communication between the elements integrated in the same device.

To verify this condition, the test is performed with the following sequence of operations:

1 Connect the generator to a power source that feeds the generator and that is capable of supplying a power equal to or greater than the power of the generator to be tested.

2 Connect the generator to the internal network to be tested.

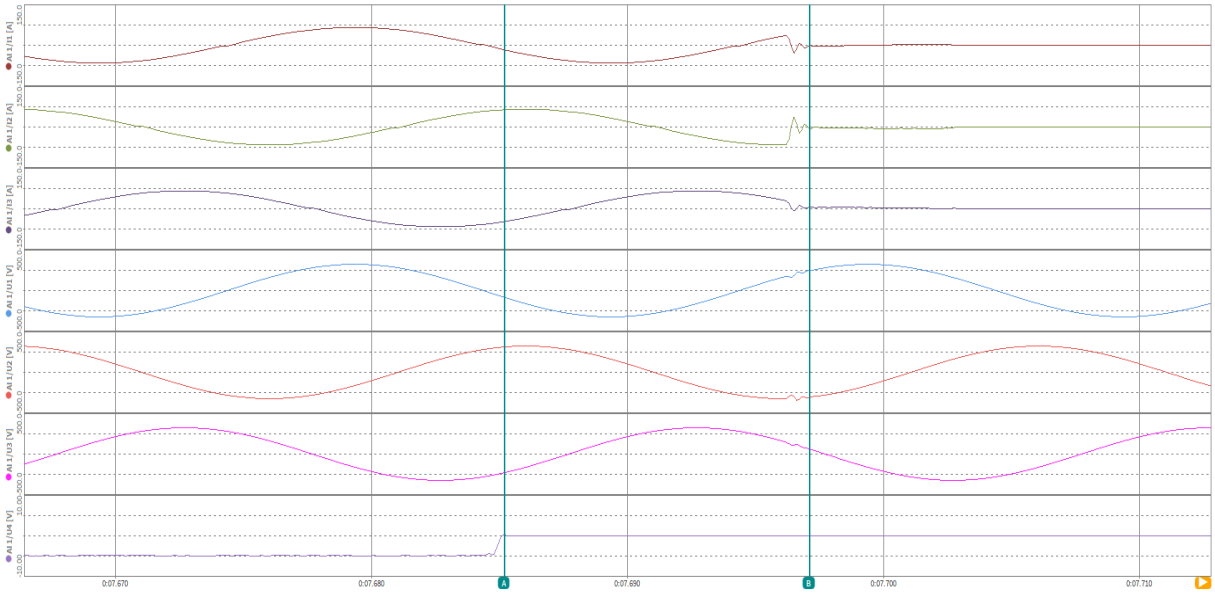
3 Set a load of 60% and 70% of the nominal power of the generator.

4 Cut off communication between the control element and the power measuring equipment.

5 Measure the time elapsed between the communication cut and the disconnection of the generator or total limitation of the generator power (0%).

6 Measure the power generated by the generator, with an uncertainty better than or equal to 0.5% + 25 W, making measurements every 50 ms.

The test will be repeated 3 times.



时间 [s]	A 7.68518969	B 7.69710156	间隔 0.01191187
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AI 1/U1 [V]	-74.74900	248.1842	322.9332
AI 1/U2 [V]	310.6971	-313.2065	-623.9036
AI 1/U3 [V]	-236.2664	64.93569	301.2021
AI 1/U4 [V]	0.099421	0.012875	-0.086546

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b) Test 2 (Parallel operation with two inverters, see Figure 4)

Step	AC load	Power DC source	Communication between energy meter and generator	Test 1	Test 2	Test 3	Result
	P_{inv}%	P_{inv}%		Response time in sec.	Response time in sec.	Response time in sec.	
1	60-70%	90-100%	Yes	0,012	0,013	0,012	P
2	60-70%	90-100%	No				

Test procedure:

The generator must stop generating in case of loss of communication between the different elements of the system in a time less than the required action time. If the control element is integrated into one of the required devices (power measuring equipment or generator) it will not be necessary to check the communication between the elements integrated in the same device.

To verify this condition, the test is performed with the following sequence of operations:

1 Connect the generator to a power source that feeds the generator and that is capable of supplying a power equal to or greater than the power of the generator to be tested.

2 Connect the generator to the internal network to be tested.

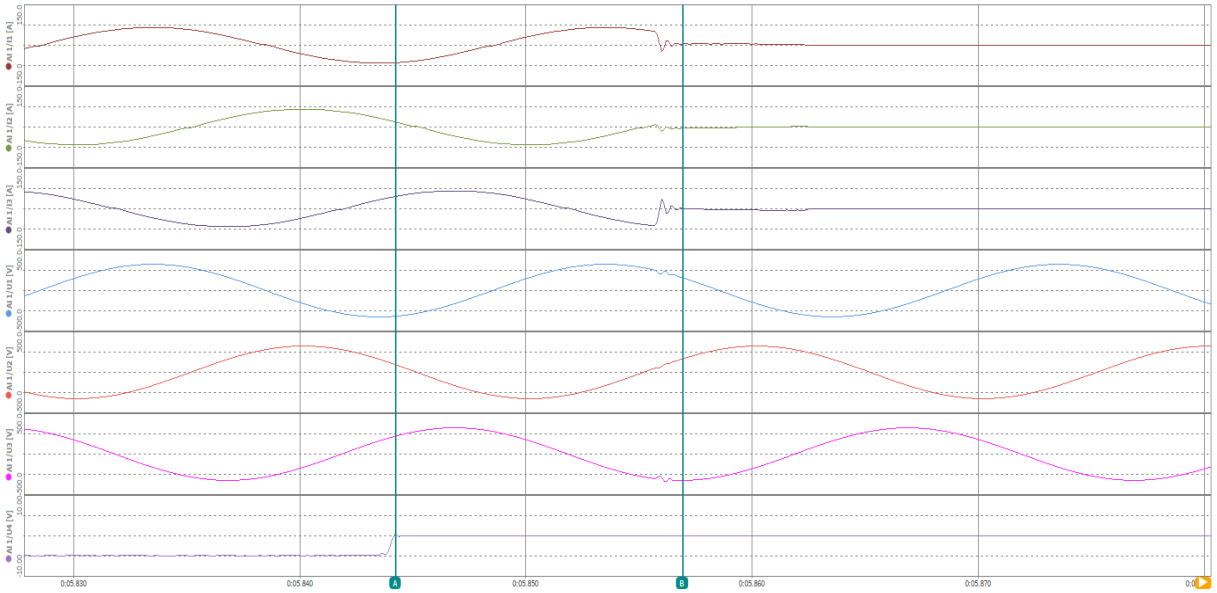
3 Set a load of 60% and 70% of the nominal power of the generator.

4 Cut off communication between the control element and the power measuring equipment.

5 Measure the time elapsed between the communication cut and the disconnection of the generator or total limitation of the generator power (0%).

6 Measure the power generated by the generator, with an uncertainty better than or equal to 0.5% + 25 W, making measurements every 50 ms.

The test will be repeated 3 times.



时间 [s]	A 5.84424681	B 5.85692520	间隔 0.01267839
AI 1/I1 [A]	-64.80898	3.437293	68.24627
AI 1/I2 [A]	19.63537	-4.473084	-24.10845
AI 1/I3 [A]	45.11418	1.801866	-43.31231
AI 1/U1 [V]	-317.6027	160.3594	477.9620
AI 1/U2 [V]	98.55056	165.4697	66.91909
AI 1/U3 [V]	219.0476	-325.5074	-544.5550
AI 1/U4 [V]	0.397921	0.014544	-0.383377

Assessment criterion:

For adjustable PGUs:

The power limitation system must guarantee that before a load disconnection, the generator readjusts its production, reaching the permanent regime again in less than t_a(the required time of action).

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Note:

The tests had been performed on the T-REX-50KHP3G01 are valid for the T-REX-25KHP3G01, T-REX-29K9HP3G01, T-REX-30KHP3G01 and T-REX-40KHP3G01 since it is almost same as in hardware and just power derated by software.

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4.5 Determination of the maximum number of generators

Test: Response to load disconnections

TEST	Initial load	Final load	Test 1	Test 2	Test 3	Result
	P_{inv}%	P_{inv}%	Response time in sec.	Response time in sec.	Response time in sec.	
1	90-100%	60-70%	0,95	0,95	1,00	P
2	90-100%	30-40%	1,50	1,35	1,45	P
3	90-100%	0%	1,55	1,60	1,50	P
4	60-70%	30-40%	1,20	1,05	1,05	P
5	60-70%	0%	1,45	1,55	1,60	P
6	30-40%	0%	1,45	1,15	1,25	P

Note: (Stand-alone operation)

In case the power limitation system can be used with more than one generator, the following tests will be repeated with one generator, giving it 100% of the total power of the loads

Test: Response to load disconnections

TEST	Initial load	Final load	Test 1	Test 2	Test 3	Result
	P_{inv}%	P_{inv}%	Response time in sec.	Response time in sec.	Response time in sec.	
1	90-100%	60-70%	0,70	1,00	0,95	P
2	90-100%	30-40%	1,35	1,20	1,15	P
3	90-100%	0%	1,65	1,55	1,50	P
4	60-70%	30-40%	1,10	0,75	0,75	P
5	60-70%	0%	1,75	1,30	1,20	P
6	30-40%	0%	1,45	1,15	1,30	P

Note: (Parallel operation with two inverters)

In case the power limitation system can be used with more than one generator, the following tests will be repeated with two generators working in parallel, giving each of them between 40% and 60% of the total power of the loads, such that both together satisfy 100% of the consumption

Maximum time measured for one generator, t1= 1,60 s;

Maximum time measured for two generator, t2= 1,75 s;

Difference between the maximum time obtained for one generator and for two generators: tr=t2-t1=0,15s

Maximum number of generators: N≤(ta-t1)/tr+1

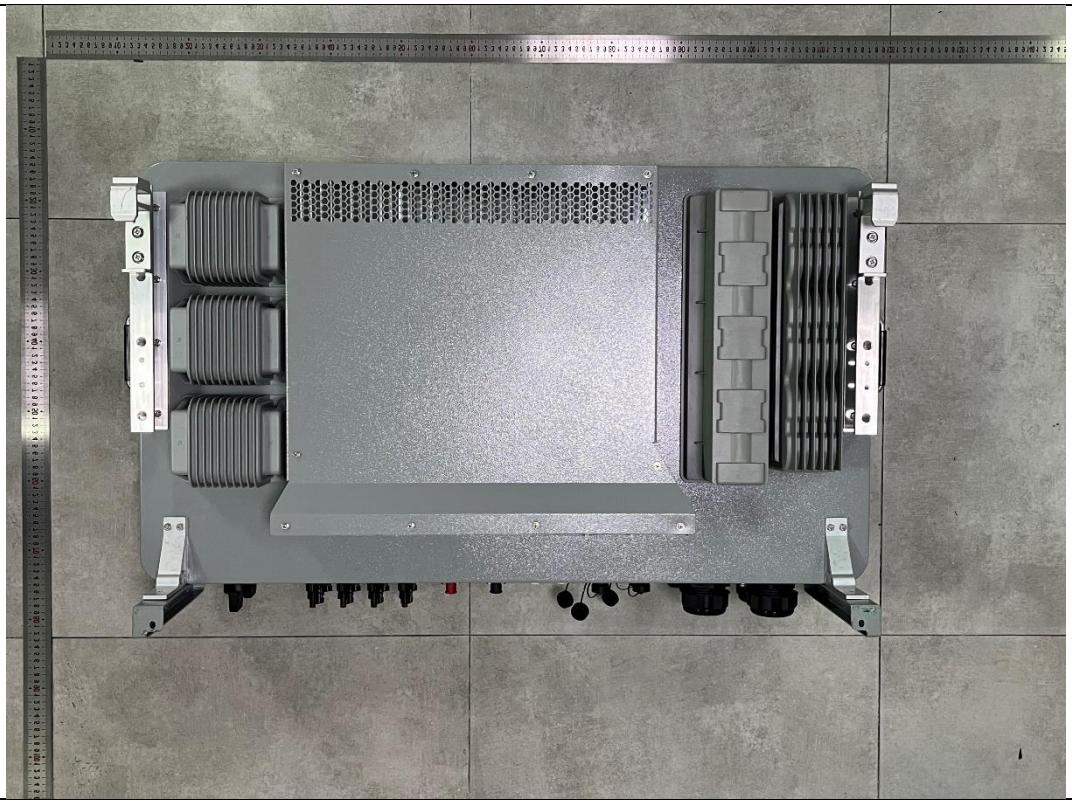
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Annex No. 1

Pictures of the unit

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Photo of EUT
Enclosure front view

Enclosure rear view


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Photo of EUT

Enclosure left view



Enclosure right view



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Photo of EUT

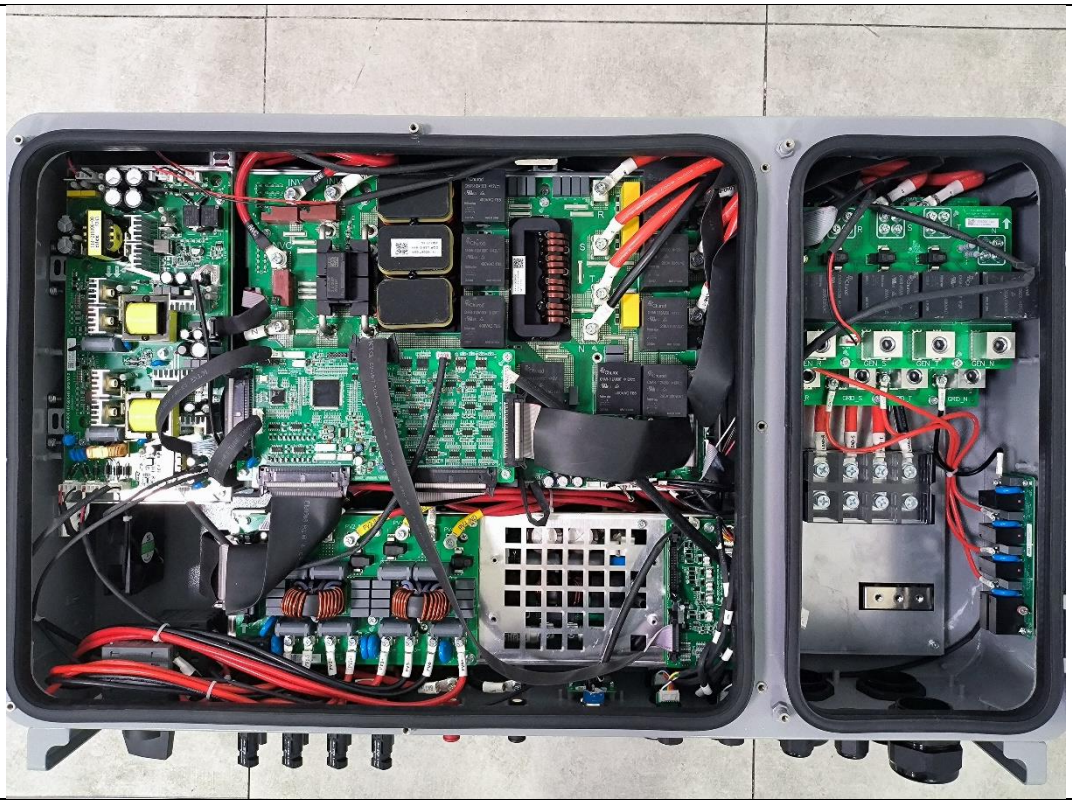
Enclosure top view



Enclosure bottom view



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Photo of EUT
Internal view


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Annex No. 2

Test Equipment list

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Date(s) of performance test: 2024-08-26 to 2024-10-31

Equipment	Internal No.	Manufacturer	Type	Serial No.	Next Calibration
Power Analyzer	FLS*YF0033	DEWESoft	TRTONet+1820-PA	C9220196-CHN	May. 25, 2025
AC Source	XNYYF0068	ACTIONPOWER	AGS-20-4505N	F2042D0013	Monitored by Power Analyzer
DC Simulation Power Supply	XNYYF0081	ACTIONPOWER	PRD1503E	B1042E1023	
	FLS*YF0196	ACTIONPOWER	PRD1503E	B2032I1977	
	FLS*YF0194	ACTIONPOWER	PRD1503E	B2032I1979	
	FLS*YF0191	ACTIONPOWER	PRD1503E	B2032I1990	
RLC Load	A7150027DG	EMAX	IMAX3350-100KW	202409023	
Current transducer	FLS*YF0046	CYBERTEK	CTA 200	CTA2200456	May. 25, 2025
	FLS*YF0049	CYBERTEK	CTA 200	CTA2100425	May. 25, 2025
	FLS*YF0051	CYBERTEK	CTA 200	CTA2200432	May. 25, 2025
	FLS*YF0040	CYBERTEK	CTA 200	CTA2100515	May. 25, 2025
	FLS*YF0045	CYBERTEK	CTA 200	CTA2100512	May. 25, 2025
	FLS*YF0047	CYBERTEK	CTA 200	CTA2100482	May. 25, 2025

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END OF TEST REPORT

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