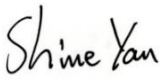
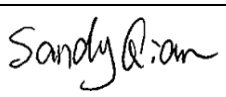
TEST REPORT
CEI 0-21
Reference technical rules for the connection of active and passive users to the LV networks of electrical distribution companies

Report	
Report Number. ..... :	6250065.50
Date of issue..... :	2026-01-07
Total number of pages	364 pages
Testing Laboratory ..... :	DEKRA Testing and Certification (Suzhou) Co., Ltd.
Address ..... :	No. 99, Hongye Road, Suzhou Industrial Park Suzhou, 215006, P.R. China
Applicant's name ..... :	Afore New Energy Technology (Shanghai) Co., Ltd.
Address ..... :	Building 7, No.333 Wanfang Rd, Minhang District, Shanghai, China
Test specification:	
Standard..... :	CEI 0-21:2022-03+V1:2022-11+V2:2024-01+V3:2025-10
Test procedure ..... :	Type test
Non-standard test method……..:	N/A
Test Report Form No. ..... :	CEI 0-21_V4.0
Test Report Form(s) Originator ..... :	DEKRA Testing and Certification (Suzhou) Co., Ltd.
Master TRF ..... :	Dated 2022-04
Test item description..... :	Hybrid Inverter
Trade Mark ..... :	Afore
Manufacturer ..... :	Afore New Energy Technology (Shanghai) Co., Ltd. Building 7, No.333 Wanfang Rd, Minhang District, Shanghai, China
Model/Type reference ..... :	AF3K-MTH, AF4K-MTH, AF5K-MTH, AF6K-MTH, AF8K-MTH, AF10K-MTH, AF12K-MTH, AF15K-MTH; AF3K-ATH, AF4K-ATH, AF5K-ATH, AF6K-ATH, AF8K-ATH, AF10K-ATH, AF12K-ATH, AF15K-ATH; AF3K-MTH-0, AF4K-MTH-0, AF5K-MTH-0, AF6K-MTH-0, AF8K-MTH-0, AF10K-MTH-0, AF12K-MTH-0, AF15K-MTH-0; AF3K-ATH-0, AF4K-ATH-0, AF5K-ATH-0, AF6K-ATH-0, AF8K-ATH-0, AF10K-ATH-0, AF12K-ATH-0, AF15K-ATH-0;
Ratings ..... :	See product marking plate on page 4 to 5 and ratings of the test products on page 10 to 14.

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒	**Testing Laboratory:**	DEKRA Testing and Certification (Suzhou) Co., Ltd.	
Testing location/ address ..... :		No. 99, Hongye Road, Suzhou Industrial Park Suzhou, 215006, P.R. China	
☐	~~**Associated Testing Laboratory:**~~		
~~**Testing location/ address ..... :**~~			
Tested by (name, function, signature) ..... :		Shine Yan (ENG)	
Approved by (name, function, signature) .. :		Sandy Qian (REW)	
☐	~~**Testing procedure: CTF Stage 1:**~~		
~~**Testing location/ address ..... :**~~			
~~**Tested by (name, function, signature) ..... :**~~			
~~**Approved by (name, function, signature) .. :**~~			
☐	~~**Testing procedure: CTF Stage 2:**~~		
~~**Testing location/ address ..... :**~~			
~~**Tested by (name + signature) ..... :**~~			
~~**Witnessed by (name, function, signature) . :**~~			
~~**Approved by (name, function, signature) .. :**~~			
☐	~~**Testing procedure: CTF Stage 3:**~~		
☐	~~**Testing procedure: CTF Stage 4:**~~		
~~**Testing location/ address ..... :**~~			
~~**Tested by (name, function, signature) ..... :**~~			
~~**Witnessed by (name, function, signature) . :**~~			
~~**Approved by (name, function, signature) .. :**~~			
~~**Supervised by (name, function, signature) :**~~			

List of Attachments (including a total number of pages in each attachment):

Annex 1: ISO 9001 certificate (1 pages)

Annex 2: IEC 62619 Certificate for used battery (2 pages)

Annex 3: Datasheet of the relay (12 pages)

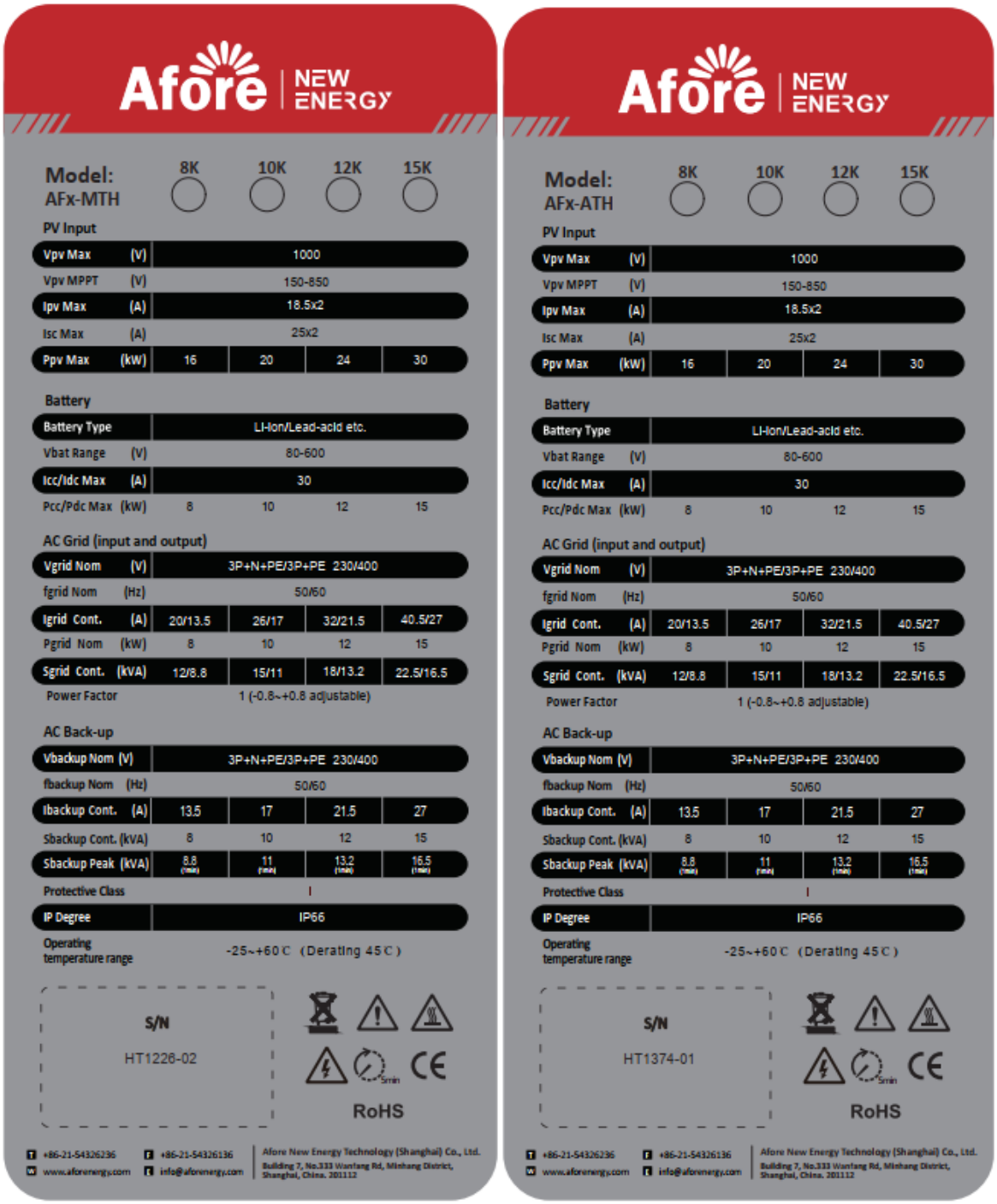
Annex 4: Pictures of the unit (10 pages)

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
All tests (except clause A.4.6 EMC tests)	DEKRA Testing and Certification (Suzhou) Co., Ltd. No.99, Hongye Road, Suzhou Industrial Park, Suzhou, Jiangsu, P.R. China
A.4.6 EMC tests (The EMC test reports provided by the customer)	1. Intertek Testing Services Shanghai Building No.86, 1198 Qinzhou Road (North), Caohejing Development Zone, Shanghai 200233, China Report No.: 2509B0697SHA-001 2509B0699SHA-001 Accreditation Number: 3309.02 (A2LA-ILAC) 2. Shanghai Inspection and Testing Institute of Instruments and Automation Systems Co., Ltd. No.103, Caobao Road, Xuhui District, Shanghai, China Report No.: J25-376-WT-04 J25-376-WT-05 Accreditation Number: L0130 (CNAS-ILAC)

Copy of marking plate:

The artwork below may be only a draft.



Afore NEW ENERGY

Model: AFx-MTH — 8K ○ 10K ○ 12K ○ 15K

PV Input					
Vpv Max	(V)	1000			
Vpv MPPT	(V)	150-850			
Ipv Max	(A)	18.5x2			
Isc Max	(A)	25x2			
Ppv Max	(kW)	16	20	24	30
Battery					
Battery Type		LI-Ion/Lead-acid etc.			
Vbat Range	(V)	80-600			
Icc/Idc Max	(A)	30			
Pcc/Pdc Max	(kW)	8	10	12	15
AC Grid (input and output)					
Vgrid Nom	(V)	3P+N+PE/3P+PE 230/400			
fgrid Nom	(Hz)	50/60			
Igrid Cont.	(A)	20/13.5	26/17	32/21.5	40.5/27
Pgrid Nom	(kW)	8	10	12	15
Sgrid Cont.	(kVA)	12/8.8	15/11	18/13.2	22.5/16.5
Power Factor		1 (-0.8~+0.8 adjustable)			
AC Back-up					
Vbackup Nom	(V)	3P+N+PE/3P+PE 230/400			
fbackup Nom	(Hz)	50/60			
Ibackup Cont.	(A)	13.5	17	21.5	27
Sbackup Cont.	(kVA)	8	10	12	15
Sbackup Peak	(kVA)	8.8 (1min)	11 (1min)	13.2 (1min)	16.5 (1min)
Protective Class		I			
IP Degree		IP66			
Operating temperature range		-25~+60℃ (Derating 45℃)			

S/N HT1226-02

RoHS

+86-21-54326236 | +86-21-54326136 | www.aforenergy.com | info@aforenergy.com | Afore New Energy Technology (Shanghai) Co., Ltd. Building 7, No.333 Wanfang Rd, Minhang District, Shanghai, China. 201112

Afore NEW ENERGY

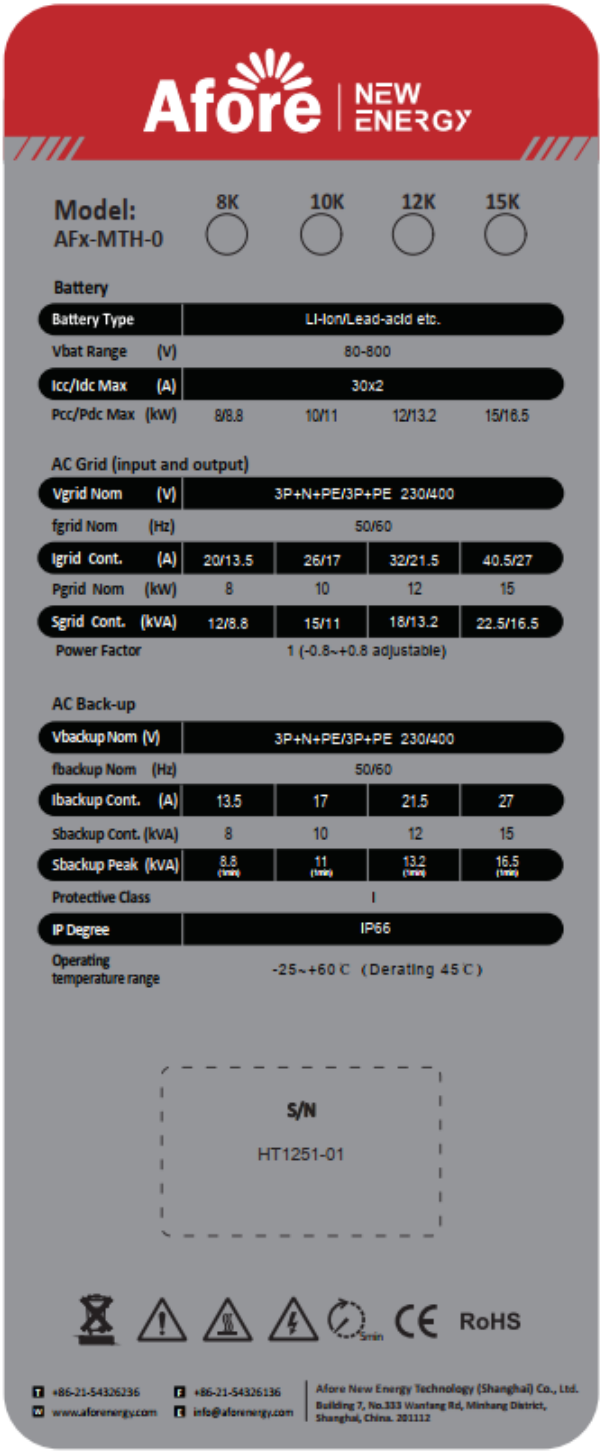
Model: AFx-ATH — 8K ○ 10K ○ 12K ○ 15K

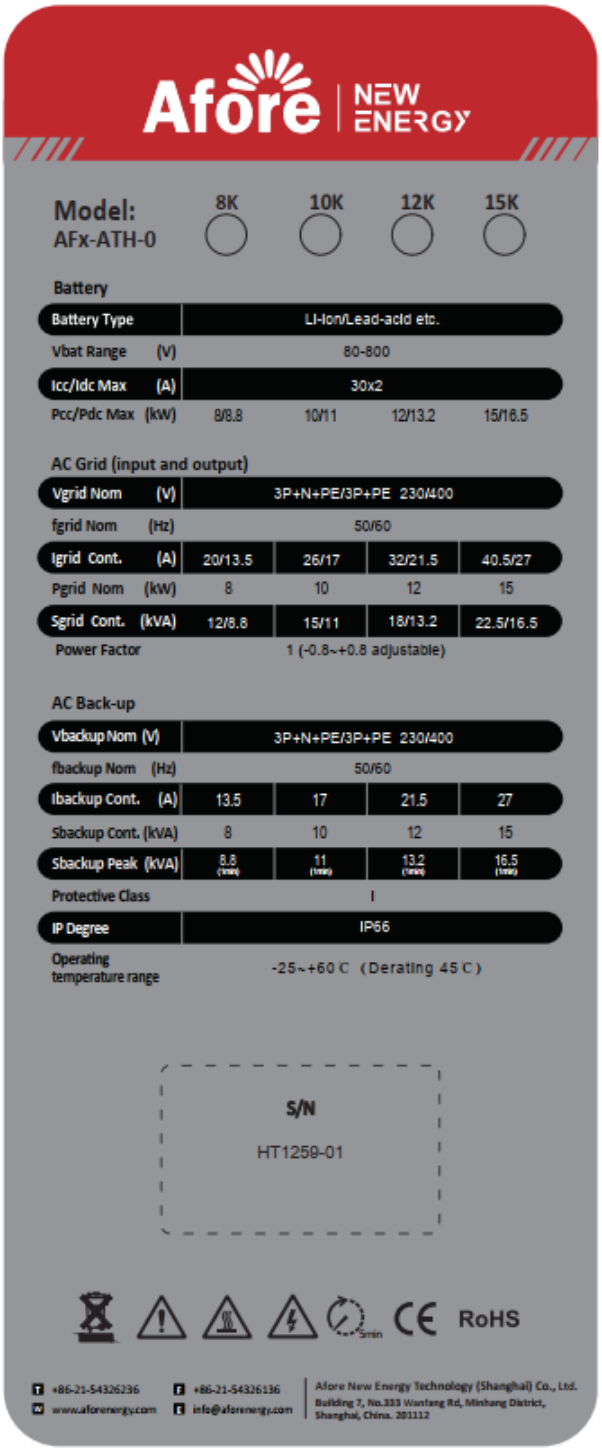
PV Input					
Vpv Max	(V)	1000			
Vpv MPPT	(V)	150-850			
Ipv Max	(A)	18.5x2			
Isc Max	(A)	25x2			
Ppv Max	(kW)	16	20	24	30
Battery					
Battery Type		LI-Ion/Lead-acid etc.			
Vbat Range	(V)	80-600			
Icc/Idc Max	(A)	30			
Pcc/Pdc Max	(kW)	8	10	12	15
AC Grid (input and output)					
Vgrid Nom	(V)	3P+N+PE/3P+PE 230/400			
fgrid Nom	(Hz)	50/60			
Igrid Cont.	(A)	20/13.5	26/17	32/21.5	40.5/27
Pgrid Nom	(kW)	8	10	12	15
Sgrid Cont.	(kVA)	12/8.8	15/11	18/13.2	22.5/16.5
Power Factor		1 (-0.8~+0.8 adjustable)			
AC Back-up					
Vbackup Nom	(V)	3P+N+PE/3P+PE 230/400			
fbackup Nom	(Hz)	50/60			
Ibackup Cont.	(A)	13.5	17	21.5	27
Sbackup Cont.	(kVA)	8	10	12	15
Sbackup Peak	(kVA)	8.8 (1min)	11 (1min)	13.2 (1min)	16.5 (1min)
Protective Class		I			
IP Degree		IP66			
Operating temperature range		-25~+60℃ (Derating 45℃)			

S/N HT1374-01

RoHS

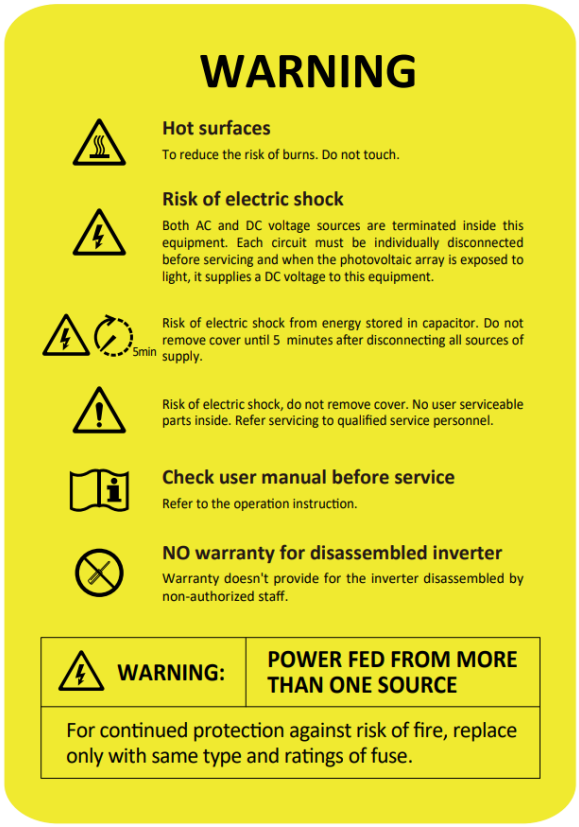
+86-21-54326236 | +86-21-54326136 | www.aforenergy.com | info@aforenergy.com | Afore New Energy Technology (Shanghai) Co., Ltd. Building 7, No.333 Wanfang Rd, Minhang District, Shanghai, China. 201112





Remark: According to customer's requirement, these models were evaluated under the grid frequency of 50 Hz.

Warning label:



Test item particulars:				
Equipment mobility	movable fixed	hand-held transportable	stationary for building-in	
Connection to the mains	pluggable equipment permanent connection		direct plug-in for building-in	
Enviromental category	outdoor	indoor unconditional	indoor conditional	
Over voltage category Mains	OVC I	OVC II	OVC III	OVC IV
Over voltage category PV	OVC I	OVC II	OVC III	OVC IV
Mains supply tolerance (%)	-85 / +115 %			
Tested for power systems	TN			
IT testing, phase-phase voltage (V)	N/A			
Class of equipment	Class I Not classified	Class II	Class III	
Mass of equipment (kg)	28 kg			
Pollution degree	Outside PD3; Inside PD2			
IP protection class	IP66			
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)			
- this clause is information reference for installation	Info.			
Testing:				
Date of receipt of test item	2024-11-11 (samples provided by applicant) 2025-10-11 (Amendment 1 report)			
Date (s) of performance of tests	2024-11-12 to 2025-01-17 2025-10-12 to 2025-11-24 (Amendment 1 report)			

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
"(see Enclosure #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.
The clause A.4.6 EMC tests are not in the CNAS scope of DEKRA Testing and Certification (Suzhou) Co., Ltd.
Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

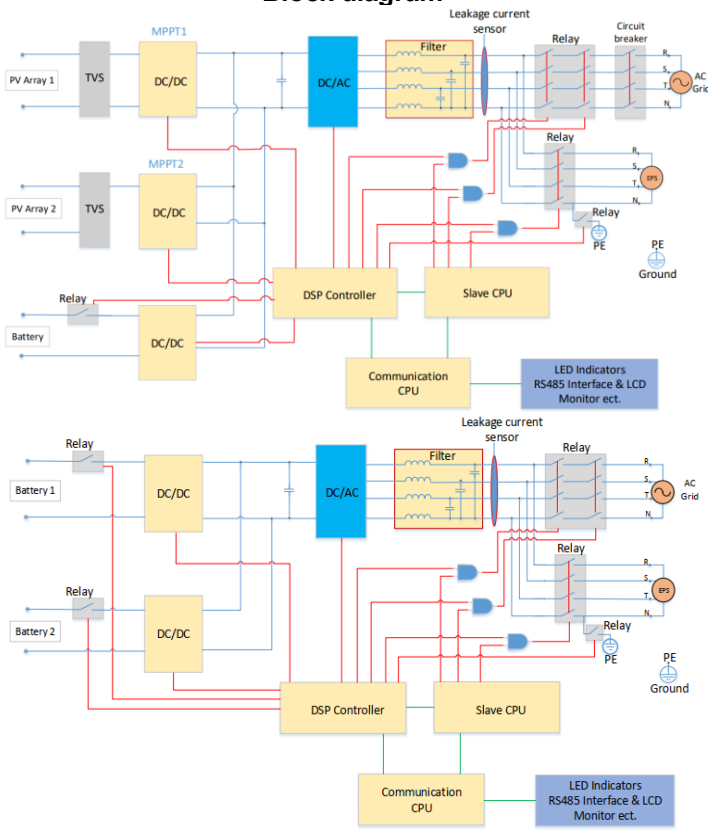
Use of uncertainty of measurement for decisions on conformity (decision rule):

No decision rule is specified by this standard, when comparing the measurement result with the applicable limit according to the specification in that standard. The decisions on conformity are made without applying the measurement uncertainty (“simple acceptance” decision rule, previously known as “accuracy method”).

Name and address of factory (ies):
Afore New Energy Technology (Shanghai) Co., Ltd.
Building 7, No.333 Wanfang Rd, Minhang District, Shanghai, China

General product information:
The products under test are three-phase storage inverter that convert DC voltage into AC voltage and feed it into the low-voltage public grid or store energy into battery.
The input and output are protected by varistors to earth. The unit is providing EMC filtering at the input and output towards mains. The output is switched off redundant by the high-power switching bridge and two relay in series. This assures that the opening of the output circuit will also operate in case of one error.
The battery port can be charged by the energy from either PV port or AC grid port. The storage inverter does not provide galvanic separation between the PV input and AC output circuit, the battery circuit also does not provide galvanic separation from the PV input or AC output circuit. The storage inverter also can operate under standalone mode beside the grid-connected mode.
Model difference:
All models have same circuit, PWB layout and software. Only different enclosure, output rating, PV input string number and PV switch.
Model AF*-MTH & AF*-MTH-0 (*=3K, 4K, 5K, 6K, 8K, 10K, 12K, 15K) have same enclosure, AC terminal and outlet bushing.
Model AF*-ATH & AF*-ATH-0 (*=3K, 4K, 5K, 6K, 8K, 10K, 12K, 15K) have same enclosure, heatsink and AC connector.
Model AF*-MTH-0 & AF*-ATH-0 (*=3K, 4K, 5K, 6K, 8K, 10K, 12K, 15K) have no PV and PV switch.
Model AF*-MTH & AF*-ATH (*=3K, 4K, 5K, 6K, 8K, 10K, 12K, 15K) have 2 MPPT trackers with 2 input strings and 1 PV switch. They have the same electrical parameters, only different enclosures.
Model AF*-MTH & AF*-ATH (*=3K, 4K, 5K, 6K, 8K, 10K, 12K, 15K) have 1 battery port and AF*-MTH-0 & AF*-ATH-0 (*=3K, 4K, 5K, 6K, 8K, 10K, 12K, 15K) have 2 battery ports.
For IT system, the grid side is not grounded and the client side is protectively grounded. The final N-wire connection shall comply the local code requirement. The wiring method is shown in the manual.

Block diagram



The product was tested on:
Hardware version: 1.01
Software version: V05
Amendment 1:
The report 6250065.50 was based on the report 6217735.50 issued by DEKRA Testing andCertification (Suzhou) Co., Ltd., issued on 2025-03-06, and COC No.: 6217735.01 issued byDEKRA Testing and Certification (Shanghai) Ltd., issued on 2025-03-06. It was issued due tobelow modifications:
---Change the specification of the battery.
After technical review, tests were considered necessary, see the "summary of testing".

Specifications table				
Model	AF3K-MTH	AF4K-MTH	AF5K-MTH	AF6K-MTH
	AF3K-ATH	AF4K-ATH	AF5K-ATH	AF6K-ATH
PV input				
P pv Max (kW)	6	8	10	12
Vmax PV (Vdc) (absolute Max.)	1000	1000	1000	1000
Isc PV (absolute Max.) (A)	25*2	25*2	25*2	25*2
Number MPP trackers	2	2	2	2
Number input strings	1/1	1/1	1/1	1/1
Max. PV input current (A)	18.5*2	18.5*2	18.5*2	18.5*2
MPPT voltage range (Vdc)	150-850	150-850	150-850	150-850
Battery (charge/discharge**)**				
Battery type	Rechargeable Li-ion Battery/ LiFePO4/ Lead-acid			
Battery Normal Voltage Range (Vdc)	80-600(Field adapt battery voltage range)			
Max charge/discharge Current(A)	30	30	30	30
Max charge/discharge Power(kW)	3	4	5	6
AC Grid (input and output)				
Normal AC Voltage (Vac)	3P+N+PE/3P+PE 230/400			
Frequency (Hz)	50 / 60			
Normal AC Current (A)	4.4	5.8	7.3	8.7
Max. cont. input/output current (A)	8 / 5.3	10.5 / 7	13 / 8.5	16 / 10.5
Rated Power (kW)	3	4	5	6
Rated Apparent Power (kVA)	3	4	5	6
Max. cont. input/output Power (kW)	4.5 / 3.3	6 / 4.4	7.5 / 5.5	9 / 6.6
Max. cont. Apparent input/output Power (kVA)	4.5 / 3.3	6 / 4.4	7.5 / 5.5	9 / 6.6
Power factor(adjustable)	1.0(-0.8~ +0.8)			
AC Load output (stand-alone)				
Normal Voltage (Vac)	3P+N+PE/3P+PE 230/400			
Frequency (Hz)	50 / 60			
Nominal Current (A)	4.4	5.8	7.3	8.7
Max. cont. current (A)	5.3	7	8.5	10.5
Max. cont. Power (kW)	3	4	5	6
Rated Apparent Power (kVA)	3	4	5	6
Max. cont. Apparent Power (kVA)	3	4	5	6
Others				
Ingress protection (IP)	IP66			
Protective class	Class I			
Temperature (℃)	-25℃ to +60℃ (Derating 45℃)			
Inverter Isolation	Non-isolated (PV - AC - BAT)			
Overvoltage category	OVC III (AC Main), OVC II (DC)			

Specifications table				
Model	AF8K-MTH	AF10K-MTH	AF12K-MTH	AF15K-MTH
	AF8K-ATH	AF10K-ATH	AF12K-ATH	AF15K-ATH
PV input				
P pv Max (kW)	16	20	24	30
Vmax PV (Vdc) (absolute Max.)	1000	1000	1000	1000
Isc PV (absolute Max.) (A)	25*2	25*2	25*2	25*2
Number MPP trackers	2	2	2	2
Number input strings	1/1	1/1	1/1	1/1
Max. PV input current (A)	18.5*2	18.5*2	18.5*2	18.5*2
MPPT voltage range (Vdc)	150-850	150-850	150-850	150-850
Battery (charge/discharge**)**				
Battery type	Rechargeable Li-ion Battery/ LiFePO4/ Lead-acid			
Battery Normal Voltage Range (Vdc)	80-600(Field adapt battery voltage range)			
Max charge/discharge Current(A)	30	30	30	30
Max charge/discharge Power(kW)	8	10	12	15
AC Grid (input and output)				
Normal AC Voltage (Vac)	3P+N+PE/3P+PE 230/400			
Frequency (Hz)	50 / 60			
Normal AC Current (A)	11.6	14.5	17.4	21.8
Max. cont. input/output current (A)	20 / 13.5	26 / 17	32 / 21.5	40.5 / 27
Rated Power (kW)	8	10	12	15
Rated Apparent Power (kVA)	8	10	12	15
Max. cont. input/output Power (kW)	12 / 8.8	15 / 11	18 / 13.2	22.5 / 16.5
Max. cont. Apparent input/output Power (kVA)	12 / 8.8	15 / 11	18 / 13.2	22.5 / 16.5
Power factor(adjustable)	1.0(-0.8~ +0.8)			
AC Load output (stand-alone)				
Normal Voltage (Vac)	3P+N+PE/3P+PE 230/400			
Frequency (Hz)	50 / 60			
Nominal Current (A)	11.6	14.5	17.4	21.8
Max. cont. current (A)	13.5	17	21.5	27
Max. cont. Power (kW)	8	10	12	15
Rated Apparent Power (kVA)	8	10	12	15
Max. cont. Apparent Power (kVA)	8	10	12	15
Others				
Ingress protection (IP)	IP66			
Protective class	Class I			
Temperature (℃)	-25℃ to +60℃ (Derating 45℃)			
Inverter Isolation	Non-isolated (PV - AC - BAT)			
Overvoltage category	OVC III (AC Main), OVC II (DC)			

Specifications table				
Model	AF3K-MTH-0	AF4K-MTH-0	AF5K-MTH-0	AF6K-MTH-0
	AF3K-ATH-0	AF4K-ATH-0	AF5K-ATH-0	AF6K-ATH-0
Battery (charge/discharge**)**				
Battery type	Rechargeable Li-ion Battery/ LiFePO4/ Lead-acid			
Battery Normal Voltage Range (Vdc)	80-800(Field adapt battery voltage range)			
Max charge/discharge Current(A)	30*2	30*2	30*2	30*2
Max charge/discharge Power(kW)	3 / 3.3	4 / 4.4	5 / 5.5	6 / 6.6
AC Grid (input and output)				
Normal AC Voltage (Vac)	3P+N+PE/3P+PE 230/400			
Frequency (Hz)	50 / 60			
Normal AC Current (A)	4.4	5.8	7.3	8.7
Max. cont. input/output current (A)	8 / 5.3	10.5 / 7	13 / 8.5	16 / 10.5
Rated Power (kW)	3	4	5	6
Rated Apparent Power (kVA)	3	4	5	6
Max. cont. input/output Power (kW)	4.5 / 3.3	6 / 4.4	7.5 / 5.5	9 / 6.6
Max. cont. Apparent input/output Power (kVA)	4.5 / 3.3	6 / 4.4	7.5 / 5.5	9 / 6.6
Power factor(adjustable)	1.0(-0.8~ +0.8)			
AC Load output (stand-alone)				
Normal Voltage (Vac)	3P+N+PE/3P+PE 230/400			
Frequency (Hz)	50 / 60			
Nominal Current (A)	4.4	5.8	7.3	8.7
Max. cont. current (A)	5.3	7	8.5	10.5
Max. cont. Power (kW)	3	4	5	6
Rated Apparent Power (kVA)	3	4	5	6
Max. cont. Apparent Power (kVA)	3	4	5	6
Others				
Ingress protection (IP)	IP66			
Protective class	Class I			
Temperature (℃)	-25℃ to +60℃ (Derating 45℃)			
Inverter Isolation	Non-isolated (AC - BAT)			
Overvoltage category	OVC III (AC Main), OVC II (DC)			

Specifications table				
Model	AF8K-MTH-0	AF10K-MTH-0	AF12K-MTH-0	AF15K-MTH-0
	AF8K-ATH-0	AF10K-ATH-0	AF12K-ATH-0	AF15K-ATH-0
Battery (charge/discharge***)***				
Battery type	Rechargeable Li-ion Battery/ LiFePO4/ Lead-acid			
Battery Normal Voltage Range (Vdc)	80-800(Field adapt battery voltage range)			
Max charge/discharge Current(A)	30*2	30*2	30*2	30*2
Max charge/discharge Power(kW)	8 / 8.8	10 / 11	12/13.2	15 / 16.5
AC Grid (input and output)				
Normal AC Voltage (Vac)	3P+N+PE/3P+PE 230/400			
Frequency (Hz)	50 / 60			
Normal AC Current (A)	11.6	14.5	17.4	21.8
Max. cont. input/output current (A)	20 / 13.5	26 / 17	32 / 21.5	40.5 / 27
Rated Power (kW)	8	10	12	15
Rated Apparent Power (kVA)	8	10	12	15
Max. cont. input/output Power (kW)	12 / 8.8	15 / 11	18 / 13.2	22.5 / 16.5
Max. cont. Apparent input/output Power (kVA)	12 / 8.8	15 / 11	18 / 13.2	22.5 / 16.5
Power factor(adjustable)	1.0(-0.8~ +0.8)			
AC Load output (stand-alone)				
Normal Voltage (Vac)	3P+N+PE/3P+PE 230/400			
Frequency (Hz)	50 / 60			
Nominal Current (A)	11.6	14.5	17.4	21.8
Max. cont. current (A)	13.5	17	21.5	27
Max. cont. Power (kW)	8	10	12	15
Rated Apparent Power (kVA)	8	10	12	15
Max. cont. Apparent Power (kVA)	8	10	12	15
Others				
Ingress protection (IP)	IP66			
Protective class	Class I			
Temperature (℃)	-25℃ to +60℃ (Derating 45℃)			
Inverter Isolation	Non-isolated (AC - BAT)			
Overvoltage category	OVC III (AC Main), OVC II (DC)			

The battery used for testing with the Hybrid Inverter:

Manufacturer	Shenzhen Hailei New Energy Co.,Ltd		
Battery Models	ATOM HVS-7.68	ATOM HVS-10.24	ATOM HVS-12.8
Nominal Voltage	153.6 V	204.8 V	256.0 V
Nominal capacity	50 Ah	50 Ah	50 Ah
Battery System Capacity	7.68 kWh	10.24 kWh	12.80 kWh
Battery Models	ATOM HVS-15.36	ATOM HVS-17.92	ATOM HVS-20.48
Nominal Voltage	307.2 V	358.4 V	409.6 V
Nominal capacity	50 Ah	50 Ah	50 Ah
Battery System Capacity	15.36 kWh	17.92 kWh	20.48 kWh
Remark: The CB test certificate No. of the battery: FR_723199/M1 When the batteries are connected in parallel, the charge/ discharge current is superimposed and is limited by the maximum current of the battery port of the Hybrid Inverter. The batteries are not integrated into the Hybrid Inverter and must be installed according to the local regulations.			

Clause	Test Item	Remark	P / F / N/A
A.4.3.1 & A.4.3.2	Test procedure for maximum/minimum frequency		P
A.4.3.1 & A.4.3.2	Test procedure for maximum/minimum voltage		P
A.4.3.3.1	Insensitivity to harmonics of the frequency relay		P
A.4.3.3.2	Remote trip signal		P
A.4.3.3.3	Communication Signal		P
A.4.3.4	Verification of insensitivity to the frequency derivative		P
A.4.4	Self -test		P
A.4.5	Single fault tolerance		P
A.4.7	Climatic compatibility tests		P
A.4.8	Insulation tests (CEI EN 60255-5)		P
A.4.9	Test for the overload capacity of measuring circuits		P
A.4.11	Automatic mechanism to prevent current imbalance during production		N/A
B.1 a)/b)	Harmonic current emission		P
B.1 c)	Flicker emission		P
B.1.1	Conditions of connection, reconnection and gradual power supply		P
B.1.2.2.1	Reactive power capability - Inverter in systems with total capacity up to 11.08 kW	≤11.08 kW	N/A
B.1.2.2.2	Reactive power capability - Inverter in systems with total capacity greater than 11.08 kW	>11.08 kW	P
B.1.2.3	Reactive power supply at a given level (greater 11.08 kW systems, but can requested for smaller systems as well)	>11.08 kW *	P
B.1.2.4	Response time to an assigned step level change (greater 11.08 kW systems)	>11.08 kW *	P
B.1.2.5	Automatic supply of reactive power according to the characteristic curve cos φ = f(P)		P
B.1.2.6	Automatic supply of reactive power according to the characteristic curve Q= f(V) (greater 11.08kW systems)	>11.08 kW *	P
B.1.3.1	Automatic limitation of active power for voltage values close to 110% of the rated voltage		P
B.1.3.2	Adjustment of active power in the presence of over-frequency transistors on the transmission network		P
B.1.3.3	Verification of the operating range in voltage and frequency		P
B.1.3.3.1	Reduction of active power in the presence of transient under-frequency on transmission network		P
B.1.3.4	Limitation of active power by external control from the distributor		P
B.1.4.1	Checking the DC component output current		P
B.1.4.2	Checking the protection against DC input		P
B.1.5	Checking insensitivity of voltage dips (LVRT and OVRT(8.5. 1-figure 30) capability) [greater 11.08 kW systems]	>11.08 kW	P
B.1.6	Checking the insensitivity to automatic reclosing during phase discordance		P

Clause	Test Item	Remark	P / F / N/A
Hybrid inverter use battery for testing：			
Bbis.3 a)/b)	*Harmonics measurement*		*P*
Bbis.3 c)	*Flicker measurement*		*P*
Bbis.4	*Check the operating range in voltage and frequency*		*P*
Bbis.5	*Conditions of connection, reconnection and gradual power supply*		*P*
Bbis.6.1 & Bbis.6.2	*Checking construction requirements: reactive power capability*		*P*
Bbis.6.3 & Bbis.6.4	*Reactive power production according to an assigned level*	*>11.08 kW **	*P*
Bbis.6.5	*Response time to a step change of the assigned level*	*>11.08 kW **	*P*
Bbis.6.6 & Bbis.6.7	*Automatic production of reactive power according to a characteristic curve cos φ = f(P)*		*P*
Bbis.6.8 & Bbis.6.9	*Automatic reactive power production according to a characteristic curve Q = f(V)*	*>11.08 kW **	*P*
Bbis.7.1	*Active power limitation for voltage values near to 110 % Un*		*P*
Bbis.7.2	*Verification of automatic reduction of active power in the presence of overfrequency transients on the network*		*P*
Bbis.7.3	*Verification of the automatic increase of active power in the presence of underfrequency transients on the network*		*P*
Bbis.7.4	*Active power limitation in coincidence with external command coming from the Electricity Distributor*		*P*
Bbis.7.4.1	*Verification of the settling time at a power increase / decrease command*		*P*
Bbis.8.1	*Verification of continuous component emission*		*P*
Bbis.8.2	*Verification of protections against the continuous DC injection*		*P*
Bbis.9	*Verification of insensitivity to voltage dips (UVRT and OVRT(8.5. 1-figure 30 capability)*	*>11.08 kW*	*P*
Bbis.10	*Verification of insensitivity to automatic reclosing in phase discrepancy*		*P*
Remark: ** The tests described in this paragraph are mandatory only for inverters used in plants with a power greater than 11.08 kW, but at the request of the manufacturer they can also be carried out and documented for smaller size converters.*			

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Clause	Requirement - Test	Result - Remark	Verdict

A.3	TABLE: Adjustment ranges for the SPI							P
Voltage values								
Threshold	85% U_n (27.S1)	t_{min} (27.S1)	15% U_n (27.S2)	t_{min} (27.S2)	110% U_n (59.S1)	t_{max} (59.S1)	115% U_n (59.S2)	t_{max} (59.S2)
Range	0.2-1.0 U_n	0.05-5 s	0.05-1.0 U_n	0.05-5 s	1.0-1.2 U_n	0.2-10 s	1.0-1.3 U_n	0.05-1.0 s
Steps	0.05 U_n	0.05 s	0.05 U_n	0.05 s	0.01 U_n	0.1 s	0.01 U_n	0.05 s
Frequency values								
Threshold	49.50 Hz (81<.S1)	t_{min} (81<.S1)	47.50 Hz (81<.S2)	t_{min} (81<.S2)	50.50 Hz (81>.S1)	t_{max} (81>.S1)	51.50 Hz (81>.S2)	t_{max} (81>.S2)
Range	47.0-50.0 Hz	0.05-5s	47.0-50.0 Hz	0.05-5s	50.0-52.0 Hz	0.05-5 s	50.0-52.0 Hz	0.05-5 s
Steps	0.1 Hz	0.05 s	0.1 Hz	0.05 s	0.1 Hz	0.05 s	0.1 Hz	0.05 s

Table 13 - SPI adjustments (with the exception of systems with power less than 800 W)

Protection	Intervention threshold	Intervention time (time elapsing between the instant the anomalous condition detected by the protection starts and the release of the trip command)
Maximum voltage (59.S1, 10 min moving average measurement, in accordance with CEI EN 61000-4-30)	1,10 Vn	Variable according to the initial and final voltage value, maximum 603 s.
Maximum voltage (59.S2)	1,15 Vn	0,2 s
Minimum voltage (27.S1)	0,85 Vn	1,5 s
Minimum voltage (27.S2) *	0,15 Vn	0,2 s
Maximum frequency (81>.S1)** ◊	50,2 Hz	0,1 s
Minimum frequency (81<.S1)** ◊	49,8 Hz	0,1 s
Maximum frequency (81>.S2) ◊	51,5 Hz	0,1 s or 1 s §
Minimum frequency (81<.S2) ◊	47,5 Hz	0,1 s or 4 s §

* The value indicated for the intervention time must be adopted when the total power is higher than 11.08 kW, while for lower powers, an intervention time without intentional delay can be optionally used. In the case of synchronous generators, the value can be raised to 0.7 Vn and t = 0.150 s

** Threshold enabled only with external signal at high value and with high local command.

◊ For voltage values below 0.2 Vn, the maximum / minimum frequency protection must be inhibited.

§ In this regard, see what is reported in the text that follows Figure 35.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.3.1 & A.4.3.2	**TABLE: Test procedure for maximum/minimum frequency (81.S2) (stand alone, use of the SPI on the basis of local information only)**						**P**
Model	AF15K-MTH						
	Under frequency:			**Over frequency:**			
A) STEPS for trip value [Hz to Hz]:	1.01 threshold -> decrease by max 10mHz steps			0.99 threshold -> increase by max 10mHz steps			
D) STEP trip time [Hz to Hz]:	1.01 threshold -> 0.99 threshold			0.99 threshold -> 1.01 threshold			
Ambient temperature							
Limit [Hz]:	47.50 Hz (81<.S2)			51.50 Hz (81>.S2)			
Measurement accuracy of the tripping value [Hz]:	47.47	47.49	47.45	51.59	51.56	51.55	
Trip time limit [ms]:	100			100			
Measurement the trip time [ms]:	96.0	97.0	94.0	93.0	97.0	97.0	
-25°C temperature							
Limit [Hz]:	47.50 Hz (81<.S2)			51.50 Hz (81>.S2)			
Measurement accuracy of the tripping value [Hz]:	47.49	47.44	47.44	51.57	51.51	51.57	
Trip time limit [ms]:	100			100			
Measurement the trip time [ms]:	92.0	94.0	95.0	99.0	91.0	97.0	
+60°C temperature							
Limit [ms]:	47.50 Hz (81<.S2)			51.50 Hz (81>.S2)			
Measurement accuracy of the tripping value [Hz]:	47.41	47.44	47.48	51.55	51.52	51.56	
Trip time limit [ms]:	100			100			
Measurement the trip time [ms]:	97.0	92.0	99.0	97.0	98.0	98.0	

Assessment criterion:
For frequencies of between 47,5 Hz and 51,5 Hz (±0,1% fn) automatic disconnection from the network as a result of a deviation in frequency is not permitted.
Limit values:
Frequency decrease protectionf<47,5 Hz100 ms
Frequency increase protectionf<51,5 Hz100 ms
Verification is pass when the SPI trip occurs within the following limits for at least 3 consecutive tests:
- ≤ 1% Vn for voltage intervention thresholds
- ±20 mHz for frequency intervention thresholds
- ≤ 3 % ± 20 ms for intervention times
- ≤ 1 % Vn for voltage recovery thresholds
- ±20 mHz for frequency recovery thresholds

For **each repetition** of the tests, the max tolerances of the values are:
Voltage: 2%
Frequency: ±20mHz
Trip times: 1%±20ms

Note:
*If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.3.1 & A.4.3.2	**TABLE: Test procedure for maximum/minimum frequency (81.S2) (use of SPI on the basis of local readings and external information/commands)**						**P**
Model	AF15K-MTH						
	Under frequency:			**Over frequency:**			
A) STEPS for trip value [Hz to Hz]:	1.01 threshold -> decrease by max 10mHz steps			0.99 threshold -> increase by max 10mHz steps			
D) STEP trip time [Hz to Hz]:	1.01 threshold -> 0.99 threshold			0.99 threshold -> 1.01 threshold			
Ambient temperature							
Limit [Hz]:	47.50 Hz (81<.S2)			51.50 Hz (81>.S2)			
Measurement accuracy of the tripping value [Hz]:	47.49	47.47	47.42	51.54	51.53	51.51	
Trip time limit [ms]:	4000			1000			
Measurement the trip time [ms]:	3990	3970	3980	996	992	999	
-25°C temperature							
Limit [Hz]:	47.50 Hz (81<.S2)			51.50 Hz (81>.S2)			
Measurement accuracy of the tripping value [Hz]:	47.47	47.45	47.45	51.56	51.61	51.51	
Trip time limit [ms]:	4000			1000			
Measurement the trip time [ms]:	3980	3990	3980	991	997	999	
+60°C temperature							
Limit [ms]:	47.50 Hz (81<.S2)			51.50 Hz (81>.S2)			
Measurement accuracy of the tripping value [Hz]:	47.42	47.41	47.45	51.53	51.58	51.55	
Trip time limit [ms]:	4000			1000			
Measurement the trip time [ms]:	3990	3990	3980	991	990	996	

Assessment criterion:
For frequencies of between 47,5 Hz and 51,5 Hz (±0,1% fn) automatic disconnection from the network as a result of a deviation in frequency is not permitted.
Limit values:
Frequency decrease protectionf<47,5 Hz4000 ms
Frequency increase protectionf<51,5 Hz1000 ms
Verification is pass when the SPI trip occurs within the following limits for at least 3 consecutive tests:
- ≤ 1% Vn for voltage intervention thresholds
- ±20 mHz for frequency intervention thresholds
- ≤ 3 % ± 20 ms for intervention times
- ≤ 1 % Vn for voltage recovery thresholds
- ±20 mHz for frequency recovery thresholds

For **each repetition** of the tests, the max tolerances of the values are:
Voltage: 2%
Frequency: ±20mHz
Trip times: 1%±20ms

Note:
*If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.3.1 & A4.3.2	**TABLE: Test procedure for maximum/minimum frequency functions (81.S1)**						**P**
Model	AF15K-MTH						
	Under frequency:			**Over frequency:**			
A) STEPS for trip value [Hz to Hz]:	1.01 threshold -> decrease by max 10mHz steps			0.99 threshold -> increase by max 10mHz steps			
D) STEP trip time [Hz to Hz]:	1.01 threshold -> 0.99 threshold			0.99 threshold -> 1.01 threshold			
Ambient temperature							
Tripping threshold limit [Hz]:	49.80 (81<.S1)			50.20 (81>.S1)			
Measurement accuracy of the tripping value [Hz]:	49.78	49.78	49.74	50.26	50.27	50.21	
Trip time limit [ms]:	100			100			
Measurement the trip time [ms]:	90.0	90.0	99.0	96.0	99.0	91.0	
-25°C temperature							
Tripping threshold limit [Hz]:	49.80 (81<.S1)			50.20 (81>.S1)			
Measurement accuracy of the tripping value [Hz]:	49.75	49.77	49.69	50.22	50.25	50.29	
Trip time limit [ms]:	100			100			
Measurement the trip time [ms]:	91.0	95.0	99.0	92.0	96.0	92.0	
+60°C temperature							
Tripping threshold limit [Hz]:	49.80 (81<.S1)			50.20 (81>.S1)			
Measurement accuracy of the tripping value [Hz]:	49.78	49.75	49.74	50.26	50.28	50.24	
Trip time limit [ms]:	100			100			
Measurement the trip time [ms]:	95.0	98.0	90.0	90.0	97.0	93.0	
Note: Threshold enabled only with external signal at high value and with high local command.							

Assessment criterion:
For frequencies of between 49,8 Hz and 50,2 Hz automatic disconnection from the network as a result of a deviation in frequency is not permitted.
Limit values:
Frequency decrease protectionf<49,8 Hz100 ms
Frequency increase protectionf<50,2 Hz100 ms
Verification is pass when the SPI trip occurs within the following limits for at least 3 consecutive tests:
- ≤ 1% Vn for voltage intervention thresholds
- ±20 mHz for frequency intervention thresholds
- ≤ 3 % ± 20 ms for intervention times
- ≤ 1 % Vn for voltage recovery thresholds
- ±20 mHz for frequency recovery thresholds

For **each repetition** of the tests, the max tolerances of the values are:
Voltage: 2%
Frequency: ±20mHz
Trip times: 1%±20ms

Note:
*If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test (such as -25°C / +60°C).

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.3.1 & A.4.3.2	**TABLE: Test procedure for maximum/minimum voltage (27.S1)**		**P**
Model:	AF15K-MTH		
L1L2L3	**Under voltage:**		
A) STEPS for trip value [V to V]:	1.1 threshold -> decrease by 0.5% Vn steps		
D) STEP for trip time [V to V]:	1.1 threshold -> 0.9 threshold		
Ambient temperature			
Limit [V]:	195.5 V (27.S1)		
Measurement accuracy of the tripping value [V]:	195.4	195.2	195.3
Trip time limit [ms]:	1500 ms		
Measurement the trip time [ms]:	1491	1491	1499
-25°C temperature			
Limit [V]:	195.5 V (27.S1)		
Measurement accuracy of the tripping value [V]:	195.2	195.4	195.2
Trip time limit [ms]:	1500 ms		
Measurement the trip time [ms]:	1491	1495	1499
+60°C temperature			
Limit [V]:	195.5 V (27.S1)		
Measurement accuracy of the tripping value [V]:	195.3	195.2	195.4
Trip time limit [ms]:	1500 ms		
Measurement the trip time [ms]:	1499	1498	1494

Note:
Verification is pass when the SPI trip occurs within the following limits for at least 3 consecutive tests:
- ≤ 1% Vn for voltage intervention thresholds
- ±20 mHz for frequency intervention thresholds
- ≤ 3 % ± 20 ms for intervention times
- ≤ 1 % Vn for voltage recovery thresholds
- ±20 mHz for frequency recovery thresholds

For **each repetition** of the tests, the max tolerances of the values are:
Voltage: 2%
Frequency: ±20mHz
Trip times: 1%±20ms
*If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test (such as -25°C / +60°C).

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.3.1 & A.4.3.2	**TABLE: Test procedure for maximum/minimum voltage (27.S1)**		**P**
Model:	AF15K-MTH		
L1	**Under voltage:**		
A) STEPS for trip value [V to V]:	1.1 threshold -> decrease by 0.5% Vn steps		
D) STEP for trip time [V to V]:	1.1 threshold -> 0.9 threshold		
Ambient temperature			
Limit [V]:	195.5 V (27.S1)		
Measurement accuracy of the tripping value [V]:	195.3	195.2	195.4
Trip time limit [ms]:	1500 ms		
Measurement the trip time [ms]:	1491	1490	1495
-25°C temperature			
Limit [V]:	195.5 V (27.S1)		
Measurement accuracy of the tripping value [V]:	195.1	195.3	195.4
Trip time limit [ms]:	1500 ms		
Measurement the trip time [ms]:	1495	1498	1498
+60°C temperature			
Limit [V]:	195.5 V (27.S1)		
Measurement accuracy of the tripping value [V]:	195.2	195.1	195.2
Trip time limit [ms]:	1500 ms		
Measurement the trip time [ms]:	1494	1493	1490

Note:
Verification is pass when the SPI trip occurs within the following limits for at least 3 consecutive tests:
- ≤ 1% Vn for voltage intervention thresholds
- ±20 mHz for frequency intervention thresholds
- ≤ 3 % ± 20 ms for intervention times
- ≤ 1 % Vn for voltage recovery thresholds
- ±20 mHz for frequency recovery thresholds

For **each repetition** of the tests, the max tolerances of the values are:
Voltage: 2%
Frequency: ±20mHz
Trip times: 1%±20ms
*If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test (such as -25°C / +60°C).

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.3.1 & A.4.3.2	**TABLE: Test procedure for maximum/minimum voltage (27.S1)**		**P**
Model:	AF15K-MTH		
L2	**Under voltage:**		
A) STEPS for trip value [V to V]:	1.1 threshold -> decrease by 0.5% Vn steps		
D) STEP for trip time [V to V]:	1.1 threshold -> 0.9 threshold		
Ambient temperature			
Limit [V]:	195.5 V (27.S1)		
Measurement accuracy of the tripping value [V]:	195.3	195.1	195.2
Trip time limit [ms]:	1500 ms		
Measurement the trip time [ms]:	1498	1498	1494
-25°C temperature			
Limit [V]:	195.5 V (27.S1)		
Measurement accuracy of the tripping value [V]:	195.4	195.2	195.3
Trip time limit [ms]:	1500 ms		
Measurement the trip time [ms]:	1499	1499	1493
+60°C temperature			
Limit [V]:	195.5 V (27.S1)		
Measurement accuracy of the tripping value [V]:	195.1	195.3	195.1
Trip time limit [ms]:	1500 ms		
Measurement the trip time [ms]:	1495	1491	1495

Note:
Verification is pass when the SPI trip occurs within the following limits for at least 3 consecutive tests:
- ≤ 1% Vn for voltage intervention thresholds
- ±20 mHz for frequency intervention thresholds
- ≤ 3 % ± 20 ms for intervention times
- ≤ 1 % Vn for voltage recovery thresholds
- ±20 mHz for frequency recovery thresholds

For **each repetition** of the tests, the max tolerances of the values are:
Voltage: 2%
Frequency: ±20mHz
Trip times: 1%±20ms
*If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test (such as -25°C / +60°C).

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.3.1 & A.4.3.2	**TABLE: Test procedure for maximum/minimum voltage (27.S1)**			**P**
Model:	AF15K-MTH			
L3	**Under voltage:**			
A) STEPS for trip value [V to V]:	1.1 threshold -> decrease by 0.5% Vn steps			
D) STEP for trip time [V to V]:	1.1 threshold -> 0.9 threshold			
Ambient temperature				
Limit [V]:	195.5 V (27.S1)			
Measurement accuracy of the tripping value [V]:	195.2	195.3	195.3	
Trip time limit [ms]:	1500 ms			
Measurement the trip time [ms]:	1499	1495	1499	
-25°C temperature				
Limit [V]:	195.5 V (27.S1)			
Measurement accuracy of the tripping value [V]:	195.1	195.2	195.4	
Trip time limit [ms]:	1500 ms			
Measurement the trip time [ms]:	1491	1495	1495	
+60°C temperature				
Limit [V]:	195.5 V (27.S1)			
Measurement accuracy of the tripping value [V]:	195.2	195.3	195.1	
Trip time limit [ms]:	1500 ms			
Measurement the trip time [ms]:	1499	1495	1499	

Note:
Verification is pass when the SPI trip occurs within the following limits for at least 3 consecutive tests:
- ≤ 1% Vn for voltage intervention thresholds
- ±20 mHz for frequency intervention thresholds
- ≤ 3 % ± 20 ms for intervention times
- ≤ 1 % Vn for voltage recovery thresholds
- ±20 mHz for frequency recovery thresholds

For **each repetition** of the tests, the max tolerances of the values are:
Voltage: 2%
Frequency: ±20mHz
Trip times: 1%±20ms
*If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test (such as -25°C / +60°C).

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.3.1 & A.4.3.2	**TABLE: Test procedure for maximum/minimum voltage (27.S2) (59.S2)**						**P**
Model	AF15K-MTH						
L1L2L3	**Under voltage:**			**Over voltage:**			
A) STEPS for trip value [V to V]:	1.1 threshold -> decrease by 0.5% Vn steps			0.9 threshold -> increase by 0.5% Vn steps			
D) STEP for trip time [V to V]:	1.1 threshold -> 0.9 threshold			0.9 threshold -> 1.08 threshold			
Ambient temperature							
Limit [V]:	34.5 V (27.S2)			264.5 V (59.S2)			
Measurement accuracy of the tripping value [V]:	34.35	34.33	34.21	264.58	264.63	264.55	
Trip time limit [ms]:	200 ms			200 ms			
Measurement the trip time [ms]:	198.0	195.0	199.0	196.0	199.0	191.0	
-25°C temperature							
Limit [V]:	34.5 V (27.S2)			264.5 V (59.S2)			
Measurement accuracy of the tripping value [V]:	34.22	34.35	34.28	264.53	264.66	264.56	
Trip time limit [ms]:	200 ms			200 ms			
Measurement the trip time [ms]:	190.0	191.0	194.0	191.0	190.0	199.0	
+60°C temperature							
Limit [V]:	34.5 V (27.S2)			264.5 V (59.S2)			
Measurement accuracy of the tripping value [V]:	34.26	34.35	34.19	264.62	264.59	264.57	
Trip time limit [ms]:	200 ms			200 ms			
Measurement the trip time [ms]:	199.0	190.0	195.0	190.0	192.0	197.0	

Note:
Verification is pass when the SPI trip occurs within the following limits for at least 3 consecutive tests:
- ≤ 1% Vn for voltage intervention thresholds
- ±20 mHz for frequency intervention thresholds
- ≤ 3 % ± 20 ms for intervention times
- ≤ 1 % Vn for voltage recovery thresholds
- ±20 mHz for frequency recovery thresholds

For **each repetition** of the tests, the max tolerances of the values are:
Voltage: 2%
Frequency: ±20mHz
Trip times: 1%±20ms
*If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test (such as -25°C / +60°C).

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.3.1 & A.4.3.2	**TABLE: Test procedure for maximum/minimum voltage (27.S2) (59.S2)**						**P**
Model	AF15K-MTH						
L1	**Under voltage:**			**Over voltage:**			
A) STEPS for trip value [V to V]:	1.1 threshold -> decrease by 0.5% Vn steps			0.9 threshold -> increase by 0.5% Vn steps			
D) STEP for trip time [V to V]:	1.1 threshold -> 0.9 threshold			0.9 threshold -> 1.08 threshold			
Ambient temperature							
Limit [V]:	34.5 V (27.S2)			264.5 V (59.S2)			
Measurement accuracy of the tripping value [V]:	34.26	34.35	34.19	264.67	264.55	264.63	
Trip time limit [ms]:	200 ms			200 ms			
Measurement the trip time [ms]:	192.0	199.0	191.0	192.0	198.0	192.0	
-25°C temperature							
Limit [V]:	34.5 V (27.S2)			264.5 V (59.S2)			
Measurement accuracy of the tripping value [V]:	34.20	34.34	34.33	264.62	264.61	264.59	
Trip time limit [ms]:	200 ms			200 ms			
Measurement the trip time [ms]:	198.0	191.0	193.0	199.0	192.0	191.0	
+60°C temperature							
Limit [V]:	34.5 V (27.S2)			264.5 V (59.S2)			
Measurement accuracy of the tripping value [V]:	34.32	34.20	34.31	264.66	264.55	264.53	
Trip time limit [ms]:	200 ms			200 ms			
Measurement the trip time [ms]:	196.0	190.0	190.0	199.0	190.0	191.0	

Note:
Verification is pass when the SPI trip occurs within the following limits for at least 3 consecutive tests:
- ≤ 1% Vn for voltage intervention thresholds
- ±20 mHz for frequency intervention thresholds
- ≤ 3 % ± 20 ms for intervention times
- ≤ 1 % Vn for voltage recovery thresholds
- ±20 mHz for frequency recovery thresholds

For **each repetition** of the tests, the max tolerances of the values are:
Voltage: 2%
Frequency: ±20mHz
Trip times: 1%±20ms
*If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test (such as -25°C / +60°C).

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.3.1 & A.4.3.2	**TABLE: Test procedure for maximum/minimum voltage (27.S2) (59.S2)**						**P**
Model	AF15K-MTH						
L2		**Under voltage:**			**Over voltage:**		
A) STEPS for trip value [V to V]:		1.1 threshold -> decrease by 0.5% Vn steps			0.9 threshold -> increase by 0.5% Vn steps		
D) STEP for trip time [V to V]:		1.1 threshold -> 0.9 threshold			0.9 threshold -> 1.08 threshold		
Ambient temperature							
Limit [V]:		34.5 V (27.S2)			264.5 V (59.S2)		
Measurement accuracy of the tripping value [V]:		34.25	34.36	34.18	264.54	264.63	264.52
Trip time limit [ms]:		200 ms			200 ms		
Measurement the trip time [ms]:		190.0	191.0	196.0	190.0	198.0	195.0
-25°C temperature							
Limit [V]:		34.5 V (27.S2)			264.5 V (59.S2)		
Measurement accuracy of the tripping value [V]:		34.38	34.27	34.25	264.59	264.56	264.54
Trip time limit [ms]:		200 ms			200 ms		
Measurement the trip time [ms]:		192.0	196.0	198.0	198.0	199.0	197.0
+60°C temperature							
Limit [V]:		34.5 V (27.S2)			264.5 V (59.S2)		
Measurement accuracy of the tripping value [V]:		34.36	34.39	34.41	264.61	264.57	264.58
Trip time limit [ms]:		200 ms			200 ms		
Measurement the trip time [ms]:		197.0	199.0	190.0	199.0	190.0	191.0

Note:
Verification is pass when the SPI trip occurs within the following limits for at least 3 consecutive tests:
- ≤ 1% Vn for voltage intervention thresholds
- ±20 mHz for frequency intervention thresholds
- ≤ 3 % ± 20 ms for intervention times
- ≤ 1 % Vn for voltage recovery thresholds
- ±20 mHz for frequency recovery thresholds

For **each repetition** of the tests, the max tolerances of the values are:
Voltage: 2%
Frequency: ±20mHz
Trip times: 1%±20ms
*If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test (such as -25°C / +60°C).

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.3.1 & A.4.3.2	**TABLE: Test procedure for maximum/minimum voltage (27.S2) (59.S2)**						**P**
Model	AF15K-MTH						
L3	**Under voltage:**			**Over voltage:**			
A) STEPS for trip value [V to V]:	1.1 threshold -> decrease by 0.5% Vn steps			0.9 threshold -> increase by 0.5% Vn steps			
D) STEP for trip time [V to V]:	1.1 threshold -> 0.9 threshold			0.9 threshold -> 1.08 threshold			
Ambient temperature							
Limit [V]:	34.5 V (27.S2)			264.5 V (59.S2)			
Measurement accuracy of the tripping value [V]:	34.29	34.30	34.37	264.56	264.62	264.60	
Trip time limit [ms]:	200 ms			200 ms			
Measurement the trip time [ms]:	199.0	190.0	199.0	194.0	199.0	199.0	
-25°C temperature							
Limit [V]:	34.5 V (27.S2)			264.5 V (59.S2)			
Measurement accuracy of the tripping value [V]:	34.22	34.29	34.31	264.55	264.60	264.55	
Trip time limit [ms]:	200 ms			200 ms			
Measurement the trip time [ms]:	199.0	191.0	197.0	193.0	194.0	199.0	
+60°C temperature							
Limit [V]:	34.5 V (27.S2)			264.5 V (59.S2)			
Measurement accuracy of the tripping value [V]:	34.45	34.38	34.22	264.63	264.57	264.59	
Trip time limit [ms]:	200 ms			200 ms			
Measurement the trip time [ms]:	190.0	195.0	199.0	190.0	199.0	193.0	

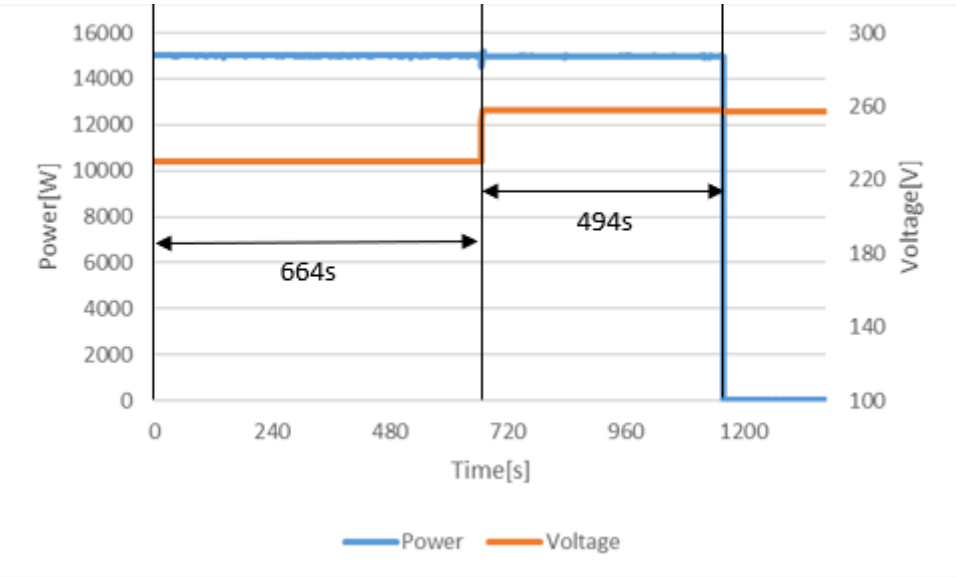
Note:
Verification is pass when the SPI trip occurs within the following limits for at least 3 consecutive tests:
- ≤ 1% Vn for voltage intervention thresholds
- ±20 mHz for frequency intervention thresholds
- ≤ 3 % ± 20 ms for intervention times
- ≤ 1 % Vn for voltage recovery thresholds
- ±20 mHz for frequency recovery thresholds

For **each repetition** of the tests, the max tolerances of the values are:
Voltage: 2%
Frequency: ±20mHz
Trip times: 1%±20ms
*If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test (such as -25°C / +60°C).

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

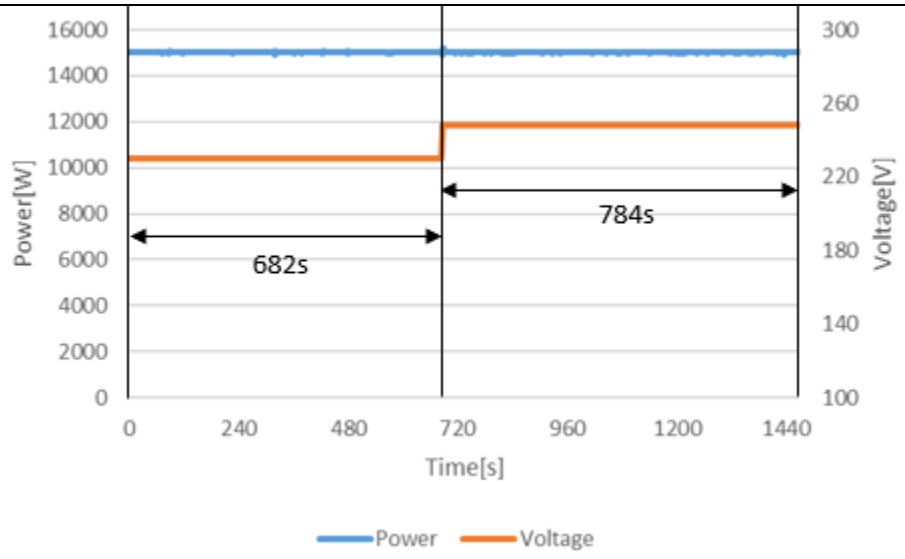
A.4.3.1 & A.4.3.2	**TABLE: Measuring the rise-in voltage protection as a running 10-minute mean value (59.S1)**		**P**
Model:	AF15K-MTH		
Test:		Disconnection time:	Limit:
a)	The voltage is set to 100% U_n and held for 600 s. Thereafter the voltage is set to 112% U_n (257.6 V). Disconnection must take place within 603 s.		
	Phase 1	494	≤ 603 s
	Phase 2	495	
	Phase 3	493	
b)	The voltage is set to U_n for 600 s and then to 108% U_n (248.4 V) for 600 s. No disconnection should take place.		
	Phase 1	No disconnection	Disconnection should not take place.
	Phase 2	No disconnection	
	Phase 3	No disconnection	
c)	The voltage is set to 106 % U_n (243.8 V) and held for 600 s. Thereafter the voltage is set to 114 % U_n (262.6 V). Disconnection must take place within 300 s or about 50 % of the disconnection time measured in point a).*		
	Phase 1	288	The disconnection time should be about 50 % of the value measured in a). *
	Phase 2	285	
	Phase 3	286	

Note:
*If the setting value is set to 600 s, then the disconnection time can be in the range between 225 s and 375 s.

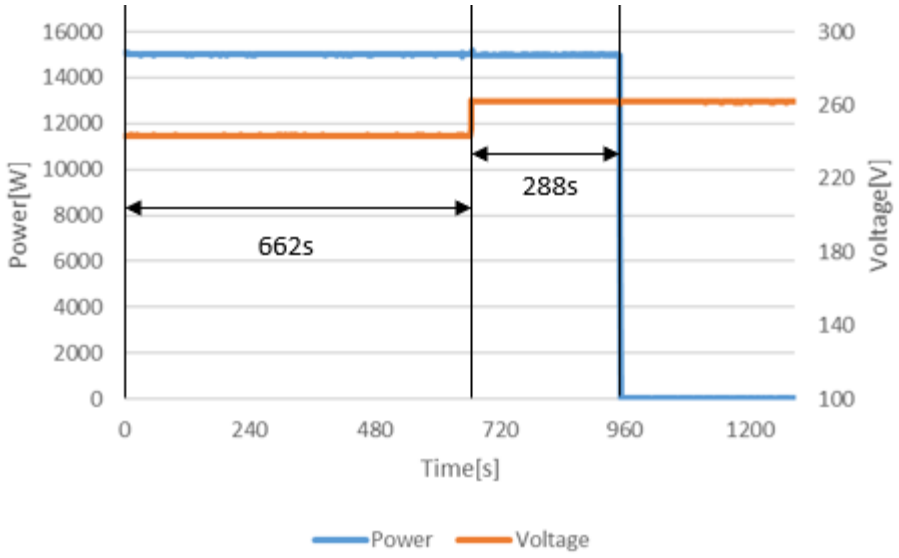


a)

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict



b)



c)

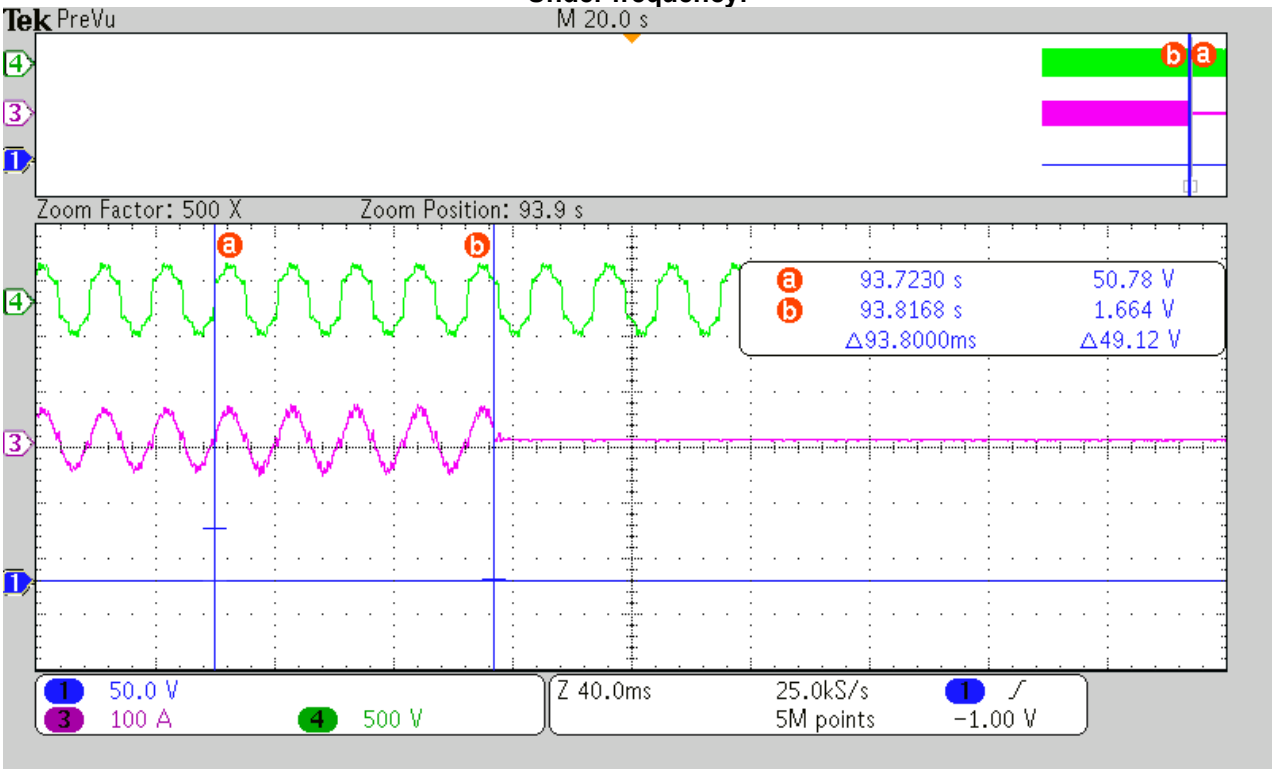
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.3.3.1	TABLE: Insensitivity to harmonics of the frequency relay								P
Mode	AF15K-MTH								
Grid simulator settings according to Table 17:	Harmonics order:	2nd	3rd	5th	7th	9th	11th	13th	17th
	$\%U_n$:	4.0	10,0	12,0	10,0	3,0	7,0	6,0	4,0

Operating time of the monitoring device:

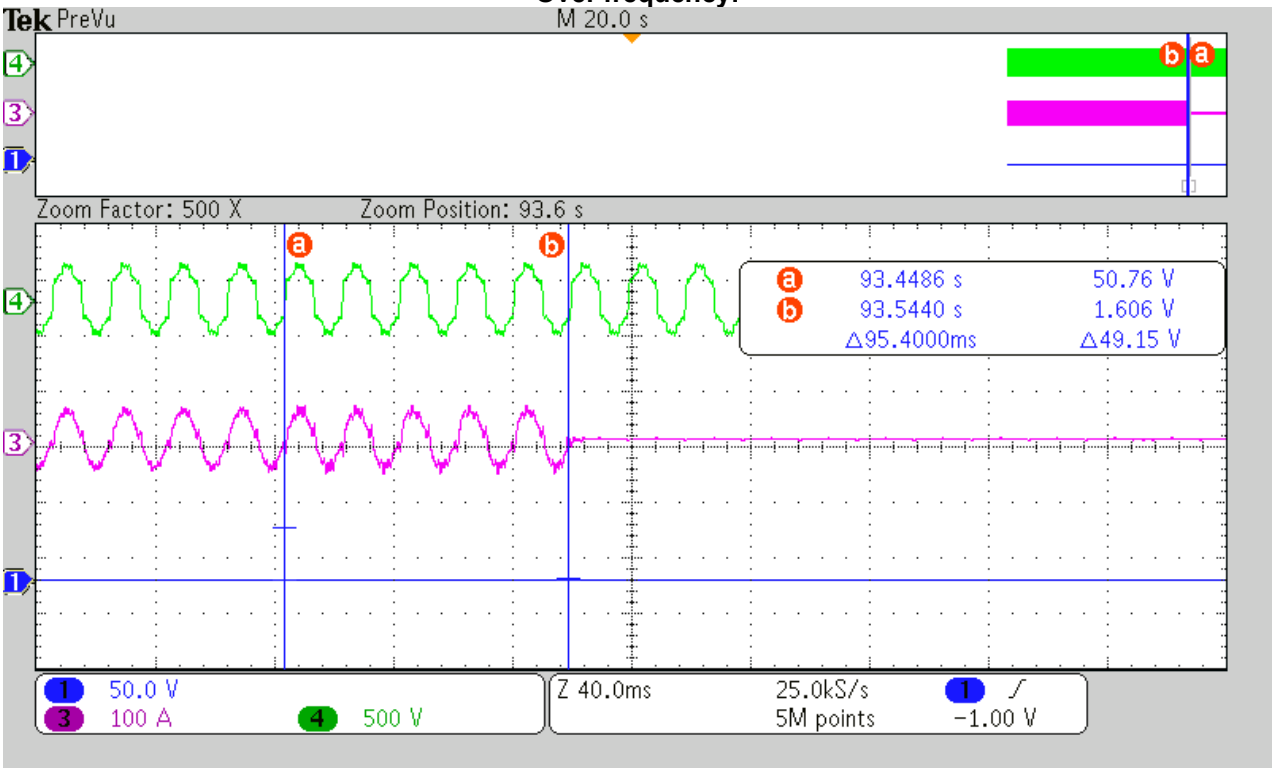
	Under frequency:			Over frequency:		
A) STEPS for trip value [Hz to Hz]:	1.01 threshold -> decrease by max 10mHz steps			0.99 threshold -> increase by max 10mHz steps		
D) STEP trip time [Hz to Hz]:	1.01 threshold -> 0.99 threshold			0.99 threshold -> 1.01 threshold		
Limit [Hz]:	47.50 Hz			51.50 Hz		
Measurement accuracy of the tripping value [V]:	47.47	47.49	47.48	51.53	51.51	51.52
	100 ms			100 ms		
Measurement the trip time [ms]:	93.8	90.6	98.1	95.4	92.2	94.2

Under frequency:



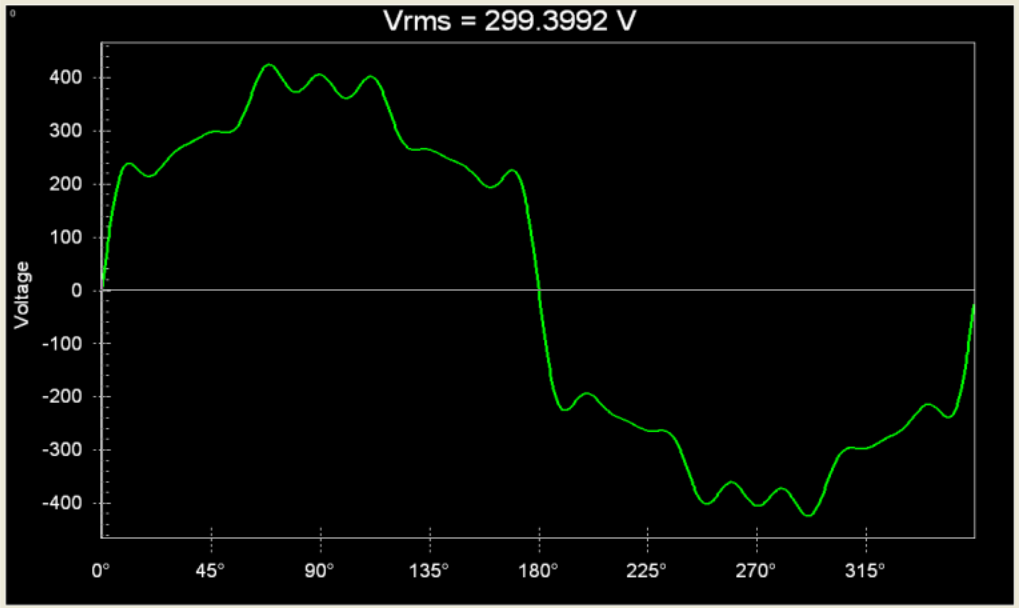
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Over frequency:



Note:
The setting value and the trip value of the frequency may not vary by more than **±20mHz** and **3%±20ms**.
Differences between the test values: **±20mHz** and **1%±20ms.**

Screenshot of voltage waveform, distorted as required by CEI 0-21 Table 17 – Harmonics for the insensitivity of the frequency protection function.

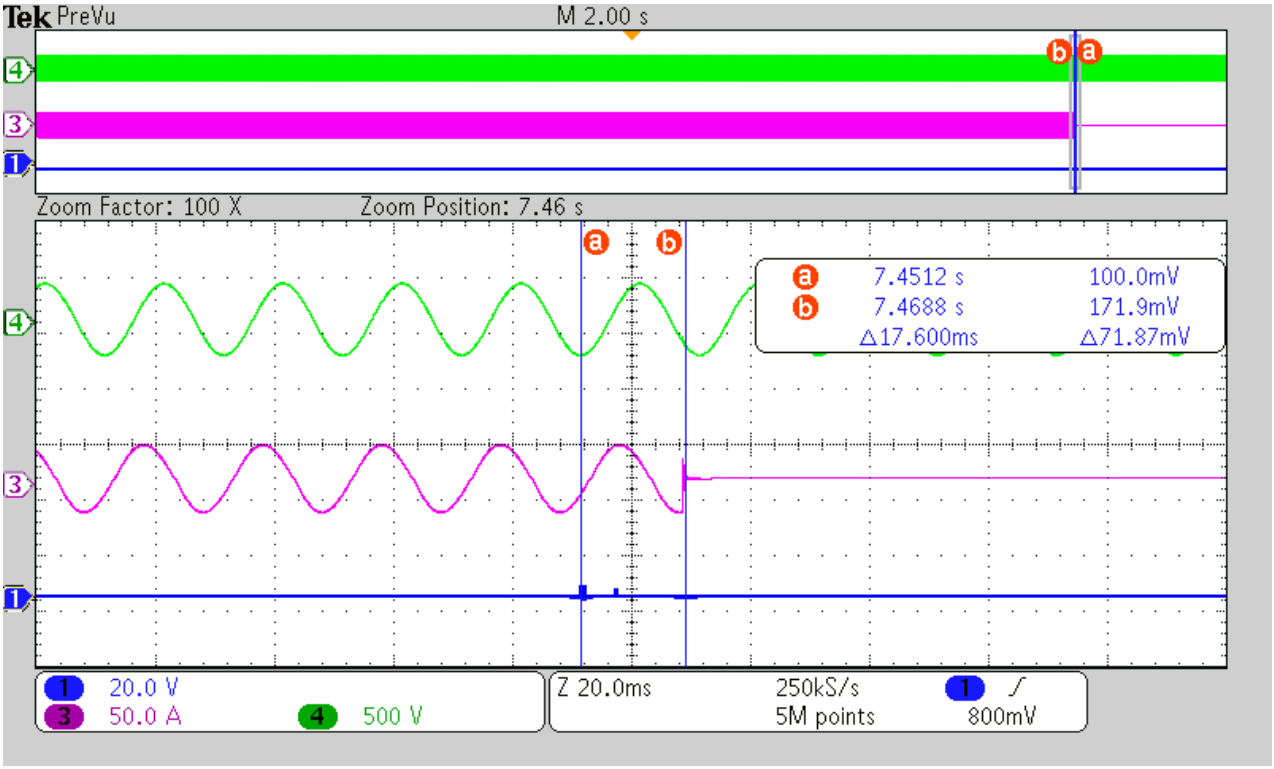


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.3.3.2	TABLE: Remote trip signal	P
Model	AF15K-MTH	

Test:	Remote tripping signal for the external disconnection
Limit [ms]:	50
Measurement time of the tripping value [ms]:	17.6

Graph of remote trip signal:



Note:
The protection interface has to have a maximum delay of the remote tripping signal from receiving to transmitting to the DDI of 50ms.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.3.3.3	TABLE: Communication Signal		P
Model	AF15K-MTH		
Enlargement of the frequency limits:		Yes	No
Enabled the trip of the functions 81<.S1 (49.8Hz) and 81>.S1 (50.2Hz) without communication signal		☒	☐
Enabled the trip of the functions 81<.S2 (47.5Hz) and 81>.S2 (51.5Hz) with communication signal		☒	☐

Note:

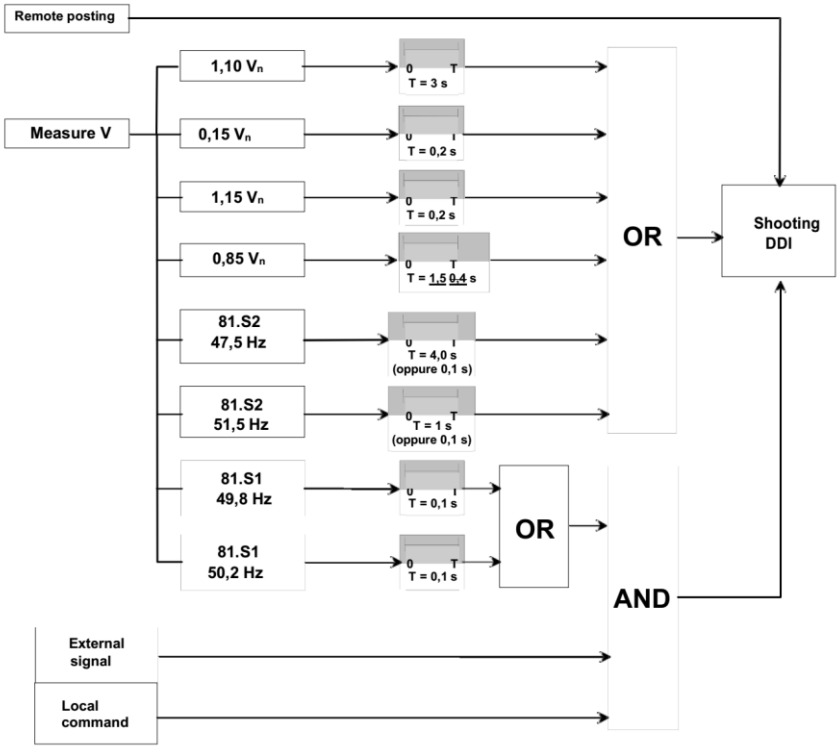


Figure 35 - Functional logic diagram of the SPI of the power park modules (the values in brackets refer to the transitory operating mode of the SPI)

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.3.4	TABLE: Verification of insensitivity to the frequency derivative (ROCOF)						P
Model	AF15K-MTH						
Setting threshold (81 >)		Setting trip time		Setting threshold (81 <)		Setting trip time	
51.5 Hz		0.15 s		47.5 Hz		0.15 s	
Step	Frequency		Change time	Output power (W)	Result (Continuous operation or not)		Requirement
	Begin	End					
1)	47.55 Hz	47.55 Hz	10.0 s	15021	Continuous operation		Stay connected
2)	47.55 Hz	51.45 Hz	1.56 s	15036	Continuous operation		Stay connected
3)	51.45 Hz	47.55 Hz	1.56 s	15040	Continuous operation		Stay connected
2)	47.55 Hz	51.45 Hz	1.56 s	15033	Continuous operation		Stay connected
3)	51.45 Hz	47.55 Hz	1.56 s	15019	Continuous operation		Stay connected
2)	47.55 Hz	51.45 Hz	1.56 s	15028	Continuous operation		Stay connected
3)	51.45 Hz	47.55 Hz	1.56 s	15026	Continuous operation		Stay connected
2)	47.55 Hz	51.45 Hz	1.56 s	15031	Continuous operation		Stay connected
3)	51.45 Hz	47.55 Hz	1.56 s	15027	Continuous operation		Stay connected
2)	47.55 Hz	51.45 Hz	1.56 s	15019	Continuous operation		Stay connected
3)	51.45 Hz	47.55 Hz	1.56 s	15011	Continuous operation		Stay connected
5)	47.55 Hz	47.55 Hz	10.0 s	15034	Continuous operation		Stay connected

Test procedure:

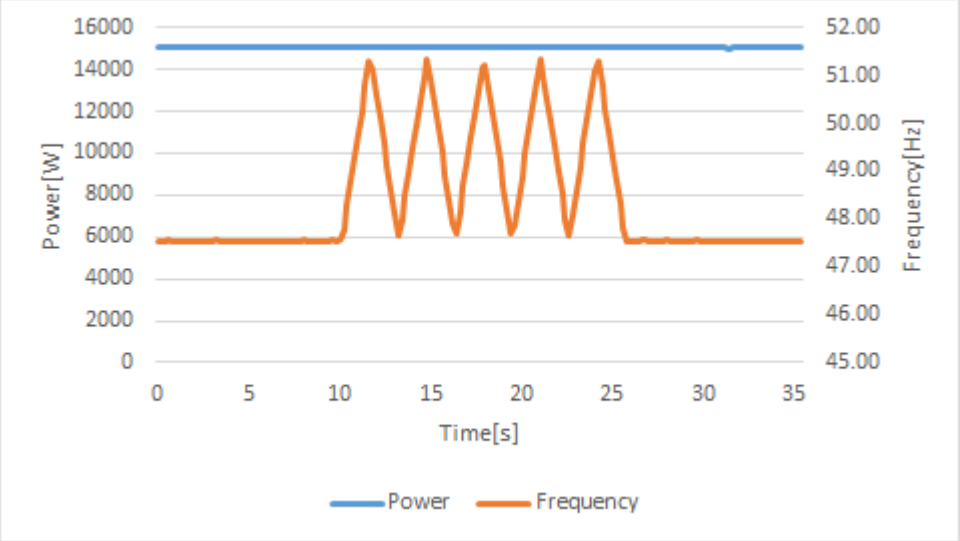
1) Apply a three-phase of symmetrical voltages of direct cyclic sequence having an amplitude of 100% of the rated voltage and a frequency of 47.550 Hz;
2) increase the frequency of the three-phase voltages, with ramp steps having an amplitude of 12.5 mHz and duration of 5 ms, until reaching the frequency value of 51.450 Hz;
3) decrease the frequency of the three-phase voltages, with ramp steps having an amplitude equal to 12.5 mHz and duration 5 ms until reaching the frequency value of 47.550 Hz;
4) repeat the tests referred to in points 2 and 3 above four times, for a total of 5 positive and negative ramps.
5) Apply a three-phase of symmetrical voltages of direct cyclic sequence having an amplitude of 100% of the rated voltage and a frequency of 47.550 Hz for 10 s.

Note:

When considering a sliding measurement window of 1.56 s, these profiles have a maximum RoCoF of 2.5 Hz/s.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Diagram:



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.4	**TABLE: Self-test**			**P**
Model	AF15K-MTH			
Software version: Control board: V02, Display board: V02				
Can the self-test be activated from any user? (☒ YES; ☐ NO)				
Do the procedures be written / described in the user manual? (☒ YES; ☐ NO)				
Can the self-test results and the preset values be clearly readable / displayed? (☒ YES; ☐ NO)				
Accuracy		Threshold	Disconnection time	Tolerance
Overvoltage 59.S1	Reading	253.0 V	600496 ms	Is the voltage thresholds deviation within 1%? (☒ YES, ☐NO) Is the time deviation within 3% ± 20 ms? (☒ YES, ☐NO)
	Default	253.0 V	<603000 ms	
Overvoltage 59.S2	Reading	264.6 V	197 ms	
	Default	264.5 V	200 ms	
Undervoltage 27.S1	Reading	195.2 V	1493 ms	
	Default	195.5 V	1500 ms	
Undervoltage 27.S2	Reading	34.1 V	194 ms	
	Default	34.5 V	200 ms	
Overfrequency 81>.S1	Reading	50.2 Hz	97 ms	Is the frequency thresholds deviation within ± 20 mHz? (☒ YES, ☐NO) Is the time deviation within 3% ± 20 ms? (☒ YES, ☐NO)
	Default	50.2 Hz	100 ms	
Overfrequency 81>.S2	Reading	51.5 Hz	95 ms	
	Default	51.5 Hz	100 ms	
Underfrequency 81<.S1	Reading	49.8 Hz	94 ms	
	Default	49.8 Hz	100 ms	
Underfrequency 81<.S2	Reading	47.5 Hz	98 ms	
	Default	47.5 Hz	100 ms	

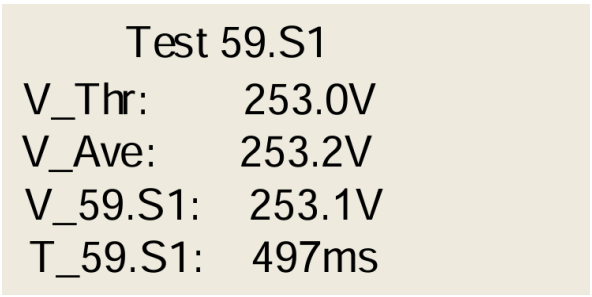
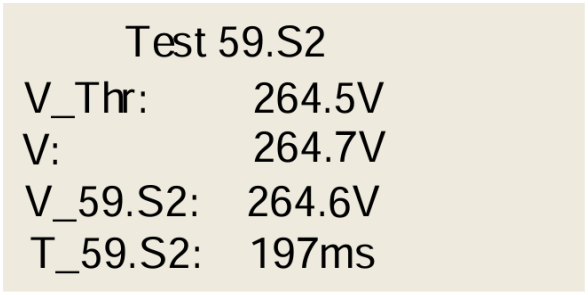
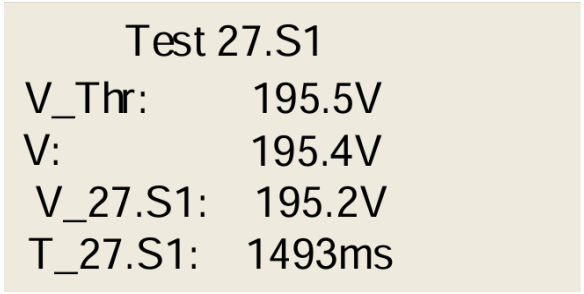
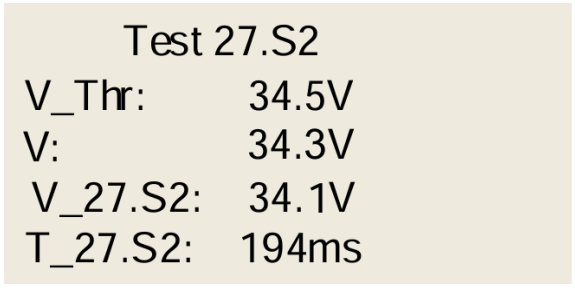
Note:

In the event that the interface protection functions are integrated into the inverter, at least one self-test system must be provided to check the maximum / minimum frequency and maximum / minimum voltage functions provided for in the SPI as described below:

- for each frequency and voltage protection function, the rise or fall intervention threshold shall be linearly varied with a ramp ≤ 0,05 Hz/s or ≤ 0,05 Vn/s for frequency and voltage protection respectively;
- this determines, at a certain point of the test, the coincidence between the threshold and the current value of the controlled magnitude (frequency or voltage) and therefore the intervention of the protection and the consequent opening of the interface device.

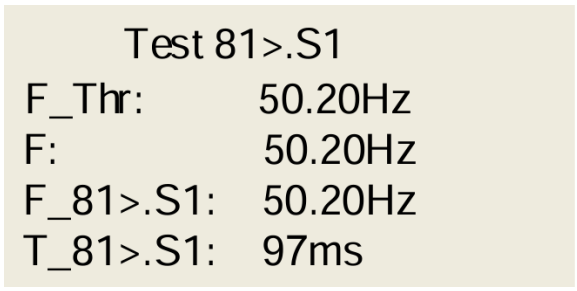
For each test the values of the quantities and the intervention times shall be viewable by the tester as well as the current value of the voltage and frequency detected by the converter.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

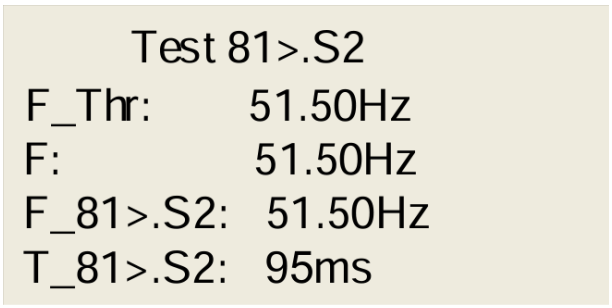
Diagram of auto-test:
Overvoltage 59.S1 
Overvoltage 59.S2 
Undervoltage 27.S1 
Undervoltage 27.S2 

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

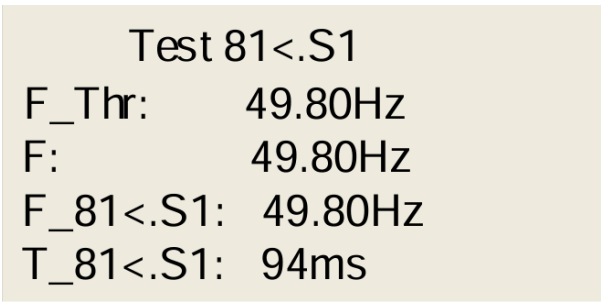
Overfrequency 81>S1



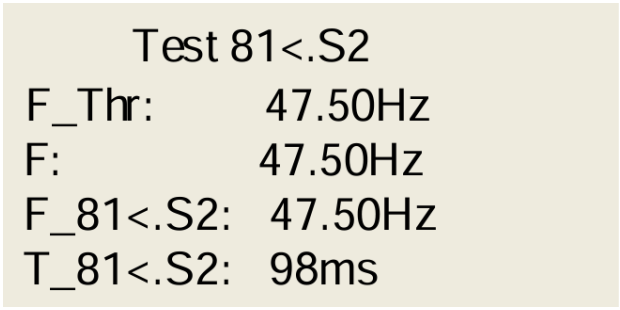
Overfrequency 81>S2



Underfrequency 81<S1



Underfrequency 81<S2



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.5	**TABLE: Single fault tolerance**				**P**
Model	AF15K-MTH				
Ambient temperature (°C) ……..……:					25°C
No.	component No.	fault	test voltage (V)	test time	result
1	ISO Relay (ALFG1)	Short circuit before start up inverter	620Vdc - 230Vac	3min	Unit can't operate, error message: Iso Fault.no danger ,no hazard ,no fire
2	Monitoring Relay - L(K4)	Pin3 to Pin4 short circuit before start up inverter	620Vdc- 230Vac	3min	Unit can't operate, error message: GridRelay Fault.no danger ,no hazard ,no fire
3	Monitoring Relay - L(K4)	Pin3 to Pin4 open circuit before start up inverter	620Vdc- 230Vac	3min	Unit can't operate, error message: GridRelay Fault. no danger ,no hazard ,no fire
4	Monitoring Relay - N (K8)	Pin3 to Pin4short circuit before start up inverter	620Vdc - 230Vac	3min	Unit can't operate, error message: GridRelay Fault. no danger ,no hazard ,no fire
5	Monitoring Relay - N (K8)	Pin3 to Pin4open circuit before start up inverter	620Vdc - 230Vac	3min	Unit can't operate, error message: GridRelay Fault. no danger ,no hazard ,no fire
6	AC voltage measure 1 (D5)	Pin2-Pin3 Short circuit	620Vdc- 230Vac	3min	Unit shut down, Error message: GridOverVolt Fault. no danger ,no hazard ,no fire
7	AC voltage measure 1 (D5)	Pin1-Pin3Short circuit	620Vdc- 230Vac	3min	Unit shut down, Error message: GridOverVolt Fault. no danger ,no hazard ,no fire
8	AC current measure 1 (D25)	Pin1-Pin3Short circuit	620Vdc- 230Vac	3min	Unit can't operating, error message: RInvCurAdChaFault.No damage ,no hazard ,no fire.
9	AC current measure 1 (D25)	Pin2-Pin3Short circuit	620Vdc- 230Vac	3min	Unit can't operating, error message: RInvCurAdChaFault.No damage ,no hazard ,no fire.
10	AC current measure 2 (D15)	Pin1-Pin3Short circuit	620Vdc- 230Vac	3min	Unit can't operating, error message: SInvCurAdChaFault.No damage ,no hazard ,no fire.
11	AC current measure 2 (D15)	Pin2-Pin3Short circuit	620Vdc- 230Vac	3min	Unit can't operating, error message: SInvCurAdChaFault.No damage ,no hazard ,no fire.
12	AC frequency measure (C122)	Pin1-Pin2Short circuit	620Vdc- 230Vac	3min	Unit shut down, error message: GridOverFreq Fault.No damage ,no hazard ,no fire
13	V-bus measure (C147)	Pin2-Pin3Short circuit	620Vdc - 230Vac	3min	Unit can't operate, error message: BusAllVoltHwOveFault.No damage, no hazard, no fire.
14	DC current measure 1 (R366)	Pin1-Pin2Short circuit	620Vdc - 230Vac	3min	Unit shut down, error message: Pv1HwOverCurrFault. no danger ,no hazard ,no fire

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

15	DC current measure 2 (C174)	Pin1-Pin2Short circuit	620Vdc - 230Vac	3min	Unit shut down, error message: Pv2HwOverCurrFault. no danger ,no hazard ,no fire
16	T measure (C132)	Pin1-Pin2Short circuit	620Vdc - 230Vac	3min	Unit can't operate, error message: TemperatureAdChanFault.No damage, no hazard, no fire.
17	power tube Boost (Q14)	Pin2-Pin3Short circuit before start up	620Vdc - 230Vac	3min	Unit cannot start up, No damage, no hazard, no fire.
18	Diode (D66)	Short circuit	620Vdc - 230Vac	3min	Unit normal operation, No danger ,no hazard ,no fire
19	power tube IGBT (Q1)	Pin2-Pin3Short circuit before start up	620Vdc - 230Vac	3min	Unit can’t operate, error message: InvOpenTestErr.No danger ,no hazard ,no fire
20	power tubeIGBT(Q 1)	Pin2-Pin3Short circuit before start up	620Vdc- 230Vac	3min	Unit can’t operating, error message: InvOpenTestErr.No danger ,no hazard ,no fire
21	power tubeIGBT(Q 5)	Pin2-Pin3Short circuit before start up	620Vdc- 230Vac	3min	Unit shut down, error message: InvOpenTestErr.No damage ,no hazard ,no fire
22	Bus cap (C45)	Pin1-Pin2Short circuit before start up	620Vdc - 230Vac	3min	Unit cannot start up, No damage, no hazard, no fire.
23	Transformer short circuit tests (T1)	Pin22-Pin24Short circuit	620Vdc - 230Vac	3min	Unit cannot start up, No damage, no hazard, no fire.
24	Transformer short circuit tests(T1)	Pin32-Pin36Short circuit	620Vdc - 230Vac	3min	Unit cannot start up, No damage, no hazard, no fire.
25	power tube MOS-SPS (Q18)	G-D Short circuit	620Vdc - 230Vac	3min	SPS no output, no danger, no hazard, no fire
26	power tube MOS-SPS (Q18)	D-S Short circuit	620Vdc - 230Vac	3min	SPS no output, no danger, no hazard, no fire
27	Output L to N	short circuit	620Vdc - 230Vac	3min	Unit shut down ,error message: GridUnderVoltFault. No damage, no hazard, no fire
28	Output L to PE	short circuit	620Vdc - 230Vac	3min	Unit shut down ,error message: GridLossFault. No damage, no hazard, no fire
29	DC	--	620Vdc - 230Vac	3min	Vac=0, V_{BAT}=0
30	AC	--	620Vdc - 230Vac	3min	Vdc=0, V_{BAT}=0
31	BAT	--	620Vdc - 230Vac	3min	Vdc=0, Vac=0
32	Overload	Output overload (110%)	620Vdc - 230Vac	3min	Unit normal operation, No damage, no hazard, no fire
33	Cooling system failure – Blanketing test	Put the unit to box	620Vdc - 230Vac	3min	1 hour power run at 50%

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

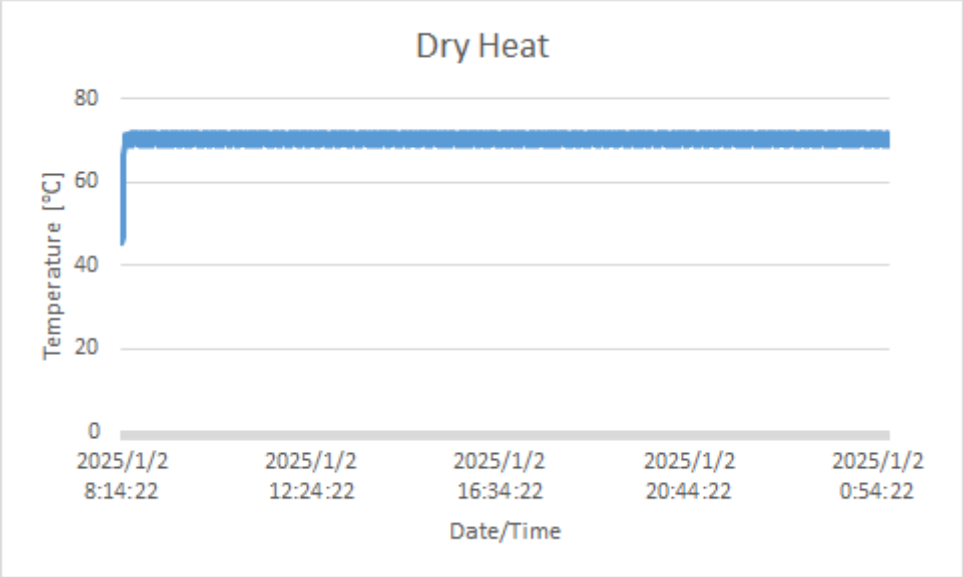
34	PV+ to PV-	Reverse polarity	620Vdc - 230Vac	3min	Unit cannot start up. No danger, no hazard, no fire
35	Output L - N	Reverse polarity before start up	620Vdc - 230Vac	3min	Unit normal operation. No damage, no hazard, no fire.
36	Output L1 - L2	Reverse polarity before start up	620Vdc - 230Vac	3min	Unit can't operate, error message: PhsAbnormal. No danger, no hazard, no fire
Supplementary information: Tests performed under abnormal or fault conditions shall be tested with a source capable of 1,25 to 1,5 times the PCE rated maximum input current (Isc PV) for that input.					

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

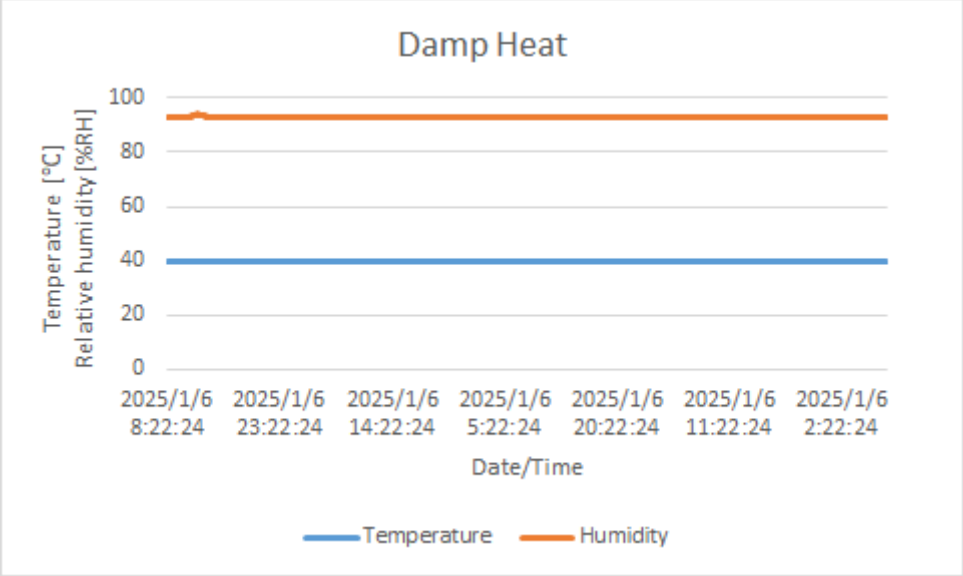
A.4.7	**TABLE: Climatic compatibility tests**			**P**
Model	AF15K-MTH			
Climatic tests of unpowered equipment:				
Temperature	Relative humidity	Standards	Test time	
70°C ± 2°C	--	EN 60068-2-2	16h	
40°C ± 2°C	93% ± 3%	EN 60068-2-78	4 days	
-25°C ± 2°C	--	EN 60068-2-1	16h	
-25°C -> +70°C ± 2°C	--	EN 60068-2-14	3h @ -25°C, 3h @ +70°C	
Climatic tests of powered equipment:				
Temperature	Relative humidity	Standards	Test time	
60°C± 2°C*	--	EN 60068-2-2	16h	
40°C ± 2°C	93% ± 3%	EN 60068-2-78	4 days	
-25°C ± 2°C	--	EN 60068-2-1	16h	
-25°C -> +60°C ± 2°C*	--	EN 60068-2-14	3h @ -25°C, 3h @ +60°C	
Note: The unit is not allowed to be damaged while testing. *If the PV inverter max operating temperature above 55°C, please use the max operating temperature in the test.				

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Temperature diagram of unpowered equipment:

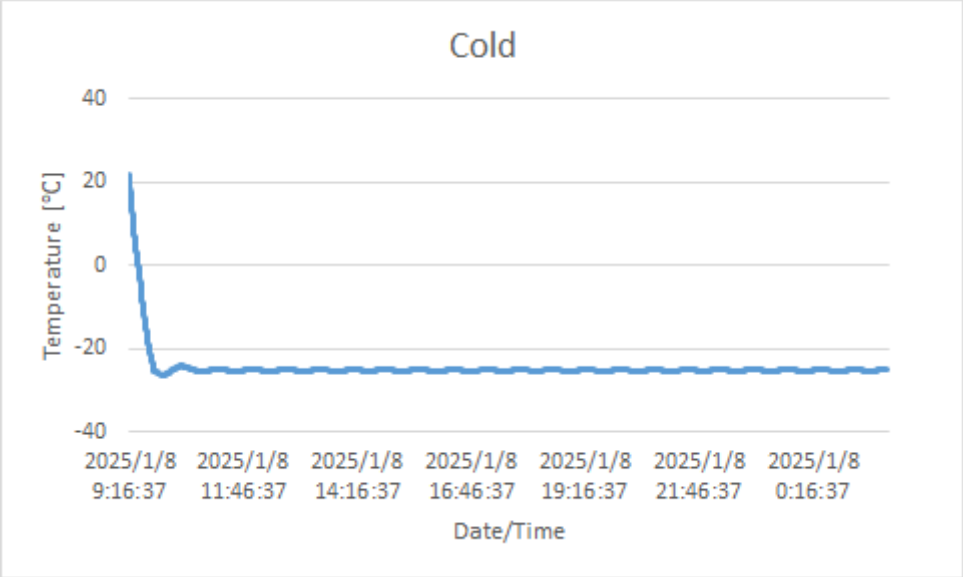


Temperature diagram of unpowered equipment:

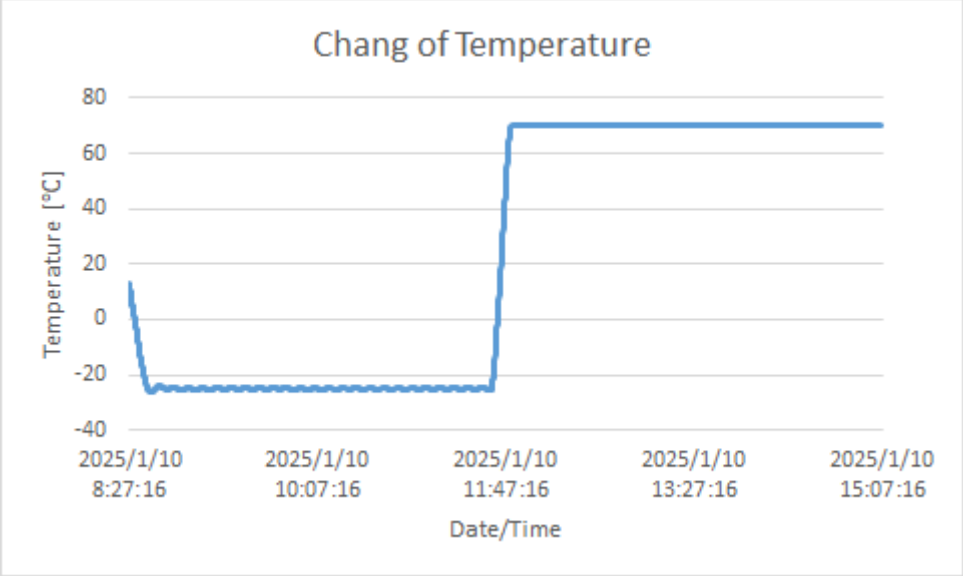


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Temperature diagram of unpowered equipment:

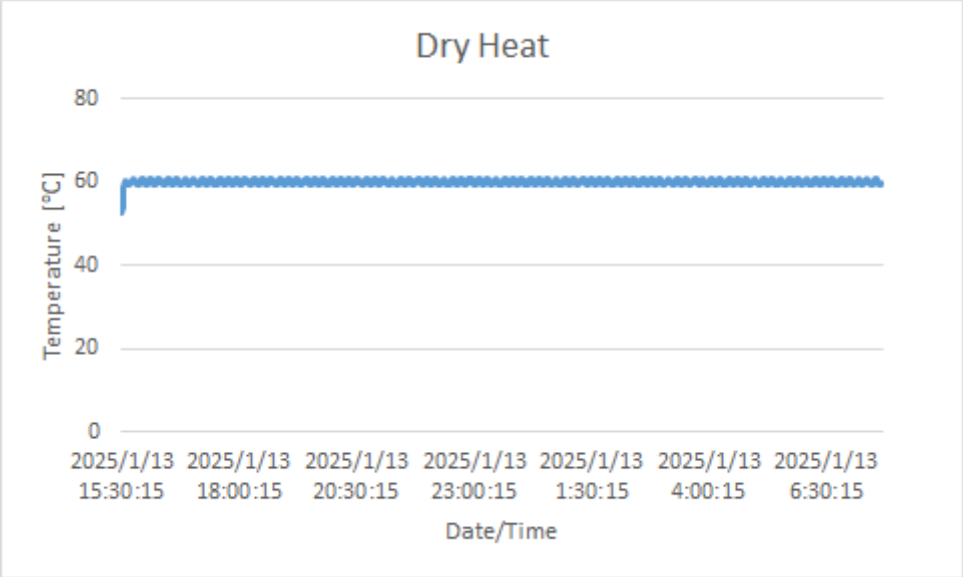


Temperature diagram of unpowered equipment:

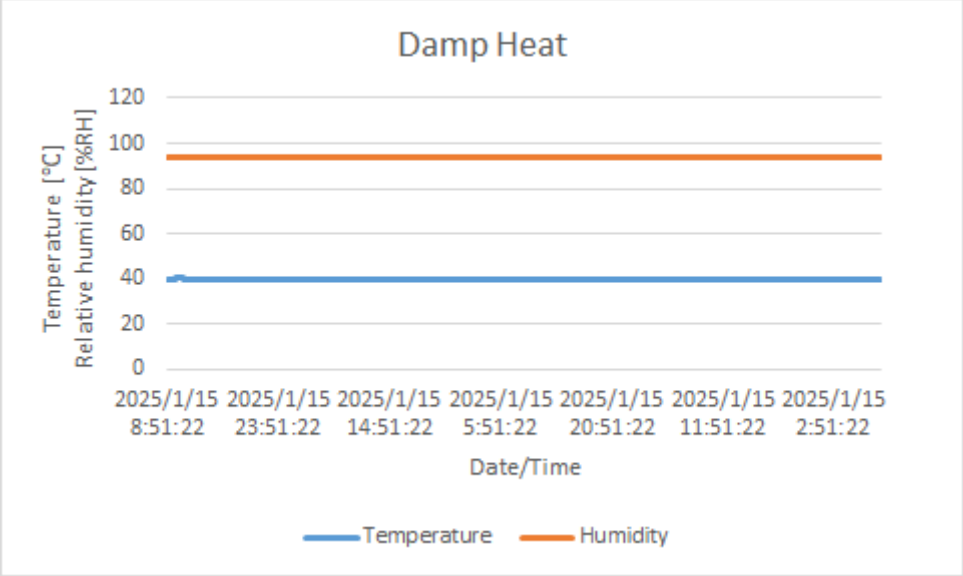


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Temperature diagram of powered equipment:

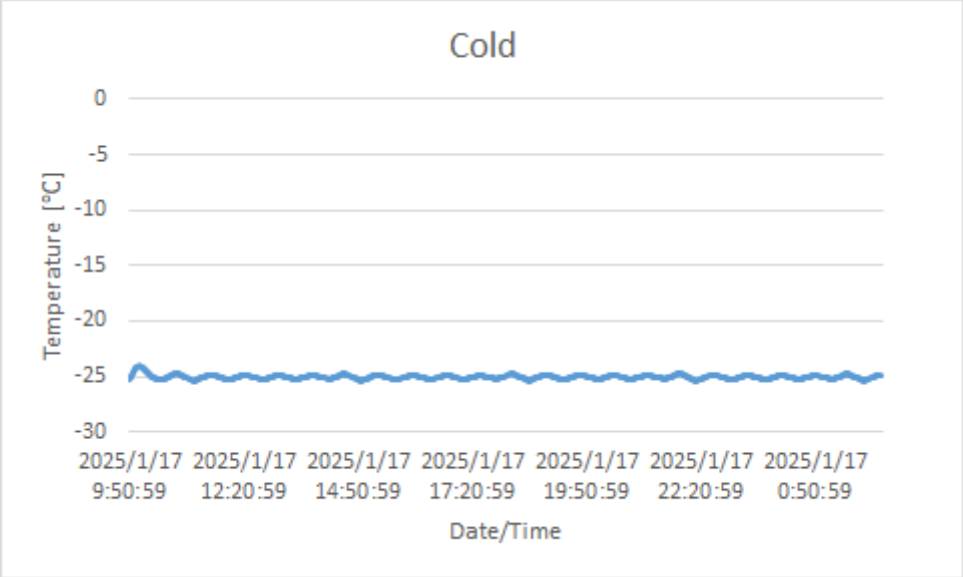


Temperature diagram of powered equipment:

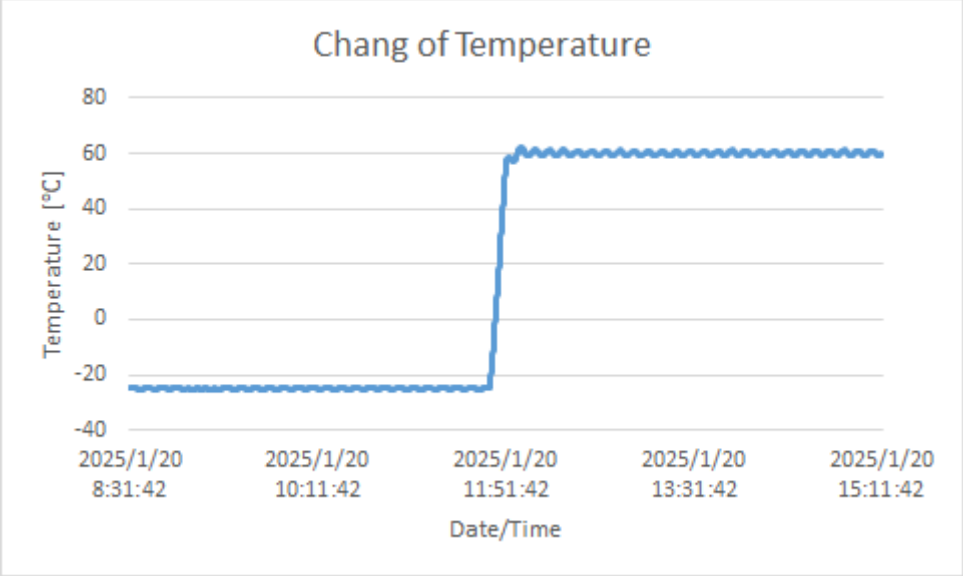


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Temperature diagram of powered equipment:



Temperature diagram of powered equipment:



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.8	**TABLE: Insulation tests (CEI EN 60255-5)**		**P**
Model	AF15K-MTH		
Location		Test voltage	Result
Rigidity of electricity:			
AC to PE		2 kVac / 2.8kVdc	P
DC to PE		2 kVac / 2.8kVdc	P
AC to communication port		2 kVac / 2.8kVdc	P
DC to communication port		2 kVac / 2.8kVdc	P
Impulse test:			
AC to PE		5 kV (1.2/50µs)	P
DC to PE		5 kV (1.2/50µs)	P
AC to communication port		5 kV (1.2/50µs)	P
DC to communication port		5 kV (1.2/50µs)	P
Measurement of the insulation resistance:			
AC to PE		>100 MΩ at 500 Vdc	P
DC to PE		>100 MΩ at 500 Vdc	P
AC to communication port		>100 MΩ at 500 Vdc	P
DC to communication port		>100 MΩ at 500 Vdc	P
Note:			

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.9	**TABLE: Test for the overload capacity of measuring circuits**		**P**
Model	AF15K-MTH		
Voltage		Test time	Result:
≥130%U_N		permanent	P
≥150%U_N		1s	P

Note:
The unit is not allowed to be damaged while testing. The measurement circuit must show after the test the same values like befor the test.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.11	TABLE: Automatic mechanism to prevent current imbalance during production		N/A
Model	AF15K-MTH		
Test No. 1			
Imbalance of power:		Test time:	Limit:
6kW<P<10kW		30min	max. 30 min
Test No.2			
Imbalance of power:		Test time:	Limit:
P>10kW		1min	max. 1 min

Note:
Test No.1
- System operating at its nominal conditions;
- Creation of a permanent artificial imbalance greater than 6 kW and less than 10 kW ;
- Checking the disconnection of the entire production system using the interface device (DDI) within a maximum time of 30 min.

Test No.2:
- System operating at its nominal conditions;
- Creation of a permanent artificial imbalance greater than 10 kW ;
- Checking the disconnection of the entire production system using the interface device (DDI) within a maximum time of 1 min.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1 a) / b)	**TABLE: Harmonic current emission**	**P**
Model	AF15K-MTH	
☒ CEI EN 61000-3-2 ☒ CEI EN 61000-3-12		
☒ Ambient temperature ☒ -25°C temperature ☒ +60°C temperature		
☒ 100% P_n ☒ 66% P_n ☒ 33% P_n		
Note: *If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test (such as -25°C / +60°C).		

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B1 a)/b)	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C, 100% P_n / 66% P_n / 33% P_n (CEI EN 61000-3-12)**						**P**
Model	AF15K-MTH						
Active power (W)	15086 (100% P_n, 25°C)						
Voltage (V)	231.30						
Current (A)	21.75						
Power Factor	0.9996						
Frequency (Hz)	50.00						

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	21.747	21.746	21.746	--	--	--	--
2nd	0.019	0.031	0.037	0.088	0.141	0.171	8
3rd	0.487	0.536	0.506	2.237	2.466	2.327	N/A
4th	0.020	0.016	0.020	0.091	0.072	0.091	4
5th	0.012	0.010	0.034	0.054	0.045	0.154	10.7
6th	0.005	0.011	0.008	0.024	0.052	0.038	2.7
7th	0.125	0.124	0.129	0.573	0.568	0.593	7.2
8th	0.006	0.004	0.007	0.028	0.020	0.031	2
9th	0.075	0.089	0.089	0.343	0.409	0.409	N/A
10th	0.008	0.007	0.006	0.037	0.031	0.026	1.6
11th	0.056	0.056	0.056	0.258	0.257	0.260	3.1
12th	0.007	0.005	0.005	0.031	0.025	0.022	1.3
13th	0.042	0.043	0.043	0.193	0.199	0.196	2
14th	0.005	0.004	0.004	0.025	0.018	0.017	N/A
15th	0.030	0.030	0.028	0.137	0.137	0.131	N/A
16th	0.004	0.003	0.003	0.018	0.016	0.016	N/A
17th	0.030	0.031	0.025	0.137	0.140	0.114	N/A
18th	0.006	0.003	0.005	0.026	0.016	0.025	N/A
19th	0.027	0.029	0.025	0.124	0.132	0.115	N/A
20th	0.003	0.002	0.004	0.016	0.011	0.020	N/A
21st	0.019	0.023	0.020	0.086	0.106	0.092	N/A
22nd	0.003	0.003	0.005	0.013	0.012	0.023	N/A
23rd	0.014	0.015	0.015	0.066	0.070	0.068	N/A
24th	0.002	0.002	0.003	0.011	0.011	0.012	N/A
25th	0.014	0.015	0.011	0.066	0.067	0.051	N/A
26th	0.004	0.003	0.003	0.017	0.012	0.012	N/A
27th	0.012	0.014	0.010	0.054	0.064	0.045	N/A
28th	0.004	0.003	0.003	0.017	0.014	0.015	N/A
29th	0.012	0.012	0.011	0.055	0.056	0.050	N/A
30th	0.003	0.003	0.003	0.015	0.013	0.014	N/A
31st	0.009	0.011	0.008	0.040	0.050	0.039	N/A
32nd	0.003	0.003	0.003	0.013	0.012	0.014	N/A
33rd	0.009	0.010	0.007	0.041	0.048	0.031	N/A
34th	0.003	0.003	0.003	0.016	0.015	0.012	N/A
35th	0.008	0.009	0.008	0.036	0.039	0.036	N/A
36th	0.003	0.003	0.003	0.013	0.013	0.013	N/A
37th	0.008	0.008	0.006	0.038	0.039	0.030	N/A
38th	0.003	0.002	0.002	0.013	0.011	0.011	N/A
39th	0.005	0.007	0.004	0.022	0.034	0.020	N/A
40th	0.002	0.002	0.002	0.011	0.010	0.011	N/A
THD	--	--	--	2.429	2.666	2.564	13
PWHD	--	--	--	1.317	1.407	1.210	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B1 a)/b)	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C, 100% P_n / 66% P_n / 33% P_n (CEI EN 61000-3-12)**						**P**
Model	AF15K-MTH						
Active power (W)	15080 (100% P_n, -25°C)						
Voltage (V)	231.31						
Current (A)	21.75						
Power Factor	0.9996						
Frequency (Hz)	50.00						
Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	21.746	21.744	21.745	--	--	--	--
2nd	0.019	0.029	0.036	0.085	0.134	0.165	8
3rd	0.487	0.536	0.504	2.239	2.462	2.319	N/A
4th	0.019	0.016	0.019	0.089	0.075	0.089	4
5th	0.011	0.010	0.034	0.053	0.047	0.158	10.7
6th	0.006	0.012	0.008	0.026	0.054	0.037	2.7
7th	0.124	0.123	0.129	0.569	0.564	0.593	7.2
8th	0.006	0.004	0.007	0.028	0.019	0.031	2
9th	0.074	0.089	0.089	0.341	0.409	0.409	N/A
10th	0.008	0.007	0.006	0.035	0.032	0.029	1.6
11th	0.055	0.056	0.056	0.254	0.256	0.258	3.1
12th	0.007	0.006	0.005	0.033	0.026	0.025	1.3
13th	0.042	0.043	0.042	0.192	0.198	0.195	2
14th	0.005	0.004	0.004	0.024	0.018	0.016	N/A
15th	0.030	0.029	0.028	0.136	0.135	0.129	N/A
16th	0.003	0.003	0.003	0.016	0.015	0.013	N/A
17th	0.029	0.030	0.025	0.135	0.139	0.113	N/A
18th	0.005	0.003	0.005	0.023	0.014	0.023	N/A
19th	0.026	0.029	0.025	0.122	0.131	0.114	N/A
20th	0.003	0.002	0.004	0.014	0.009	0.019	N/A
21st	0.019	0.023	0.020	0.086	0.106	0.091	N/A
22nd	0.003	0.002	0.004	0.012	0.011	0.017	N/A
23rd	0.014	0.015	0.014	0.065	0.069	0.066	N/A
24th	0.002	0.002	0.002	0.010	0.009	0.011	N/A
25th	0.014	0.015	0.011	0.065	0.067	0.051	N/A
26th	0.003	0.003	0.002	0.016	0.012	0.011	N/A
27th	0.012	0.014	0.009	0.054	0.064	0.043	N/A
28th	0.003	0.003	0.003	0.016	0.013	0.014	N/A
29th	0.012	0.012	0.011	0.054	0.056	0.050	N/A
30th	0.002	0.002	0.002	0.011	0.010	0.010	N/A
31st	0.009	0.011	0.008	0.039	0.050	0.038	N/A
32nd	0.003	0.003	0.003	0.011	0.012	0.013	N/A
33rd	0.009	0.010	0.007	0.040	0.046	0.030	N/A
34th	0.004	0.003	0.003	0.016	0.016	0.012	N/A
35th	0.008	0.009	0.008	0.037	0.040	0.036	N/A
36th	0.002	0.002	0.002	0.010	0.010	0.010	N/A
37th	0.008	0.008	0.006	0.037	0.038	0.030	N/A
38th	0.003	0.002	0.002	0.013	0.011	0.010	N/A
39th	0.005	0.007	0.004	0.022	0.034	0.020	N/A
40th	0.002	0.002	0.002	0.011	0.010	0.011	N/A
THD	--	--	--	2.443	2.673	2.562	13
PWHD	--	--	--	1.298	1.396	1.188	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B1 a)/b)	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C, 100% P_n / 66% P_n / 33% P_n (CEI EN 61000-3-12)**						**P**
Model	AF15K-MTH						
Active power (W)	15079 (100% P_n, 60°C)						
Voltage (V)	231.31						
Current (A)	21.75						
Power Factor	0.9996						
Frequency (Hz)	50.00						
Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	21.744	21.743	21.744	--	--	--	--
2nd	0.020	0.029	0.037	0.092	0.132	0.169	8
3rd	0.487	0.536	0.504	2.237	2.465	2.319	N/A
4th	0.019	0.016	0.019	0.089	0.074	0.089	4
5th	0.012	0.011	0.034	0.054	0.049	0.157	10.7
6th	0.006	0.012	0.008	0.026	0.053	0.035	2.7
7th	0.123	0.122	0.128	0.566	0.563	0.588	7.2
8th	0.006	0.004	0.007	0.026	0.019	0.031	2
9th	0.074	0.089	0.089	0.341	0.410	0.410	N/A
10th	0.008	0.007	0.006	0.036	0.032	0.030	1.6
11th	0.055	0.055	0.056	0.253	0.254	0.256	3.1
12th	0.007	0.006	0.005	0.033	0.026	0.024	1.3
13th	0.042	0.043	0.043	0.193	0.198	0.196	2
14th	0.005	0.004	0.004	0.022	0.017	0.017	N/A
15th	0.030	0.030	0.028	0.136	0.136	0.128	N/A
16th	0.003	0.003	0.003	0.016	0.015	0.013	N/A
17th	0.029	0.030	0.024	0.134	0.139	0.112	N/A
18th	0.005	0.003	0.005	0.024	0.014	0.023	N/A
19th	0.027	0.028	0.025	0.122	0.131	0.114	N/A
20th	0.003	0.002	0.004	0.013	0.010	0.019	N/A
21st	0.019	0.023	0.020	0.086	0.106	0.090	N/A
22nd	0.003	0.002	0.003	0.012	0.011	0.013	N/A
23rd	0.014	0.015	0.015	0.065	0.070	0.067	N/A
24th	0.002	0.002	0.002	0.011	0.010	0.011	N/A
25th	0.014	0.015	0.011	0.065	0.067	0.050	N/A
26th	0.003	0.002	0.002	0.016	0.011	0.011	N/A
27th	0.012	0.014	0.009	0.053	0.063	0.042	N/A
28th	0.004	0.003	0.003	0.017	0.014	0.014	N/A
29th	0.012	0.012	0.011	0.054	0.055	0.050	N/A
30th	0.003	0.003	0.003	0.014	0.014	0.013	N/A
31st	0.009	0.011	0.008	0.039	0.051	0.037	N/A
32nd	0.002	0.003	0.003	0.011	0.012	0.013	N/A
33rd	0.009	0.010	0.006	0.041	0.046	0.030	N/A
34th	0.003	0.003	0.003	0.016	0.015	0.013	N/A
35th	0.008	0.009	0.008	0.036	0.039	0.036	N/A
36th	0.003	0.003	0.003	0.012	0.012	0.012	N/A
37th	0.008	0.008	0.006	0.038	0.038	0.030	N/A
38th	0.003	0.002	0.002	0.012	0.010	0.010	N/A
39th	0.005	0.007	0.005	0.022	0.034	0.021	N/A
40th	0.002	0.002	0.002	0.011	0.009	0.010	N/A
THD	--	--	--	2.423	2.690	2.555	13
PWHD	--	--	--	1.298	1.397	1.185	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B1 a)/b)	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C, 100% P_n / 66% P_n / 33% P_n (CEI EN 61000-3-12)**						**P**
Model	AF15K-MTH						
Active power (W)	9986 (66% P_n, 25°C)						
Voltage (V)	231.24						
Current (A)	14.40						
Power Factor	0.9994						
Frequency (Hz)	50.00						

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	14.395	14.393	14.395	--	--	--	--
2nd	0.019	0.023	0.033	0.135	0.157	0.228	8
3rd	0.396	0.437	0.394	2.749	3.037	2.734	N/A
4th	0.012	0.011	0.012	0.082	0.077	0.082	4
5th	0.062	0.064	0.059	0.432	0.445	0.409	10.7
6th	0.005	0.005	0.006	0.034	0.036	0.043	2.7
7th	0.103	0.103	0.106	0.718	0.713	0.737	7.2
8th	0.004	0.004	0.005	0.031	0.027	0.031	2
9th	0.065	0.068	0.068	0.450	0.472	0.472	N/A
10th	0.005	0.004	0.003	0.034	0.029	0.023	1.6
11th	0.052	0.051	0.050	0.360	0.357	0.349	3.1
12th	0.006	0.003	0.004	0.039	0.019	0.029	1.3
13th	0.046	0.045	0.044	0.318	0.312	0.308	2
14th	0.004	0.003	0.003	0.028	0.021	0.024	N/A
15th	0.030	0.032	0.029	0.211	0.222	0.203	N/A
16th	0.003	0.002	0.003	0.019	0.015	0.018	N/A
17th	0.030	0.030	0.028	0.208	0.209	0.194	N/A
18th	0.003	0.002	0.004	0.020	0.012	0.028	N/A
19th	0.025	0.025	0.025	0.176	0.172	0.173	N/A
20th	0.002	0.002	0.002	0.013	0.012	0.015	N/A
21st	0.017	0.017	0.017	0.118	0.121	0.119	N/A
22nd	0.002	0.002	0.002	0.015	0.011	0.014	N/A
23rd	0.018	0.018	0.016	0.128	0.122	0.115	N/A
24th	0.002	0.002	0.002	0.011	0.011	0.011	N/A
25th	0.014	0.014	0.014	0.096	0.094	0.095	N/A
26th	0.003	0.002	0.002	0.018	0.013	0.012	N/A
27th	0.014	0.014	0.011	0.094	0.097	0.080	N/A
28th	0.002	0.002	0.002	0.015	0.013	0.017	N/A
29th	0.015	0.013	0.014	0.103	0.093	0.097	N/A
30th	0.003	0.002	0.002	0.018	0.017	0.015	N/A
31st	0.012	0.012	0.011	0.085	0.083	0.078	N/A
32nd	0.003	0.002	0.003	0.018	0.016	0.020	N/A
33rd	0.011	0.011	0.011	0.075	0.077	0.075	N/A
34th	0.002	0.002	0.003	0.016	0.016	0.017	N/A
35th	0.011	0.009	0.012	0.079	0.064	0.082	N/A
36th	0.002	0.003	0.002	0.015	0.017	0.017	N/A
37th	0.009	0.008	0.009	0.066	0.059	0.063	N/A
38th	0.003	0.002	0.002	0.018	0.014	0.015	N/A
39th	0.007	0.007	0.007	0.048	0.049	0.050	N/A
40th	0.002	0.002	0.002	0.012	0.013	0.012	N/A
THD	--	--	--	3.074	3.406	3.079	13
PWHD	--	--	--	2.103	2.069	2.013	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B1 a)/b)	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C, 100% P_n / 66% P_n / 33% P_n (CEI EN 61000-3-12)**						**P**
Model	AF15K-MTH						
Active power (W)	9984 (66% P_n, -25°C)						
Voltage (V)	231.24						
Current (A)	14.40						
Power Factor	0.9994						
Frequency (Hz)	50.00						
Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	14.391	14.390	14.391	--	--	--	--
2nd	0.018	0.025	0.034	0.122	0.171	0.234	8
3rd	0.396	0.439	0.392	2.751	3.051	2.726	N/A
4th	0.012	0.010	0.012	0.081	0.072	0.081	4
5th	0.063	0.064	0.059	0.434	0.445	0.407	10.7
6th	0.005	0.006	0.006	0.035	0.039	0.045	2.7
7th	0.104	0.103	0.106	0.720	0.714	0.737	7.2
8th	0.005	0.004	0.005	0.033	0.030	0.033	2
9th	0.065	0.068	0.068	0.451	0.474	0.474	N/A
10th	0.005	0.004	0.004	0.037	0.027	0.025	1.6
11th	0.052	0.051	0.050	0.363	0.358	0.350	3.1
12th	0.006	0.002	0.004	0.039	0.017	0.029	1.3
13th	0.046	0.045	0.044	0.316	0.312	0.309	2
14th	0.004	0.003	0.003	0.028	0.020	0.024	N/A
15th	0.030	0.032	0.030	0.210	0.224	0.206	N/A
16th	0.003	0.002	0.003	0.020	0.016	0.018	N/A
17th	0.030	0.030	0.028	0.212	0.209	0.194	N/A
18th	0.003	0.002	0.004	0.021	0.012	0.030	N/A
19th	0.025	0.025	0.025	0.174	0.171	0.175	N/A
20th	0.002	0.002	0.002	0.015	0.012	0.016	N/A
21st	0.017	0.018	0.017	0.118	0.122	0.119	N/A
22nd	0.002	0.002	0.002	0.016	0.012	0.016	N/A
23rd	0.019	0.018	0.017	0.129	0.122	0.115	N/A
24th	0.002	0.002	0.002	0.012	0.011	0.012	N/A
25th	0.014	0.013	0.014	0.095	0.093	0.097	N/A
26th	0.003	0.002	0.002	0.018	0.012	0.014	N/A
27th	0.014	0.014	0.011	0.096	0.096	0.079	N/A
28th	0.002	0.002	0.002	0.015	0.014	0.016	N/A
29th	0.015	0.013	0.014	0.103	0.093	0.098	N/A
30th	0.002	0.002	0.002	0.017	0.015	0.014	N/A
31st	0.013	0.012	0.011	0.089	0.081	0.078	N/A
32nd	0.002	0.002	0.003	0.015	0.015	0.020	N/A
33rd	0.011	0.011	0.011	0.076	0.076	0.075	N/A
34th	0.002	0.002	0.003	0.014	0.017	0.018	N/A
35th	0.011	0.009	0.012	0.074	0.065	0.080	N/A
36th	0.002	0.002	0.002	0.015	0.016	0.015	N/A
37th	0.010	0.009	0.009	0.069	0.062	0.061	N/A
38th	0.002	0.002	0.002	0.015	0.014	0.015	N/A
39th	0.007	0.007	0.007	0.049	0.049	0.050	N/A
40th	0.002	0.002	0.002	0.011	0.012	0.012	N/A
THD	--	--	--	3.098	3.426	3.080	13
PWHD	--	--	--	2.113	2.069	2.021	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B1 a)/b)	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C, 100% P_n / 66% P_n / 33% P_n (CEI EN 61000-3-12)**						**P**
Model	AF15K-MTH						
Active power (W)	9983 (66% P_n, 60°C)						
Voltage (V)	231.24						
Current (A)	14.40						
Power Factor	0.9994						
Frequency (Hz)	50.00						

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	14.391	14.390	14.392	--	--	--	--
2nd	0.022	0.022	0.036	0.151	0.153	0.248	8
3rd	0.398	0.437	0.394	2.764	3.039	2.738	N/A
4th	0.012	0.011	0.012	0.086	0.075	0.086	4
5th	0.062	0.064	0.059	0.431	0.444	0.408	10.7
6th	0.005	0.006	0.006	0.036	0.041	0.043	2.7
7th	0.104	0.103	0.106	0.721	0.717	0.739	7.2
8th	0.005	0.004	0.005	0.032	0.029	0.033	2
9th	0.065	0.068	0.068	0.452	0.474	0.474	N/A
10th	0.005	0.004	0.003	0.035	0.030	0.022	1.6
11th	0.052	0.052	0.051	0.362	0.359	0.351	3.1
12th	0.006	0.003	0.004	0.041	0.018	0.029	1.3
13th	0.046	0.045	0.045	0.316	0.314	0.310	2
14th	0.004	0.003	0.003	0.028	0.021	0.024	N/A
15th	0.031	0.032	0.029	0.212	0.223	0.204	N/A
16th	0.003	0.002	0.002	0.020	0.015	0.017	N/A
17th	0.030	0.030	0.028	0.210	0.208	0.194	N/A
18th	0.003	0.002	0.004	0.021	0.012	0.028	N/A
19th	0.025	0.025	0.025	0.175	0.171	0.174	N/A
20th	0.002	0.002	0.002	0.015	0.011	0.014	N/A
21st	0.017	0.018	0.017	0.119	0.122	0.119	N/A
22nd	0.002	0.002	0.003	0.015	0.012	0.019	N/A
23rd	0.019	0.017	0.016	0.129	0.121	0.114	N/A
24th	0.002	0.002	0.002	0.011	0.011	0.012	N/A
25th	0.014	0.013	0.014	0.096	0.093	0.096	N/A
26th	0.003	0.002	0.002	0.019	0.013	0.013	N/A
27th	0.014	0.014	0.012	0.096	0.097	0.082	N/A
28th	0.002	0.002	0.002	0.015	0.013	0.015	N/A
29th	0.015	0.013	0.014	0.104	0.093	0.097	N/A
30th	0.003	0.002	0.002	0.017	0.016	0.015	N/A
31st	0.013	0.011	0.011	0.088	0.080	0.078	N/A
32nd	0.002	0.002	0.003	0.017	0.016	0.020	N/A
33rd	0.011	0.011	0.011	0.077	0.076	0.076	N/A
34th	0.002	0.002	0.003	0.016	0.016	0.018	N/A
35th	0.011	0.010	0.012	0.074	0.067	0.081	N/A
36th	0.002	0.002	0.002	0.017	0.016	0.016	N/A
37th	0.010	0.009	0.009	0.069	0.060	0.063	N/A
38th	0.002	0.002	0.002	0.015	0.014	0.015	N/A
39th	0.007	0.007	0.007	0.048	0.049	0.051	N/A
40th	0.002	0.002	0.002	0.011	0.013	0.013	N/A
THD	--	--	--	3.146	3.527	3.099	13
PWHD	--	--	--	2.115	2.063	2.024	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B1 a)/b)	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C, 100% P_n / 66% P_n / 33% P_n (CEI EN 61000-3-12)**						**P**
Model	AF15K-MTH						
Active power (W)	4994 (33% P_n, 25°C)						
Voltage (V)	231.17						
Current (A)	7.22						
Power Factor	0.9981						
Frequency (Hz)	50.00						
Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	7.180	7.178	7.179	--	--	--	--
2nd	0.017	0.020	0.030	0.233	0.280	0.412	8
3rd	0.341	0.382	0.351	4.745	5.309	4.878	N/A
4th	0.009	0.008	0.009	0.127	0.111	0.127	4
5th	0.083	0.084	0.085	1.159	1.171	1.185	10.7
6th	0.004	0.005	0.004	0.059	0.071	0.062	2.7
7th	0.080	0.078	0.081	1.114	1.091	1.124	7.2
8th	0.004	0.004	0.004	0.054	0.052	0.054	2
9th	0.055	0.055	0.055	0.766	0.763	0.763	N/A
10th	0.003	0.003	0.003	0.041	0.036	0.038	1.6
11th	0.042	0.041	0.041	0.580	0.566	0.577	3.1
12th	0.002	0.003	0.004	0.034	0.044	0.055	1.3
13th	0.031	0.029	0.027	0.431	0.403	0.380	2
14th	0.002	0.002	0.002	0.027	0.029	0.028	N/A
15th	0.021	0.023	0.022	0.294	0.315	0.310	N/A
16th	0.002	0.002	0.002	0.026	0.021	0.024	N/A
17th	0.018	0.017	0.018	0.247	0.233	0.253	N/A
18th	0.002	0.002	0.002	0.022	0.034	0.029	N/A
19th	0.013	0.013	0.013	0.177	0.180	0.176	N/A
20th	0.002	0.001	0.002	0.026	0.019	0.022	N/A
21st	0.013	0.010	0.011	0.175	0.141	0.160	N/A
22nd	0.002	0.001	0.002	0.021	0.018	0.026	N/A
23rd	0.009	0.009	0.009	0.120	0.120	0.127	N/A
24th	0.002	0.002	0.002	0.030	0.024	0.023	N/A
25th	0.006	0.006	0.007	0.088	0.089	0.102	N/A
26th	0.001	0.002	0.001	0.018	0.024	0.020	N/A
27th	0.007	0.004	0.007	0.091	0.061	0.101	N/A
28th	0.001	0.002	0.002	0.020	0.029	0.024	N/A
29th	0.002	0.003	0.003	0.033	0.041	0.047	N/A
30th	0.002	0.003	0.002	0.032	0.035	0.033	N/A
31st	0.003	0.003	0.004	0.046	0.045	0.061	N/A
32nd	0.002	0.002	0.002	0.025	0.031	0.028	N/A
33rd	0.002	0.004	0.002	0.030	0.050	0.034	N/A
34th	0.003	0.003	0.002	0.039	0.035	0.028	N/A
35th	0.004	0.003	0.004	0.060	0.038	0.062	N/A
36th	0.002	0.002	0.002	0.032	0.031	0.033	N/A
37th	0.003	0.003	0.003	0.036	0.038	0.039	N/A
38th	0.002	0.002	0.002	0.024	0.026	0.025	N/A
39th	0.002	0.002	0.003	0.031	0.026	0.040	N/A
40th	0.002	0.002	0.002	0.021	0.024	0.025	N/A
THD	--	--	--	5.435	6.200	5.594	13
PWHD	--	--	--	2.224	2.172	2.305	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B1 a)/b)	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C, 100% P_n / 66% P_n / 33% P_n (CEI EN 61000-3-12)**						**P**
Model	AF15K-MTH						
Active power (W)	4994 (33% P_n, -25°C)						
Voltage (V)	231.18						
Current (A)	7.22						
Power Factor	0.9981						
Frequency (Hz)	50.00						
Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	7.176	7.173	7.175	--	--	--	--
2nd	0.017	0.019	0.028	0.236	0.266	0.396	8
3rd	0.339	0.385	0.351	4.716	5.355	4.882	N/A
4th	0.009	0.008	0.009	0.127	0.113	0.127	4
5th	0.084	0.085	0.085	1.163	1.176	1.188	10.7
6th	0.004	0.005	0.005	0.058	0.071	0.063	2.7
7th	0.080	0.078	0.081	1.118	1.091	1.129	7.2
8th	0.004	0.004	0.004	0.053	0.051	0.056	2
9th	0.055	0.055	0.055	0.769	0.766	0.766	N/A
10th	0.003	0.003	0.003	0.044	0.036	0.038	1.6
11th	0.042	0.041	0.042	0.582	0.567	0.580	3.1
12th	0.002	0.003	0.004	0.033	0.044	0.056	1.3
13th	0.031	0.029	0.027	0.429	0.400	0.379	2
14th	0.002	0.002	0.002	0.026	0.030	0.027	N/A
15th	0.021	0.022	0.022	0.291	0.311	0.307	N/A
16th	0.002	0.002	0.002	0.026	0.023	0.023	N/A
17th	0.018	0.017	0.018	0.244	0.231	0.252	N/A
18th	0.002	0.002	0.002	0.022	0.033	0.029	N/A
19th	0.013	0.013	0.013	0.177	0.180	0.174	N/A
20th	0.002	0.001	0.002	0.024	0.020	0.022	N/A
21st	0.012	0.010	0.011	0.173	0.139	0.158	N/A
22nd	0.001	0.001	0.002	0.021	0.018	0.028	N/A
23rd	0.009	0.009	0.009	0.121	0.120	0.125	N/A
24th	0.002	0.002	0.002	0.030	0.024	0.022	N/A
25th	0.006	0.006	0.007	0.089	0.090	0.101	N/A
26th	0.001	0.002	0.001	0.018	0.024	0.021	N/A
27th	0.006	0.004	0.007	0.088	0.059	0.098	N/A
28th	0.001	0.002	0.002	0.019	0.030	0.022	N/A
29th	0.003	0.003	0.003	0.038	0.042	0.045	N/A
30th	0.002	0.002	0.002	0.029	0.033	0.032	N/A
31st	0.003	0.003	0.004	0.044	0.044	0.060	N/A
32nd	0.002	0.002	0.002	0.025	0.033	0.030	N/A
33rd	0.002	0.004	0.002	0.030	0.051	0.034	N/A
34th	0.003	0.002	0.002	0.042	0.033	0.029	N/A
35th	0.004	0.003	0.004	0.055	0.038	0.061	N/A
36th	0.002	0.002	0.002	0.028	0.032	0.032	N/A
37th	0.003	0.003	0.003	0.040	0.040	0.041	N/A
38th	0.002	0.002	0.002	0.024	0.026	0.026	N/A
39th	0.002	0.002	0.003	0.031	0.027	0.045	N/A
40th	0.002	0.002	0.002	0.021	0.027	0.024	N/A
THD	--	--	--	5.441	6.186	5.637	13
PWHD	--	--	--	2.204	2.160	2.288	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B1 a)/b)	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C, 100% P_n / 66% P_n / 33% P_n (CEI EN 61000-3-12)**						**P**
Model	AF15K-MTH						
Active power (W)	4994 (33% P_n, 60°C)						
Voltage (V)	231.17						
Current (A)	7.22						
Power Factor	0.9981						
Frequency (Hz)	50.00						
Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	7.178	7.176	7.177	--	--	--	--
2nd	0.018	0.020	0.032	0.248	0.278	0.440	8
3rd	0.342	0.384	0.350	4.756	5.337	4.875	N/A
4th	0.010	0.008	0.010	0.141	0.116	0.141	4
5th	0.084	0.085	0.086	1.167	1.177	1.192	10.7
6th	0.004	0.005	0.005	0.057	0.070	0.064	2.7
7th	0.081	0.079	0.081	1.122	1.094	1.127	7.2
8th	0.004	0.004	0.004	0.059	0.052	0.058	2
9th	0.055	0.055	0.055	0.768	0.769	0.769	N/A
10th	0.003	0.003	0.003	0.049	0.037	0.042	1.6
11th	0.042	0.041	0.042	0.583	0.567	0.581	3.1
12th	0.002	0.003	0.004	0.034	0.044	0.050	1.3
13th	0.031	0.029	0.027	0.435	0.400	0.381	2
14th	0.002	0.002	0.002	0.025	0.030	0.024	N/A
15th	0.021	0.023	0.022	0.292	0.315	0.308	N/A
16th	0.002	0.001	0.001	0.026	0.020	0.019	N/A
17th	0.017	0.017	0.018	0.243	0.232	0.253	N/A
18th	0.002	0.003	0.002	0.022	0.035	0.032	N/A
19th	0.013	0.013	0.013	0.180	0.177	0.176	N/A
20th	0.002	0.001	0.001	0.026	0.018	0.021	N/A
21st	0.012	0.010	0.011	0.174	0.139	0.159	N/A
22nd	0.002	0.001	0.002	0.022	0.018	0.032	N/A
23rd	0.009	0.009	0.009	0.119	0.122	0.126	N/A
24th	0.002	0.002	0.002	0.032	0.025	0.022	N/A
25th	0.006	0.007	0.007	0.090	0.091	0.098	N/A
26th	0.001	0.002	0.001	0.018	0.022	0.020	N/A
27th	0.006	0.004	0.007	0.084	0.058	0.095	N/A
28th	0.001	0.002	0.002	0.020	0.027	0.023	N/A
29th	0.002	0.003	0.003	0.034	0.043	0.048	N/A
30th	0.002	0.003	0.002	0.033	0.037	0.034	N/A
31st	0.003	0.004	0.004	0.041	0.051	0.058	N/A
32nd	0.002	0.002	0.002	0.025	0.029	0.032	N/A
33rd	0.002	0.004	0.002	0.030	0.052	0.034	N/A
34th	0.003	0.002	0.002	0.039	0.031	0.028	N/A
35th	0.004	0.003	0.004	0.056	0.036	0.058	N/A
36th	0.002	0.003	0.003	0.035	0.037	0.036	N/A
37th	0.003	0.002	0.003	0.040	0.034	0.038	N/A
38th	0.002	0.002	0.002	0.023	0.025	0.026	N/A
39th	0.002	0.002	0.003	0.030	0.027	0.041	N/A
40th	0.001	0.002	0.002	0.020	0.026	0.023	N/A
THD	--	--	--	5.483	6.201	5.616	13
PWHD	--	--	--	2.205	2.169	2.287	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1 a) Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2)
100% P_n power condition: 25°C

Model	AF3K-MTH			
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.018	0.018	0.025	1.080
3rd	0.325	0.339	0.315	2.300
4th	0.008	0.008	0.008	0.430
5th	0.081	0.079	0.085	1.140
6th	0.005	0.005	0.005	0.300
7th	0.051	0.047	0.049	0.770
8th	0.004	0.003	0.004	0.230
9th	0.029	0.028	0.028	0.400
10th	0.002	0.002	0.003	0.184
11th	0.017	0.017	0.020	0.330
12th	0.003	0.003	0.003	0.153
13th	0.006	0.006	0.008	0.210
14th	0.002	0.002	0.002	0.131
15th	0.002	0.002	0.002	0.150
16th	0.002	0.002	0.002	0.115
17th	0.006	0.007	0.006	0.132
18th	0.002	0.002	0.002	0.102
19th	0.008	0.010	0.006	0.118
20th	0.001	0.001	0.002	0.092
21th	0.009	0.010	0.007	0.107
22th	0.001	0.002	0.002	0.084
23th	0.010	0.011	0.009	0.098
24th	0.002	0.002	0.002	0.077
25th	0.009	0.010	0.009	0.090
26th	0.002	0.002	0.002	0.071
27th	0.010	0.008	0.010	0.083
28th	0.001	0.002	0.002	0.066
29th	0.007	0.008	0.007	0.078
30th	0.002	0.002	0.002	0.061
31th	0.005	0.006	0.006	0.073
32th	0.002	0.002	0.002	0.058
33th	0.003	0.005	0.005	0.068
34th	0.002	0.002	0.002	0.054
35th	0.005	0.004	0.006	0.064
36th	0.002	0.002	0.002	0.051
37th	0.002	0.002	0.003	0.061
38th	0.002	0.002	0.002	0.048
39th	0.003	0.003	0.003	0.058
40th	0.002	0.002	0.002	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1 a) Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2) 100% P_n power condition: -25°C				
Model	AF3K-MTH			
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.018	0.018	0.024	1.080
3rd	0.324	0.339	0.315	2.300
4th	0.007	0.008	0.007	0.430
5th	0.081	0.079	0.085	1.140
6th	0.004	0.005	0.005	0.300
7th	0.050	0.047	0.049	0.770
8th	0.004	0.003	0.004	0.230
9th	0.029	0.028	0.028	0.400
10th	0.002	0.002	0.003	0.184
11th	0.017	0.017	0.020	0.330
12th	0.003	0.003	0.003	0.153
13th	0.006	0.005	0.008	0.210
14th	0.002	0.002	0.002	0.131
15th	0.002	0.002	0.002	0.150
16th	0.002	0.002	0.001	0.115
17th	0.006	0.008	0.006	0.132
18th	0.002	0.002	0.002	0.102
19th	0.008	0.010	0.006	0.118
20th	0.001	0.001	0.001	0.092
21th	0.009	0.010	0.007	0.107
22th	0.001	0.001	0.002	0.084
23th	0.010	0.011	0.009	0.098
24th	0.002	0.002	0.002	0.077
25th	0.009	0.010	0.009	0.090
26th	0.002	0.002	0.002	0.071
27th	0.010	0.008	0.010	0.083
28th	0.002	0.002	0.002	0.066
29th	0.007	0.008	0.008	0.078
30th	0.003	0.003	0.002	0.061
31th	0.005	0.006	0.006	0.073
32th	0.002	0.002	0.002	0.058
33th	0.003	0.005	0.004	0.068
34th	0.002	0.002	0.002	0.054
35th	0.006	0.004	0.006	0.064
36th	0.002	0.003	0.003	0.051
37th	0.002	0.002	0.003	0.061
38th	0.002	0.002	0.002	0.048
39th	0.003	0.003	0.003	0.058
40th	0.002	0.002	0.002	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1 a) Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2) 100% P_n power condition: 60°C				
Model	AF3K-MTH			
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.019	0.016	0.024	1.080
3rd	0.324	0.339	0.315	2.300
4th	0.008	0.008	0.008	0.430
5th	0.081	0.079	0.085	1.140
6th	0.005	0.004	0.005	0.300
7th	0.051	0.047	0.049	0.770
8th	0.004	0.004	0.004	0.230
9th	0.029	0.028	0.028	0.400
10th	0.002	0.002	0.003	0.184
11th	0.017	0.017	0.020	0.330
12th	0.003	0.003	0.003	0.153
13th	0.006	0.006	0.008	0.210
14th	0.002	0.002	0.002	0.131
15th	0.002	0.002	0.002	0.150
16th	0.002	0.002	0.002	0.115
17th	0.006	0.007	0.005	0.132
18th	0.002	0.002	0.002	0.102
19th	0.008	0.010	0.006	0.118
20th	0.001	0.001	0.002	0.092
21th	0.009	0.010	0.007	0.107
22th	0.001	0.001	0.002	0.084
23th	0.010	0.011	0.009	0.098
24th	0.002	0.002	0.002	0.077
25th	0.009	0.010	0.009	0.090
26th	0.002	0.002	0.002	0.071
27th	0.010	0.008	0.010	0.083
28th	0.001	0.002	0.002	0.066
29th	0.007	0.008	0.007	0.078
30th	0.003	0.003	0.003	0.061
31th	0.005	0.006	0.006	0.073
32th	0.002	0.002	0.002	0.058
33th	0.003	0.005	0.005	0.068
34th	0.002	0.002	0.002	0.054
35th	0.005	0.003	0.006	0.064
36th	0.003	0.003	0.003	0.051
37th	0.002	0.002	0.003	0.061
38th	0.002	0.002	0.002	0.048
39th	0.003	0.003	0.003	0.058
40th	0.001	0.002	0.002	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1 a) Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2) 66% P_n power condition: 25°C				
Model	AF3K-MTH			
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.019	0.016	0.024	1.080
3rd	0.270	0.279	0.263	2.300
4th	0.007	0.008	0.007	0.430
5th	0.071	0.070	0.075	1.140
6th	0.004	0.005	0.005	0.300
7th	0.025	0.025	0.026	0.770
8th	0.004	0.004	0.004	0.230
9th	0.006	0.007	0.007	0.400
10th	0.002	0.003	0.003	0.184
11th	0.014	0.016	0.012	0.330
12th	0.002	0.002	0.004	0.153
13th	0.021	0.022	0.017	0.210
14th	0.002	0.002	0.002	0.131
15th	0.023	0.024	0.020	0.150
16th	0.003	0.003	0.002	0.115
17th	0.018	0.018	0.016	0.132
18th	0.003	0.002	0.002	0.102
19th	0.012	0.012	0.012	0.118
20th	0.002	0.002	0.001	0.092
21th	0.007	0.005	0.008	0.107
22th	0.002	0.001	0.002	0.084
23th	0.002	0.002	0.004	0.098
24th	0.002	0.001	0.002	0.077
25th	0.005	0.006	0.003	0.090
26th	0.002	0.002	0.002	0.071
27th	0.007	0.008	0.007	0.083
28th	0.002	0.002	0.002	0.066
29th	0.008	0.009	0.006	0.078
30th	0.003	0.003	0.002	0.061
31th	0.006	0.007	0.006	0.073
32th	0.002	0.002	0.002	0.058
33th	0.003	0.005	0.005	0.068
34th	0.003	0.002	0.002	0.054
35th	0.004	0.002	0.005	0.064
36th	0.002	0.002	0.002	0.051
37th	0.002	0.002	0.002	0.061
38th	0.002	0.002	0.002	0.048
39th	0.003	0.003	0.003	0.058
40th	0.001	0.002	0.002	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1 a) Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2) 66% P_n power condition: -25°C				
Model	AF3K-MTH			
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.020	0.015	0.024	1.080
3rd	0.269	0.279	0.263	2.300
4th	0.007	0.008	0.007	0.430
5th	0.072	0.070	0.075	1.140
6th	0.004	0.005	0.005	0.300
7th	0.025	0.025	0.026	0.770
8th	0.004	0.003	0.004	0.230
9th	0.006	0.007	0.007	0.400
10th	0.003	0.003	0.003	0.184
11th	0.014	0.016	0.012	0.330
12th	0.002	0.002	0.004	0.153
13th	0.020	0.022	0.017	0.210
14th	0.002	0.002	0.002	0.131
15th	0.024	0.024	0.020	0.150
16th	0.003	0.003	0.002	0.115
17th	0.018	0.018	0.016	0.132
18th	0.003	0.002	0.002	0.102
19th	0.012	0.012	0.012	0.118
20th	0.002	0.002	0.001	0.092
21th	0.007	0.005	0.008	0.107
22th	0.002	0.001	0.002	0.084
23th	0.002	0.002	0.004	0.098
24th	0.002	0.001	0.002	0.077
25th	0.005	0.006	0.003	0.090
26th	0.002	0.002	0.002	0.071
27th	0.007	0.008	0.007	0.083
28th	0.002	0.002	0.002	0.066
29th	0.008	0.008	0.006	0.078
30th	0.003	0.003	0.002	0.061
31th	0.006	0.007	0.006	0.073
32th	0.002	0.002	0.002	0.058
33th	0.004	0.006	0.005	0.068
34th	0.004	0.003	0.002	0.054
35th	0.004	0.003	0.005	0.064
36th	0.002	0.002	0.002	0.051
37th	0.002	0.002	0.002	0.061
38th	0.001	0.002	0.002	0.048
39th	0.003	0.003	0.003	0.058
40th	0.002	0.002	0.002	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1 a) Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2) 66% P_n power condition: 60°C				
Model	AF3K-MTH			
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.020	0.015	0.023	1.080
3rd	0.270	0.279	0.263	2.300
4th	0.007	0.007	0.007	0.430
5th	0.072	0.070	0.075	1.140
6th	0.004	0.005	0.004	0.300
7th	0.025	0.025	0.026	0.770
8th	0.004	0.004	0.004	0.230
9th	0.006	0.007	0.007	0.400
10th	0.002	0.002	0.003	0.184
11th	0.014	0.016	0.012	0.330
12th	0.003	0.002	0.004	0.153
13th	0.021	0.022	0.017	0.210
14th	0.003	0.002	0.002	0.131
15th	0.024	0.024	0.020	0.150
16th	0.003	0.003	0.003	0.115
17th	0.018	0.018	0.016	0.132
18th	0.003	0.002	0.002	0.102
19th	0.012	0.012	0.012	0.118
20th	0.002	0.002	0.001	0.092
21th	0.006	0.005	0.008	0.107
22th	0.002	0.001	0.002	0.084
23th	0.002	0.002	0.004	0.098
24th	0.002	0.002	0.002	0.077
25th	0.005	0.006	0.003	0.090
26th	0.002	0.002	0.002	0.071
27th	0.007	0.007	0.007	0.083
28th	0.002	0.002	0.002	0.066
29th	0.008	0.008	0.006	0.078
30th	0.003	0.003	0.002	0.061
31th	0.006	0.007	0.006	0.073
32th	0.002	0.002	0.002	0.058
33th	0.004	0.006	0.005	0.068
34th	0.003	0.003	0.002	0.054
35th	0.004	0.003	0.005	0.064
36th	0.002	0.002	0.002	0.051
37th	0.002	0.003	0.002	0.061
38th	0.002	0.002	0.002	0.048
39th	0.003	0.003	0.003	0.058
40th	0.002	0.002	0.002	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1 a) Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2) 33% P_n power condition: 25°C				
Model	AF3K-MTH			
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.016	0.016	0.022	1.080
3rd	0.153	0.156	0.146	2.300
4th	0.007	0.008	0.007	0.430
5th	0.046	0.045	0.048	1.140
6th	0.003	0.004	0.004	0.300
7th	0.020	0.018	0.012	0.770
8th	0.004	0.005	0.004	0.230
9th	0.031	0.030	0.030	0.400
10th	0.003	0.004	0.003	0.184
11th	0.032	0.031	0.028	0.330
12th	0.002	0.002	0.003	0.153
13th	0.017	0.016	0.018	0.210
14th	0.002	0.002	0.002	0.131
15th	0.002	0.002	0.004	0.150
16th	0.002	0.002	0.002	0.115
17th	0.010	0.010	0.006	0.132
18th	0.002	0.002	0.002	0.102
19th	0.013	0.013	0.010	0.118
20th	0.002	0.002	0.002	0.092
21th	0.009	0.010	0.008	0.107
22th	0.001	0.002	0.002	0.084
23th	0.005	0.005	0.005	0.098
24th	0.003	0.002	0.002	0.077
25th	0.003	0.003	0.004	0.090
26th	0.002	0.001	0.002	0.071
27th	0.003	0.003	0.003	0.083
28th	0.003	0.003	0.002	0.066
29th	0.006	0.006	0.004	0.078
30th	0.003	0.003	0.002	0.061
31th	0.005	0.006	0.006	0.073
32th	0.002	0.003	0.002	0.058
33th	0.003	0.005	0.004	0.068
34th	0.002	0.002	0.002	0.054
35th	0.004	0.002	0.004	0.064
36th	0.002	0.002	0.002	0.051
37th	0.002	0.003	0.002	0.061
38th	0.002	0.002	0.002	0.048
39th	0.004	0.004	0.004	0.058
40th	0.002	0.002	0.002	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1 a) Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2) 33% P_n power condition: -25°C				
Model	AF3K-MTH			
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.016	0.016	0.021	1.080
3rd	0.153	0.156	0.146	2.300
4th	0.007	0.008	0.007	0.430
5th	0.046	0.045	0.048	1.140
6th	0.003	0.004	0.004	0.300
7th	0.020	0.018	0.012	0.770
8th	0.005	0.004	0.004	0.230
9th	0.031	0.030	0.030	0.400
10th	0.003	0.003	0.003	0.184
11th	0.032	0.031	0.028	0.330
12th	0.002	0.002	0.003	0.153
13th	0.018	0.016	0.018	0.210
14th	0.002	0.002	0.002	0.131
15th	0.002	0.002	0.004	0.150
16th	0.002	0.002	0.002	0.115
17th	0.010	0.010	0.006	0.132
18th	0.003	0.002	0.002	0.102
19th	0.013	0.013	0.010	0.118
20th	0.002	0.002	0.002	0.092
21th	0.009	0.010	0.008	0.107
22th	0.002	0.001	0.002	0.084
23th	0.005	0.005	0.005	0.098
24th	0.003	0.002	0.002	0.077
25th	0.003	0.003	0.004	0.090
26th	0.002	0.002	0.002	0.071
27th	0.002	0.003	0.003	0.083
28th	0.003	0.003	0.002	0.066
29th	0.005	0.006	0.004	0.078
30th	0.003	0.003	0.002	0.061
31th	0.005	0.007	0.005	0.073
32th	0.002	0.003	0.002	0.058
33th	0.003	0.005	0.004	0.068
34th	0.002	0.002	0.002	0.054
35th	0.004	0.002	0.004	0.064
36th	0.002	0.002	0.002	0.051
37th	0.002	0.003	0.002	0.061
38th	0.002	0.002	0.002	0.048
39th	0.004	0.004	0.004	0.058
40th	0.002	0.002	0.002	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1 a) Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2) 33% P_n power condition: 60°C				
Model	AF3K-MTH			
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.017	0.015	0.022	1.080
3rd	0.153	0.157	0.146	2.300
4th	0.007	0.008	0.007	0.430
5th	0.046	0.046	0.048	1.140
6th	0.004	0.004	0.004	0.300
7th	0.020	0.018	0.012	0.770
8th	0.005	0.004	0.004	0.230
9th	0.031	0.030	0.030	0.400
10th	0.003	0.003	0.003	0.184
11th	0.032	0.031	0.028	0.330
12th	0.002	0.002	0.003	0.153
13th	0.017	0.016	0.018	0.210
14th	0.002	0.002	0.002	0.131
15th	0.002	0.002	0.004	0.150
16th	0.002	0.002	0.003	0.115
17th	0.010	0.010	0.006	0.132
18th	0.002	0.002	0.002	0.102
19th	0.013	0.013	0.010	0.118
20th	0.002	0.002	0.002	0.092
21th	0.008	0.010	0.008	0.107
22th	0.002	0.001	0.002	0.084
23th	0.005	0.005	0.005	0.098
24th	0.003	0.002	0.002	0.077
25th	0.003	0.003	0.004	0.090
26th	0.002	0.002	0.002	0.071
27th	0.003	0.004	0.002	0.083
28th	0.002	0.003	0.002	0.066
29th	0.005	0.006	0.004	0.078
30th	0.003	0.004	0.002	0.061
31th	0.005	0.007	0.005	0.073
32th	0.002	0.003	0.003	0.058
33th	0.003	0.005	0.004	0.068
34th	0.002	0.002	0.002	0.054
35th	0.004	0.002	0.004	0.064
36th	0.002	0.003	0.002	0.051
37th	0.002	0.003	0.002	0.061
38th	0.002	0.002	0.002	0.048
39th	0.004	0.004	0.004	0.058
40th	0.002	0.002	0.002	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B1 c)	**TABLE: Flicker emission**									**P**
Model	AF15K-MTH									
Normal ambient										
Output power:	Flicker limits according to*:	Result:								
		Plt			Pst			dc%		
		L1	L2	L3	L1	L2	L3	L1	L2	L3
33%	EN61000-3-3 / EN61000-3-11	0.101	0.099	0.100	0.111	0.106	0.108	0.039	0.038	0.036
66%	EN61000-3-3 / EN61000-3-11	0.104	0.102	0.102	0.111	0.110	0.108	0.039	0.037	0.039
100%	EN61000-3-3 / EN61000-3-11	0.103	0.097	0.102	0.111	0.101	0.111	0.038	0.039	0.038
Minimum ambient rating -25°C										
Output power:	Flicker limits according to*:	Result:								
		Plt			Pst			dc%		
		L1	L2	L3	L1	L2	L3	L1	L2	L3
33%	EN61000-3-3 / EN61000-3-11	0.101	0.101	0.101	0.107	0.109	0.110	0.038	0.038	0.037
66%	EN61000-3-3 / EN61000-3-11	0.102	0.101	0.100	0.110	0.111	0.110	0.039	0.039	0.039
100%	EN61000-3-3 / EN61000-3-11	0.101	0.102	0.103	0.109	0.110	0.110	0.034	0.037	0.038
Maximum ambient rating +60°C										
Output power:	Flicker limits according to*:	Result:								
		Plt			Pst			dc%		
		L1	L2	L3	L1	L2	L3	L1	L2	L3
33%	EN61000-3-3 / EN61000-3-11	0.099	0.102	0.099	0.102	0.111	0.104	0.038	0.038	0.037
66%	EN61000-3-3 / EN61000-3-11	0.101	0.101	0.100	0.111	0.110	0.110	0.039	0.039	0.038
100%	EN61000-3-3 / EN61000-3-11	0.100	0.099	0.101	0.110	0.105	0.106	0.039	0.038	0.038

Note:
* Mains Impedance according EN61000-3-3 / EN61000-3-11: **R_{max} = Ω; jX_{max}= Ω @50Hz (|Z_{max}| = Ω)**

Calculation of the maximum permissible grid impedance at the point of common coupling based on d_c:
$Z_{max} = Z_{ref} * 3,3\% / d_c(P_n)$

The tests should be based on the limits of the EN61000-3-3 for less than 16A and on EN 61000-3-11 for more than 16A.
If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test (such as -25°C / +60°C).

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.034	Pass	0.268	Pass	0.0	Pass	0.101	Pass		
2	0.036	Pass	0.268	Pass	0.0	Pass	0.098	Pass		
3	0.030	Pass	0.280	Pass	0.0	Pass	0.097	Pass		
4	0.029	Pass	0.284	Pass	0.0	Pass	0.098	Pass		
5	0.036	Pass	0.268	Pass	0.0	Pass	0.095	Pass		
6	0.032	Pass	0.262	Pass	0.0	Pass	0.111	Pass		
7	0.039	Pass	0.276	Pass	0.0	Pass	0.094	Pass		
8	0.030	Pass	0.263	Pass	0.0	Pass	0.102	Pass		
9	0.029	Pass	0.272	Pass	0.0	Pass	0.101	Pass		
10	0.030	Pass	0.287	Pass	0.0	Pass	0.096	Pass		
11	0.032	Pass	0.281	Pass	0.0	Pass	0.104	Pass		
12	0.033	Pass	0.296	Pass	0.0	Pass	0.109	Pass		
Result		Pass		Pass		Pass		Pass	0.101	Pass

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

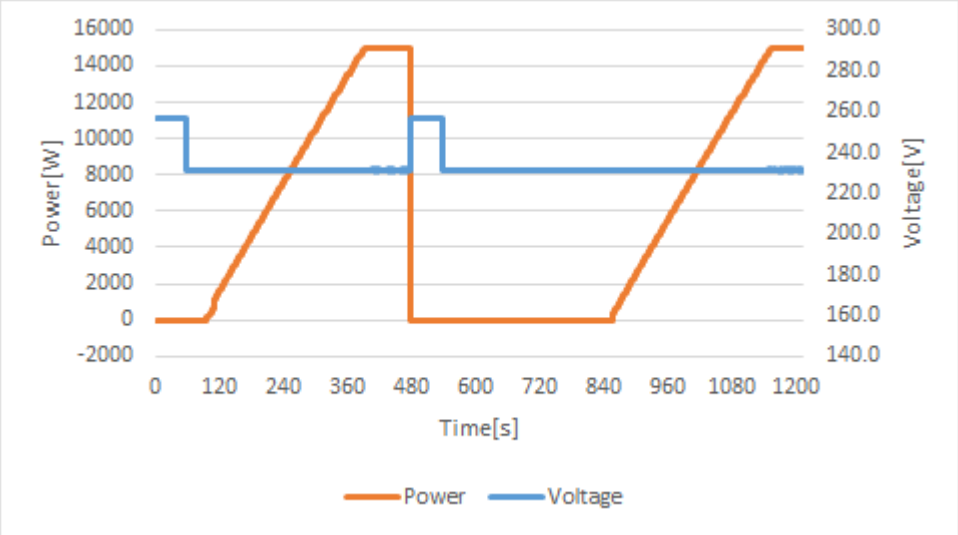
B.1.1	**TABLE: Conditions of connection, reconnection and gradual power supply**		**P**
Model	AF15K-MTH		
Test:			
Power meter measurment-data:	Sample-Rate:	0.2 s	
	Sample time:	6400	
	Voltage conditons		
a) Out of voltage range	84% U_n for 30s	111% U_n for 30s	
Connection:	No connection	No connection	
Limit	No connection allowed		
b) In voltage range at start-up	85% U_n < U <110% U_n		
Reconnection time [s]	34	33	
Limit:	Reconnection after 30s		
Gradient:	Gradient schould be recorded for at least 300s until the inverter has the full output power. Max gradient: 20%Pn/min For recorded gradient see diagram underneath		
c) In voltage range after voltage failture	85% U_n < U <110% U_n		
Reconnection time [s]	306	308	
Limit:	Reconnection after 300s		
Gradient:	Gradient schould be recorded for at least 300s until the inverter has the full output power. Max gradient: 20%Pn/min For recorded gradient see diagram underneath		
	Frequency conditions		
d) Out of frequency range	49,88 ± 0,01	50,12 ± 0,01	
Connection:	No connection	No connection	
Limit	No connection allowed		
e) In frequency range at start-up	49,90 Hz < f < 50,10		
Reconnection time [s]	35	32	
Limit:	Reconnection after 30s		
Gradient:	Gradient schould be recorded for at least 300s until the inverter has the full output power. Max gradient: 20%Pn/min For recorded gradient see diagram underneath		
f) In frequency range after frequency failture	49,90 Hz < f < 50,10		
Reconnection time [s]	304	302	
Limit:	Reconnection after 300s		
Gradient:	Gradient schould be recorded for at least 300s until the inverter has the full output power. Max gradient: 20%Pn/min For recorded gradient see diagram underneath		

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

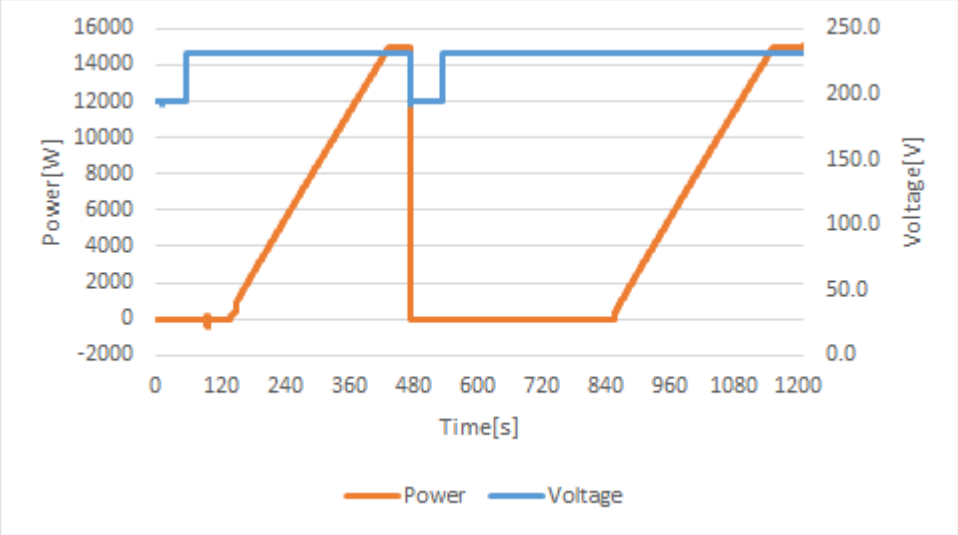
Changable reconnection conditions:	Frequency range: 49Hz-51Hz in 0,05Hz steps (default value: 49,90 and 50,10Hz)	Reconnection time range: 0-900s in steps of 5s (default value: 300s)

Test:
Test condition b) and c): voltage within the limits of 85% to 110%U_n
Test condition e) and f): frequency within the limits of 49,90Hz to 50,10Hz
Max deviation of the gradient: +2,5%P_n

Over Voltage

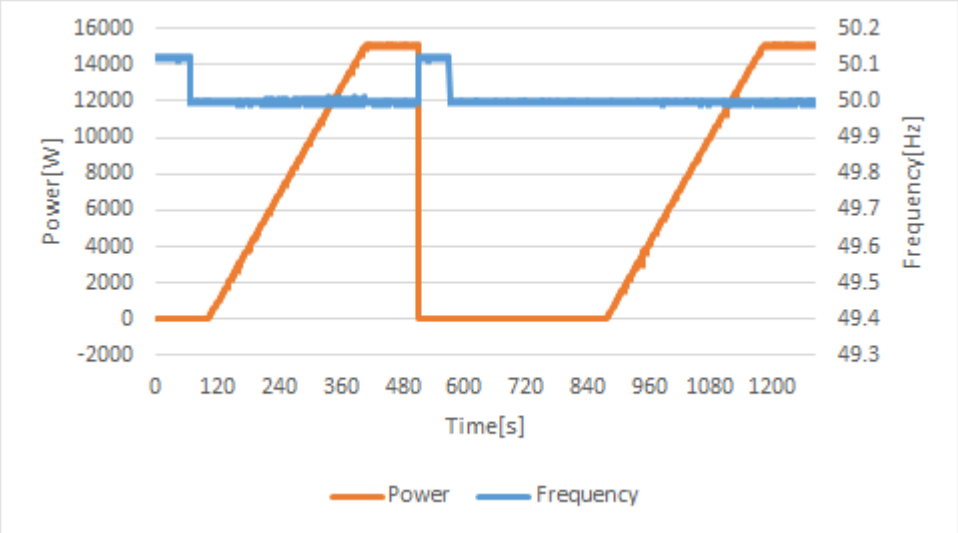


Under Voltage

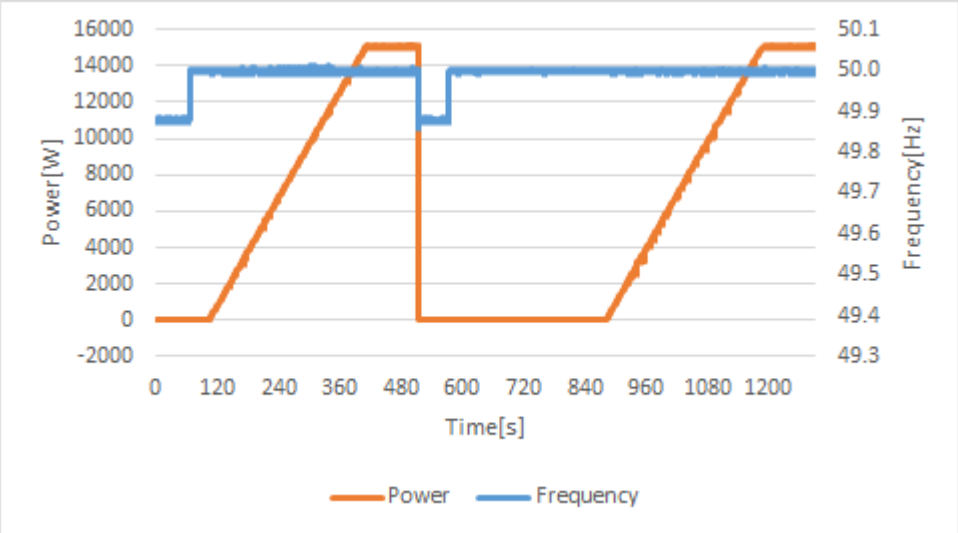


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Over Frequency



Under Frequency



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.2.2.2	TABLE: Reactive power capability - Inverter in systems with total capacity greater than 11.08 kW	P
Model	AF15K-MTH	

Inductive supply reactive power

Power-Bin [%P_n]	Active power [W]	Reactive Power [Var]	Q/P_n [%]	Power factor [cos φ]	Voltage [Vac]	DC power [W]
0% - 10%(*)	1226	-201	-1.34%	0.9868	230.16	3097
10% - 20%(*)	2725	-274	-1.83%	0.9950	229.93	6505
20% - 30%	4215	7411	49.41%	0.4943	229.99	9922
30% - 40%	5728	7382	49.21%	0.6130	229.98	13405
40% - 50%	7251	7354	49.03%	0.7021	230.16	16981
50% - 60%	8735	7380	49.20%	0.7639	230.14	20394
60% - 70%	10247	7357	49.04%	0.8123	230.15	23735
70% - 80%	11751	7386	49.24%	0.8466	230.10	27029
80% - 90%	13250	7366	49.11%	0.8740	230.22	30237
90% - 100% (***)	14746	7378	49.19%	0.8943	230.11	30224

Capacitive supply reactive power

Power-Bin [%P_n]	Active power [W]	Reactive Power [Var]	Q/P_n [%]	Power factor [cos φ]	Voltage [Vac]	DC power [W]
0% - 10%(*)	1205	-200	-1.33%	0.9865	229.84	3029
10% - 20%(*)	2708	-275	-1.84%	0.9949	229.89	6631
20% - 30%	4207	-7362	-49.08%	0.4962	229.85	10527
30% - 40%	5721	-7360	-49.07%	0.6137	229.88	14034
40% - 50%	7215	-7360	-49.07%	0.7001	229.80	17470
50% - 60%	8717	-7360	-49.07%	0.7641	229.82	20940
60% - 70%	10228	-7352	-49.01%	0.8120	229.98	24278
70% - 80%	11734	-7365	-49.10%	0.8470	229.95	27606
80% - 90%	13230	-7362	-49.08%	0.8738	230.16	30703
90% - 100% (***)	14549	-7339	-48.93%	0.8928	230.17	30645

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Cos phi = 1 no reactive power supply						
Power-Bin [%P_n]	Active power [W]	Reactive Power [Var]	Q/P_n [%]	Power factor [cos φ]	Voltage [Vac]	DC power [W]
0% - 10%(*)	1208	-199	-1.33%	0.9867	229.98	3001
10% - 20%(*)	2723	-274	-1.82%	0.9950	229.93	6627
20% - 30%	4217	-302	-2.01%	0.9974	229.89	10170
30% - 40%	5724	-316	-2.11%	0.9985	229.96	13682
40% - 50%	7239	-327	-2.18%	0.9990	229.97	17179
50% - 60%	8750	-337	-2.25%	0.9993	229.99	20634
60% - 70%	10258	-352	-2.34%	0.9994	230.05	24031
70% - 80%	11758	-368	-2.45%	0.9995	230.11	27372
80% - 90%	13257	-388	-2.59%	0.9996	230.13	30798
90% - 100% (***)	14754	-412	-2.75%	0.9996	230.10	34045

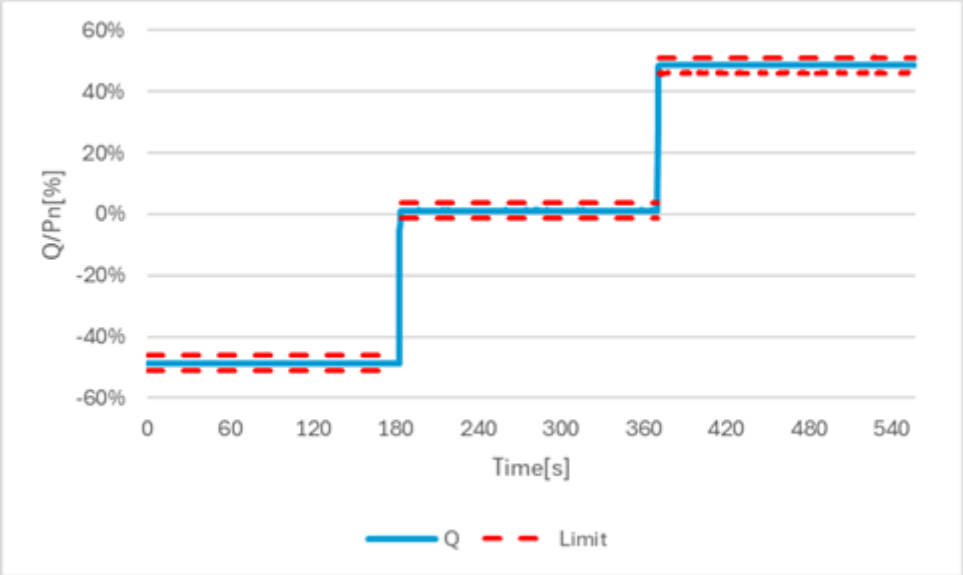
Note:
The PV inverter maximum reactive power set point Q = 48.43%P_n.
(*) For power outputs less than 10% of the nominal power the generator must not exchange a reactive power higher than 10% of the nominal power.
(**) For power outputs less than 20% of the nominal power the generator must not exchange a reactive power higher than 10% of the nominal power.
(***)Ensure that the minimum requirement for cos is sustained steadily when thermal balance is achieved.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.2.3	**TABLE: Reactive power supply at an assigned level (greater 11.08 kW systems, but can requested for smaller systems as well)**			**P**
Model	AF15K-MTH			
Power meter measurment data:		Sample-Rate:	0.2 s	
		Samples time:	3 min for each power point	
P_N in %		Qmin/cosφ min (180s)	Q=0/ cosφ=0 (180s)	Qmax/cosφ max (180s)

50% P_n	Reactive power Set point Q/P_n [%]	Reactive power measured Q/P_n [%]	Deviation from set point $\Delta Q/P_n$ [%]	Limit [%]
$-Q_{min}$	-48.43%	-48.55%	-0.12%	$\Delta Q \leq \pm 2.5\% P_n$
0	0.00%	1.18%	1.18%	$\Delta Q \leq \pm 2.5\% P_n$
$+Q_{max}$	48.43%	48.61%	0.18%	$\Delta Q \leq \pm 2.5\% P_n$

Diagram



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

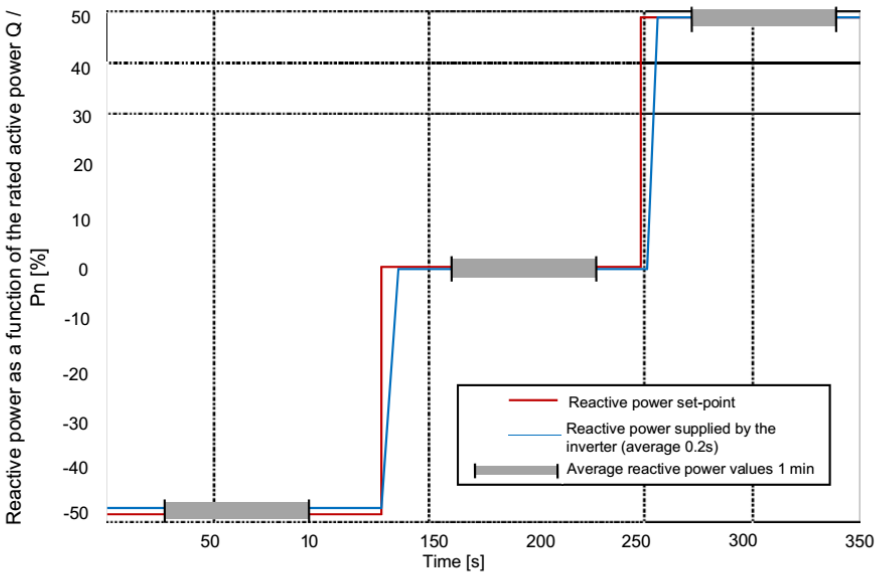


Figure 48 - Measurement of the reactive power delivered based on an external command, accuracy check

Test procedure:

- Set the DC source so that the inverter delivers about 50% of the nominal active power Pn.
- Using the methods and the control parameter established by the manufacturer, vary the reactive power supplied by the converter passing from the maximum inductive value (at least equal to Qmin ≤ -0.4843 Pn) directly to zero (Q = 0), and then go from zero at the maximum capacitive value (equal to Qmax ≥ + 0.4843 Pn).
- Maintain each of the 3 limit set-points for 180 s.
- Calculate the average values of reactive power at 1 min on the basis of the values measured over a window of 200 ms at the fundamental frequency. The calculation of the value on an average of 1 min must start from the samples detected after 30 s from the instant in which the command of the new reactive power regulation set-point is sent, this is to ensure that the system has reached the steady state.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.2.4	**TABLE: Response time to an assigned step level change (greater 11.08 kW systems)**		**P**
Model	AF15K-MTH		
Power meter measurment data:	Sample-Rate:	0,2 s	
	Samples time:	at least 2 minutes for each power point	
P_{Emax} in %	50	100	
Maximum response time :10 s	2 s	2 s	

Test:
DC source should be set to 50% (test1) and 100% (test 2) output power
Starting with Q=0 then Qmin≤ -0,4843 P_n to to Qmax≥ 0,4843 P_n, and then back to Q=0 in doing so each point must be kept for at least 2 minute.

The total tolerance is ΔQ ≤ ±5,0% of P_n or Δcosφ ≤ ±0.01
The maximum response time is 10s.

As for the requirements of the previous paragraph, also in this case the tests are required to inverters used in plants with a total power greater than 11.08 kW, which must also be able to implement a centralized control strategy via remote control signal, issued by the Distributor. However, the manufacturer has the right to voluntarily carry out tests even for smaller inverters.

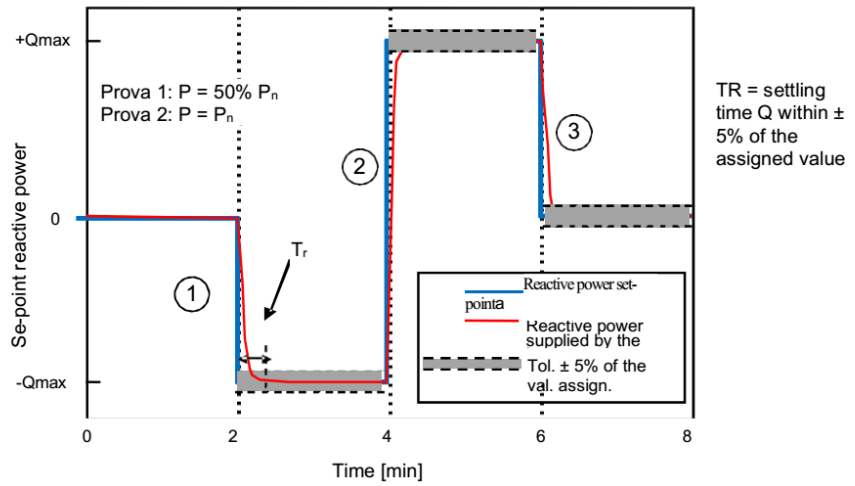
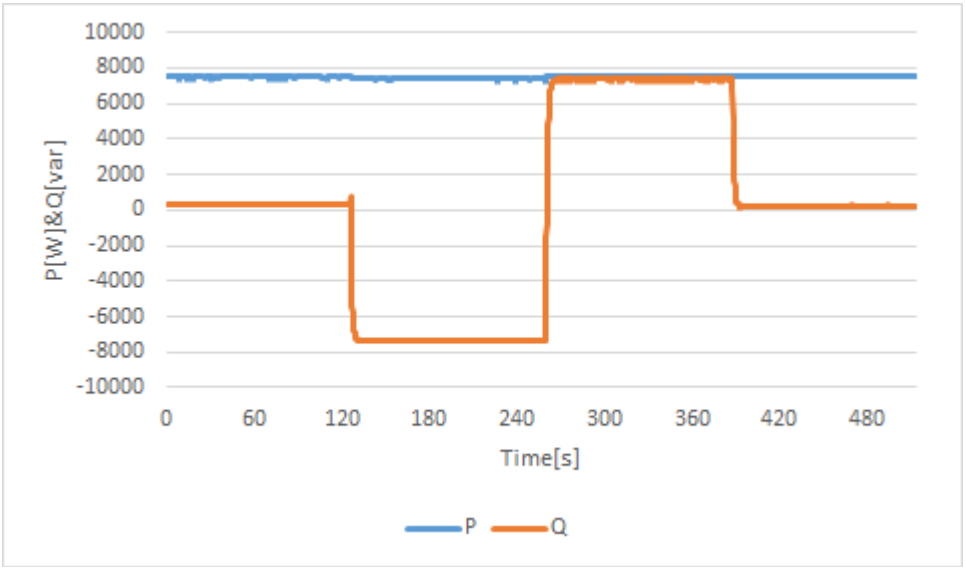


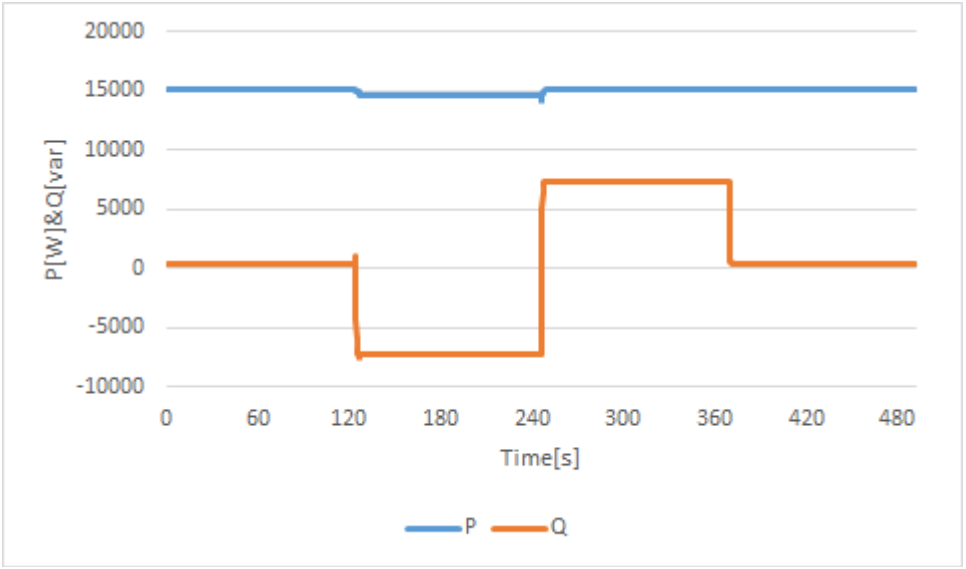
Figure 49 - Measurement of the response time to step changes of the set-point assigned for the reactive power

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test1



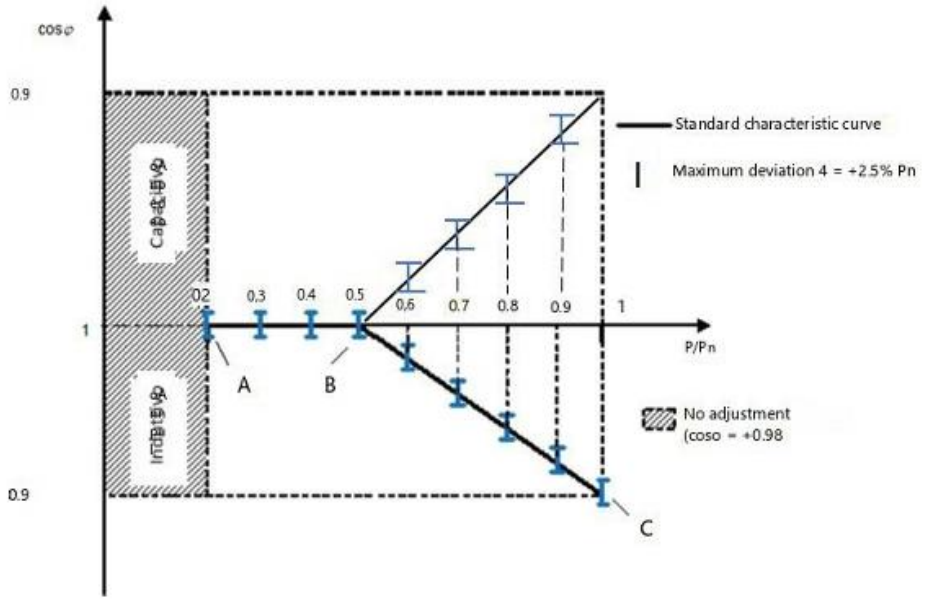
Test2



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.2.5	TABLE: Automatic supply of reactive power according to the characteristic curve cos φ=f(P)	P
Model	AF15K-MTH	

Test:
Test points A-F: Set the system voltage to 1,04V_n (default lock-in value of the manufacture1,05V_n) and increases the active power from 20% P_{Emax} in increments of 10% P_E to 60%.
Test points G-H: Set the system voltage to 1,06V_n increases the active power from 60% P_E to 100% P_{Emax}.
Test points J: Set the system voltage back to V_n at 100% P_{Emax} and check that the inverter still remain in reactive power supply.
The total tolerance is Δcosφ ≤ ±0.01

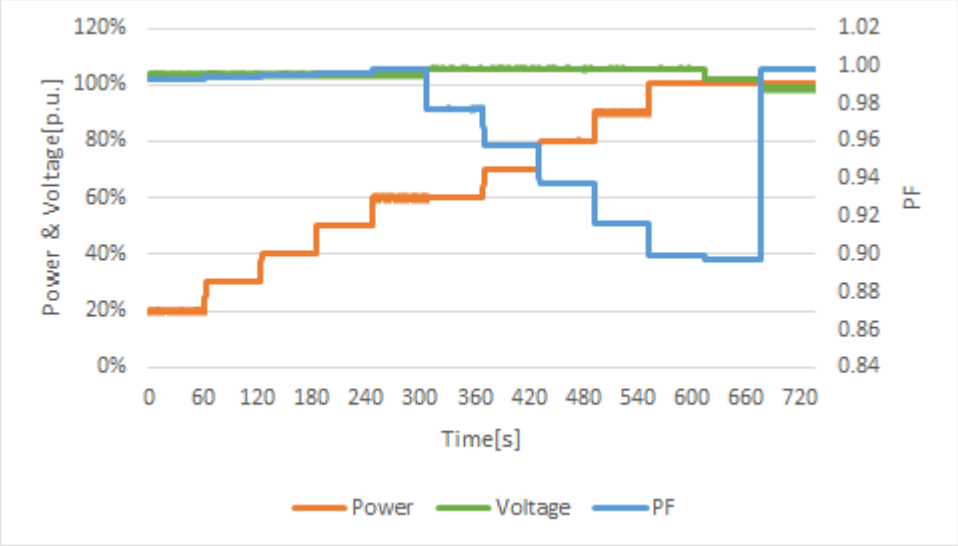


Assessment criterion:
Test 1: cos φ accuracy cos φ (±0,01)
Test 2: cos φ accuracy cos φ (±0,01)
For the test to be passed, the cos φ setpoint from the active power must be measured at the terminals of the PGU within a settling time of 10 s.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Model:	AF15K-MTH							
P/P_{SMAX}[%]	P[W]	Vout[%]	+Q[Var]	Cos φSetpoint	Cos φmeasured	ΔCosφ	Limit Δcosφ_max	Result
20	3010	238.58	360	1.00	0.993	-0.007	≤ ± 0.01	P
30	4519	238.60	483	1.00	0.994	-0.006	≤ ± 0.01	P
40	6015	238.61	585	1.00	0.995	-0.005	≤ ± 0.01	P
50	7537	238.63	671	1.00	0.996	-0.004	≤ ± 0.01	P
60	9015	238.59	579	1.00	0.998	-0.002	≤ ± 0.01	P
60	9047	243.21	1966	0.98	0.977	-0.003	≤ ± 0.01	P
70	10531	243.23	3166	0.96	0.958	-0.002	≤ ± 0.01	P
80	12034	243.22	4465	0.94	0.938	-0.002	≤ ± 0.01	P
90	13538	243.20	5915	0.92	0.916	-0.004	≤ ± 0.01	P
100	15057	243.16	7307	0.90	0.901	0.001	≤ ± 0.01	P
100	15089	233.98	7420	0.90	0.897	-0.003	≤ ± 0.01	P
100	15096	227.25	801	1.00	0.999	-0.001	≤ ± 0.01	P

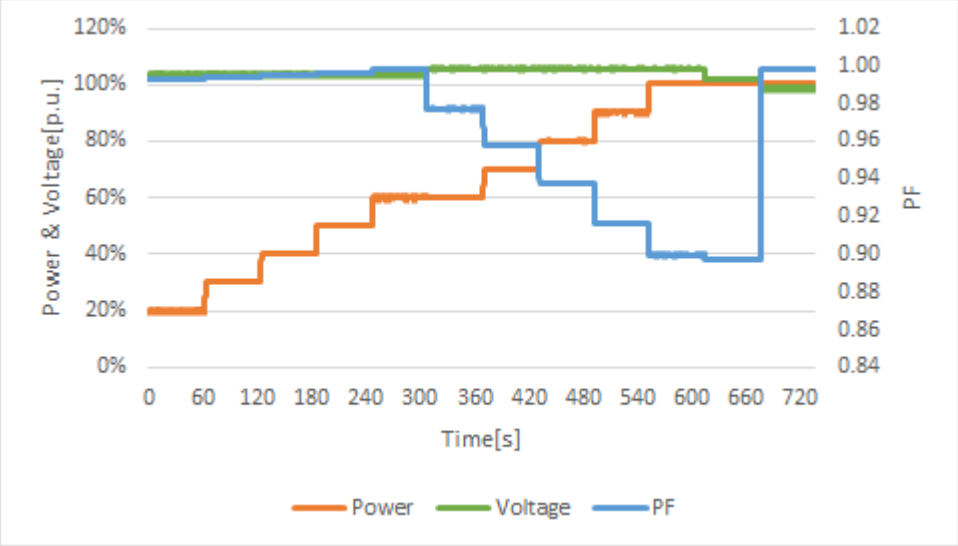
Graph reactive power production according to a characteristic curve cos(phi) = f(P)



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Model:	AF15K-MTH							
P/P_{SMAX}[%]	P[W]	Vout[%]	-Q[Var]	Cos φSetpoint	Cos φmeasured	ΔCosφ	Limit Δcosφ_max	Result
20	3014	238.61	-359	1.00	0.993	-0.007	≤ ± 0.01	P
30	4521	238.63	-482	1.00	0.994	-0.006	≤ ± 0.01	P
40	6019	238.64	-584	1.00	0.995	-0.005	≤ ± 0.01	P
50	7539	238.66	-670	1.00	0.996	-0.004	≤ ± 0.01	P
60	9018	238.62	-578	1.00	0.998	-0.002	≤ ± 0.01	P
60	9049	243.24	-1965	0.98	0.977	-0.003	≤ ± 0.01	P
70	10535	243.26	-3165	0.96	0.958	-0.002	≤ ± 0.01	P
80	12036	243.25	-4464	0.94	0.938	-0.002	≤ ± 0.01	P
90	13541	243.23	-5914	0.92	0.916	-0.004	≤ ± 0.01	P
100	15059	243.19	-7306	0.90	0.901	0.001	≤ ± 0.01	P
100	15091	234.01	-7419	0.90	0.897	-0.003	≤ ± 0.01	P
100	15099	227.28	-800	1.00	0.999	-0.001	≤ ± 0.01	P

Graph reactive power production according to a characteristic curve cos(phi) = f(P)



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B1.2.6	TABLE: Automatic supply of reactive power according to the characteristic curve Q= f(V) (greater 11.08kW systems)		P
Over voltage & Under voltage			
Power meter measurement data:	Sample-Rate:	0.2 s	
	Samples:	1000	

Test**:**

Test points A-I: Set the system voltage to 1.07 V_n / 0.93V_n (default lock-in value of the manufacture 1.08 V_n / 0.92V_n) and set up the active power to less than 20%. After stabilisation of this point increase the grid voltage from 0.93 to 0.91 and 1.08 to 1.10 V_n in 1V steps but hold the active power <20% $P_{E.}$ The active power should be now increase to 30% and and then from 30% P_{Emax} in increments of 10% P_E to 100%.

Test points J-K: Set the system voltage to 1.10V_n and 0.90V_n decreases the active power from 100% P_E to 10% P_{Emax} and after at least 30s smaller than 5% P_{Emax}.

The total tolerance is ΔQ ≤ ±2.5% of P_n

The inverter must be able to delay the activation of the curve from 0s - 30s (in 1s steps / default setting: 3s)

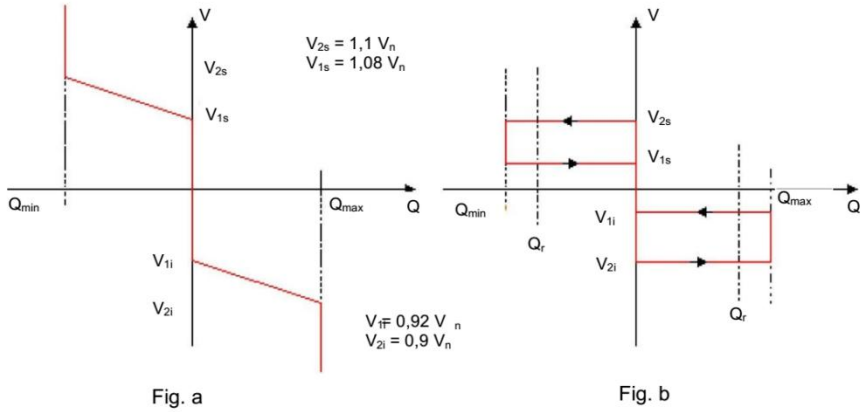


Figure 51 - Standard characteristic curves Q = f (V)

Curve settings:

V_{1s} =1.08V_n; V_{2s} = 1.1V_n

V_{1i} =0.92V_n; V2i = 0.9V_n

(V_{1i}, V_{2i}, V_{1s} and V_{2s} must be programmable in a range 0.9-1.1V_n with steps 0.01V_n)

Assessment criterion:

Test 1: cos φ accuracy cos φ (±0,01)

Test 2: cos φ accuracy cos φ (±0,01)

For the test to be passed, the cos φ setpoint from the active power must be measured at the terminals of the PGU within a settling time of 10 s.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.2.6	**TABLE: Automatic supply of reactive power according to the characteristic curve Q= f(V) (greater 11.08kW systems)**					**P**
Model	AF15K-MTH					
Q_{min} reactive power in accordance to standard characteristic curve Q=f(V)						
P/P_n [%] Set-point	Vac [V] Set-point	P/P_n [%] measured	Vac [V] measured	Q [Var] measured	Q [Var] expected	ΔQ [≤±2.5%P_n]
< 20%	1.07Vn	18%	245.88	309	≈0(<±2.5%Pn)	2.06%
< 20%	1.09Vn	18%	250.49	311	≈0(<±2.5%Pn)	2.08%
< 20%-> 30%	1.09Vn	30%	250.53	-3300	-0.5 Q_{min} (within 10s)	2.22%
40%	1.09V_n	40%	250.57	-3360	-0.5 Q_{min}	1.82%
50%	1.09V_n	50%	250.61	-3428	-0.5 Q_{min}	1.36%
60%	1.09V_n	60%	250.65	-3497	-0.5 Q_{min}	0.90%
70%	1.09V_n	70%	250.69	-3558	-0.5 Q_{min}	0.50%
80%	1.09V_n	80%	250.73	-3582	-0.5 Q_{min}	0.33%
90%	1.09V_n	90%	250.75	-3674	-0.5 Q_{min}	-0.28%
100%	1.09V_n	97%	250.79	-3772	-0.5 Q_{min}	-0.93%
100%	1.1 V_n	88%	253.09	-7254	- Q_{min}	0.07%
100%->10%	1.1 V_n	9%	252.78	-7247	- Q_{min}	0.12%
10%-> ≤5%	1.1 V_n	4%	252.76	190	≈0 (<±5%P_n)	1.27%
Q_{max} reactive power in accordance to standard characteristic curve Q=f(V)						
P/P_n [%] Set-point	Vac [V] Set-point	P/P_n [%] measured	Vac [V] measured	Q [Var] measured	Q [Var] expected	ΔQ [≤±2.5%P_n]
< 20%	0.93V_n	18%	213.74	245	≈0 (<±2.5%P_n)	1.63%
< 20%	0.91V_n	18%	209.10	242	≈0 (<±2.5%P_n)	1.61%
< 20%-30%	0.91V_n	31%	209.15	3793	-0.5 Q_{max} (within 10s)	1.07%
40%	0.91V_n	41%	209.20	3763	-0.5 Q_{max}	0.87%
50%	0.91V_n	51%	209.24	3727	-0.5 Q_{max}	0.63%
60%	0.91V_n	61%	209.28	3649	-0.5 Q_{max}	0.11%
70%	0.91V_n	71%	209.32	3620	-0.5 Q_{max}	-0.08%
80%	0.91V_n	81%	209.37	3613	-0.5 Q_{max}	-0.13%
90%	0.91V_n	91%	209.42	3630	-0.5 Q_{max}	-0.02%
100%	0.91V_n	98%	209.41	3615	-0.5 Q_{max}	-0.12%
100%	0.90V_n	90%	207.07	7349	- Q_{max}	0.57%
100%-10%	0.90V_n	9%	206.72	7447	- Q_{max}	1.22%
10%-5%	0.90V_n	5%	206.71	348	≈0(<±5%P_n)	2.32%

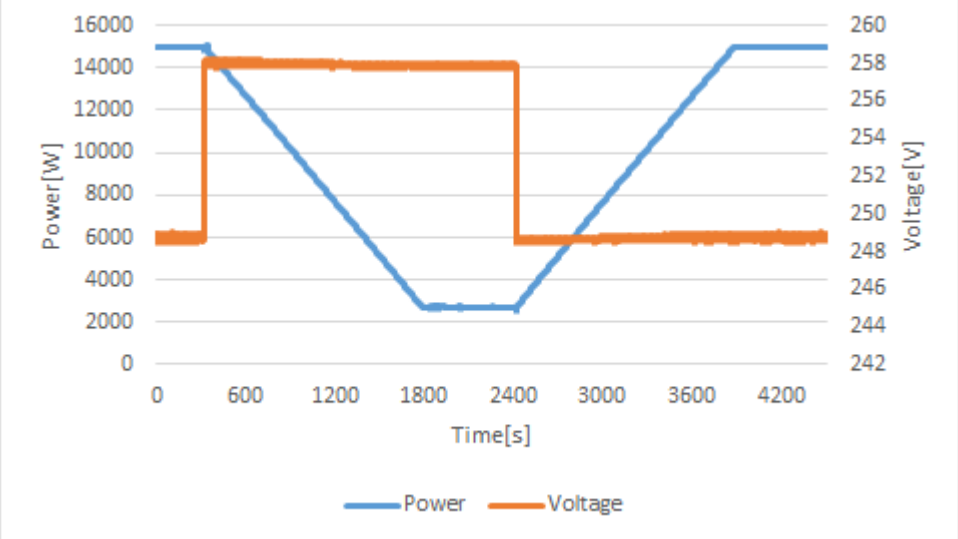
Note:
The lock-in value is adjustable between V_n and 1.1V_n and the lock-out value between V_n and 0.9V_n in 0.01V steps.
The inverter voltage on the AC side of the (inverter) is rated to 400V line to line.
In reference to the circular characteristic, the inverter reduces the active output power to maintain the reactive output power.
The under voltage measurement effects the active output power in reference to the reactive output power since the reactive output power has always priority. Therefore the inverter must lower the active output power.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.3.1	**TABLE: Automatic limitation of active power for voltage values close to 110% of the rated voltage**					**P**
Model	AF15K-MTH					
Set point		Activation threshold U_1			Deactivation threshold U_2	
U/U_n		110%			112%	
P/P_n		100%			20%	
Step	Set voltage [V/Vn]	Voltage [V]	Measured power [W]	Measured power [%]	Limit	Result
1	1.08	248.79	14978.12	99.85%	--	P
2	1.12	257.94	2683.90	17.89%	P <20%P_n	P
3	1.08	248.74	14985.00	99.90%	--	P

The purpose of the test is to verify the automatic reduction function of the active power delivered when the voltage read at the generator terminals has a value close to 110% of V_n.
Proceed as follows:

- enable the active power reduction function P(U), according to the methods indicated by the manufacturer (which must be reported in the test report);
- adjust the voltage read at the output terminals of the converter to -2% of the activation threshold declared by the manufacturer and the DC source, so that the active power delivered at the output is equal to the maximum power available for injection;
- adjust the voltage read at the output terminals of the converter to + 2% of the activation threshold declared by the manufacturer;
- the active power is measured as averages at 1 s, plotting the values obtained as a function of time;
- within 5 minutes from the instant of application of the voltage + 2% of the activation threshold declared by the manufacturer, it is verified that the active power supplied by the inverter has been reduced to a value not exceeding 20% of P_n
- adjust the voltage read at the output terminals of the converter to -2% of the activation threshold declared by the manufacturer;
- the active power is measured as averages at 1 s, plotting the values obtained as a function of time;
- verify that the active power delivered by the inverter returns to the value congruent with the power made available from the primary or simulated source.



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.3.2	**TABLE: Adjustment of active power in the presence of over-frequency transistors on the transmission network**						**P**
Model	AF15K-MTH						
Test:							
Power meter measurement data:	Sample-Rate:	0,2 s					
	Samples:	60 per frequency Point					
f [Hz] (ramps)	1) 47,51	2) 50,15	3) 50,40	4) 50,60	5) 51,49	6) 50,11	7) 50,00
file: 100% P_{Emax}	Sequence A						
file: 50% P_{Emax}	Sequence B						

Test:

The test is conducted for two powers. First, the test must start at a power 100% P_{Emax} ("Measurement 1"), and in a second test, for a power of 50% P_{Emax} ("Measurement 2"). The inverter must reduce the power and stay in this condition, until the grid stays in the limits for more than 300s. In the second test, after freezing of the momentary output power, the available active power output must be increased to a value 100% P_{Emax}, and after the network frequency of 50,3 Hz is fallen below, the rise of the active power gradient must be recorded.

Perform the measurements on 7 points (the frequency value must have an uncertainty of maximum ± 10 mHz) temporally consequent to each other:

1) f = 47.51 Hz (t_1 for sequence A, t1 for sequence B)
2) f = 50 Hz + 0.15 Hz (t_2 for sequence A, t'_2 for sequence B)
3) f = 50 Hz + 0.40 Hz (t_3 for sequence A, t'_3 for sequence B)
4) f = 50 Hz + 0.60 Hz (t_4 for sequence A, t'_4 for sequence B)
5) f = 50 Hz + 1.49 Hz (t_5 for sequence A, t'_5 for sequence B)
6) f = 50 Hz + 0.11 Hz (t_6 for sequence A, t'_6 for sequence B)

Now carry out step 7). bringing the frequency back to the nominal value to verify the conditions of gradual restoration of the maximum supply (sequence A), or to 50% of the maximum power available (sequence B):

7) f = 50 Hz (t_7 for sequence A, t'_7 for sequence B).

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

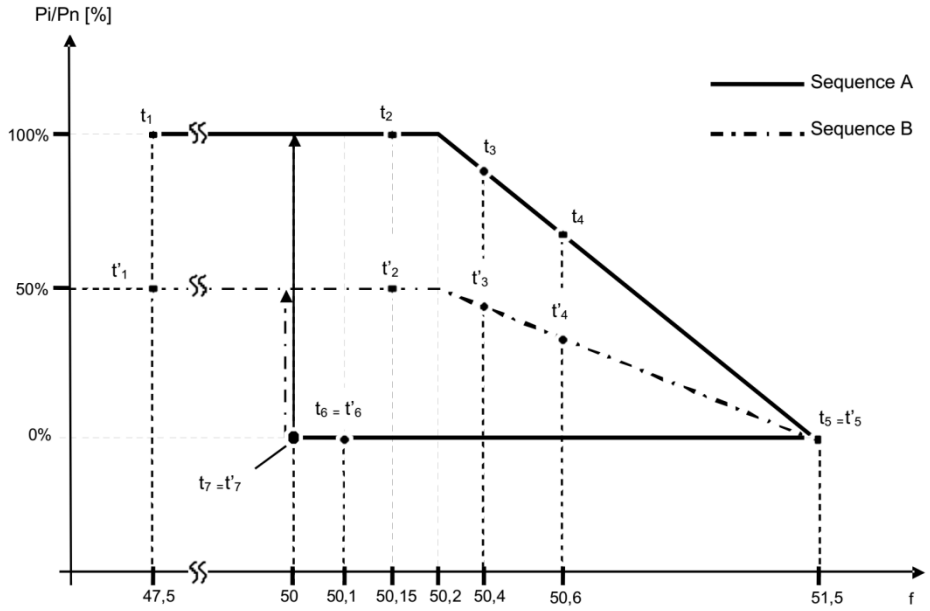
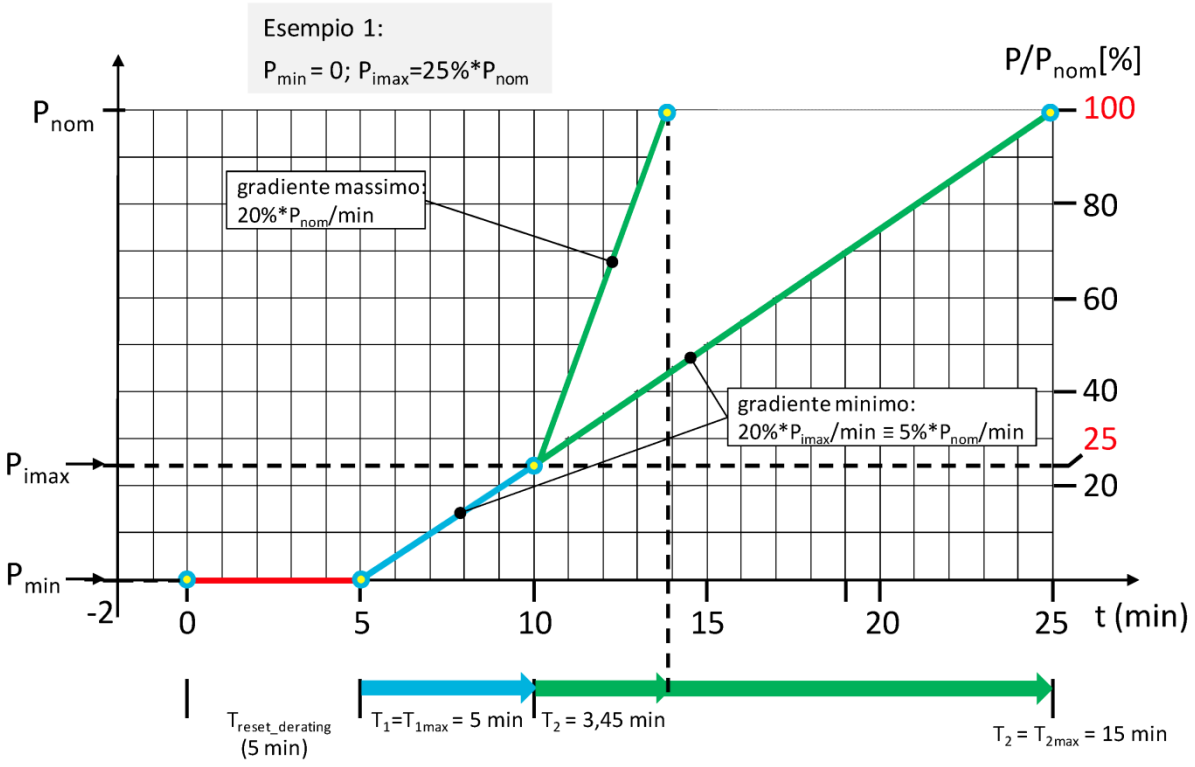


Figure 52 - Curves for limiting active power with respect to frequency

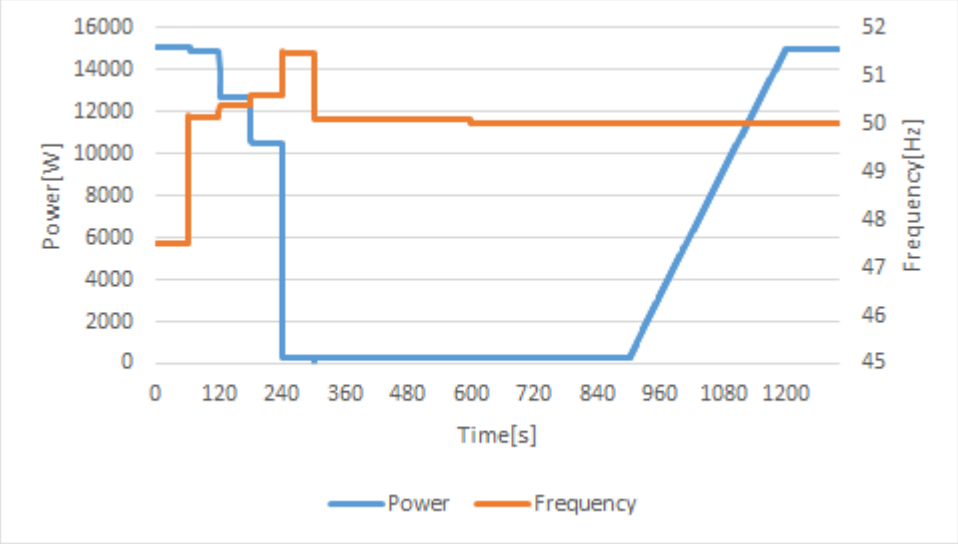
The total tolerance is $\Delta P \leq \pm 2{,}5\%$ of P_n

Limits of the power-up gradient



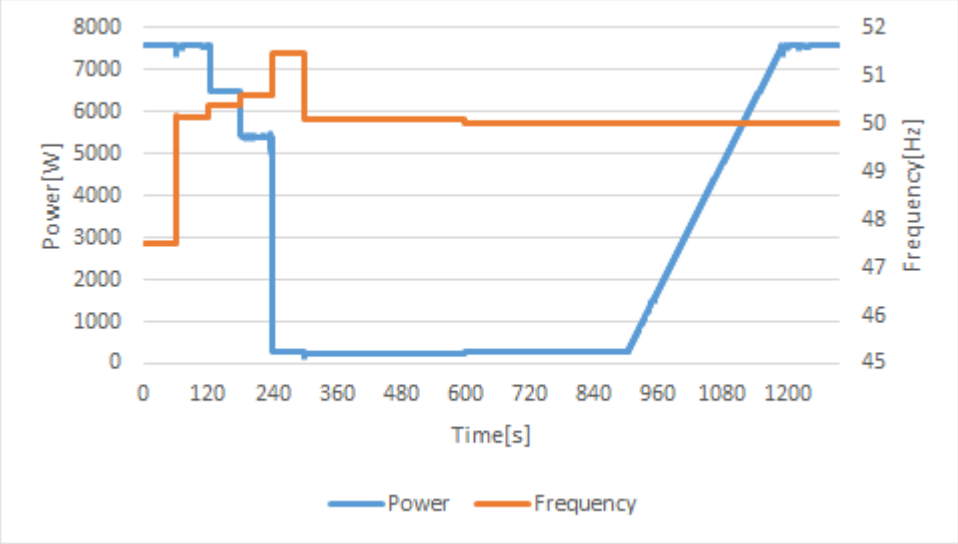
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Sequence A						
Step No.	Set output power [%]	Frequency[Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	100	47.51	15000	15063	± 2.5% Pn	t_1
2	100	50.15	15000	14909	± 2.5% Pn	t_2
3	100	50.40	12692	12672	± 2.5% Pn	t_3
4	100	50.60	10385	10543	± 2.5% Pn	t_4
5	100	51.49	115	357	± 2.5% Pn	t_5
6	100	50.10	115	253	± 2.5% Pn	t_6
7	100	50.00	15000	15013	Pn	t_7



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Sequence B						
Step No.	Set output power [%]	Frequency[Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	50	47.51	7500	7575	± 2.5% Pn	t'_1
2	50	50.15	7500	7568	± 2.5% Pn	t'_2
3	50	50.40	6346	6560	± 2.5% Pn	t'_3
4	50	50.60	5192	5398	± 2.5% Pn	t'_4
5	50	51.49	58	324	± 2.5% Pn	t'_5
6	50	50.10	58	252	± 2.5% Pn	t'_6
7	50	50.00	7500	7597	50% Pn	t'_7

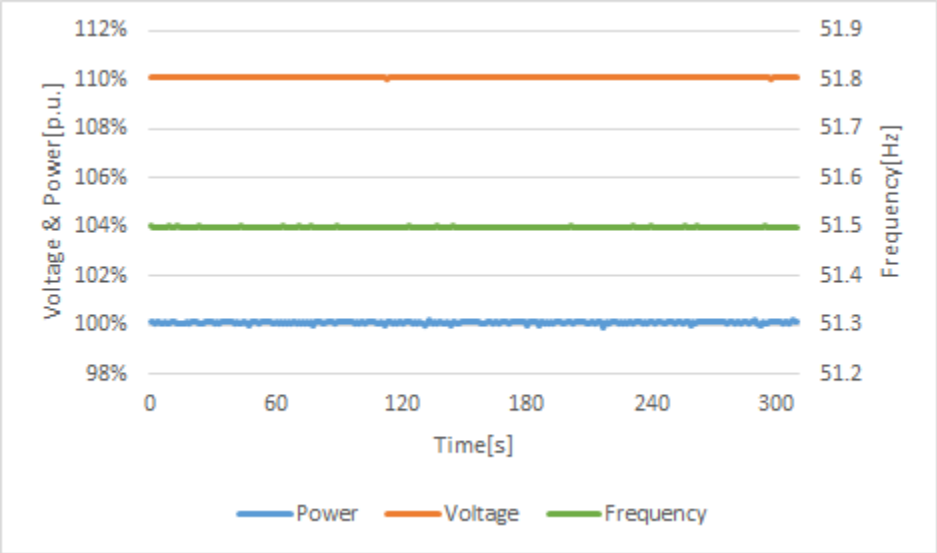


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.3.3	**TABLE: Verification of the operating range in voltage and frequency**					**P**
Model	AF15K-MTH					
Test No.	Voltage (V)	Frequency (Hz)	P (W)	Cos φ	Time (s)	Limit (%P_n)
Test 1	253.16	51.50	15014	0.9998	>5min	± 5
Test 2	195.08	50.00	13941	0.9996	>5min	± 15

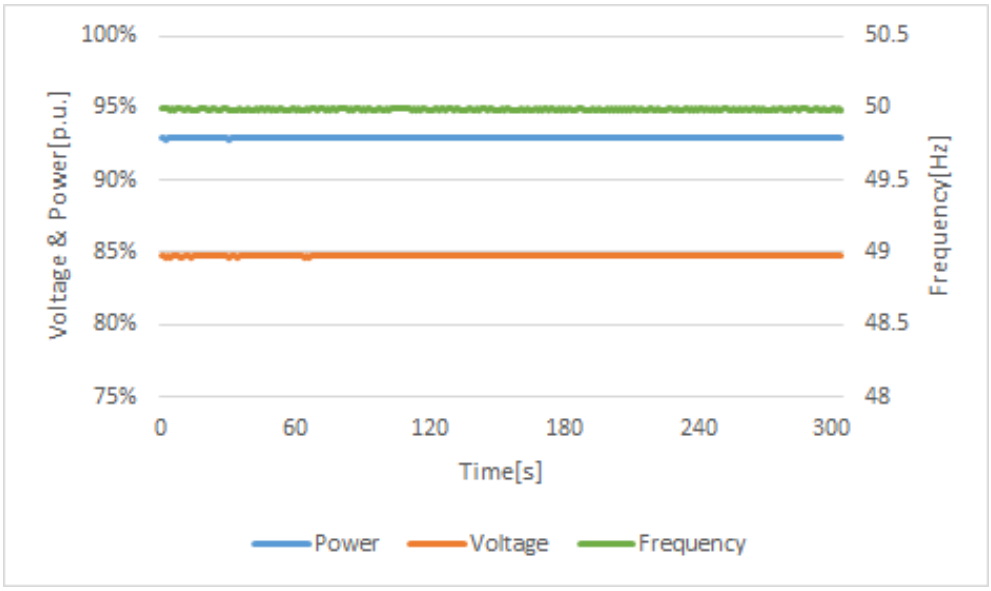
Test 1: V = 110 % * V_n; f = 51,5 Hz; P = 100 %P_n; Cos φ= 1 (Duration: at least 5 minutes)
Test 2: V = 85 % * V_n; f = 50,0 Hz; P = 100 %P_n; Cos φ= 1
Test 1 and 2 have a duration of at least 5 minutes. In Test 2, operation at reduced power is allowed, equal to the maximum deliverable when the maximum output current limit has been reached (P≥85% P_n).
To allow the tests to be carried out, the restrictive frequency thresholds must be disabled.
During the tests it is necessary to disable the automatic regulation in power reduction in case of over-frequency.
The frequency, voltage and active power measured at the generator output terminals must be recorded at a rate of at least 1 sample per second. The delivered power must remain stable within a limit of ± 5%P_n.

Test 1



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2

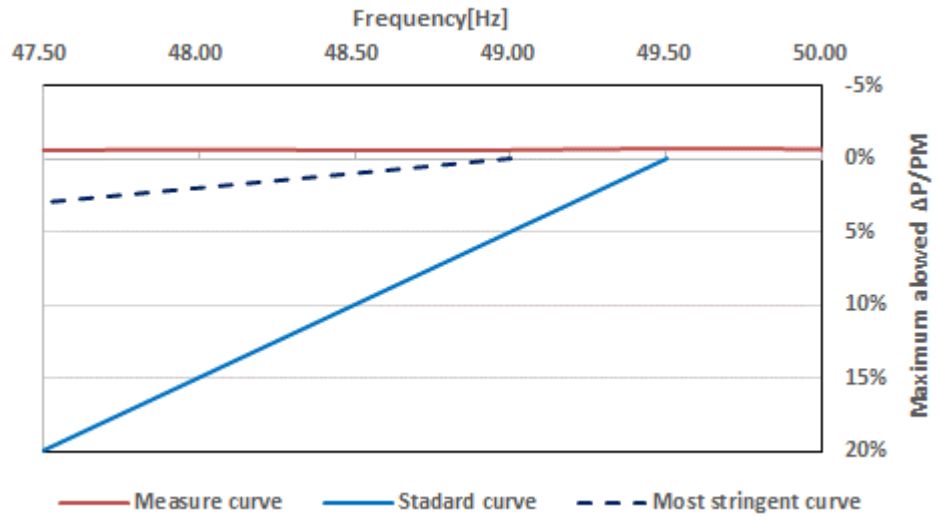


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.3.3.1	**TABLE: Reduction of active power in the presence of transient under-frequency on transmission network**					**P**
Model:	AF15K-MTH					
5-min mean value	50.0 Hz	49.5 Hz	49.0 Hz	48.5 Hz	48.0 Hz	47.5 Hz
Frequency [Hz]:	50.00	49.50	49.00	48.50	48.00	47.50
Active power [W]:	15061	15060	15062	15059	15062	15061

Test:
The test must be carried out at 100% P_n.
Measurements are carried out at the following operating points:
-Connect the object under test according to the instructions provided by the manufacturer.
-Set all the parameters of the simulated network to the respective values of normal exercise.
-Bring all the parameters of the object under test to the respective values of normal performance, such that the out power of the inverter is equal to the maximum deliverable power.
-Implement measures of active power on 6 points of time from each other on the basis of 50 Hz, and by reducing the frequency of 0.5 Hz with a step up to the minimum value of 47.5 Hz.
The each operating point shall be maintained for at least 5 min.

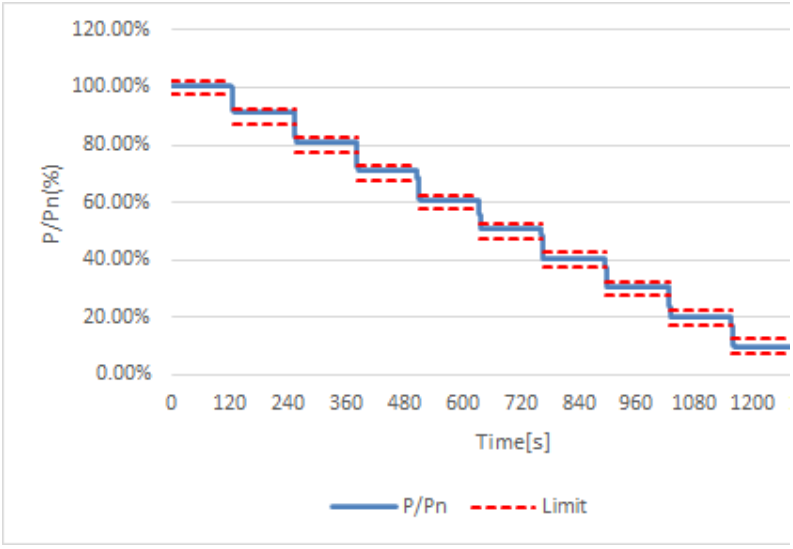
Assessment criterion:
The test is regarded as passed if:
the results should be presented in a table, and on the basis they must extrapolate the trend on a graph that must be greater than the threshold identified by continuous tract of fig. 12a contained in the 8.4.4.
• the power reduction in point c) is less or equal to the allowed power reduction according to 8.4.4.
The power reduction in point c) is less or equal to the power reduction of 10 % P_M per 1 Hz drop.



Maximum allowable power reduction in case of under-frequency

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.3.4	TABLE: Limitation of active power by external control from the distributor			P
Model	AF15K-MTH			
Set point P [P/P_n]	Set point P [W]	P measured [W]	Deviation (%)	Limit (%P_n)
100	15000	15069	0.46%	--
90	13500	13522	0.16%	± 2.5
80	12000	12030	0.25%	± 2.5
70	10500	10519	0.18%	± 2.5
60	9000	8985	-0.17%	± 2.5
50	7500	7504	0.05%	± 2.5
40	6000	6046	0.77%	± 2.5
30	4500	4503	0.07%	± 2.5
20	3000	3031	1.03%	± 2.5
10	1500	1506	0.40%	± 2.5



Test:

The setpoint signal must be reduced from 100% to 10% P_{Emax}:
For adjustable PGUs in increments of 10% P_{Emax}. 1 minute must elapse after every change to the setpoint setting so that the PGU can settle at the new setpoint. Then the active power of the PGU must be measured as a 1-min mean value.

Assessment criterion:

a) for adjustable PGUs:
- no network disconnection above 12,5% P_n
- the active power value does not exceed the setpoint by more than 2,5% P_n
- the setting time determined this way is ≤ 1min

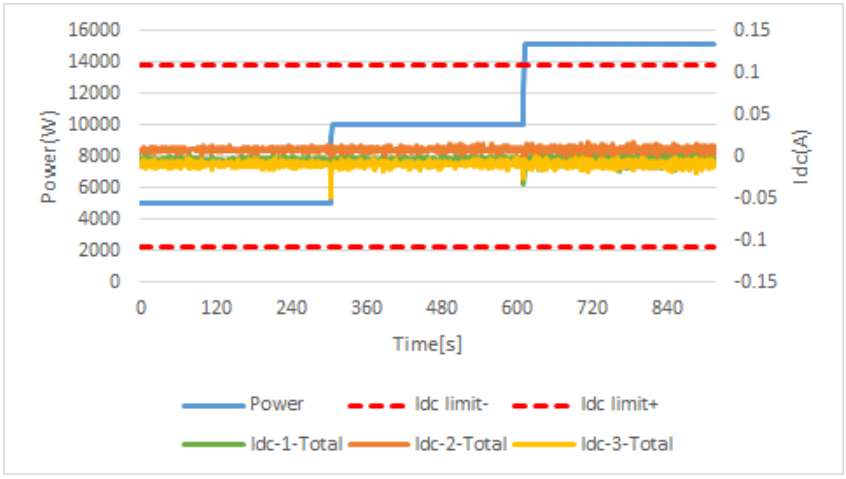
Note:

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

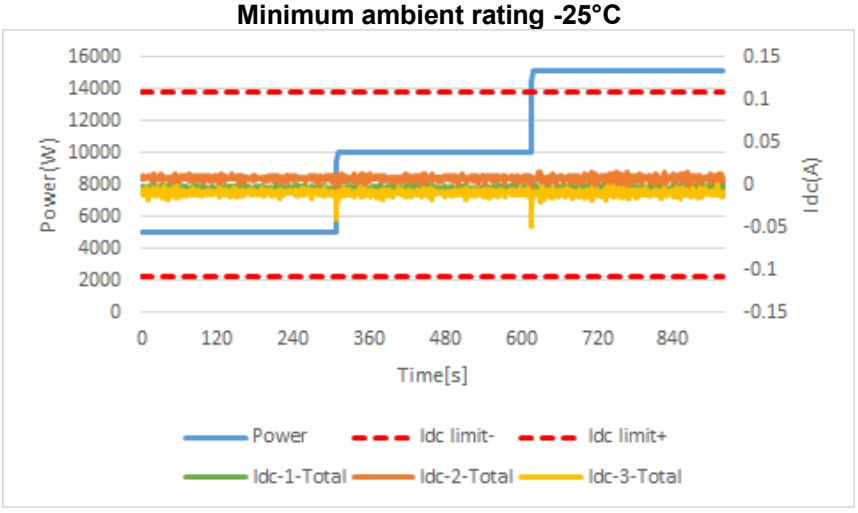
B.1.4.1	TABLE: Checking the DC component output		P
Model	AF15K-MTH		
Power Level	(33 ± 5)%	(66 ± 5)%	(100 ± 5)%
Ambient			
Total output Power (W)	4998	9988	15078
Output Vrms	230.81	230.84	230.85
Output Arms	7.23	14.43	21.78
Cos φ	0.9981	0.9994	0.9996
L1 DC Component (A)	0.002	0.001	0.002
L2 DC Component (A)	0.003	0.003	0.003
L3 DC Component (A)	0.003	0.003	0.003
L1 DC Component (% I_r)	0.008%	0.007%	0.008%
L2 DC Component (% I_r)	0.012%	0.012%	0.013%
L3 DC Component (% I_r)	0.015%	0.014%	0.014%
Minimum ambient rating -25°C			
Total output Power (W)	5002	9991	15081
Output Vrms	230.93	230.98	231.01
Output Arms	7.23	14.43	21.77
Cos φ	0.9981	0.9994	0.9996
L1 DC Component (A)	0.002	0.002	0.002
L2 DC Component (A)	0.003	0.002	0.003
L3 DC Component (A)	0.003	0.003	0.003
L1 DC Component (% I_r)	0.008%	0.008%	0.008%
L2 DC Component (% I_r)	0.012%	0.011%	0.012%
L3 DC Component (% I_r)	0.014%	0.015%	0.015%
Maximum ambient rating +60°C			
Total output Power (W)	4998	9982	15071
Output Vrms	231.00	231.05	231.10
Output Arms	7.23	14.41	21.75
Cos φ	0.9981	0.9994	0.9996
L1 DC Component (A)	0.002	0.002	0.002
L2 DC Component (A)	0.003	0.003	0.003
L3 DC Component (A)	0.003	0.003	0.003
L1 DC Component (% I_r)	0.009%	0.009%	0.009%
L2 DC Component (% I_r)	0.012%	0.012%	0.012%
L3 DC Component (% I_r)	0.014%	0.014%	0.014%

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

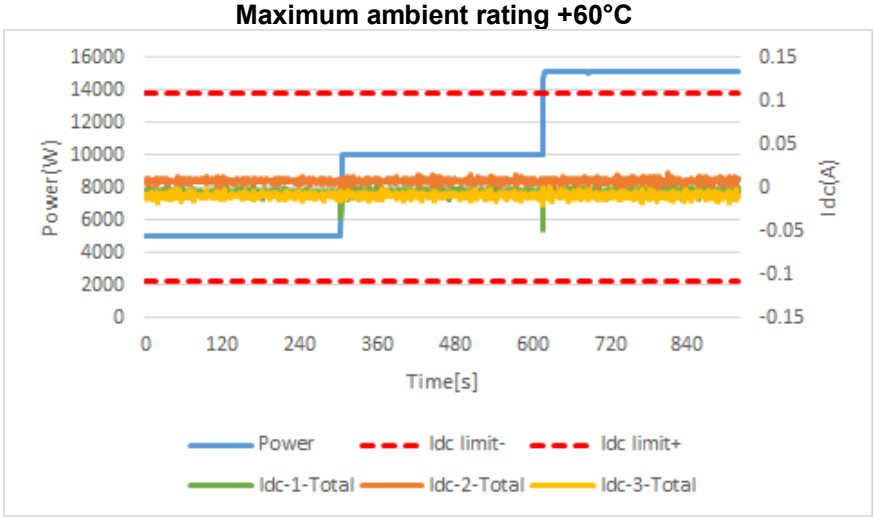
Ambient



Minimum ambient rating -25°C



Maximum ambient rating +60°C



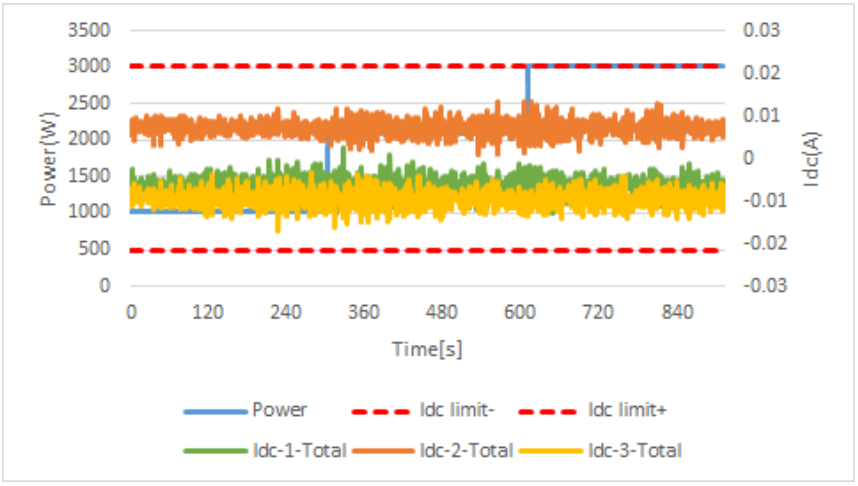
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.4.1	TABLE: Checking the DC component output		P
Model	AF3K-MTH		

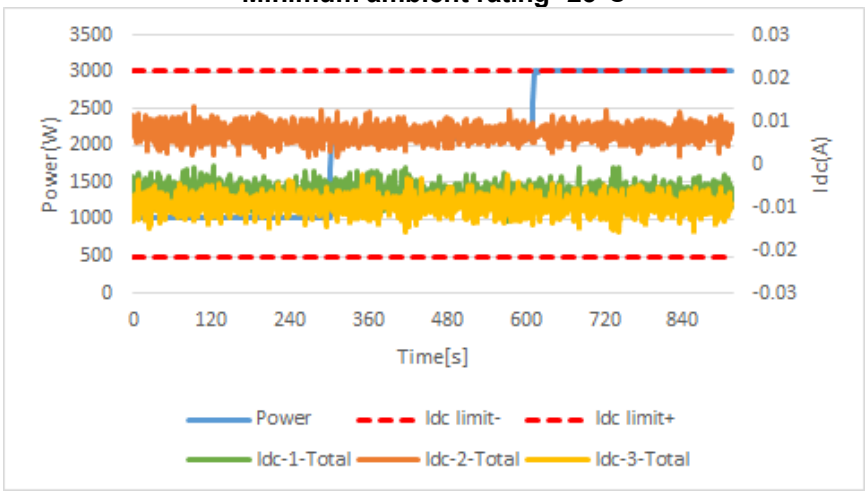
Power Level	(33 ± 5)%	(66 ± 5)%	(100 ± 5)%
Ambient			
Total output Power (W)	1026	2097	3014
Output Vrms	230.91	230.88	230.85
Output Arms	1.51	3.05	4.37
Cos φ	0.9838	0.9930	0.9957
L1 DC Component (A)	0.002	0.002	0.002
L2 DC Component (A)	0.002	0.002	0.002
L3 DC Component (A)	0.003	0.003	0.003
L1 DC Component (% I_r)	0.048%	0.050%	0.050%
L2 DC Component (% I_r)	0.056%	0.055%	0.055%
L3 DC Component (% I_r)	0.071%	0.073%	0.073%
Minimum ambient rating -25°C			
Total output Power (W)	1026	2098	3014
Output Vrms	230.99	230.99	230.98
Output Arms	1.51	3.05	4.37
Cos φ	0.9839	0.9930	0.9957
L1 DC Component (A)	0.002	0.002	0.002
L2 DC Component (A)	0.002	0.002	0.002
L3 DC Component (A)	0.003	0.003	0.003
L1 DC Component (% I_r)	0.048%	0.050%	0.050%
L2 DC Component (% I_r)	0.056%	0.055%	0.055%
L3 DC Component (% I_r)	0.070%	0.071%	0.072%
Maximum ambient rating +60°C			
Total output Power (W)	1026	2096	3015
Output Vrms	231.03	231.03	231.04
Output Arms	1.50	3.05	4.37
Cos φ	0.9834	0.9929	0.9956
L1 DC Component (A)	0.002	0.002	0.002
L2 DC Component (A)	0.002	0.002	0.002
L3 DC Component (A)	0.003	0.003	0.003
L1 DC Component (% I_r)	0.047%	0.047%	0.046%
L2 DC Component (% I_r)	0.056%	0.055%	0.056%
L3 DC Component (% I_r)	0.067%	0.069%	0.070%

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

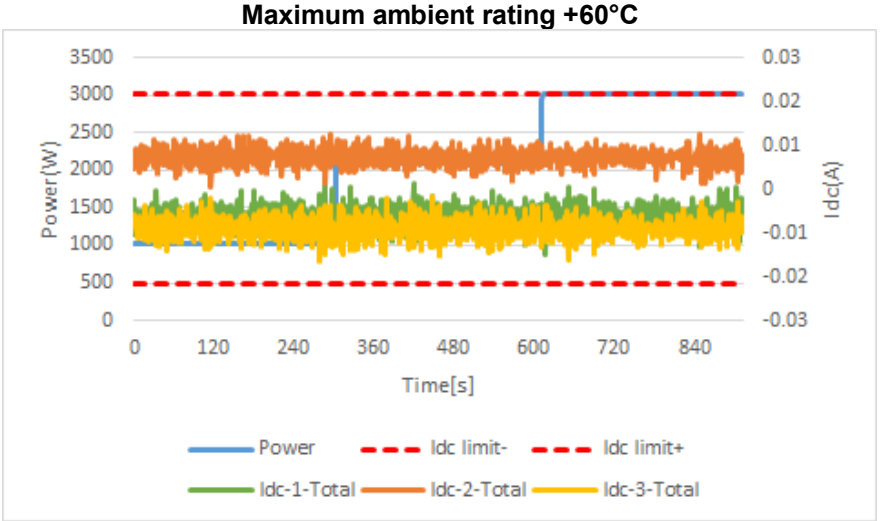
Ambient



Minimum ambient rating -25°C



Maximum ambient rating +60°C



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.4.2	TABLE: Checking the protection against DC injection			P
Model	AF15K-MTH			
Ambient				
Actual Power	Limits	Measurement:(mA)	Limiting value: (mA)	Disconnection time:(ms)
I_{dc} = 0.5% of I_{nom}				
33%	+0,5%I_{nom} /1s	108.8	108.7	998.0
66%	+0,5%I_{nom} /1s	109.3	108.7	994.0
100%	+0,5%I_{nom} /1s	109.1	108.7	996.0
I_{dc} = 1A				
33%	+1A Idc/200ms	1003	1000	191.6
66%	+1A Idc/200ms	1011	1000	196.8
100%	+1A Idc/200ms	1010	1000	196.0
Model	AF3K-MTH			
Actual Power	Limits	Measurement:(mA)	Limiting value:(mA)	Disconnection time:(ms)
I_{dc} = 0.5% of I_{nom}				
33%	+0,5%I_{nom} /1s	22.23	21.7	994.9
66%	+0,5%I_{nom} /1s	22.49	21.7	994.4
100%	+0,5%I_{nom} /1s	22.86	21.7	996.2
I_{dc} = 1A				
33%	+1A Idc/200ms	1015	1000	196.0
66%	+1A Idc/200ms	1014	1000	196.3
100%	+1A Idc/200ms	1015	1000	197.2
Note: The internal temperature of the EUT must be stabilized.				

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.4.2	**TABLE: Checking the protection against DC injection**			P
Model:	AF15K-MTH			
Minimum ambient rating -25°C				
Actual Power	Limits	Measurement:(mA)	Limiting value: (mA)	Disconnection time:(ms)
I_{dc} = 0.5% of I_{nom}				
33%	+0,5%I_{nom} /1s	108.8	108.7	994.0
66%	+0,5%I_{nom} /1s	109.3	108.7	992.0
100%	+0,5%I_{nom} /1s	108.9	108.7	992.0
I_{dc} = 1A				
33%	+1A Idc/200ms	1004	1000	193.2
66%	+1A Idc/200ms	1011	1000	196.0
100%	+1A Idc/200ms	1008	1000	195.6
Model:	AF3K-MTH			
Actual Power	Limits	Measurement:(mA)	Limiting value: (mA)	Disconnection time:(ms)
I_{dc} = 0.5% of I_{nom}				
33%	+0,5%I_{nom} /1s	22.62	21.7	996.9
66%	+0,5%I_{nom} /1s	22.73	21.7	996.8
100%	+0,5%I_{nom} /1s	22.41	21.7	994.2
I_{dc} = 1A				
33%	+1A Idc/200ms	1017	1000	193.7
66%	+1A Idc/200ms	1015	1000	192.5
100%	+1A Idc/200ms	1012	1000	194.6
Note: The internal temperature of the EUT must be stabilized.				

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.4.2	TABLE: Checking the protection against DC injection			P
Model:	AF15K-MTH			
Maximum ambient rating +60°C				
Actual Power	Limits	Measurement:(mA)	Limiting value: (mA)	Disconnection time:(ms)
I_{dc} = 0.5% of I_{nom}				
33%	+0,5%I_{nom} /1s	109.0	108.7	994.0
66%	+0,5%I_{nom} /1s	109.2	108.7	996.0
100%	+0,5%I_{nom} /1s	109.1	108.7	994.0
I_{dc} = 1A				
33%	+1A Idc/200ms	1002	1000	196.0
66%	+1A Idc/200ms	1013	1000	194.4
100%	+1A Idc/200ms	1007	1000	197.2
Model:	AF3K-MTH			
Actual Power	Limits	Measurement:(mA)	Limiting value: (mA)	Disconnection time:(ms)
I_{dc} = 0.5% of I_{nom}				
33%	+0,5%I_{nom} /1s	22.35	21.7	996.6
66%	+0,5%I_{nom} /1s	22.72	21.7	995.9
100%	+0,5%I_{nom} /1s	22.66	21.7	994.7
I_{dc} = 1A				
33%	+1A Idc/200ms	1016	1000	195.5
66%	+1A Idc/200ms	1014	1000	191.5
100%	+1A Idc/200ms	1014	1000	196.6

Note:
The internal temperature of the EUT must be stabilized.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.5	TABLE: Verification of insensitivity to voltage dips (UVRT capability) [greater 11.08kW systems]	P
Model	AF15K-MTH	

The purpose of these tests is to ensure that the converter, when used in systems with total capacity greater than 11.08 kW, is insensitive to voltage dips according to the time-amplitude profile shown in the diagram. In particular, the tests must verify that the following functional requirements are met:

- the generator must not disconnect from the grid in the white area above and along the points of the UVRT (V-t) characteristic indicated in Figure 29, where V is the phase-to-phase voltage at the connection point. Supply of active and reactive power prior to the occurrence of the fault can be temporarily interrupted in this area.
- in the area below (grey) the generator can disconnect from the grid.
- within 400 ms from restoring network voltage to within the range of +10% and -15% of nominal voltage, the generator must return to supplying active and reactive power to the network as before the fault, with a maximum tolerance of ±10% of the nominal voltage of the generator. If voltage returns but remains in the range between 85% and 90%, power distribution may be reduced in relation to the generator limits of output power.

Verification of compliance with the requirements of immunity to voltage sags are carried out according to the test sequences shown in Table 31, to be carried out with the generator running respectively:

a) between 10% and 30% of the rated power;
b) and above 90% of the rated power.

Table 12 - Parameters relating to Figure 29 for the fault-ride-through capability of power park modules over 11.08 kW

Uret	0,05 [p.u.]	Tclear	0,2 s
Uclear	0,15 [p.u.]	Trec1	0,2 s
Urec1	0,15 [p.u.]	Trec2	0,2 s
Urec2	0,85 [p.u.]	Trec3	1,5 s

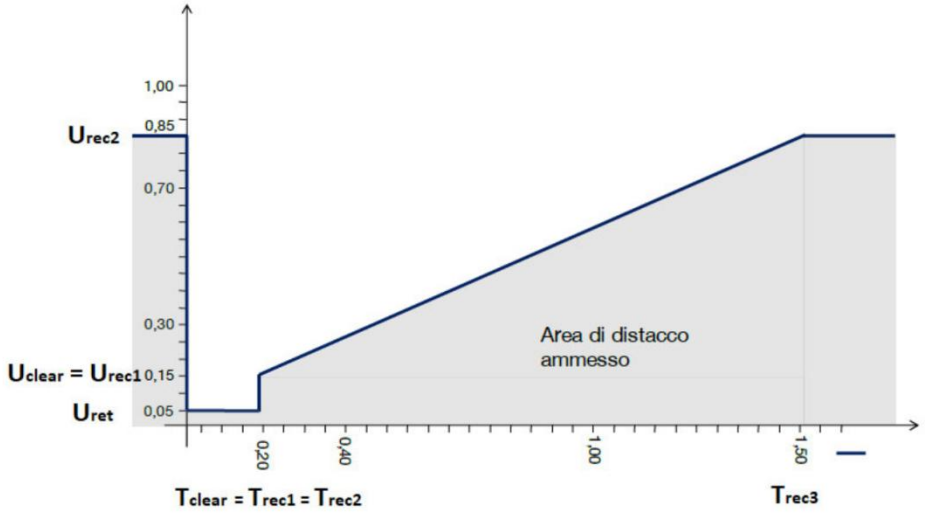
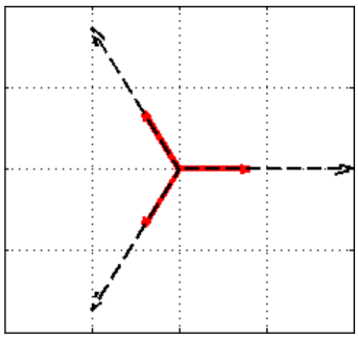


Figure 29 - Fault-ride-through profile of power park modules over 11.08 kW

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

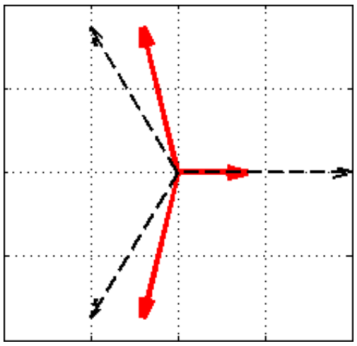
Test sequence:

1) three-phase symmetrical fault (Table 31, Tests N.1s, N.2s, N.3s and N4s)

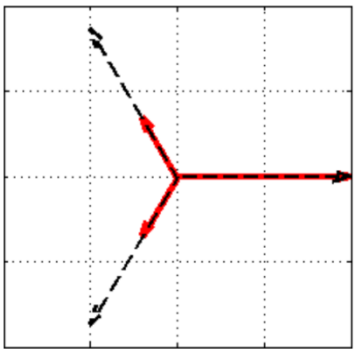


2) two-phase asymmetric fault (Table 31, Tests N.1a, N2a, N.3a and N.4a)

Failure in MV, which causes a variation in LV not only of amplitude but also of the phase relationship of the voltages (the case considered involves the presence of a transformer Dy in the secondary substation).



3) LV two-phase asymmetric fault (Table 31, Tests No. 5 and No. 6)



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Requirement of LVRT test:

Table 31 - Test sequences to verify immunity to temporary voltage dips. The amplitude, duration and shape relate to no-load test conditions

List of tests	Residual amplitude of phase-to-phase voltage V/V_{nom}	Drop duration limit [ms]	Power re-supply time after restoring network [ms]	Shape (*)
1s – three-phase symmetrical fault	0.10 ± 0.05 (V_1/Vn)	200 ± 20	400	
1a – two-phase asymmetric failure	0.10 ± 0.05 (V_1/Vn)	200 ± 20	400	
2s – three-phase symmetrical fault	0.25 ± 0.05 (V_2/Vn)	400 ± 20	400	
2a – two-phase asymmetric failure	0.25 ± 0.05 (V_2/Vn)	400 ± 20	400	
3s – three-phase asymmetrical fault	0.50 ± 0.05 (V_3/Vn)	850 ± 20	400	
3a – two-phase asymmetric failure	0.50 ± 0.05 (V_3/Vn)	850 ± 20	400	
4s – three-phase asymmetrical fault	0.75 ± 0.05 (V_4/Vn)	1300 ± 20	400	
4a – two-phase asymmetric failure	0.75 ± 0.05 (V_4/Vn)	1300 ± 20	400	
5 – LV two-phase asymmetrical fault	0.10 ± 0.05 (V_5/Vn)	200 ± 20	400	
6 – LV two-phase asymmetrical fault	0.50 ± 0.05 (V_6/Vn)	850 ± 20	400	
7 – three-phase symmetrical fault	1.20 ± 0.05(V_7/Vn)	500 ± 20	400	
8 – three-phase symmetrical fault	1.25 ± 0.05(V_8/Vn)	100 ± 20	400	

Test No.	V/V_{nom}	Phase-to-earth voltages			Phase angles		
		$U_1/U_{1,nom}$	$U_2/U_{2,nom}$	$U_3/U_{3,nom}$	φ_{U1}	φ_{U2}	φ_{U3}
1s	0.10 ± 0.05	0.10 ± 0.05	0.10 ± 0.05	0.10 ± 0.05	0°	-120°	120°
1a	0.10 ± 0.05	0.87 ± 0.05	0.87 ± 0.05	0.10 ± 0.05	27°	-147°	120°
2s	0.25 ± 0.05	0.25 ± 0.05	0.25 ± 0.05	0.25 ± 0.05	0°	-120°	120°
2a	0.25 ± 0.05	0.88 ± 0.05	0.88 ± 0.05	0.25 ± 0.05	22°	-142°	120°
3s	0.50 ± 0.05	0.50 ± 0.05	0.50 ± 0.05	0.50 ± 0.05	0°	-120°	120°
3a	0.50 ± 0.05	0.90 ± 0.05	0.90 ± 0.05	0.50 ± 0.05	14°	-134°	120°
4s	0.75 ± 0.05	0.75 ± 0.05	0.75 ± 0.05	0.75 ± 0.05	0°	-120°	120°
4a	0.75 ± 0.05	0.94 ± 0.05	0.94 ± 0.05	0.75 ± 0.05	7°	-127°	120°
5	0.10 ± 0.05	1	0.10 ± 0.05	0.10 ± 0.05	0°	-120°	120°
6	0.50 ± 0.05	1	0.50 ± 0.05	0.50 ± 0.05	0°	-120°	120°
7	1.20 ± 0.05	1.20 ± 0.05	1.20 ± 0.05	1.20 ± 0.05	0°	-120°	120°
8	1.25 ± 0.05	1.25 ± 0.05	1.25 ± 0.05	1.25 ± 0.05	0°	-120°	120°
normal condition	1	1	1	1	0°	-120°	120°

(*) Regardless of the method used to simulate the transients (simulator or impedance network), the falling and rising edges of the voltage must have a duration of less than 10 ms.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

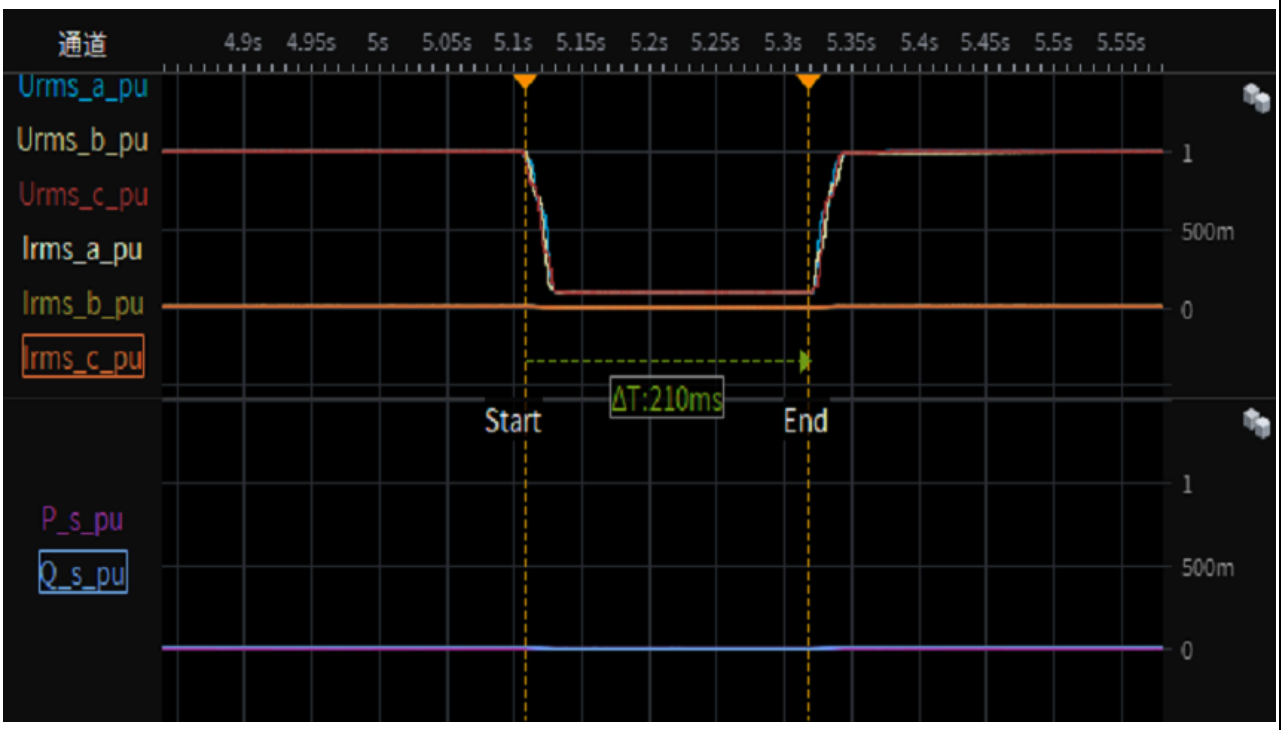
Graph of LVRT and OVRT test:

List of tests	Residual amplitude of phase-to-phase voltage V/V_{nom}	Drop duration limit [ms]	Measured drop duration [ms]	Duration of restoring network [ms]
1s – three-phase symmetrical fault (P = 0.1 - 0.3)	0.10 ± 0.05 (V_1/Vn)	200 +20	210	167
1s – three-phase symmetrical fault (P > 0.9)	0.10 ± 0.05 (V_1/Vn)	200 +20	210	178
1a – two-phase asymmetrical fault (P = 0.1 - 0.3)	0.10 ± 0.05 (V_1/Vn)	200 +20	210	164
1a – two-phase asymmetrical fault (P > 0.9)	0.10 ± 0.05 (V_1/Vn)	200 +20	210	173
2s – three-phase symmetrical fault (P = 0.1 - 0.3)	0.25 ± 0.05 (V_2/Vn)	400 +20	410	157
2s – three-phase symmetrical fault (P > 0.9)	0.25 ± 0.05 (V_2/Vn)	400 +20	410	189
2a – three-phase symmetrical fault (P = 0.1 - 0.3)	0.25 ± 0.05 (V_2/Vn)	400 +20	410	147
2a – three-phase symmetrical fault (P > 0.9)	0.25 ± 0.05 (V_2/Vn)	400 +20	410	186
3s – three-phase symmetrical fault (P = 0.1 - 0.3)	0.50 ± 0.05 (V_3/Vn)	850 ± 20	860	166
3s – three-phase symmetrical fault (P > 0.9)	0.50 ± 0.05 (V_3/Vn)	850 ± 20	860	181
3a – two-phase asymmetrical fault (P = 0.1 - 0.3)	0.50 ± 0.05 (V_3/Vn)	850 ± 20	860	168
3a – two-phase asymmetrical fault (P > 0.9)	0.50 ± 0.05 (V_3/Vn)	850 ± 20	860	185
4s – three-phase symmetrical fault (P = 0.1 - 0.3)	0.75 ± 0.05 (V_4/Vn)	1300 ± 20	1310	149
4s – three-phase symmetrical fault (P > 0.9)	0.75 ± 0.05 (V_4/Vn)	1300 ± 20	1310	184
4a – two-phase asymmetrical fault (P = 0.1 - 0.3)	0.75 ± 0.05 (V_4/Vn)	1300 ± 20	1310	146
4a – two-phase asymmetrical fault (P > 0.9)	0.75 ± 0.05 (V_4/Vn)	1300 ± 20	1310	162
5 – LV two-phase asymmetrical fault (P = 0.1 - 0.3)	0.10 ± 0.05 (V_5/Vn)	200 +20	210	154
5 – LV two-phase asymmetrical fault (P > 0.9)	0.10 ± 0.05 (V_5/Vn)	200 +20	210	175
6 – LV two-phase asymmetrical fault (P = 0.1 - 0.3)	0.50 ± 0.05 (V_6/Vn)	400 +20	860	173
6 – LV two-phase asymmetrical fault (P > 0.9)	0.50 ± 0.05 (V_6/Vn)	400 +20	860	192
7– HV two-phase asymmetrical fault (P = 0.1 - 0.3)	1.20 ± 0.05 (V_7/Vn)	500 +20	510	160
7– HV two-phase asymmetrical fault (P > 0.9)	1.20 ± 0.05 (V_7/Vn)	500 +20	510	176
8– HV two-phase asymmetrical fault (P = 0.1 - 0.3)	1.25 ± 0.05 (V_8/Vn)	100 +20	110	162
8– HV two-phase asymmetrical fault (P > 0.9)	1.25 ± 0.05 (V_8/Vn)	100 +20	110	171

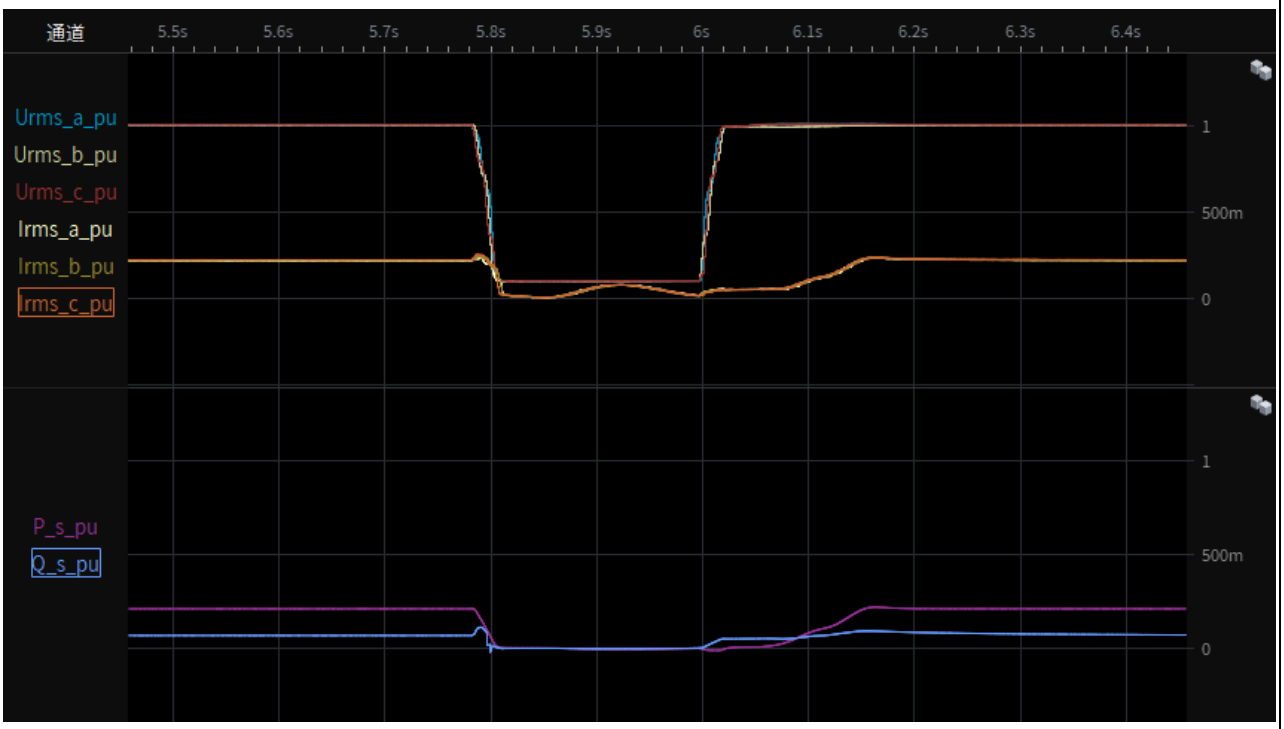
Note:
(*) Regardless of the method used to simulate transients (simulator or impedance network), the rise and fall time of the voltage must be less than 10 ms
The interface protection shall be disabled or adjusted to avoid spurious tripping during testing.
The test conditions are performed as worst case conditions. The inverter feeds maximal active and reactive power during the complete test.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1s-Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A), 0% load
Test overview(voltage,current,active and reactive power)

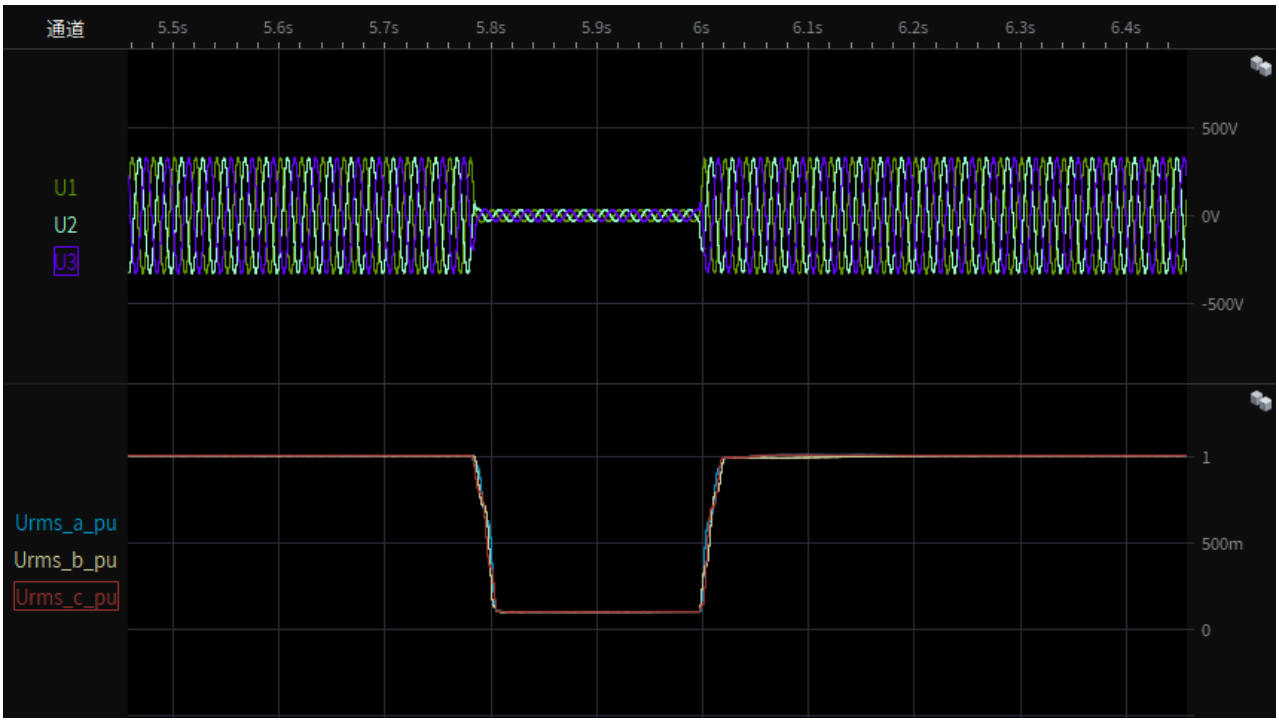


Test 1s-1.1 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)

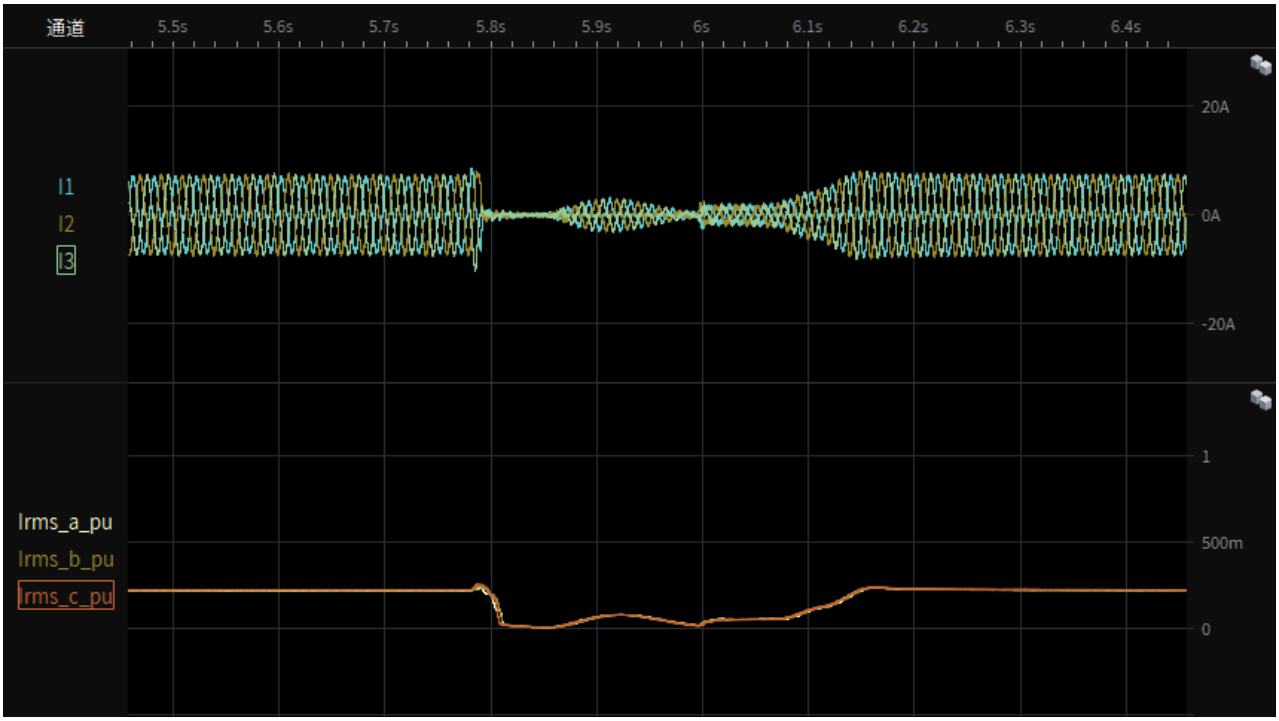


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1s-1.2 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

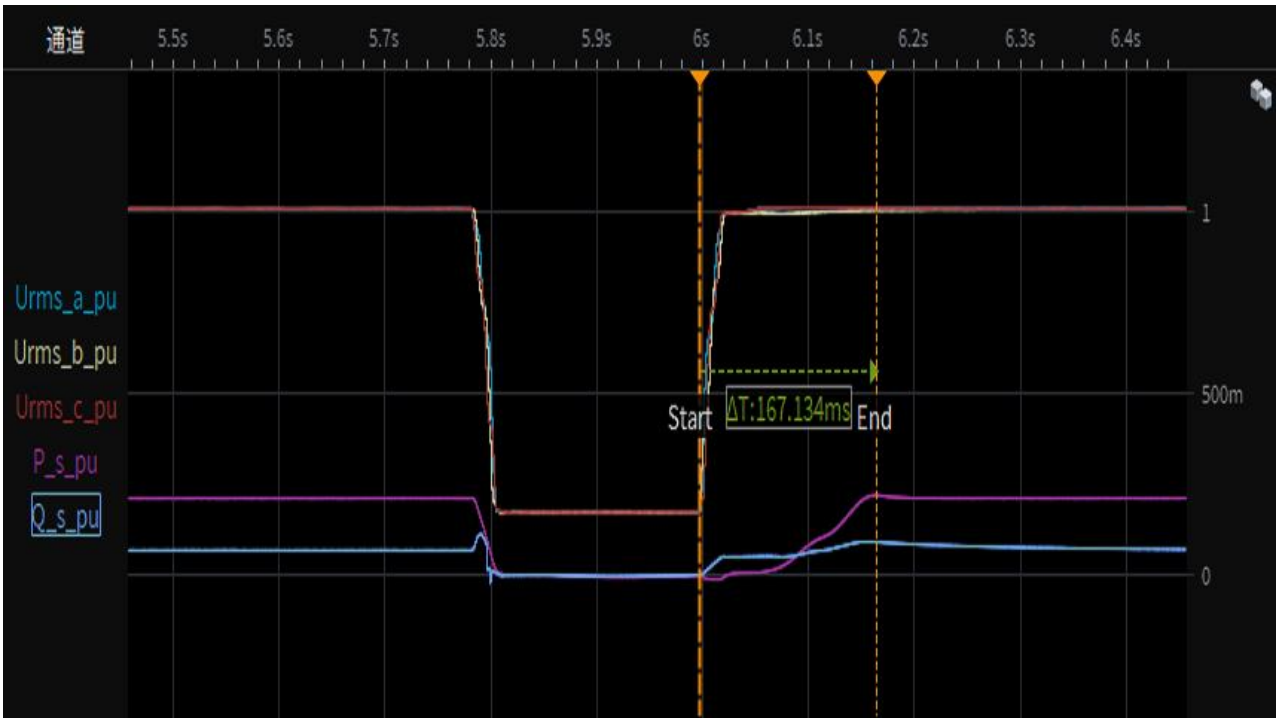


Test 1s-1.3 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents

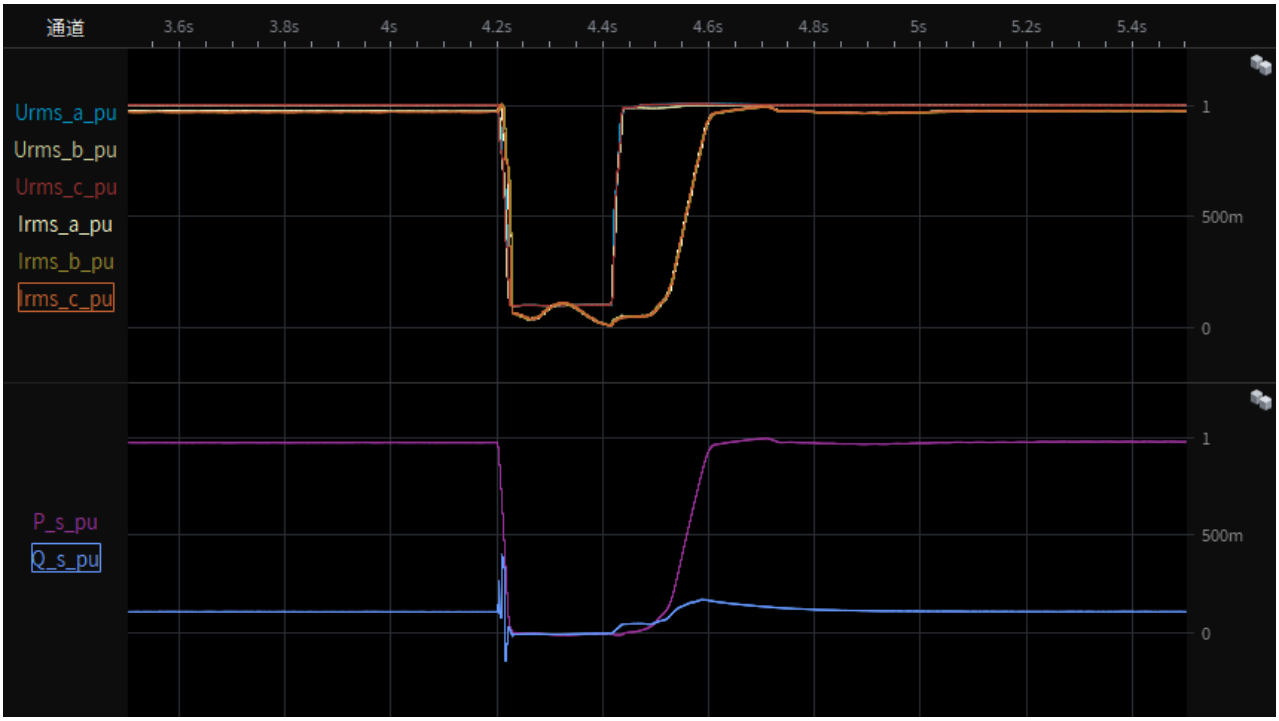


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1s-1.4 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),20% load restoring time

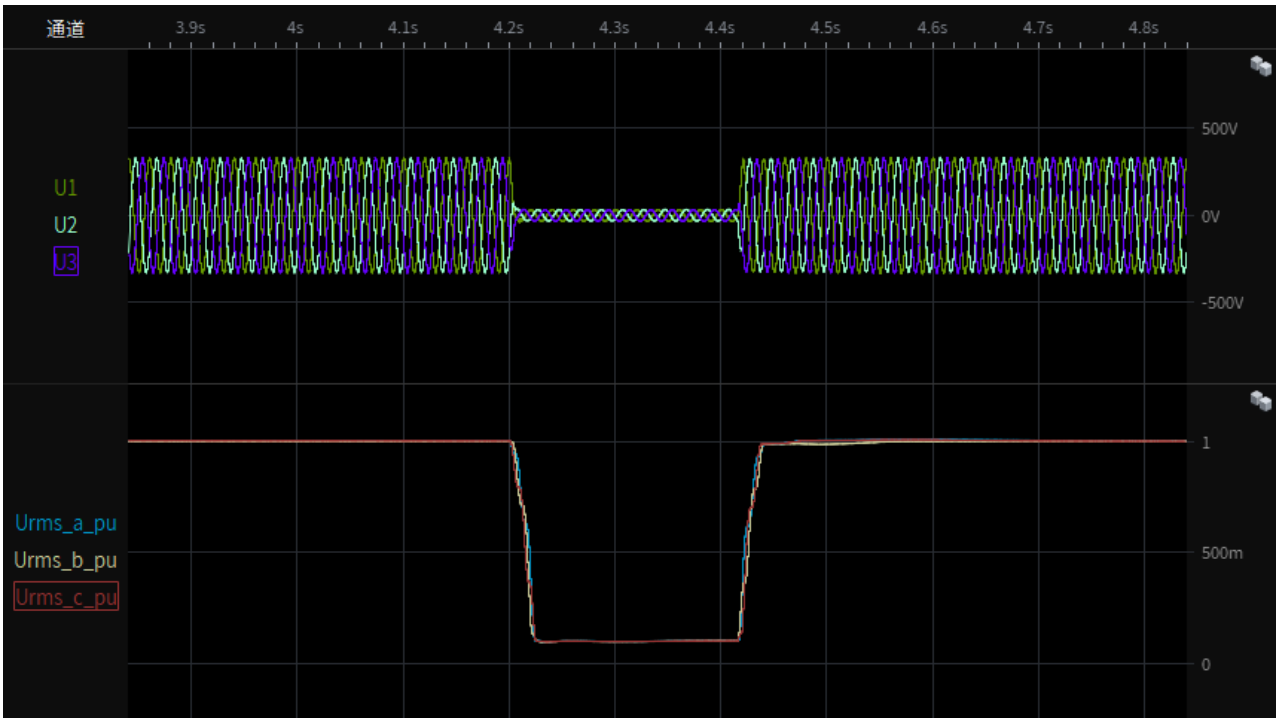


Test 1s-2.1 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),95% load
Test overview(voltage,current,active and reactive power)

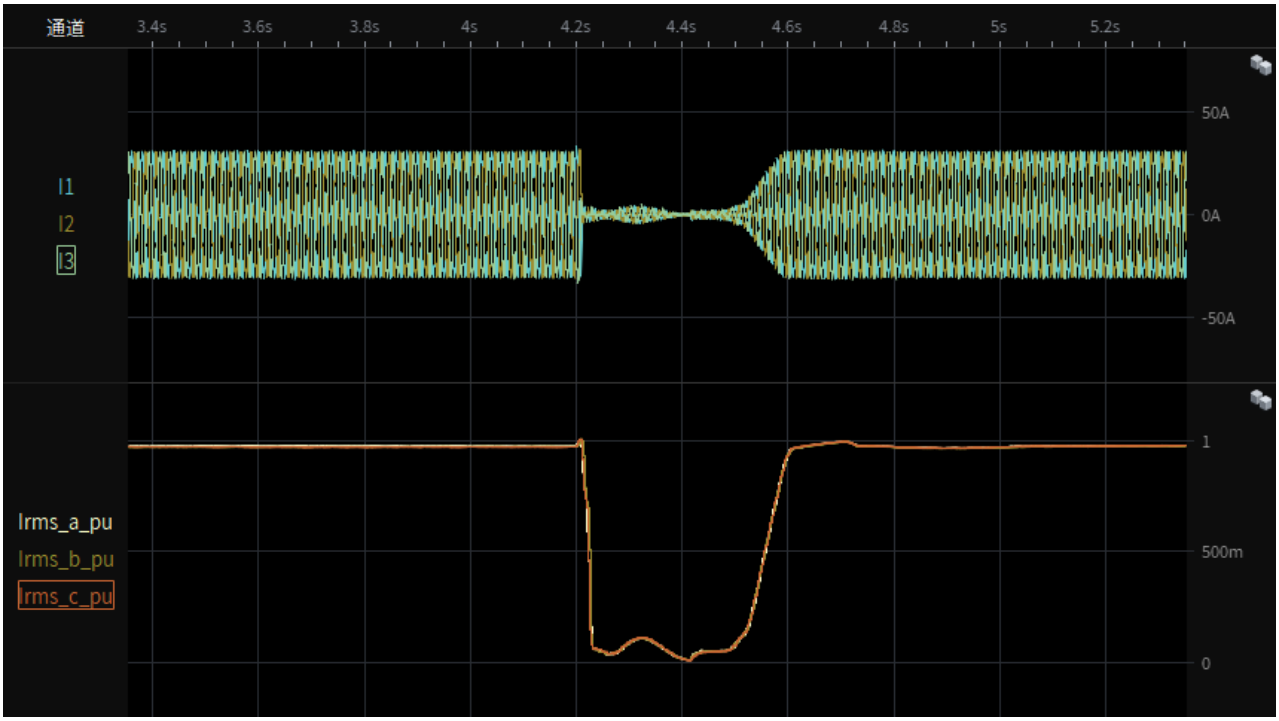


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1s-2.2 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

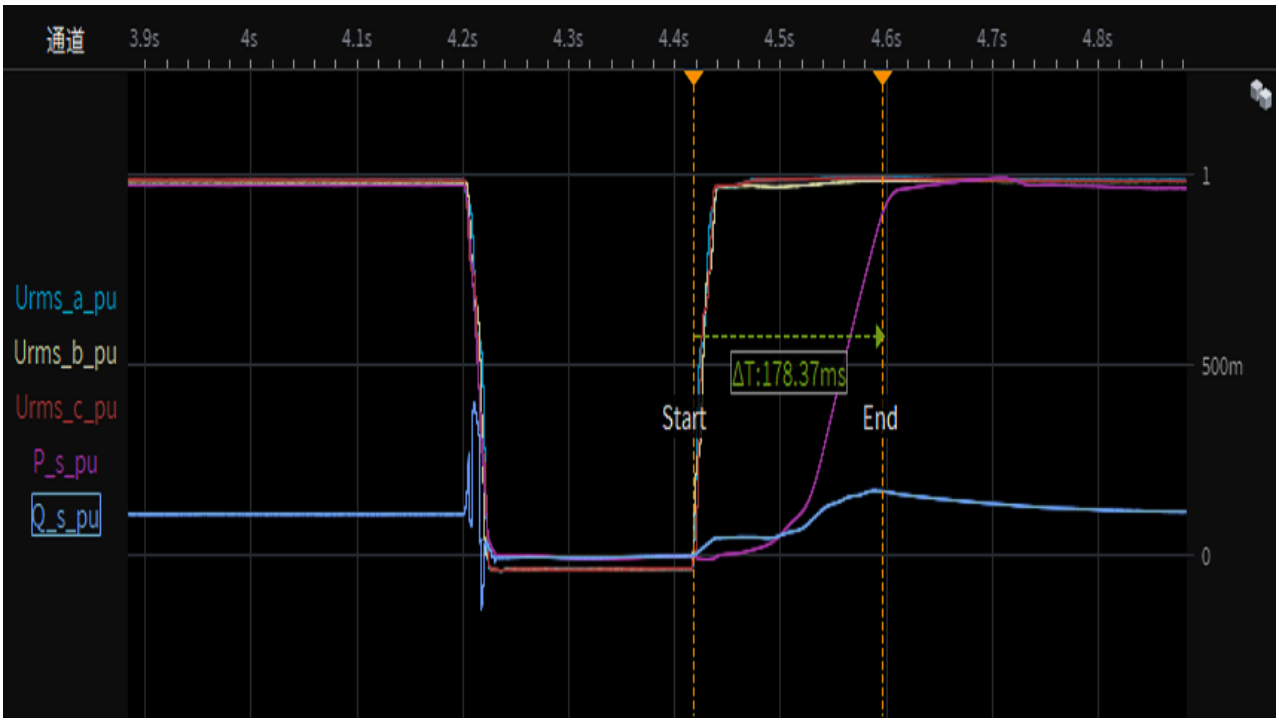


Test 1s-2.3 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents

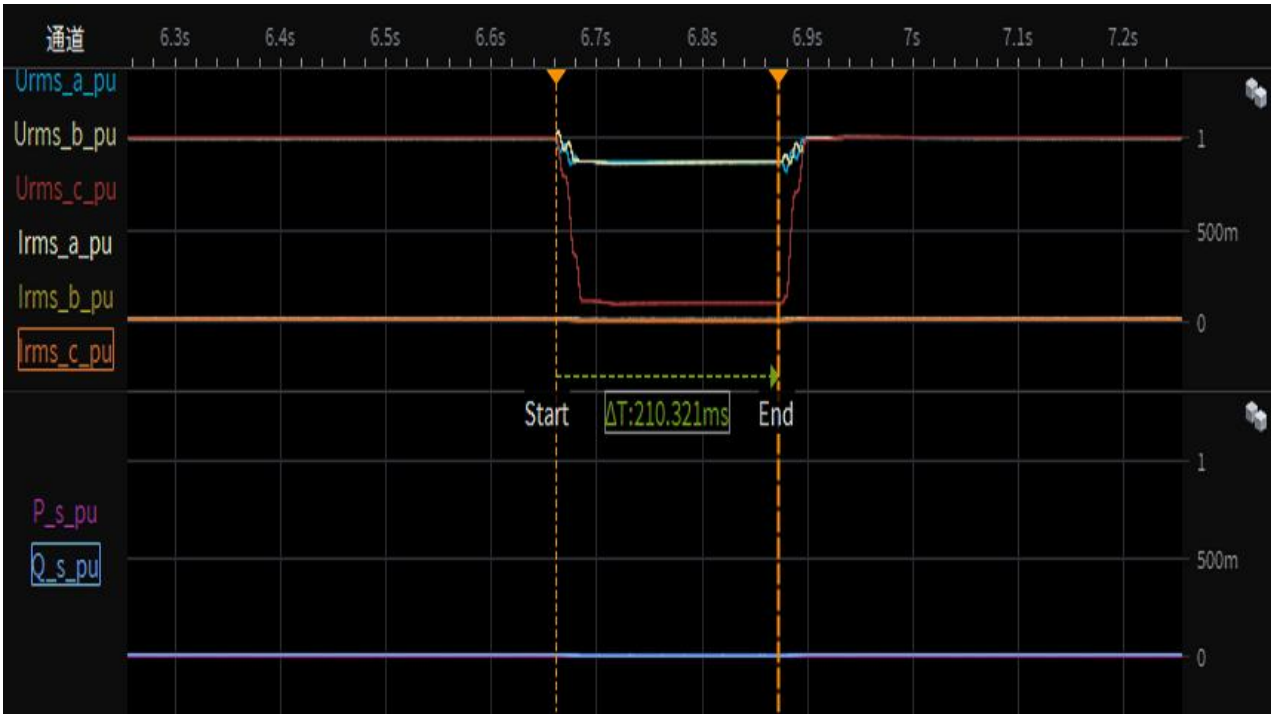


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1s-2.4 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A), 95% load restoring time

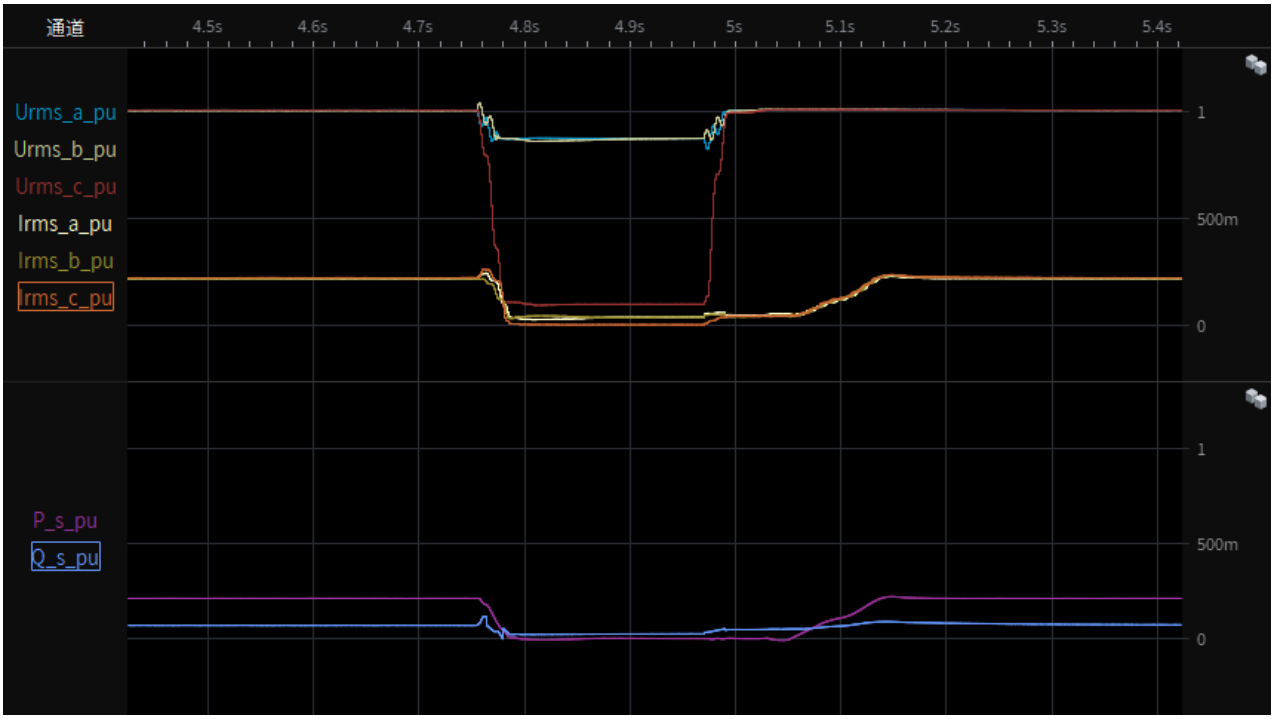


Test 1a-Depth of fault phase: 0.1p.u.,two-phase-asymmetrical (type D), 0% load
Test overview(voltage,current,active and reactive power)

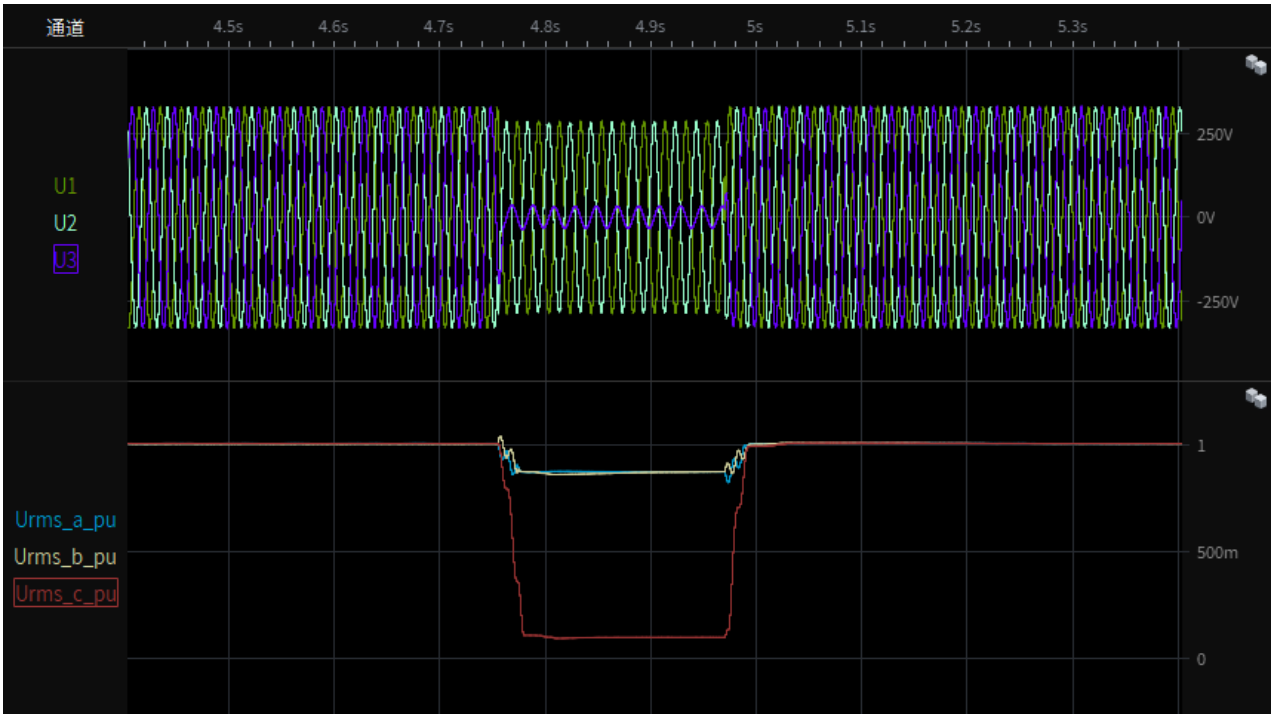


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1a-1.1 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),20% load
Test overview(voltage,current,active and reactive power)

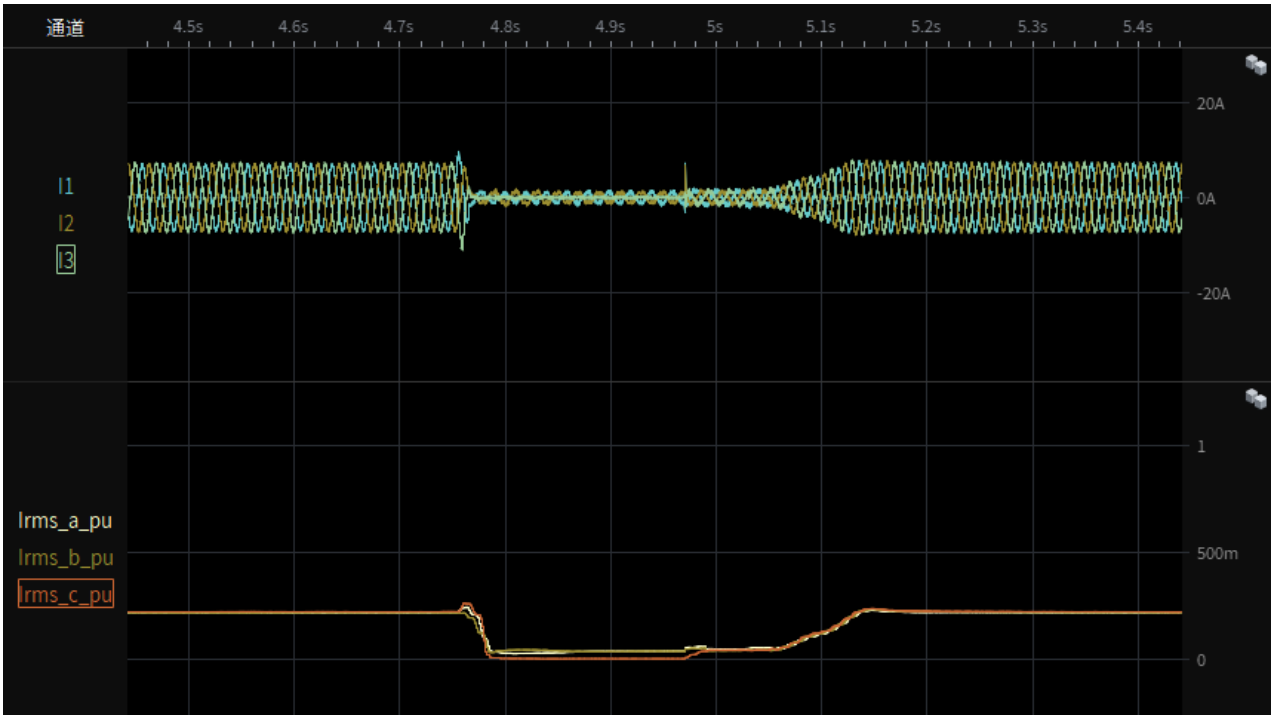


Test 1a-1.2 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

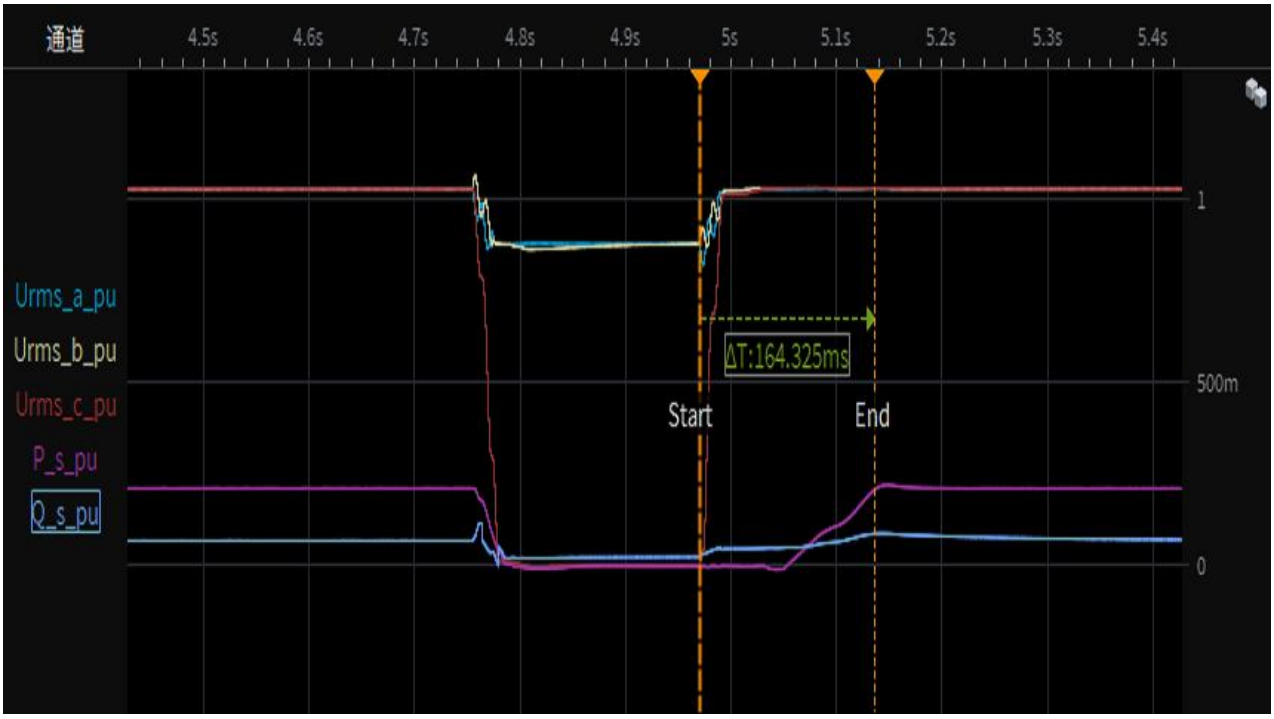


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1a-1.3 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase currents

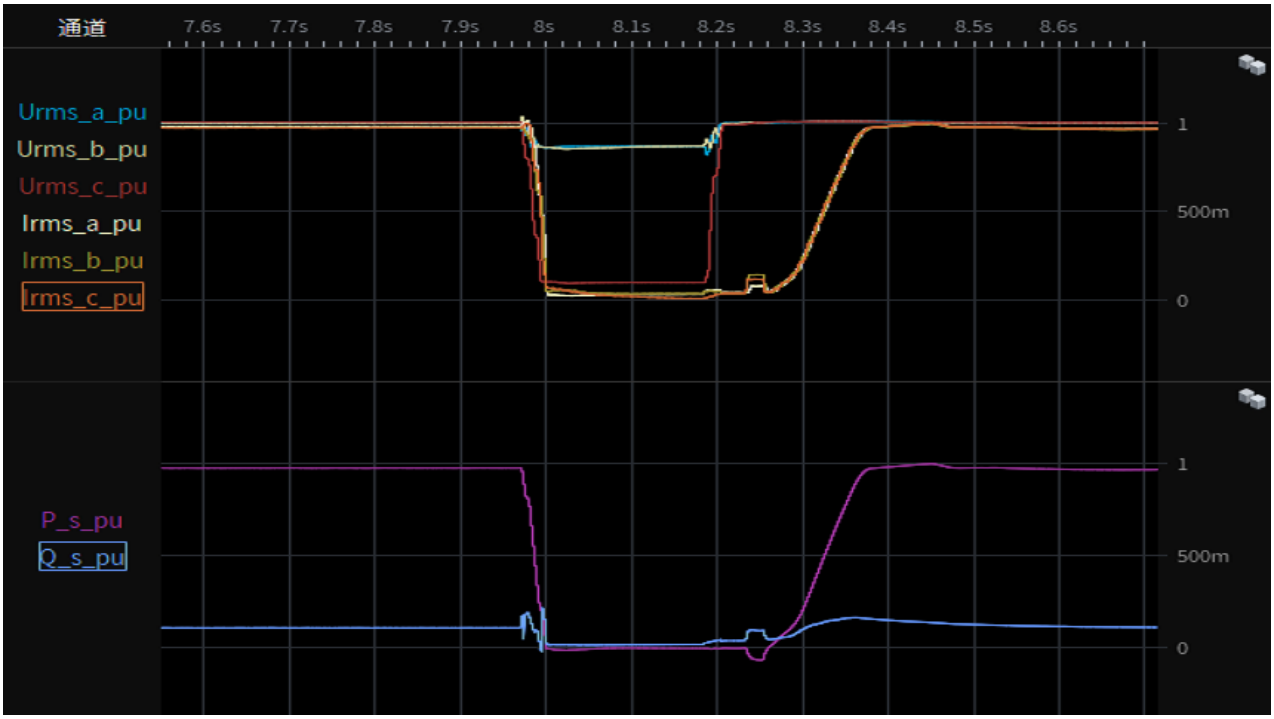


Test 1a-1.4 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),20% load
restoring time

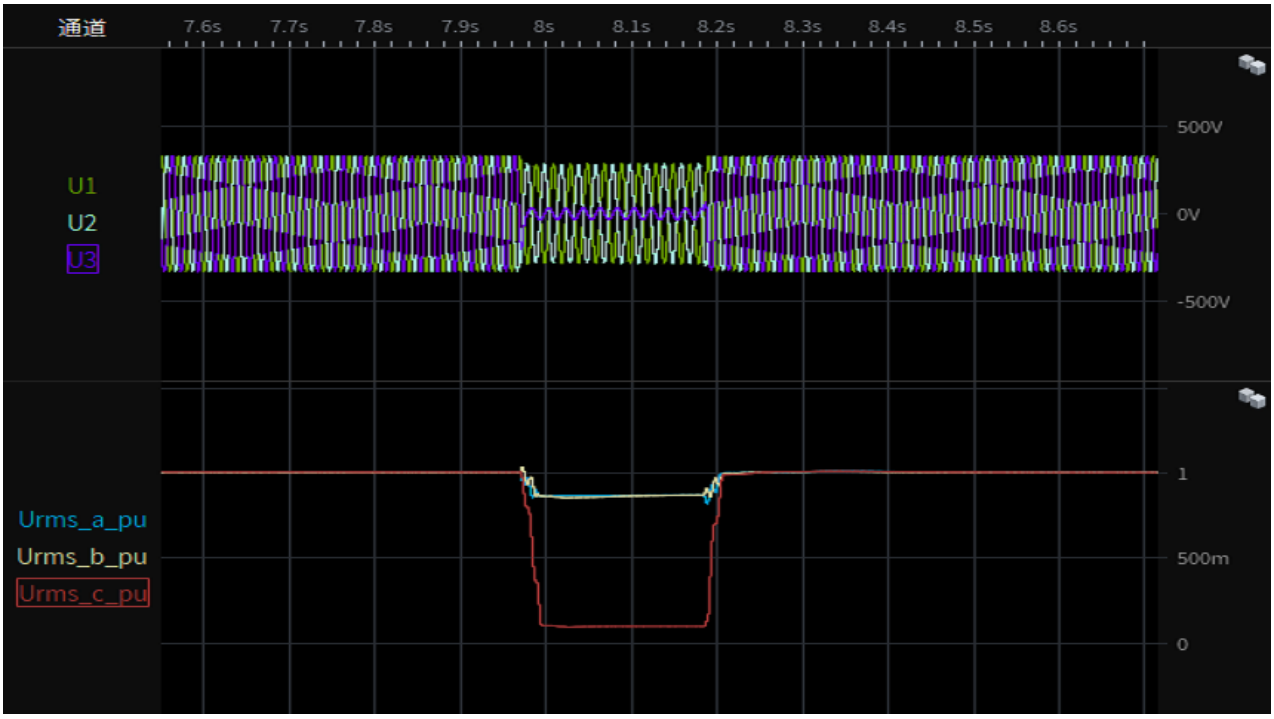


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1a-2.1 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),95% load
Test overview(voltage,current,active and reactive power)

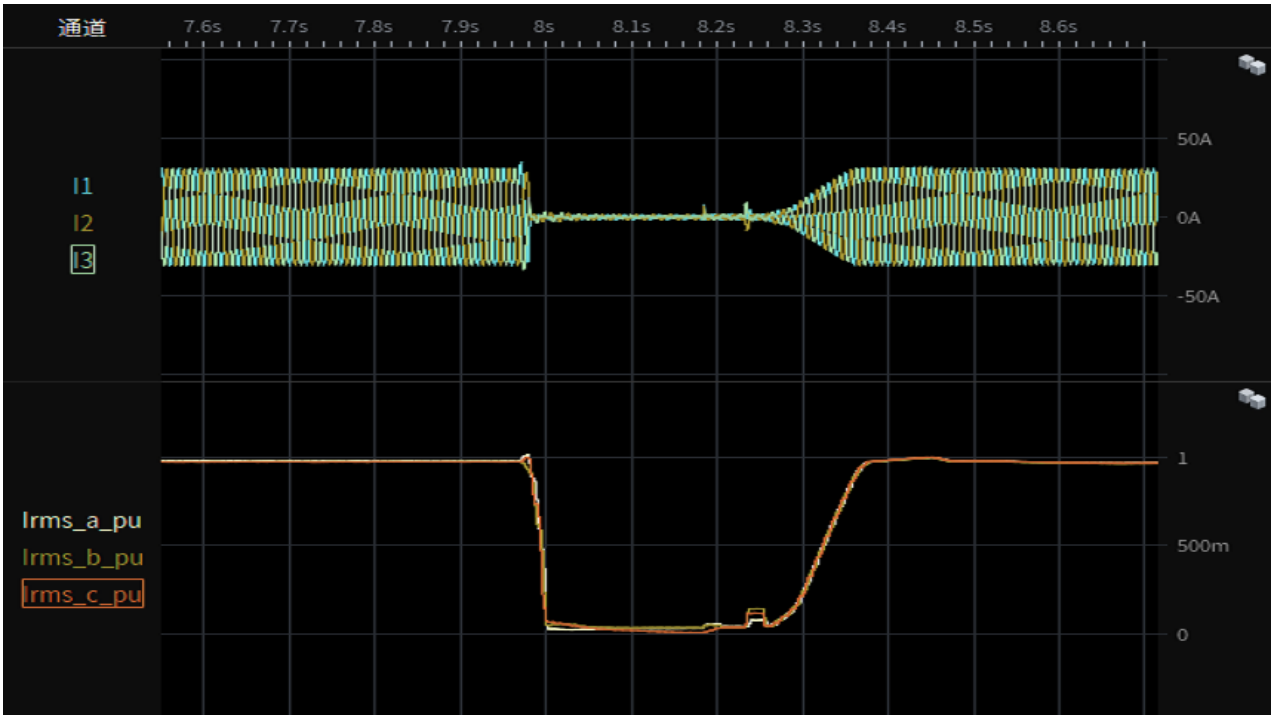


Test 1a-2.2 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1a-2.3 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase currents

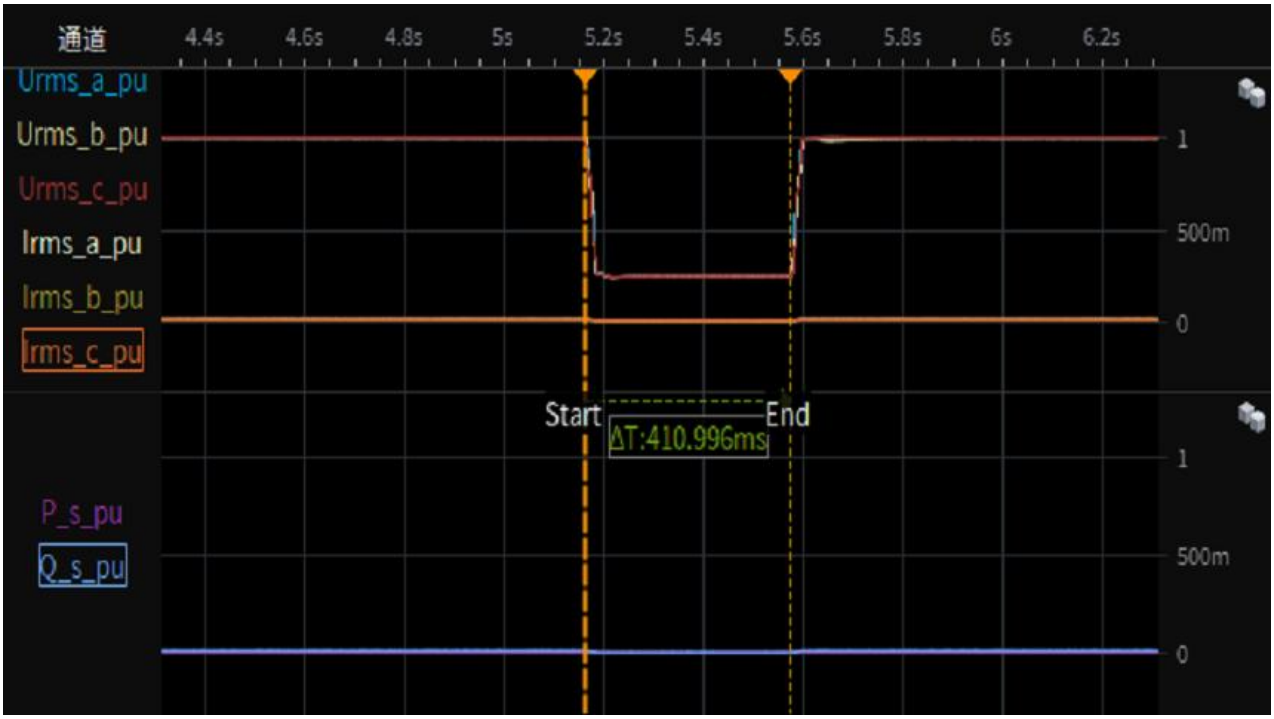


Test 1a-2.4 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D), 95% load
restoring time

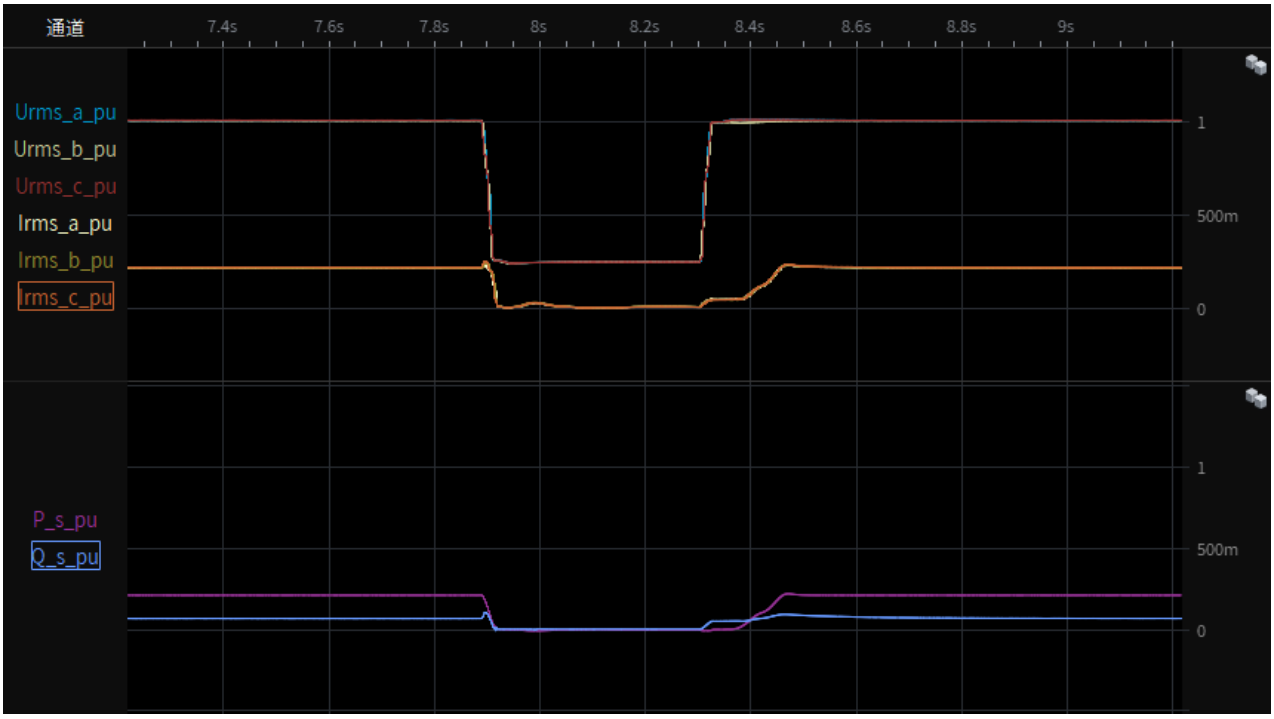


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2s-Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A), 0% load
Test overview(voltage,current,active and reactive power)

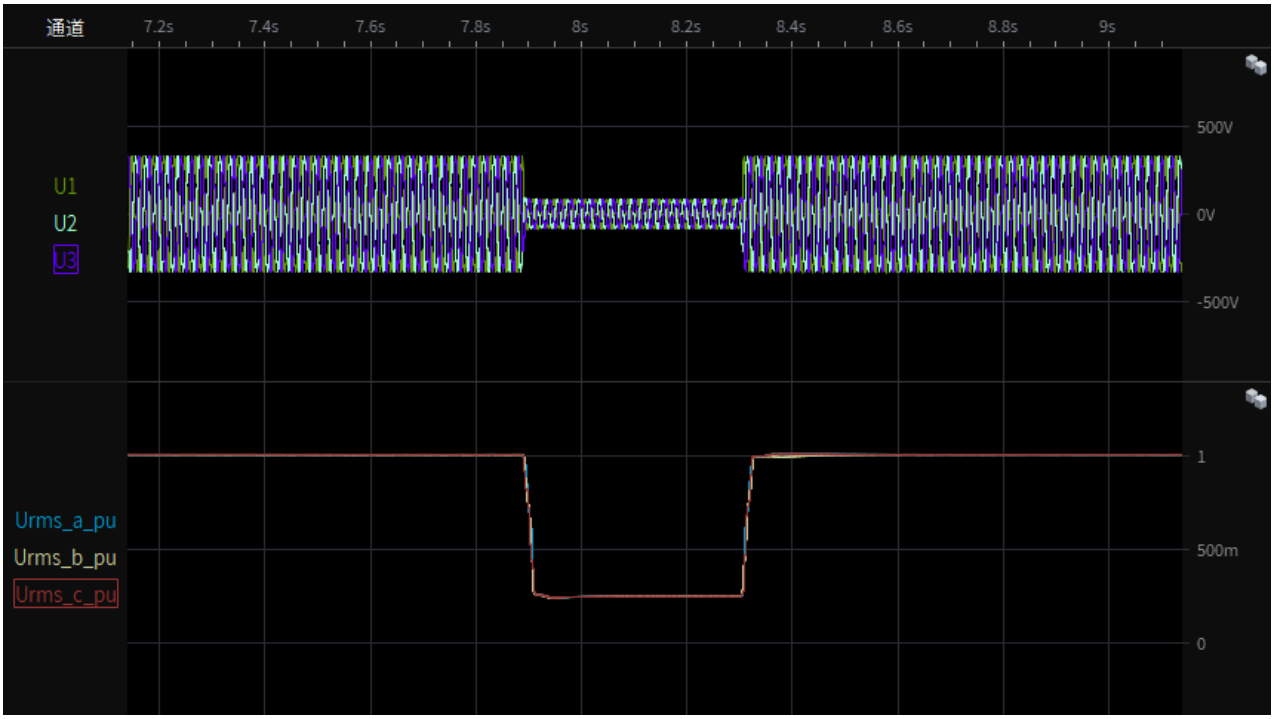


Test 2s-1.1 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)

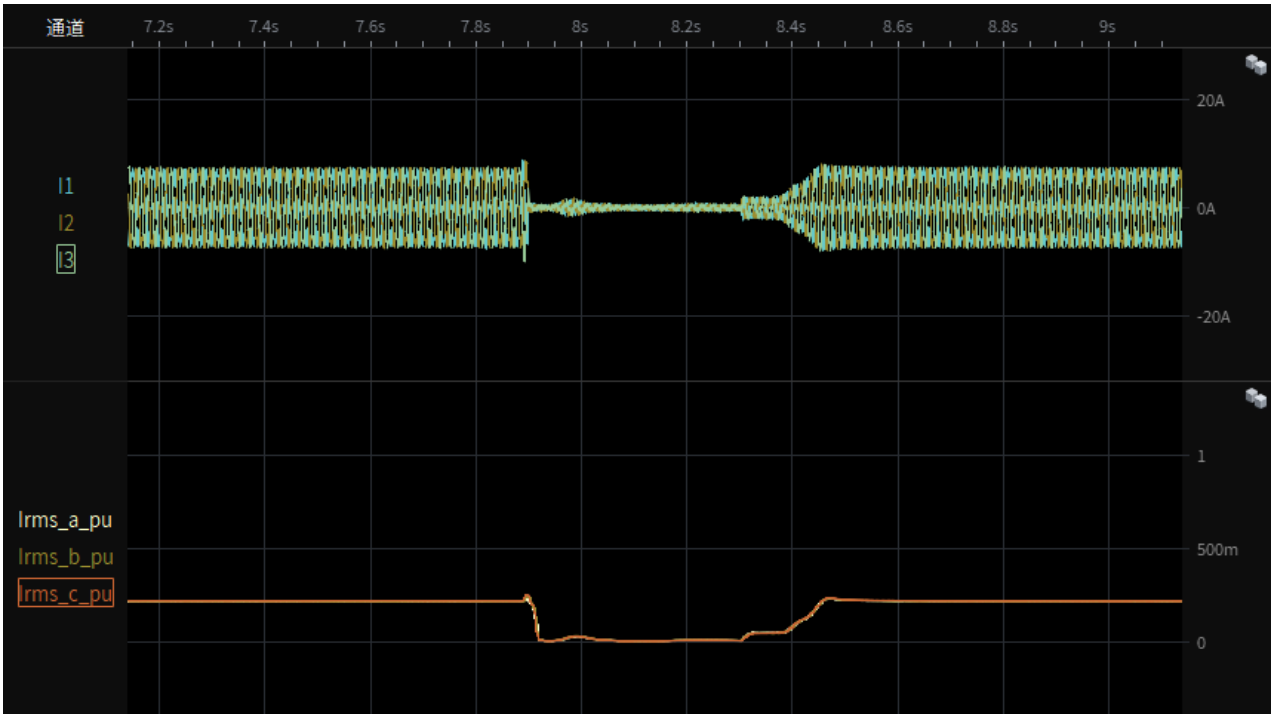


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2s-1.2 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

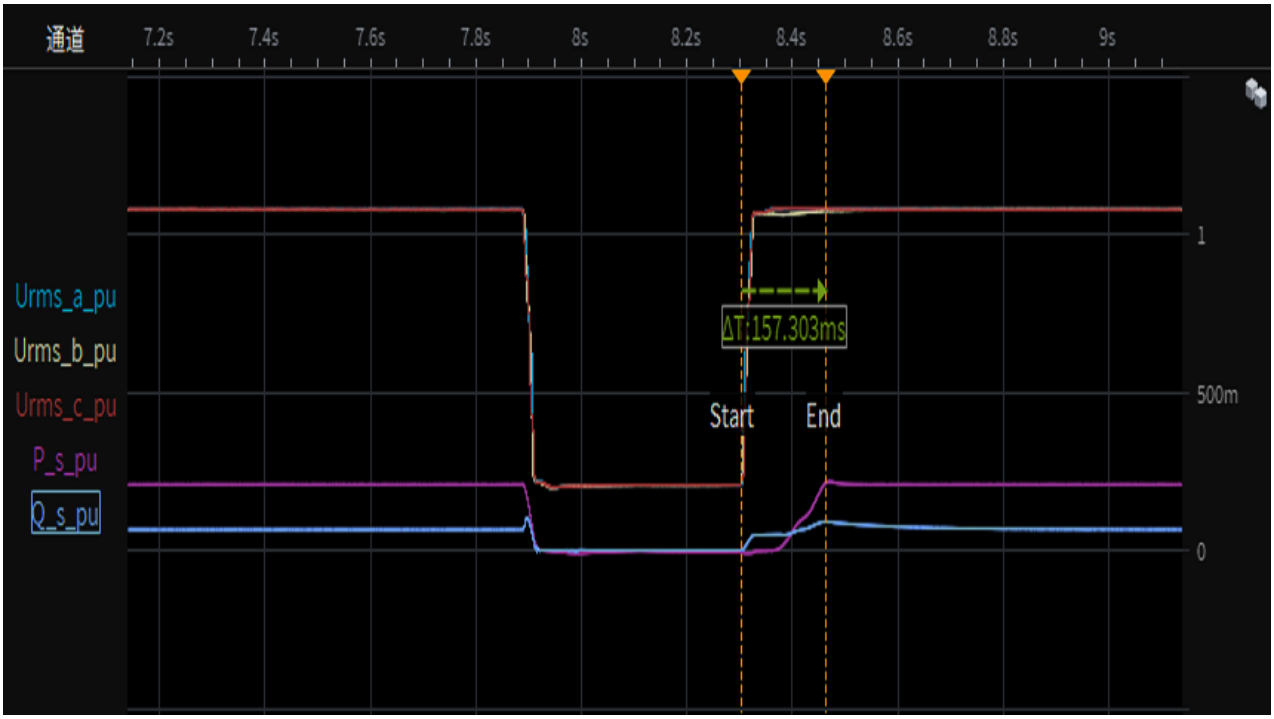


Test 2s-1.3 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents

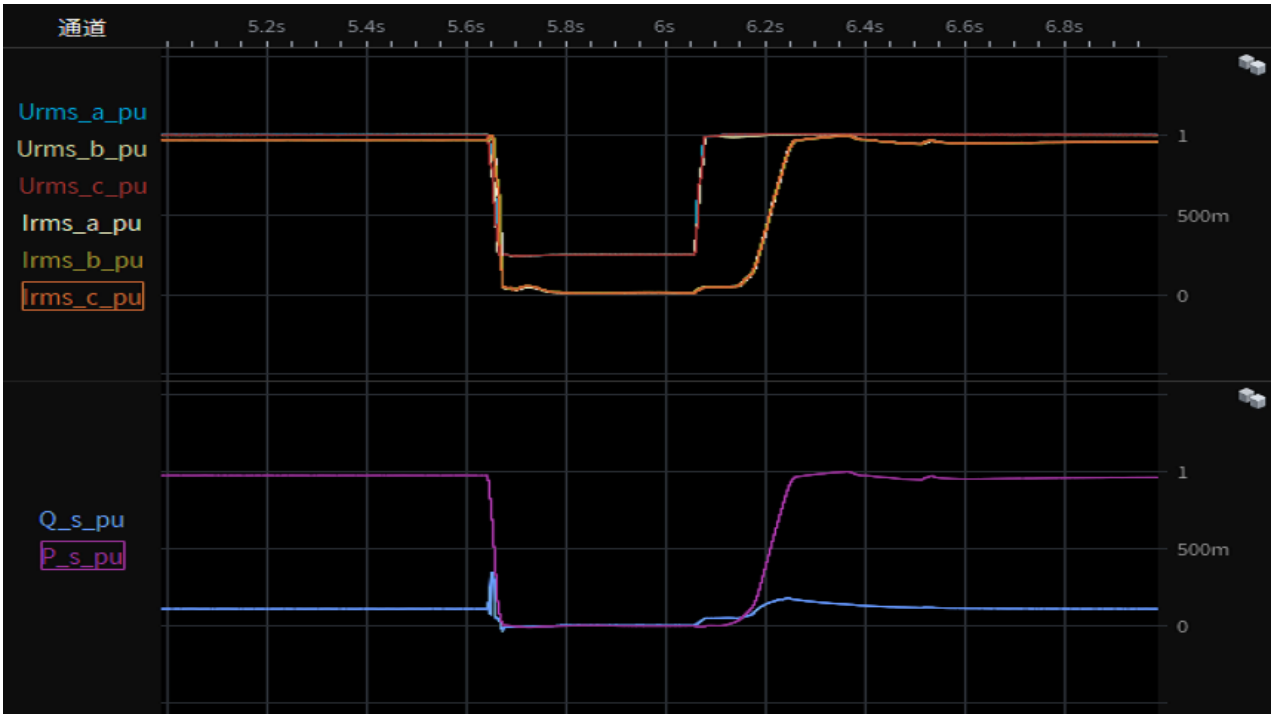


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2s-1.4 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),20% load restoring time

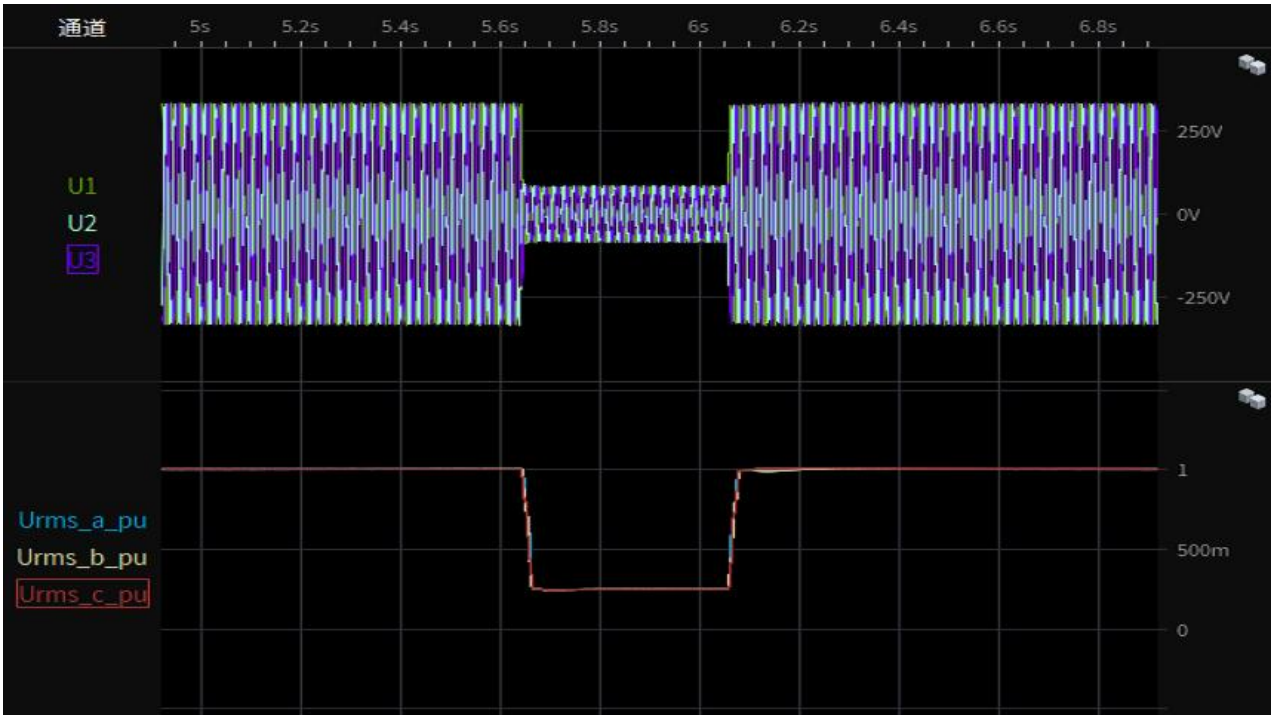


Test 2s-2.1 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),95% load
Test overview(voltage,current,active and reactive power)

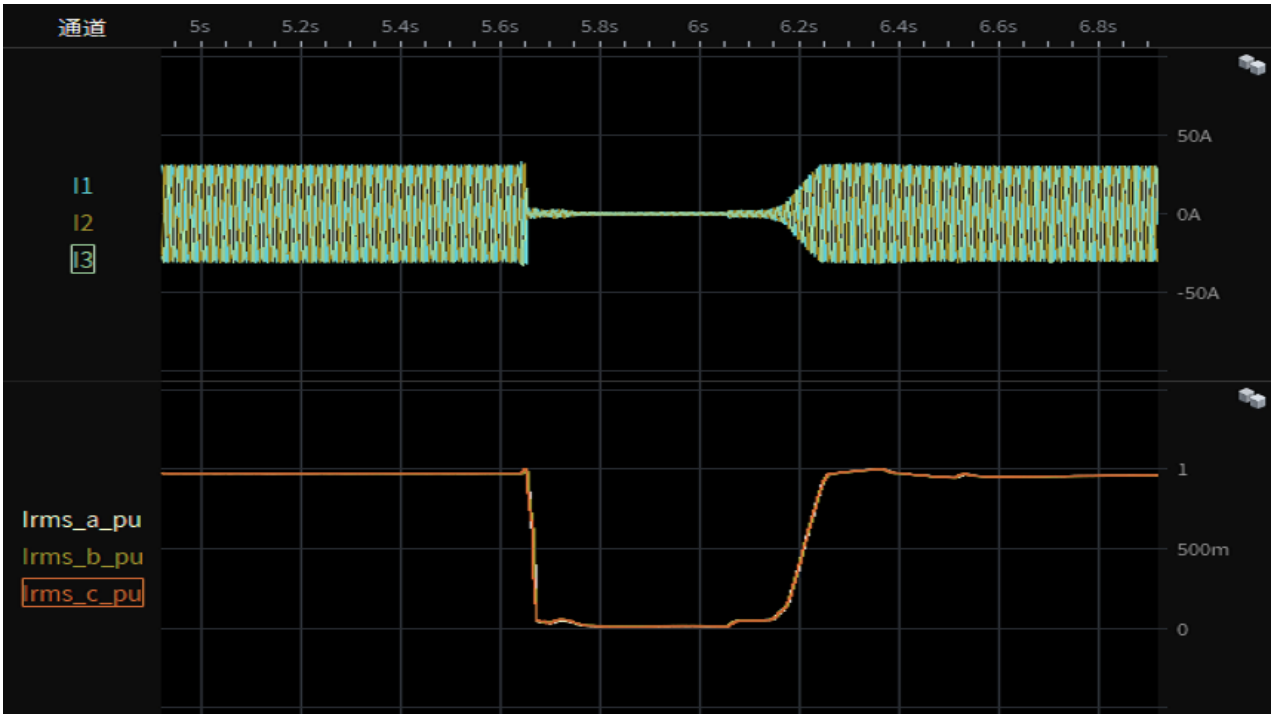


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2s-2.2 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

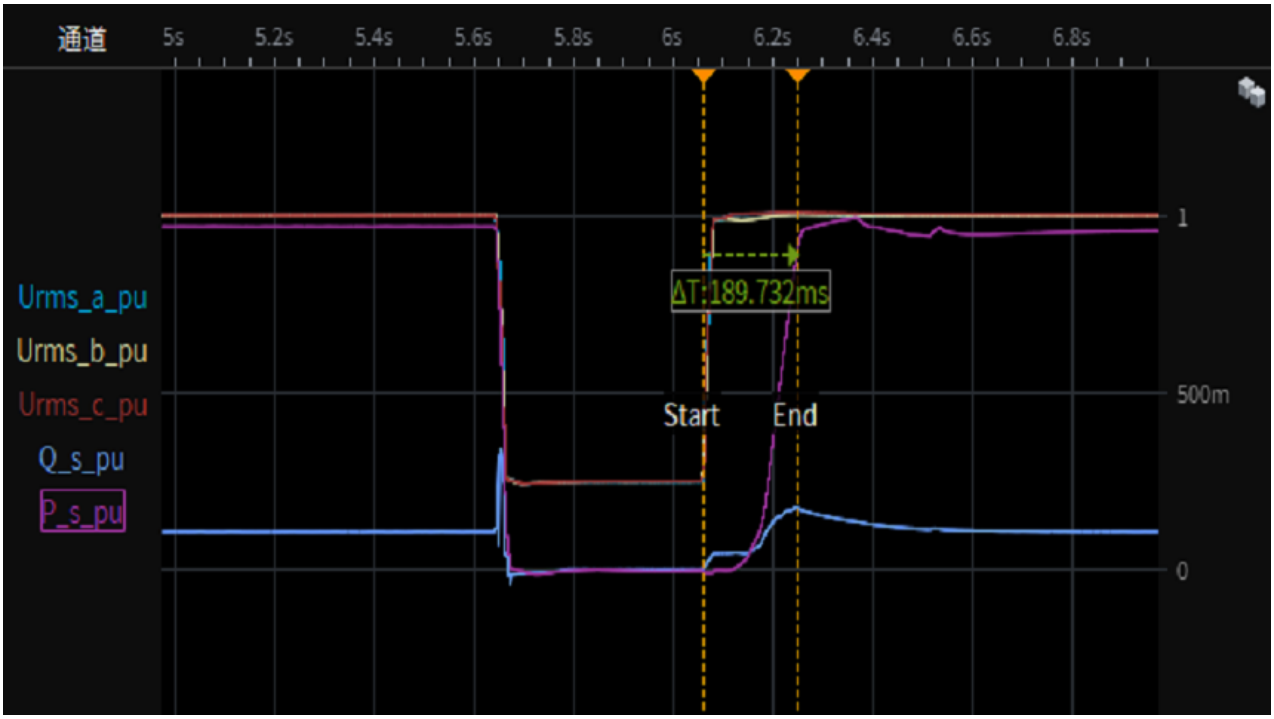


Test 2s-2.3 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents

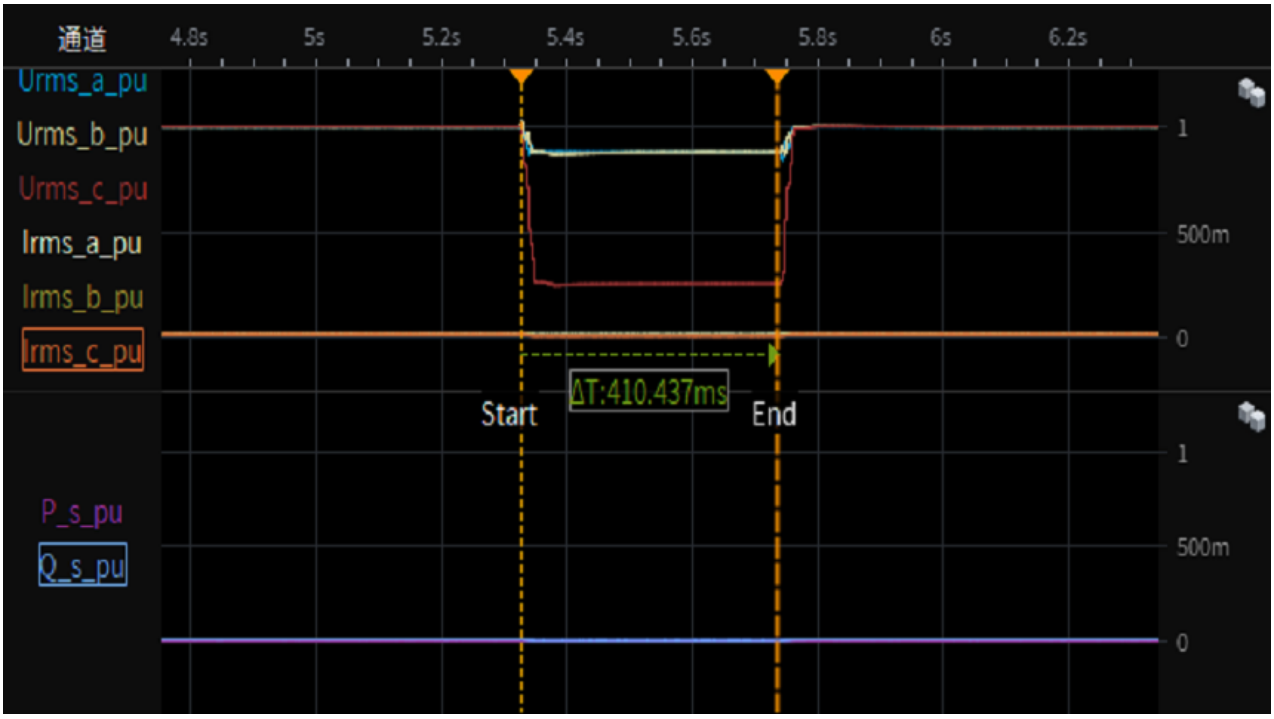


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2s-2.4 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A), 95% load restoring time

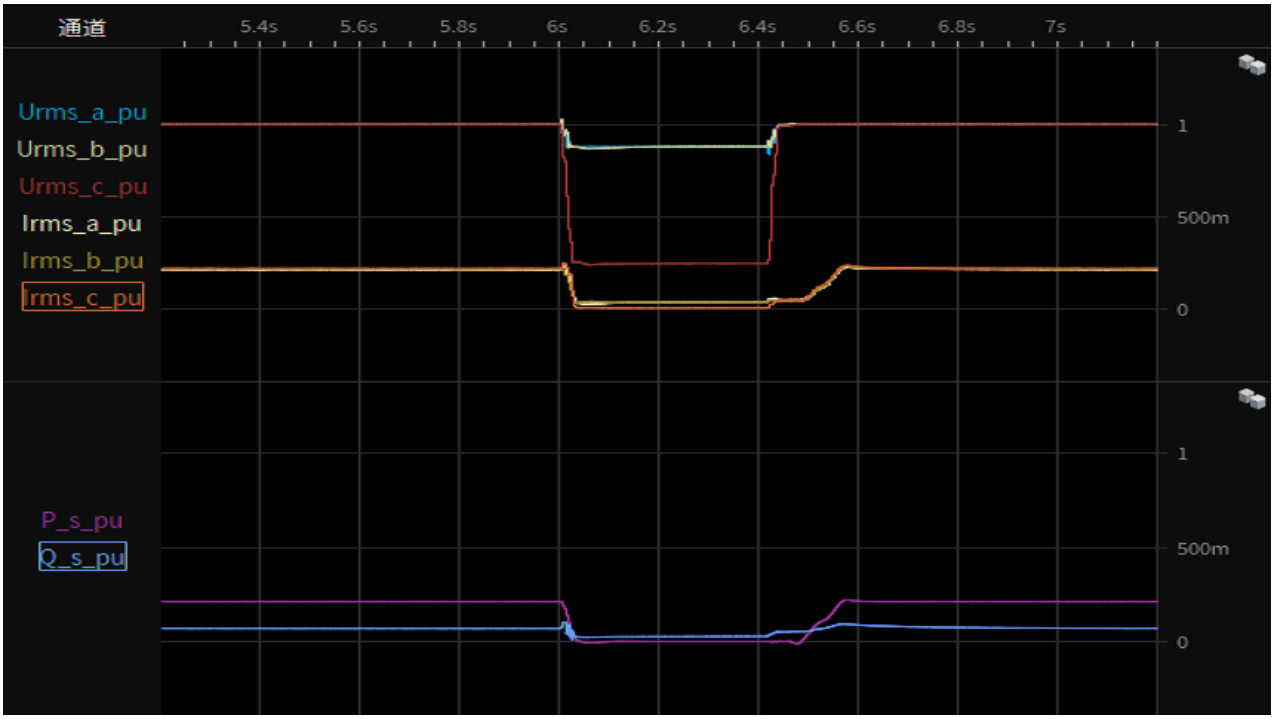


Test 2a-Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D), 0% load
Test overview(voltage,current,active and reactive power)

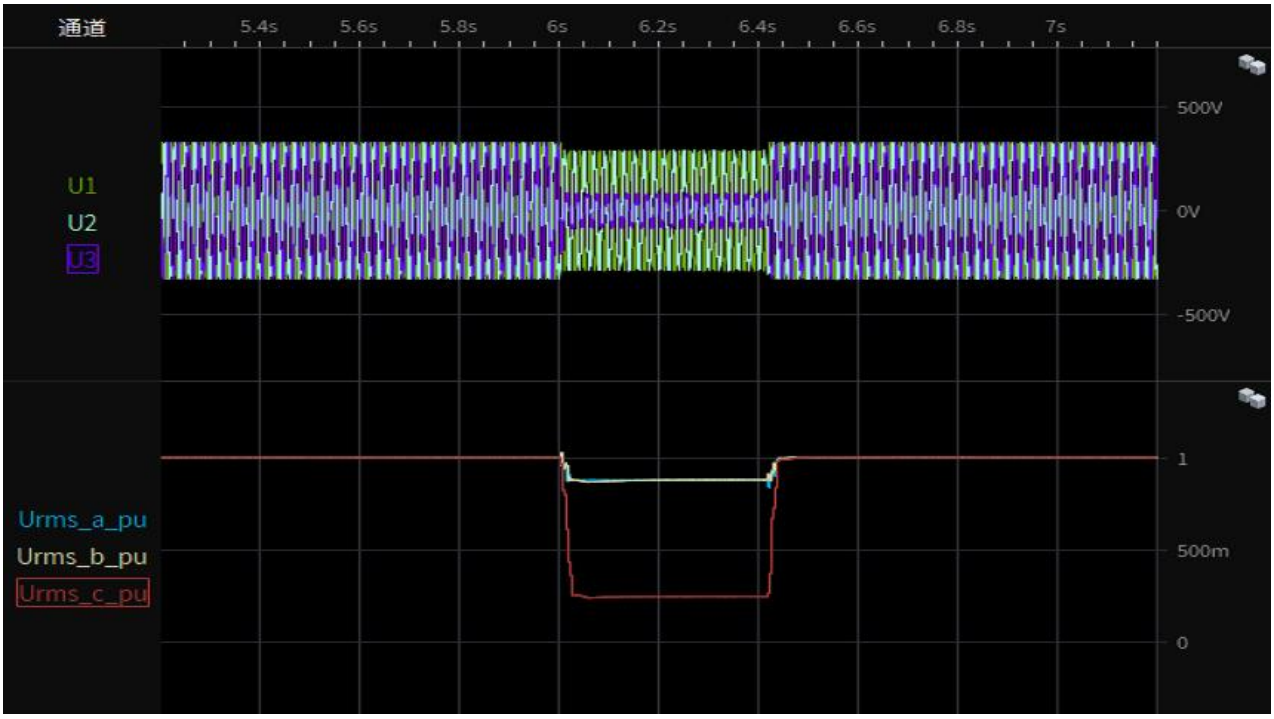


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2a-1.1 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),20% load
Test overview(voltage,current,active and reactive power)

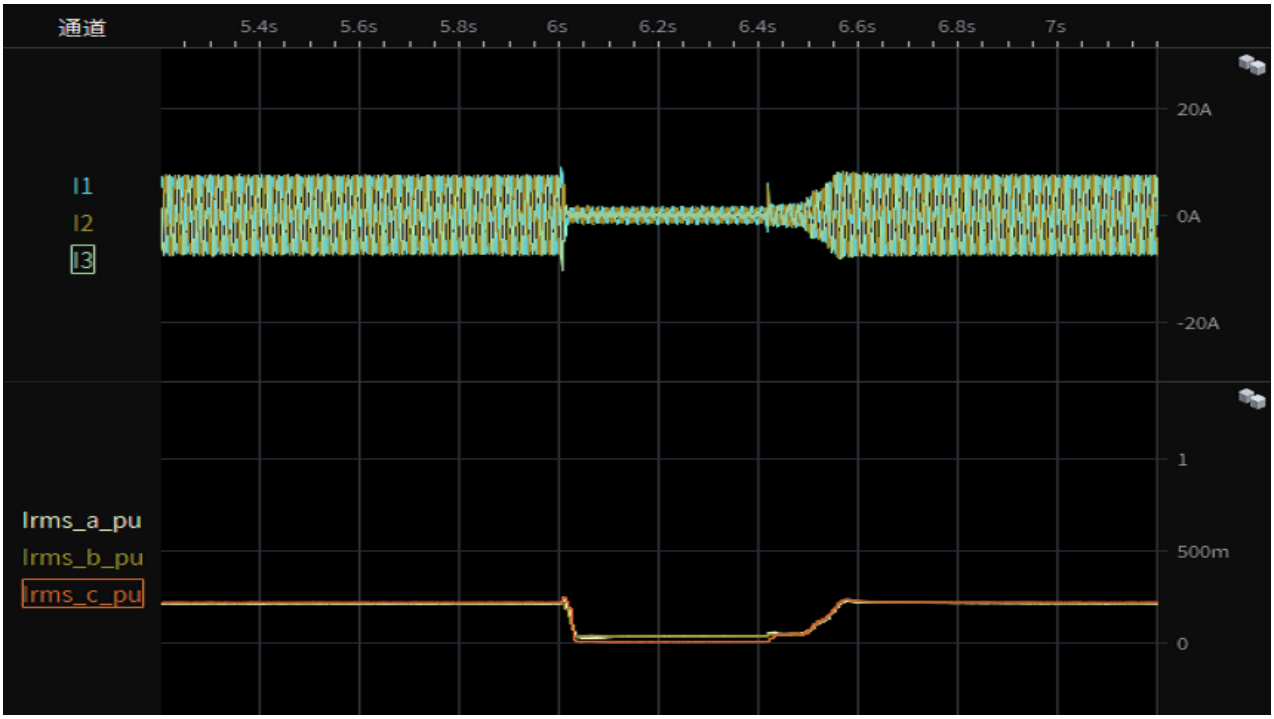


Test 2a-1.2 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

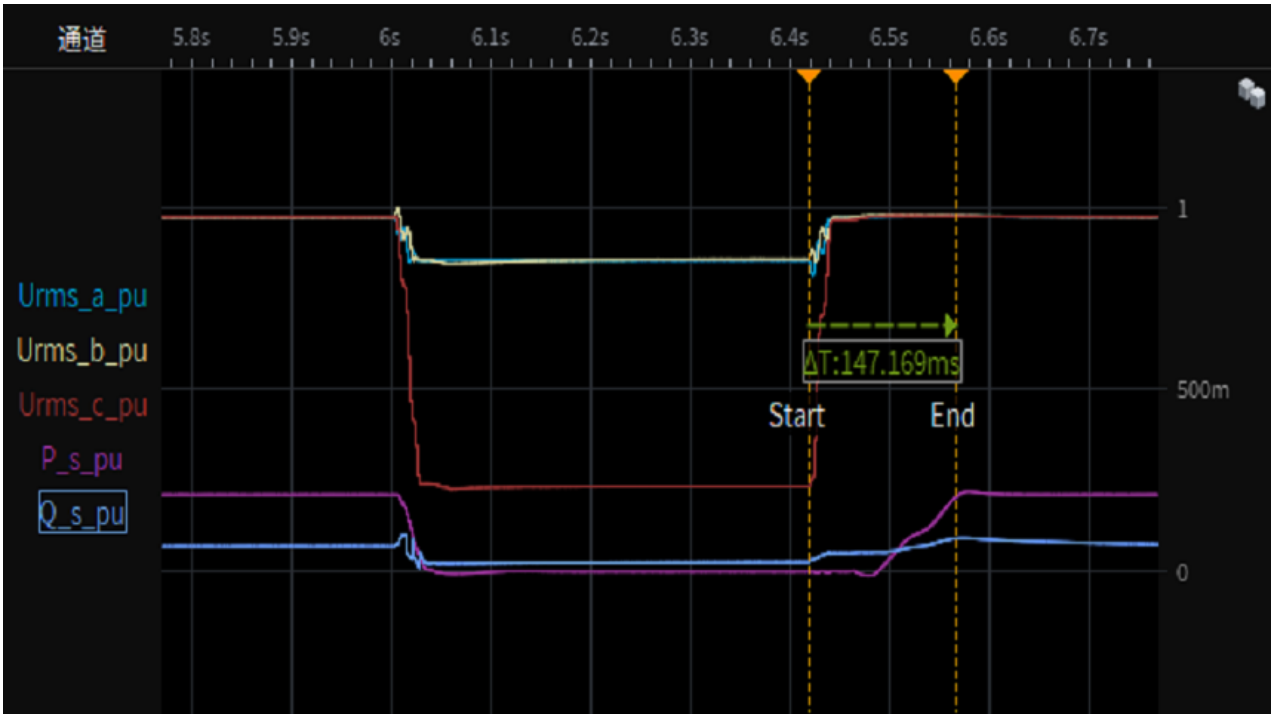


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2a-1.3 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase currents

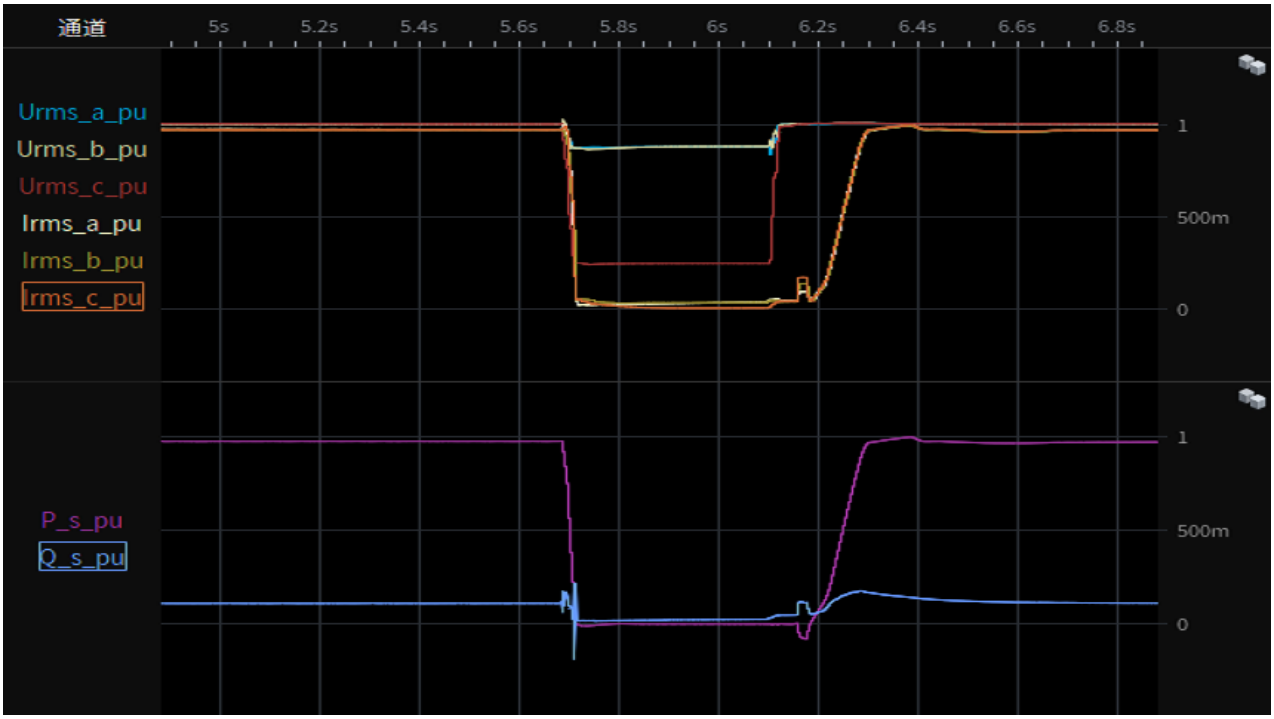


Test 2a-1.4 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),20% load
restoring time

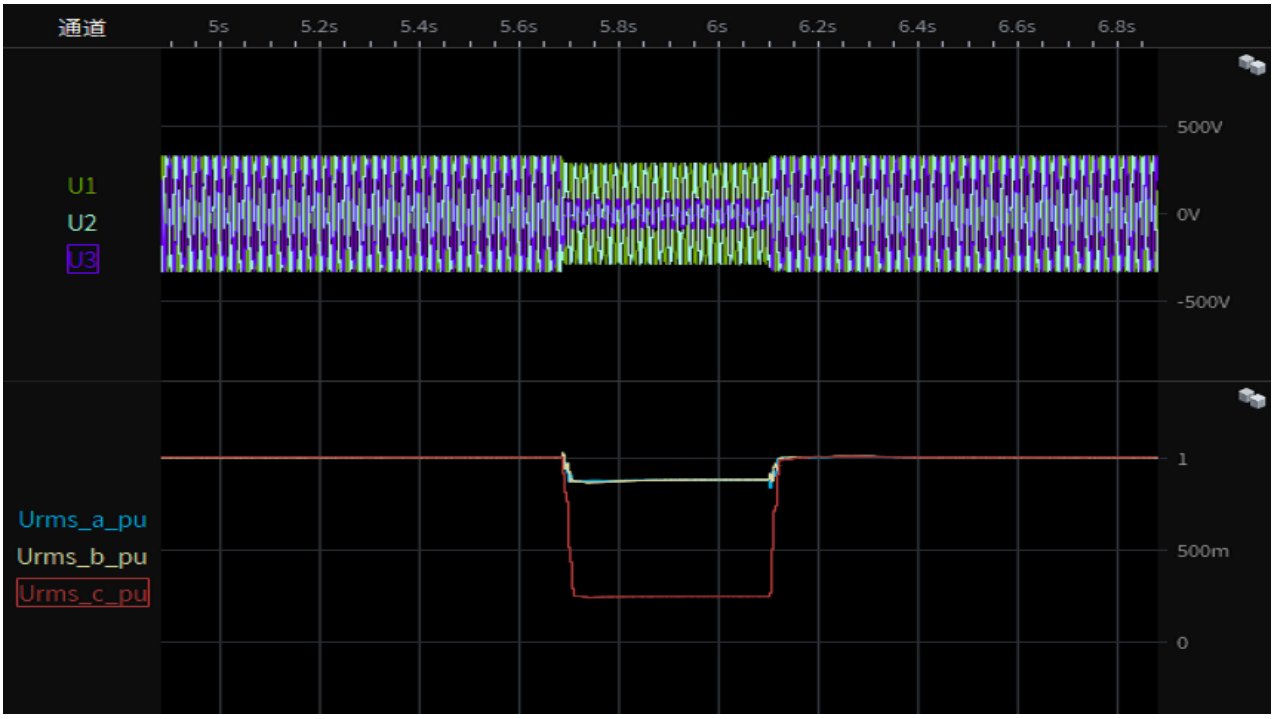


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2a-2.1 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),95% load
Test overview(voltage,current,active and reactive power)

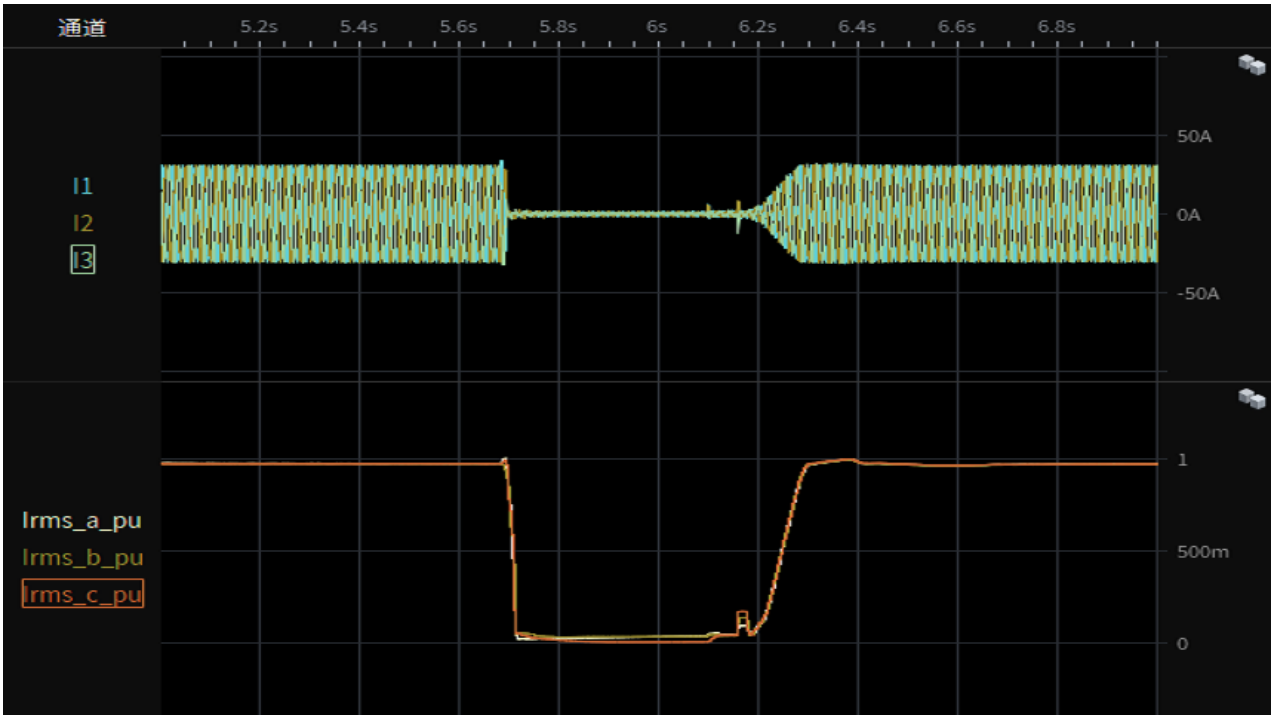


Test 2a-2.2 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

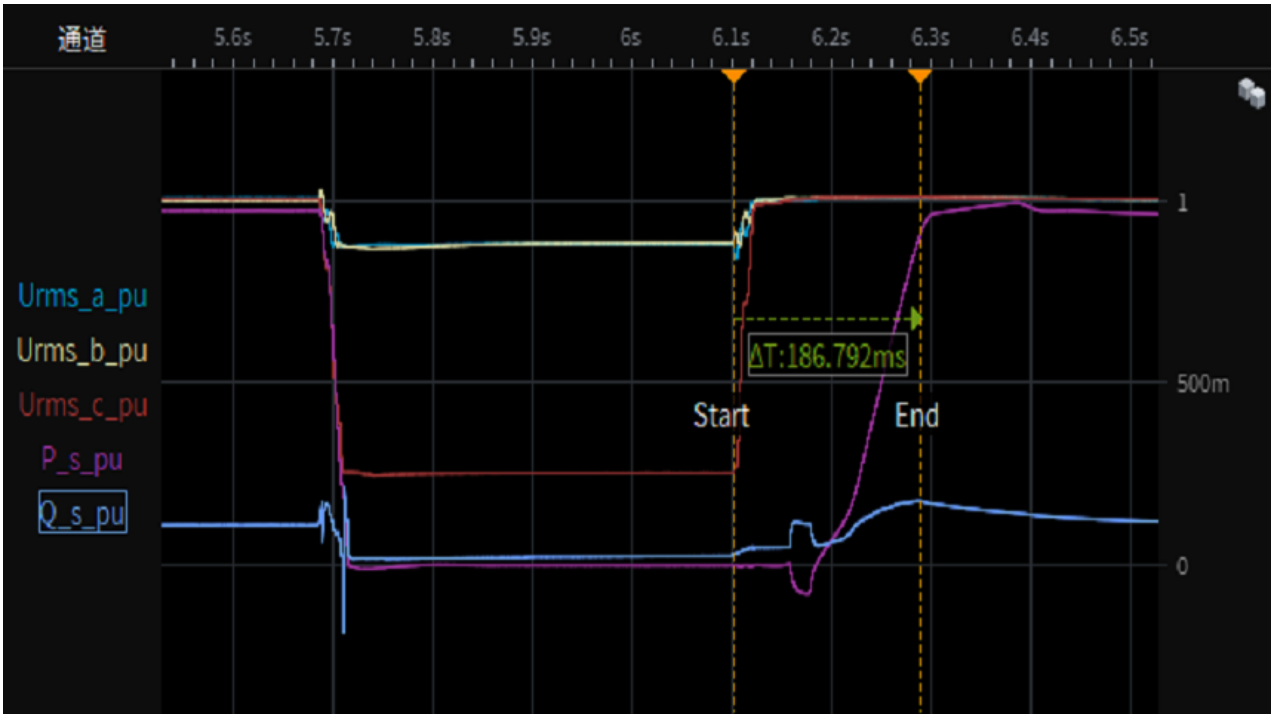


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2a-2.3 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase currents

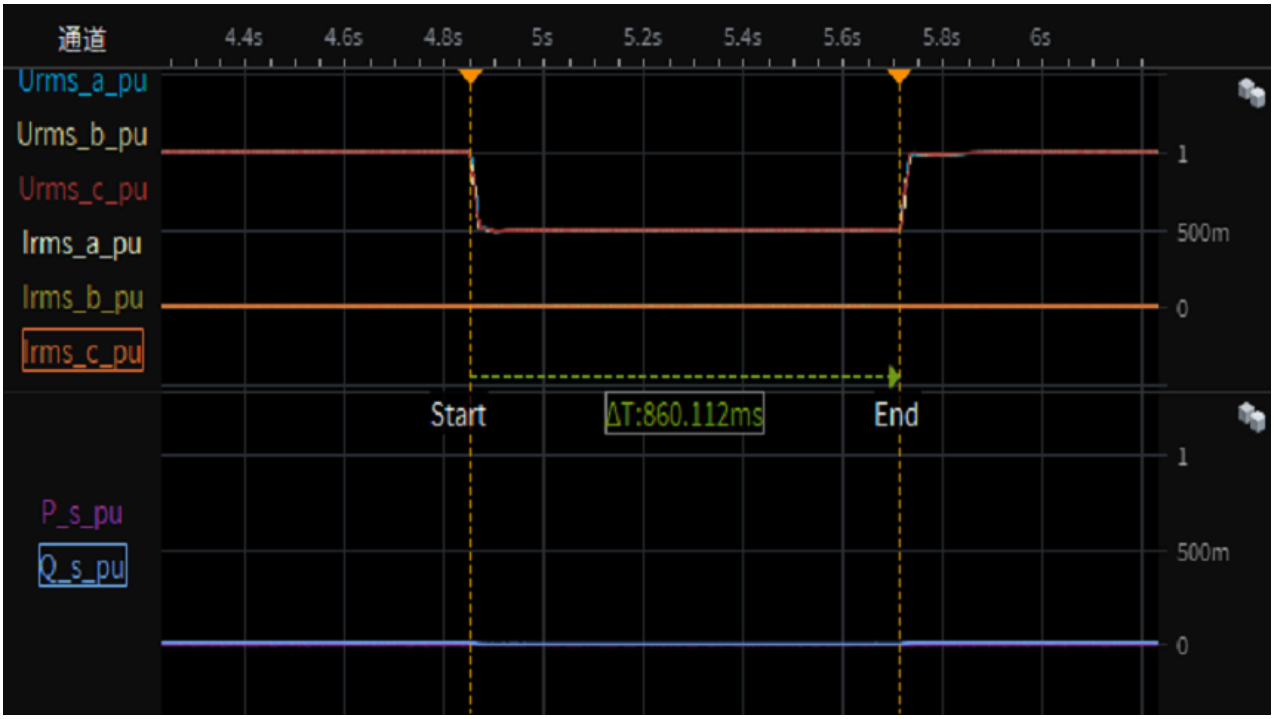


Test 2a-2.4 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D), 95% load
restoring time

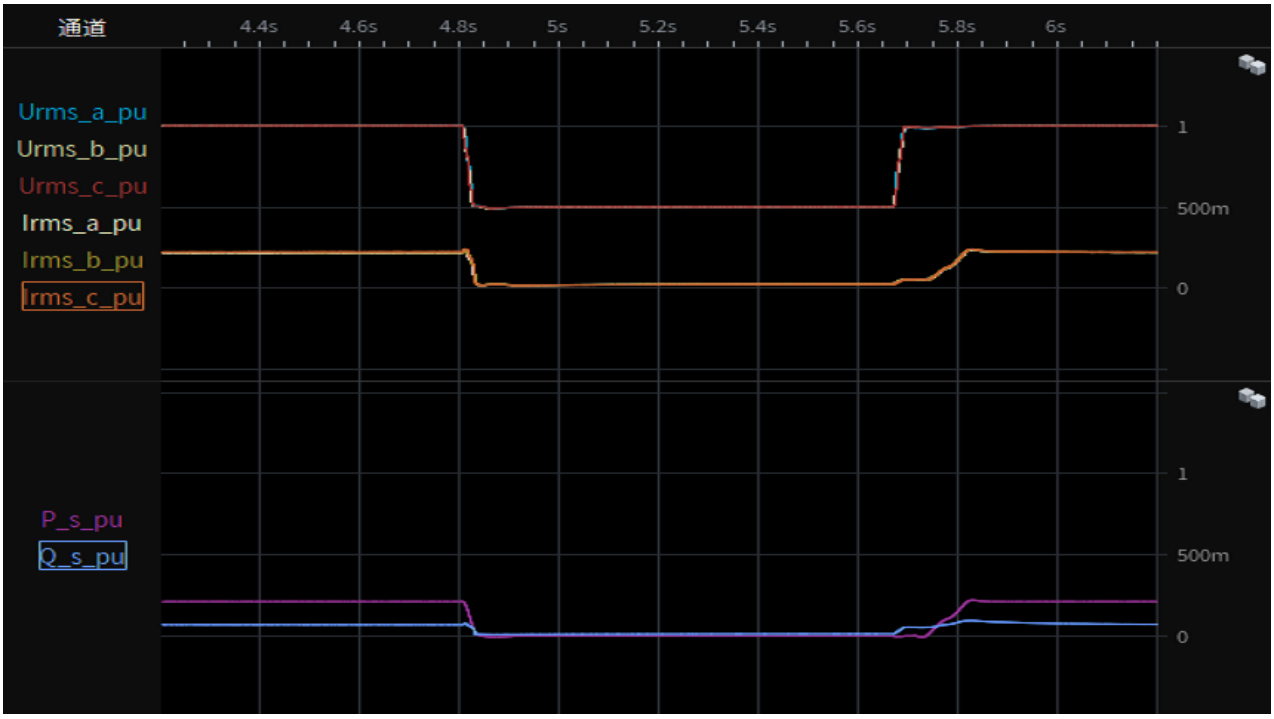


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3s-Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A), 0% load
Test overview(voltage,current,active and reactive power)

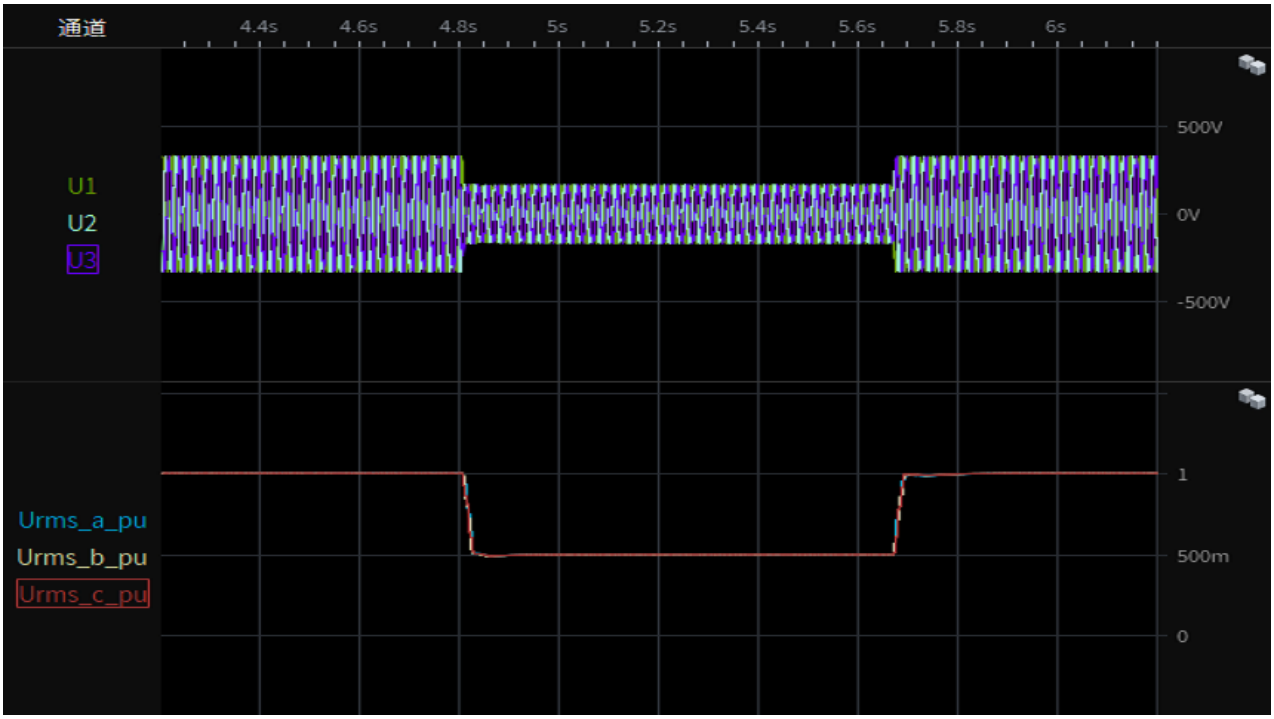


Test 3s-1.1 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)

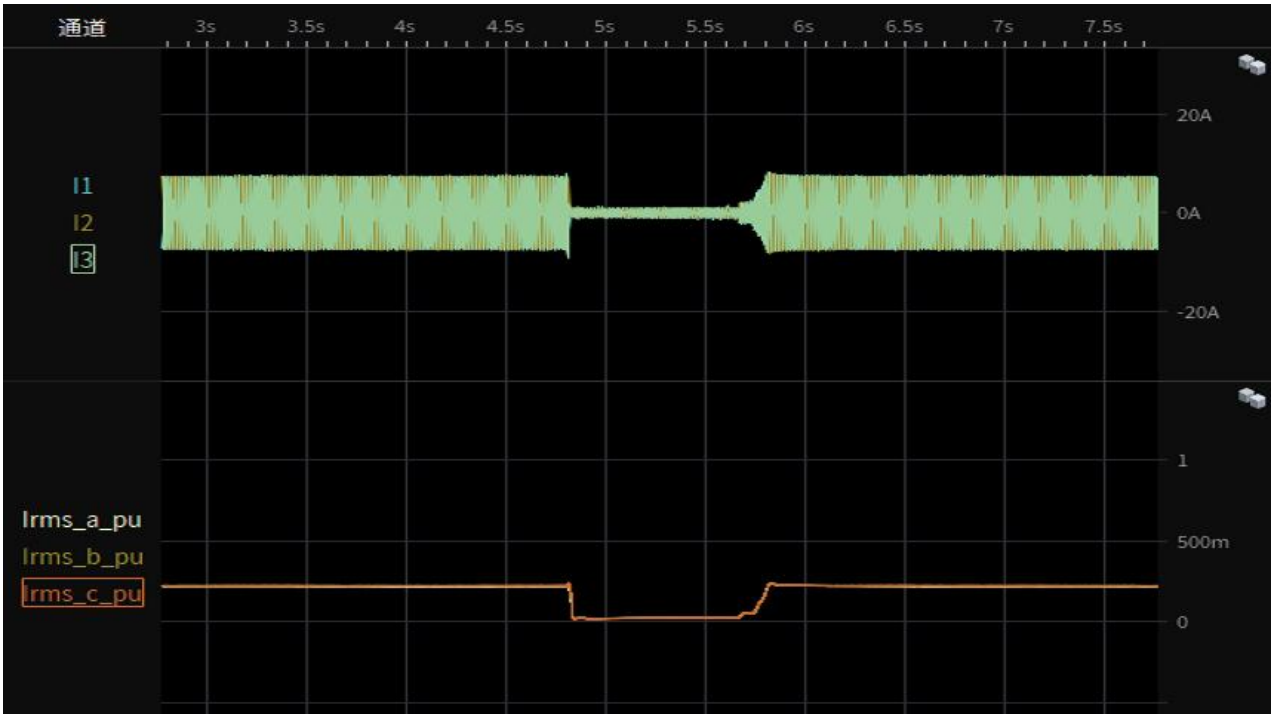


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3s-1.2 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

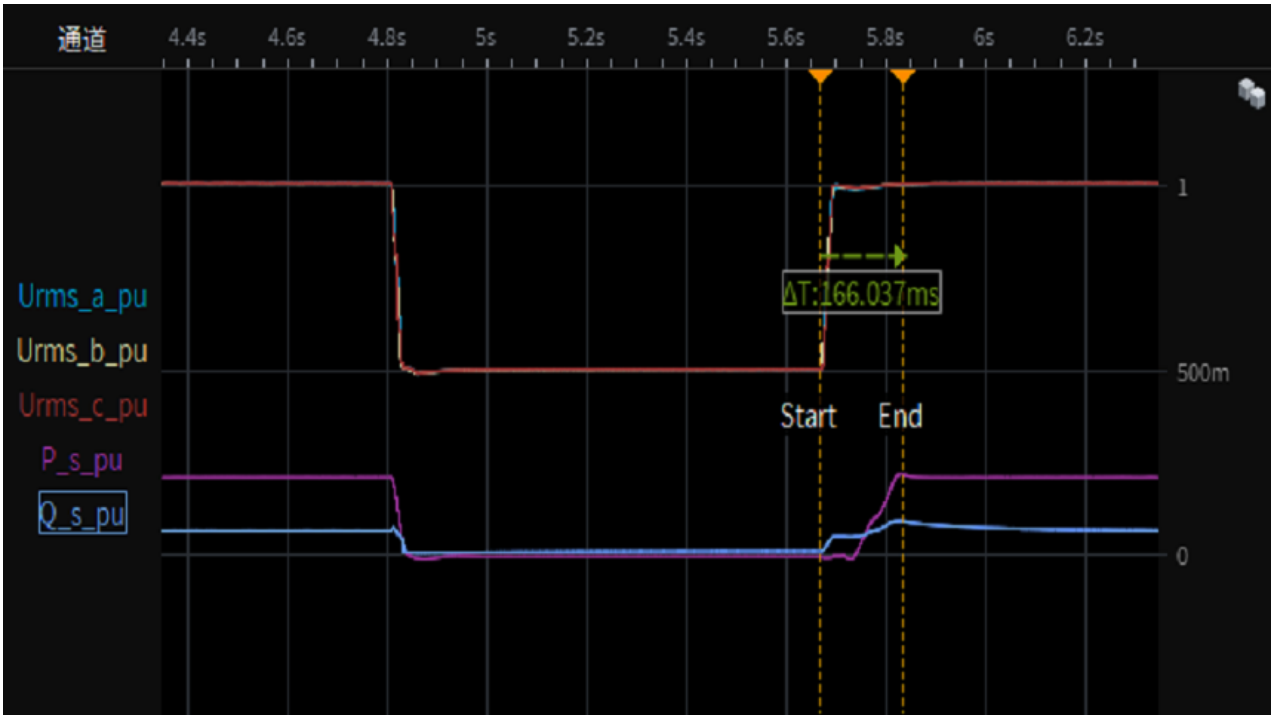


Test 3s-1.3 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents

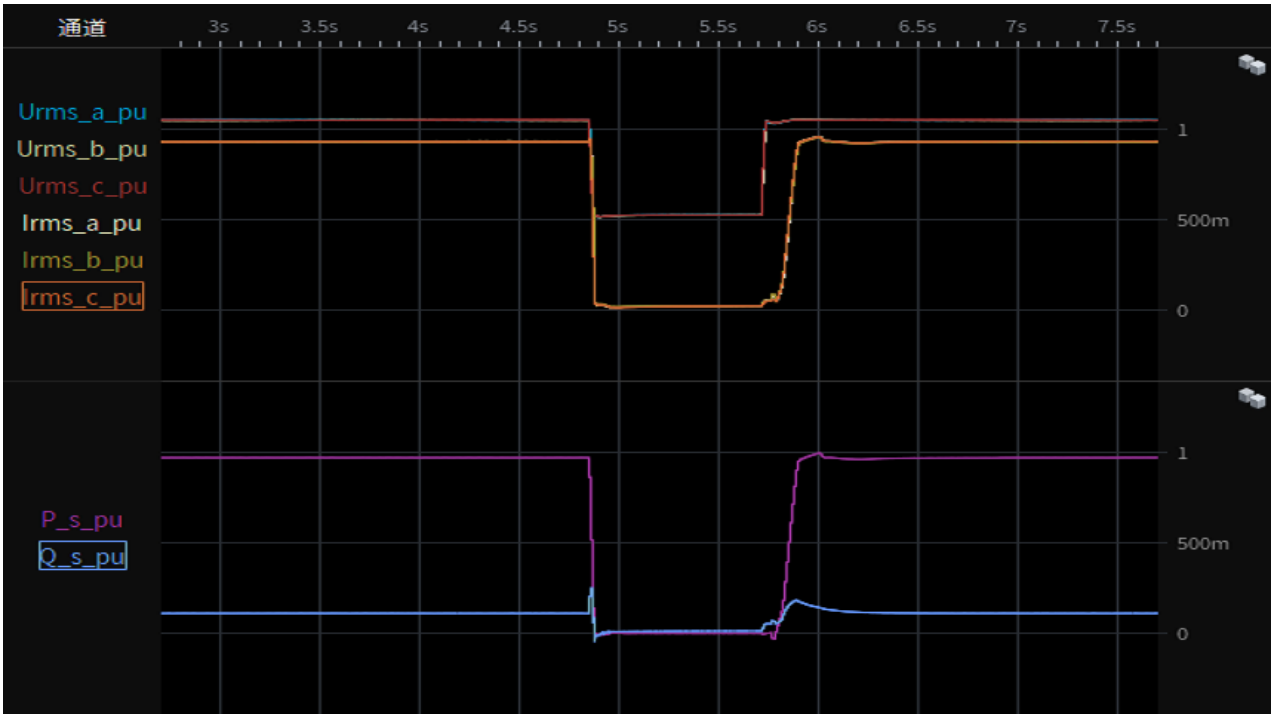


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3s-1.4 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),20% load restoring time

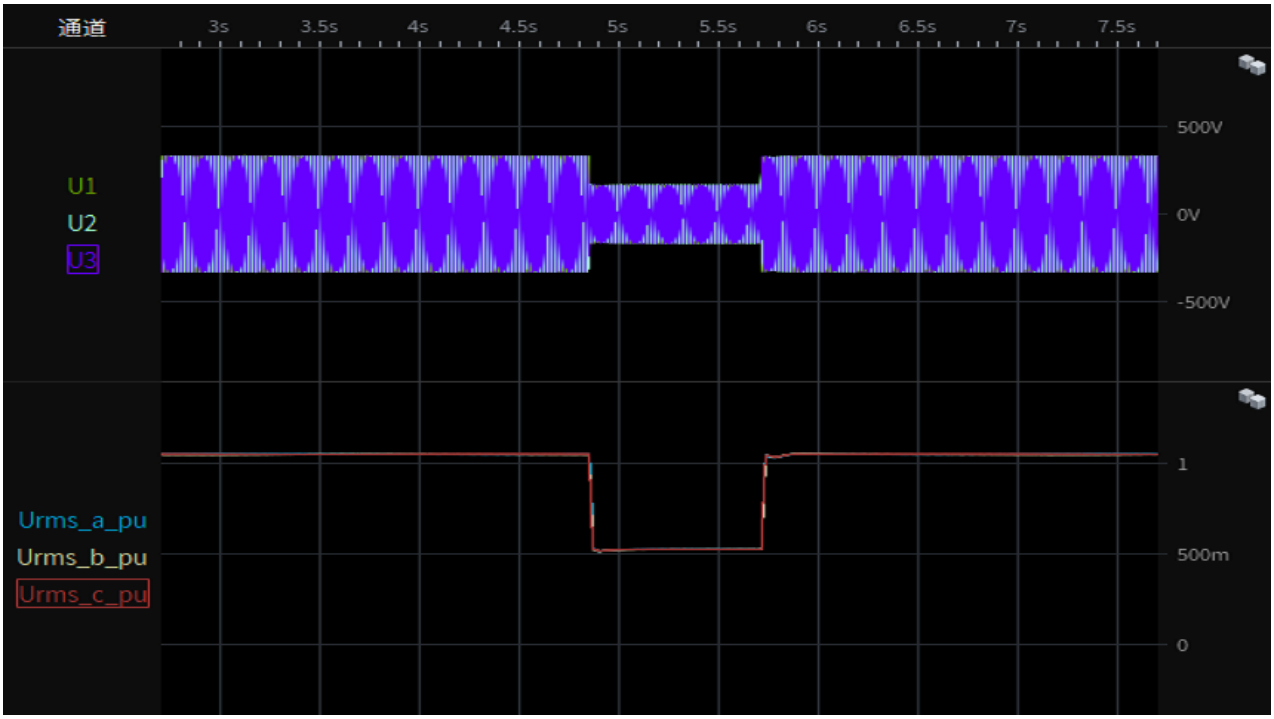


Test 3s-2.1 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),95% load
Test overview(voltage,current,active and reactive power)

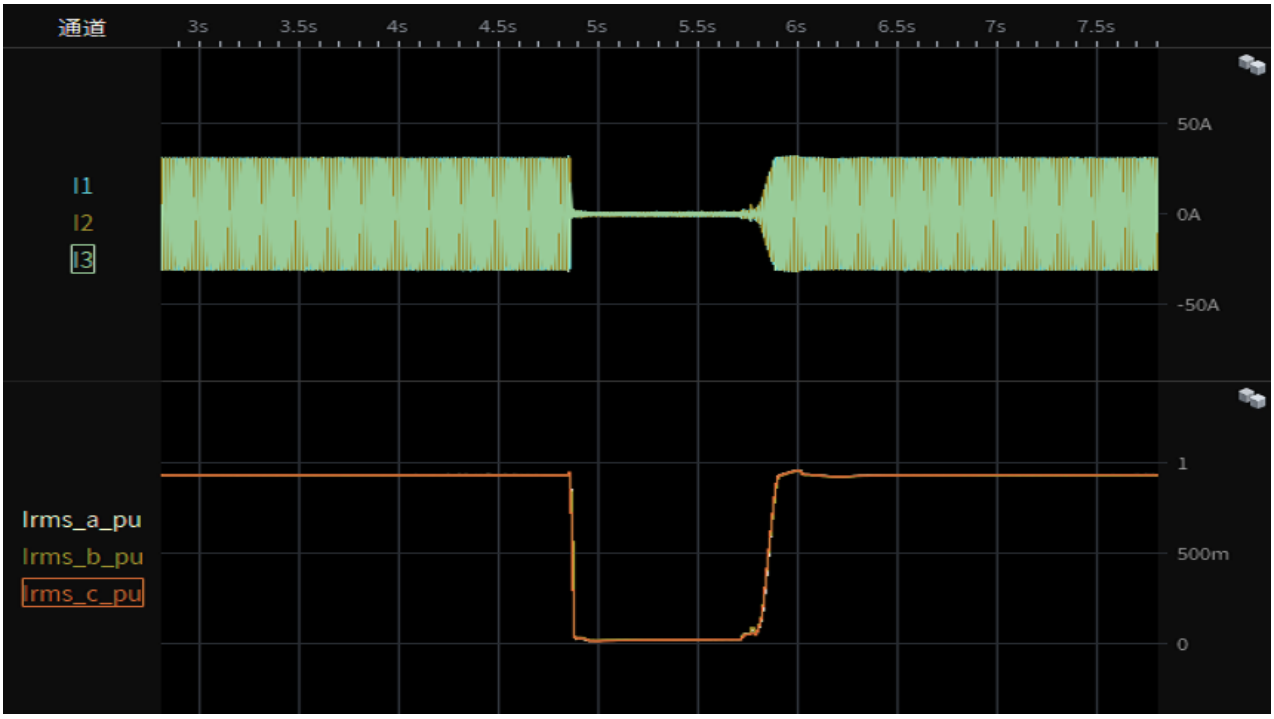


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3s-2.2 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

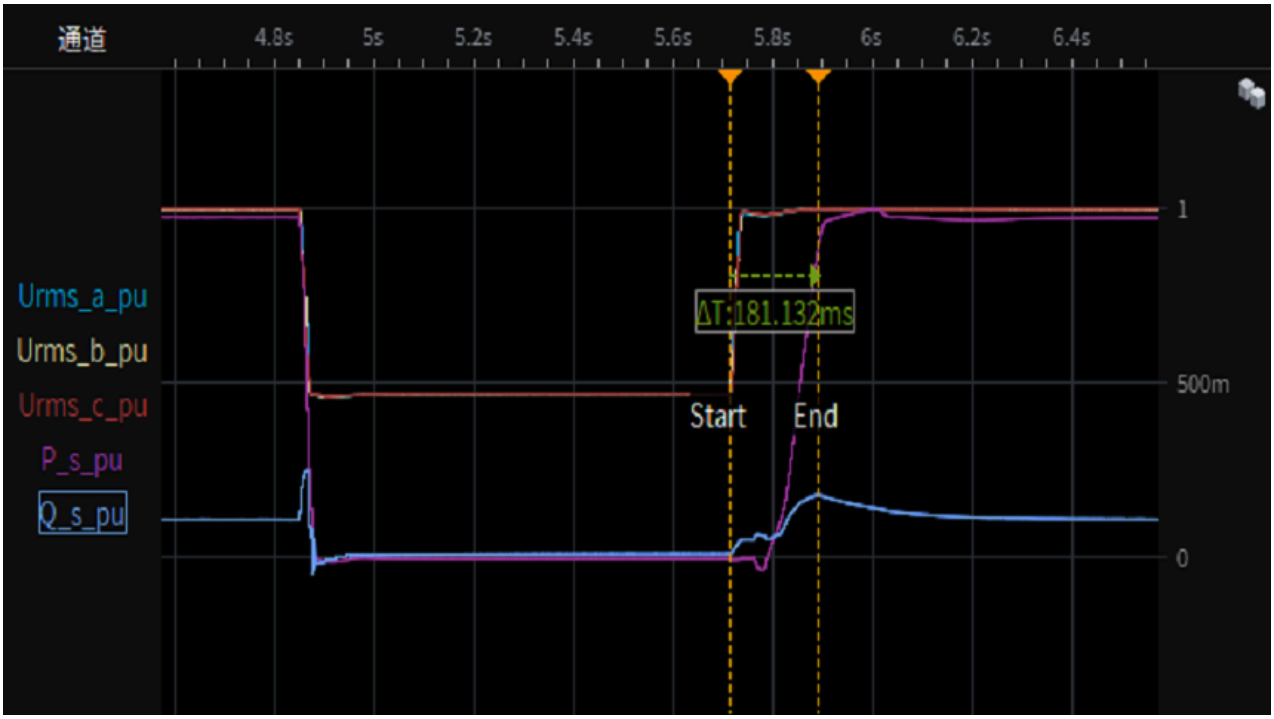


Test 3s-2.3 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents

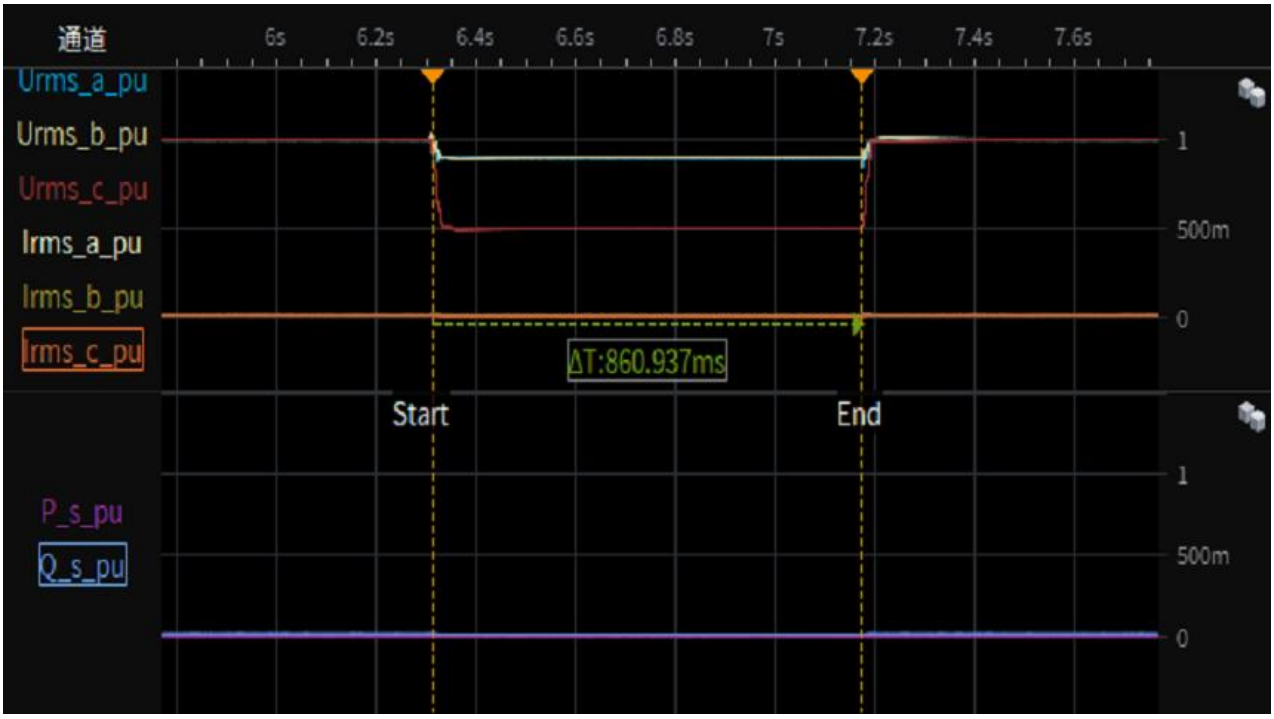


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3s-2.4 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A), 95% load restoring time

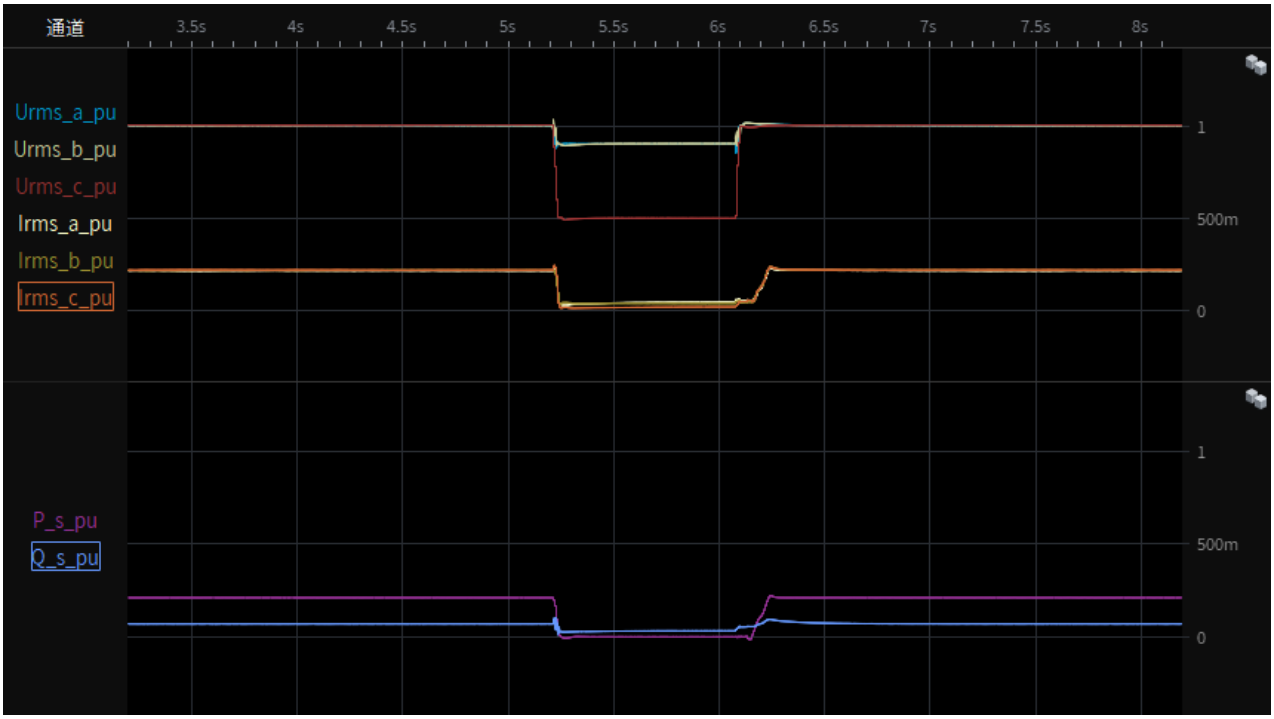


Test 3a-Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D), 0% load
Test overview(voltage,current,active and reactive power)

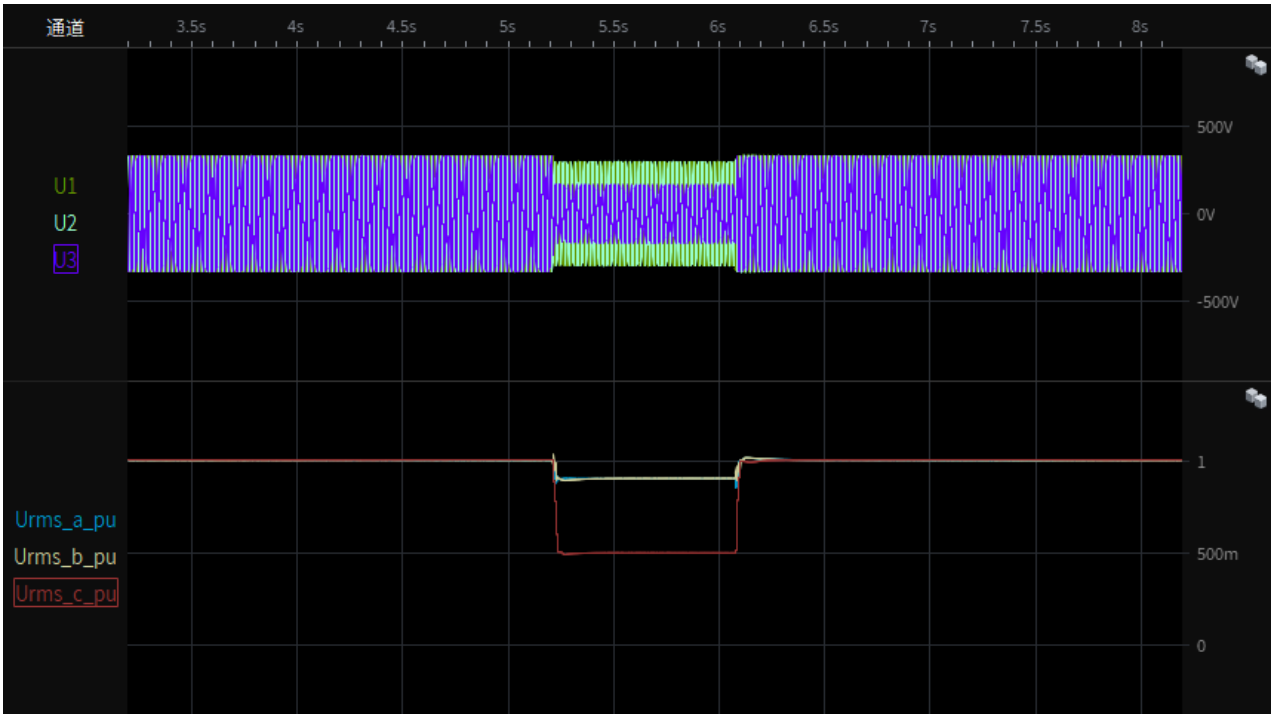


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3a-1.1 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),20% load
Test overview(voltage,current,active and reactive power)

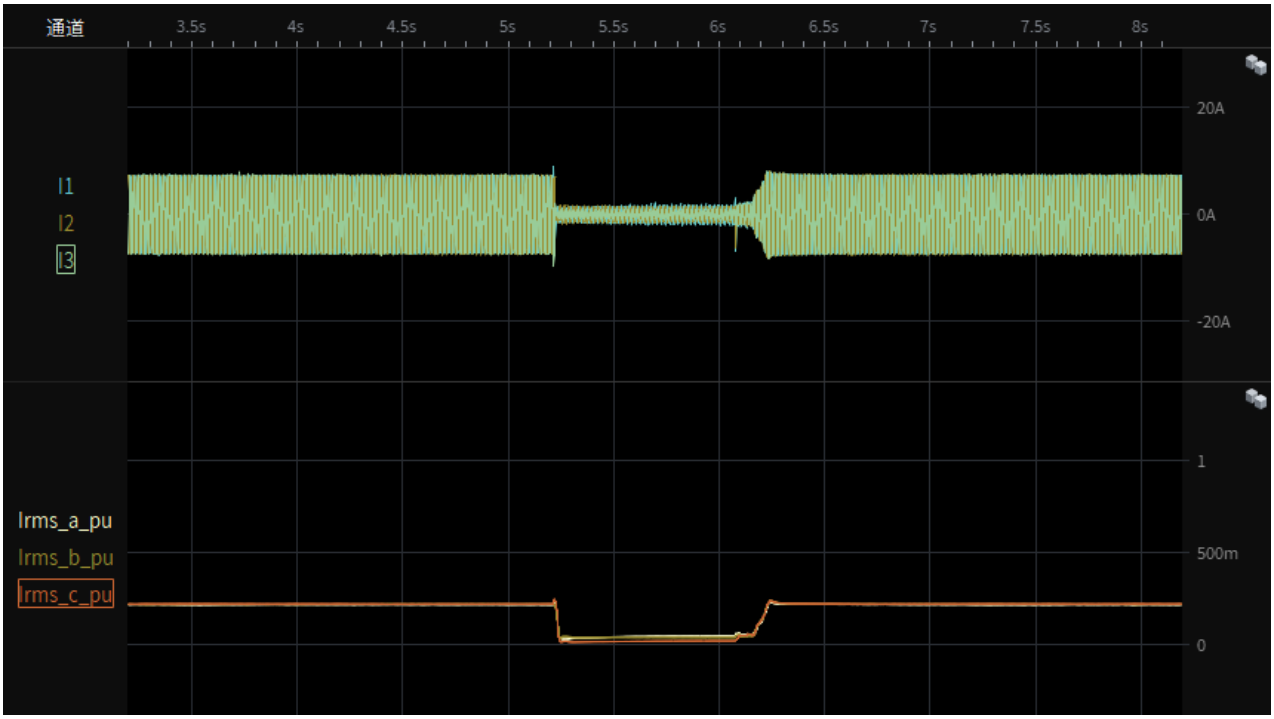


Test 3a-1.2 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

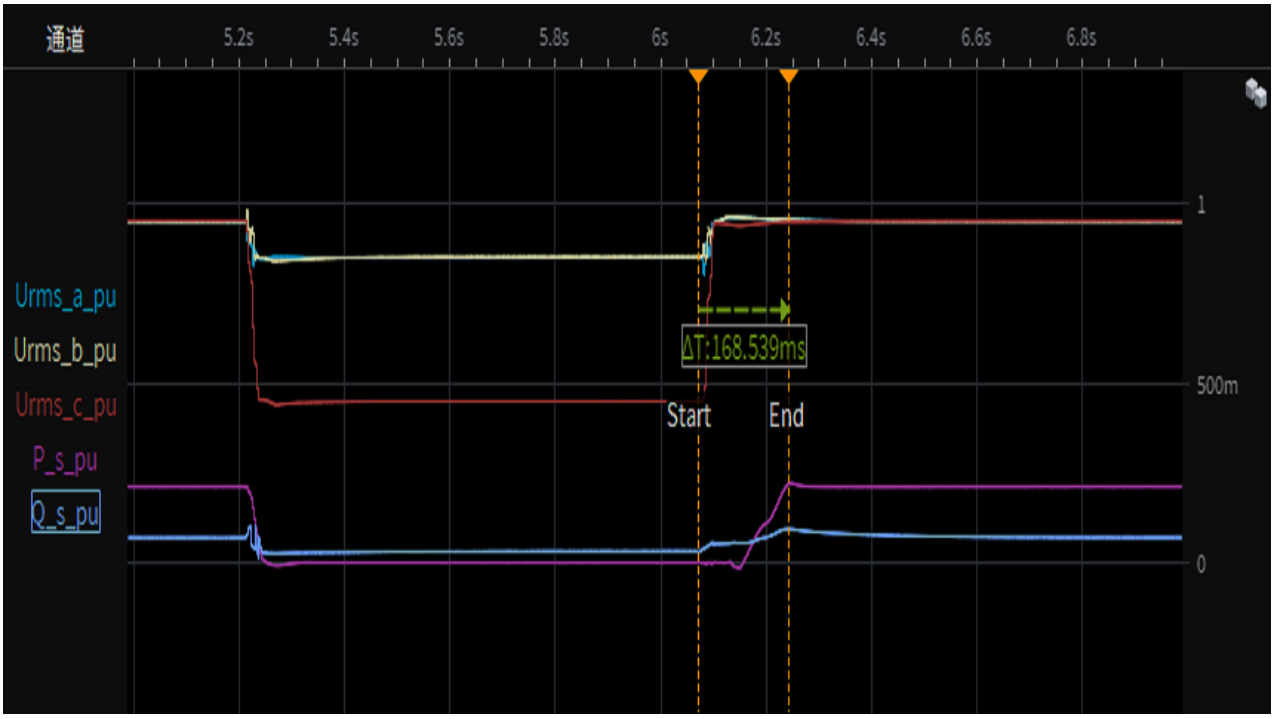


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3a-1.3 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase currents

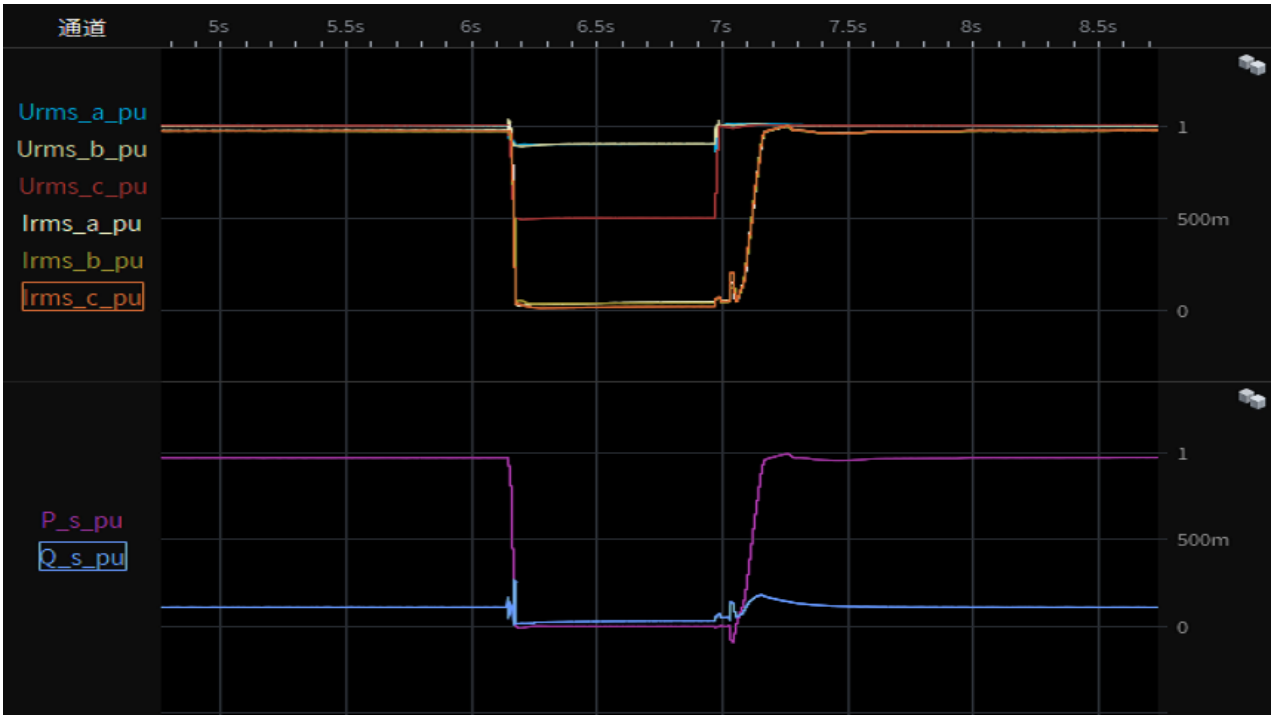


Test 3a-1.4 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),20% load
restoring time

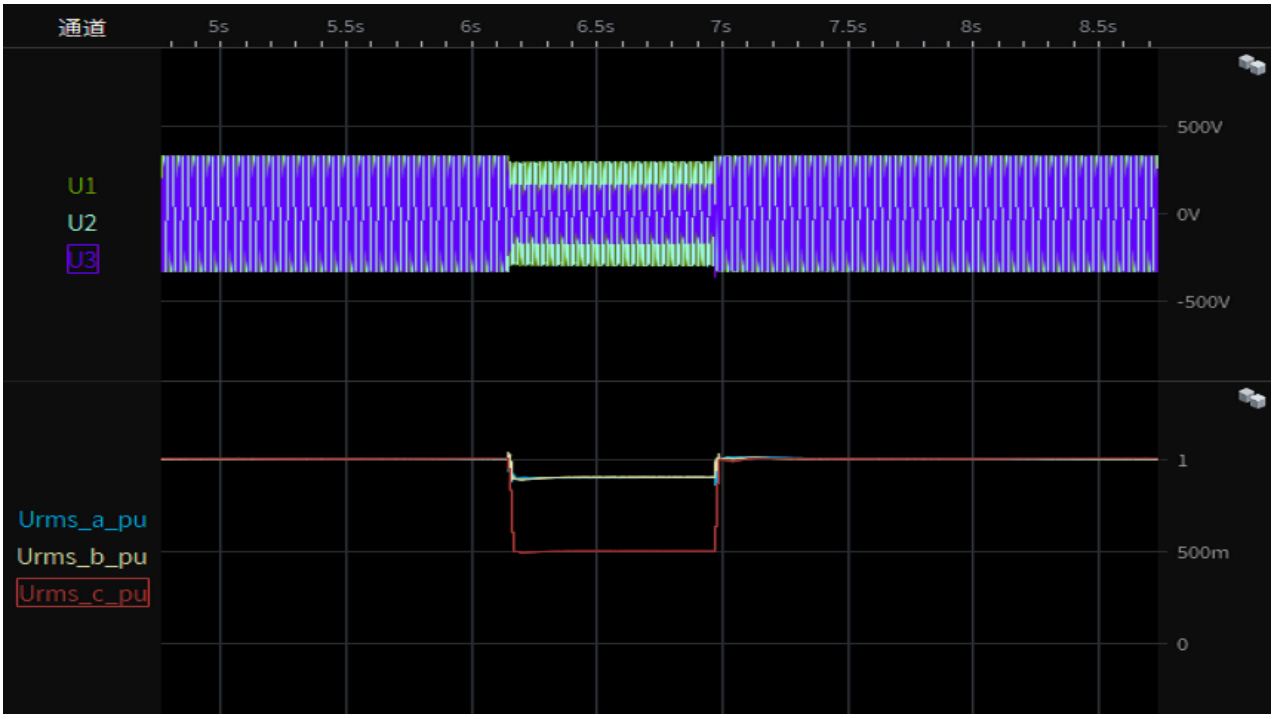


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3a-2.1 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),95% load
Test overview(voltage,current,active and reactive power)

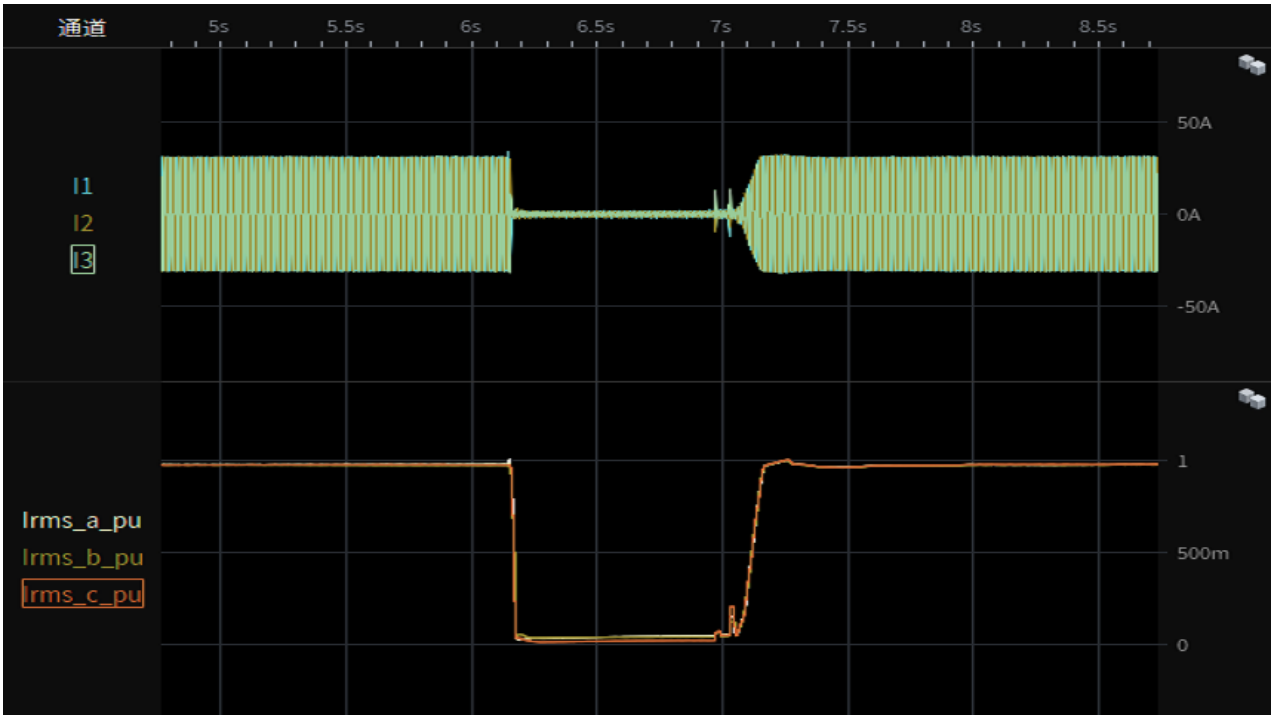


Test 3a-2.2 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

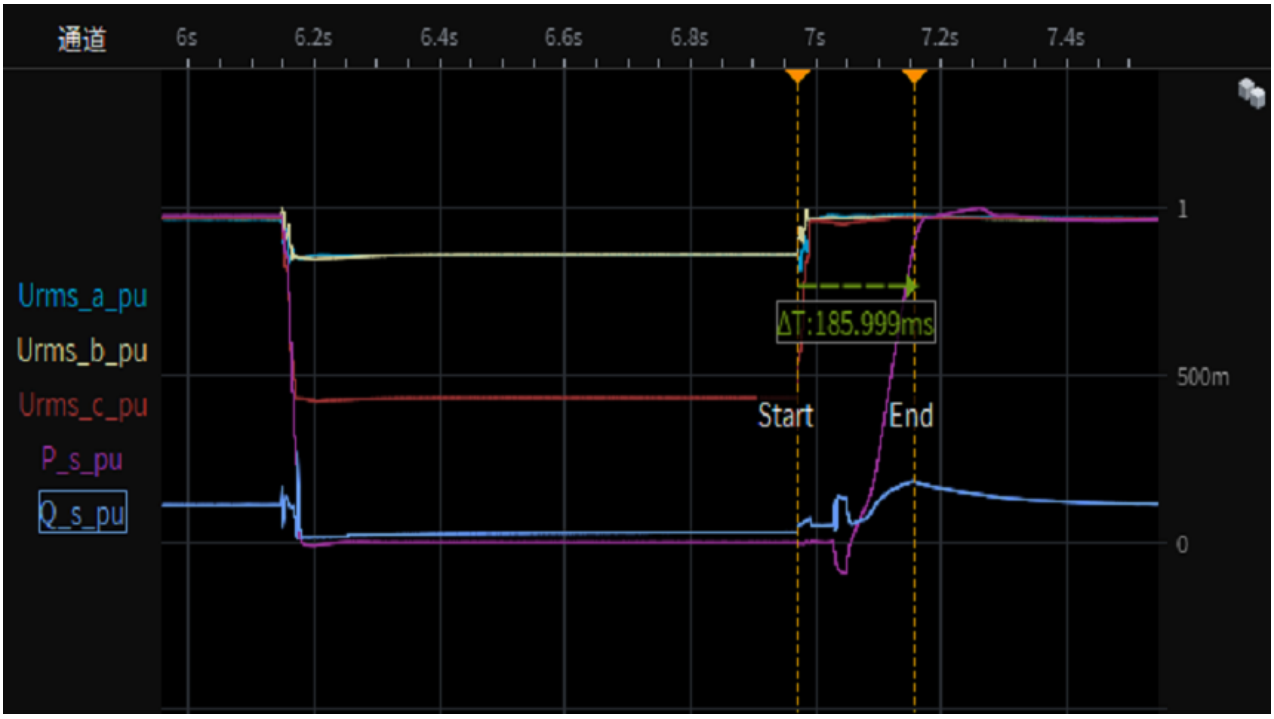


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3a-2.3 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase currents

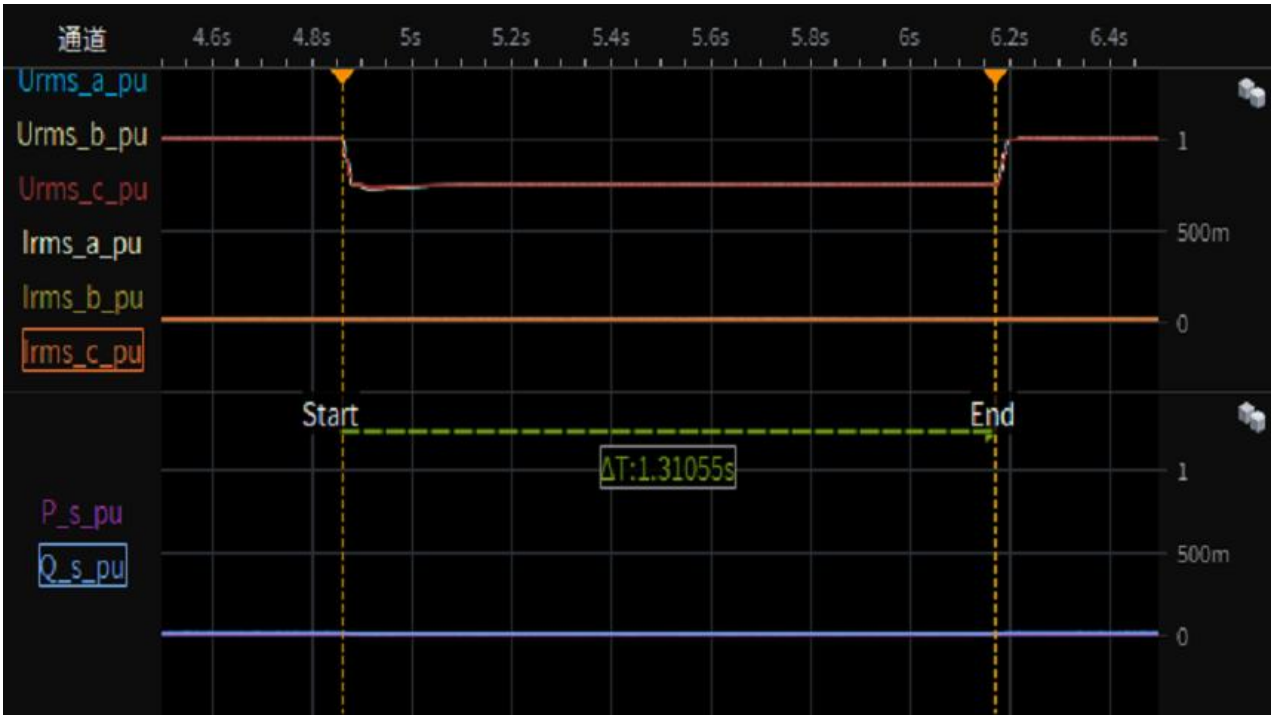


Test 3a-2.4 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D), 95% load
restoring time

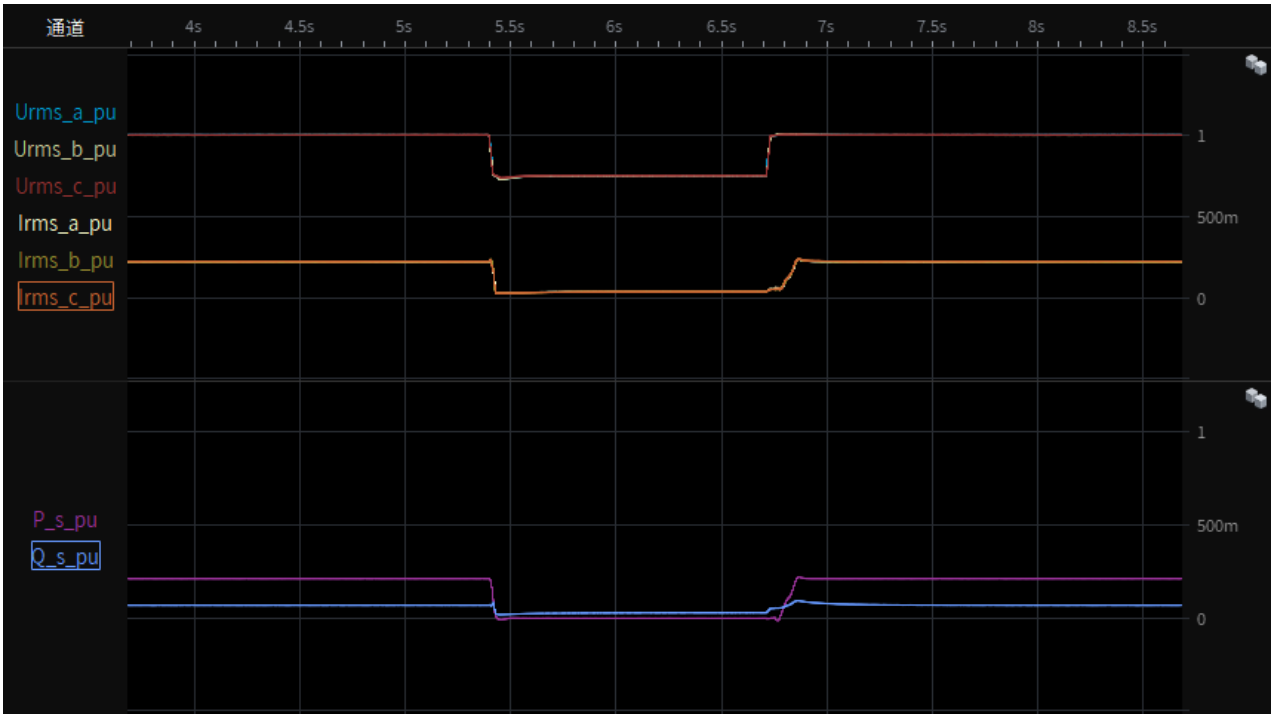


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4s-Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A), 0% load
Test overview(voltage,current,active and reactive power)

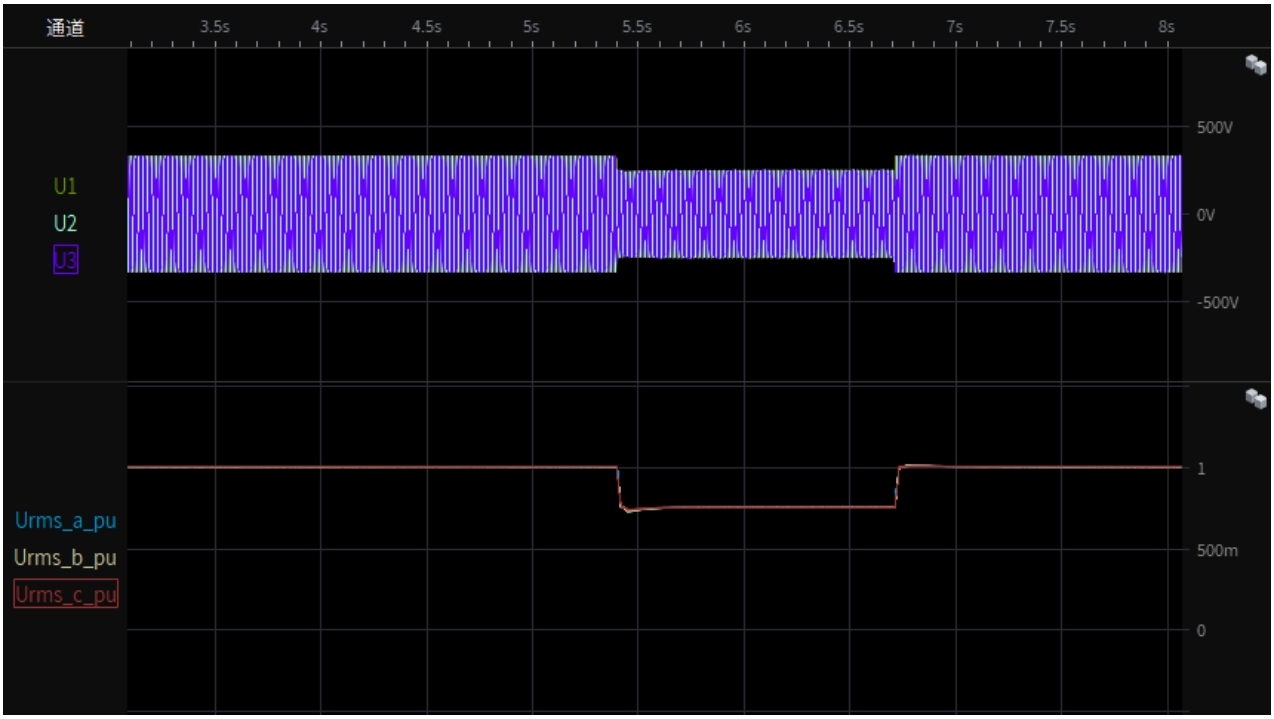


Test 4s-1.1 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)

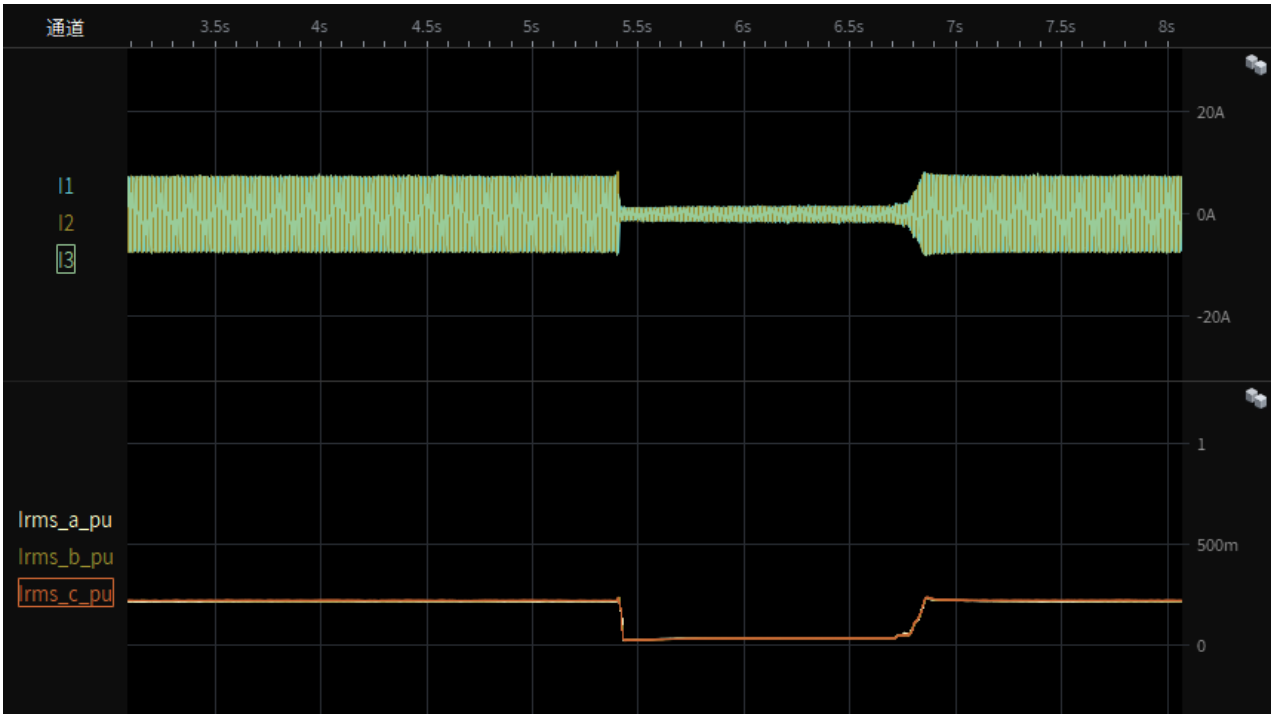


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4s-1.2 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

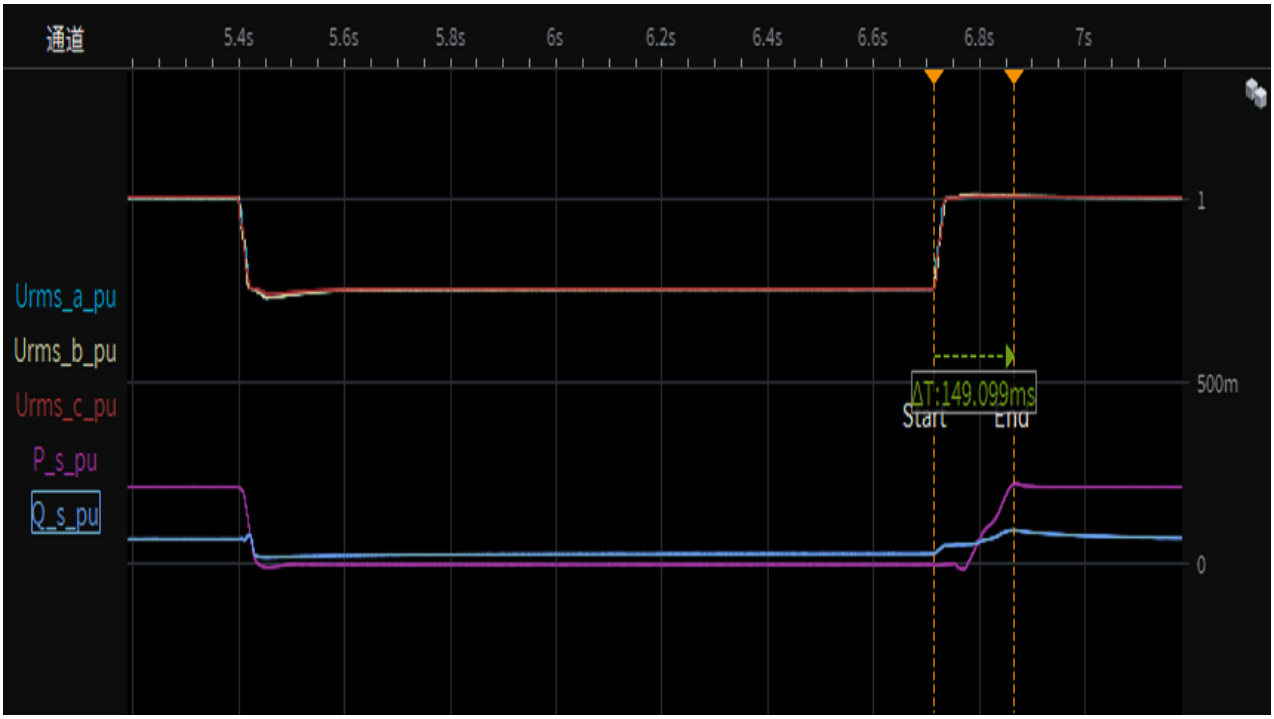


Test 4s-1.3 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents

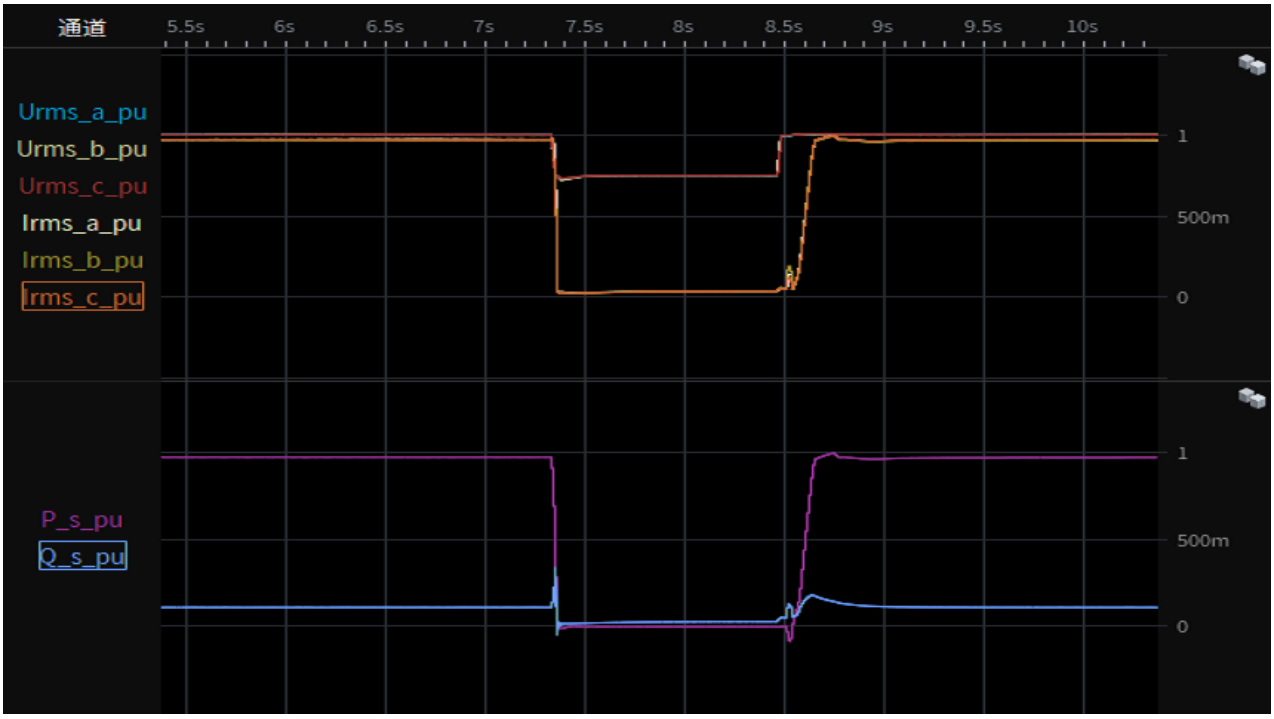


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4s-1.4 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),20% load restoring time

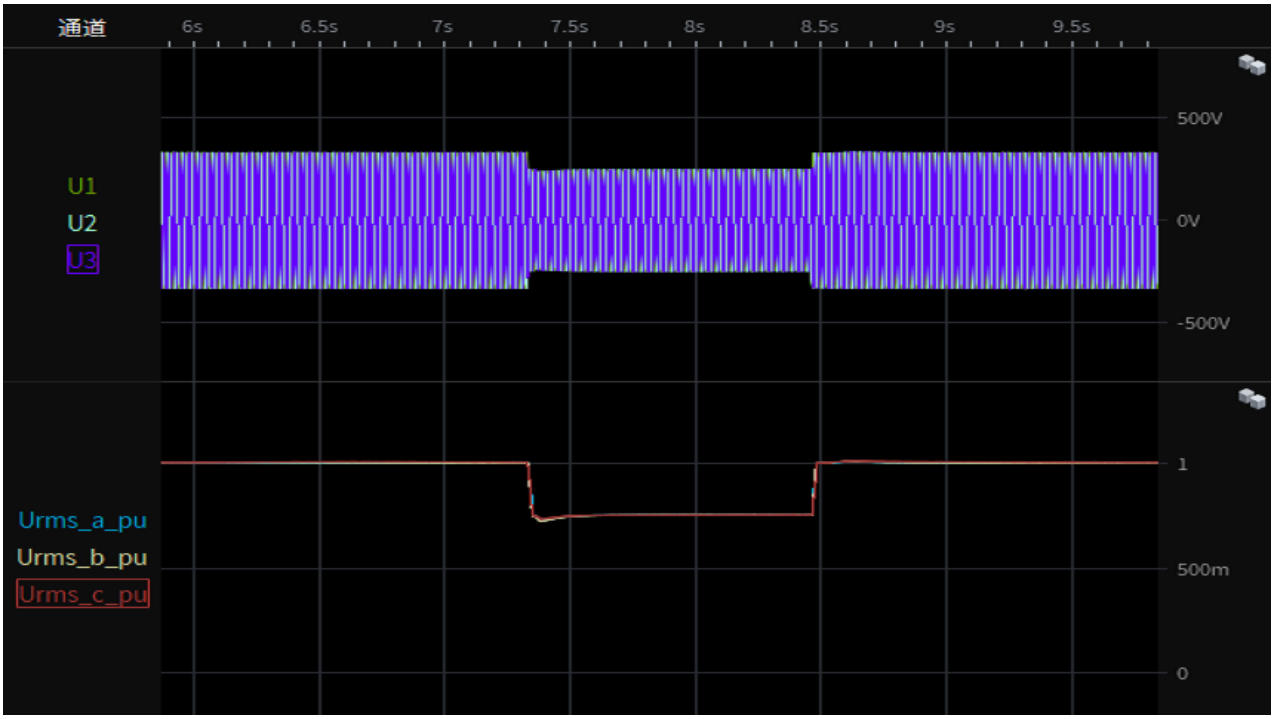


Test 4s-2.1 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),95% load
Test overview(voltage,current,active and reactive power)

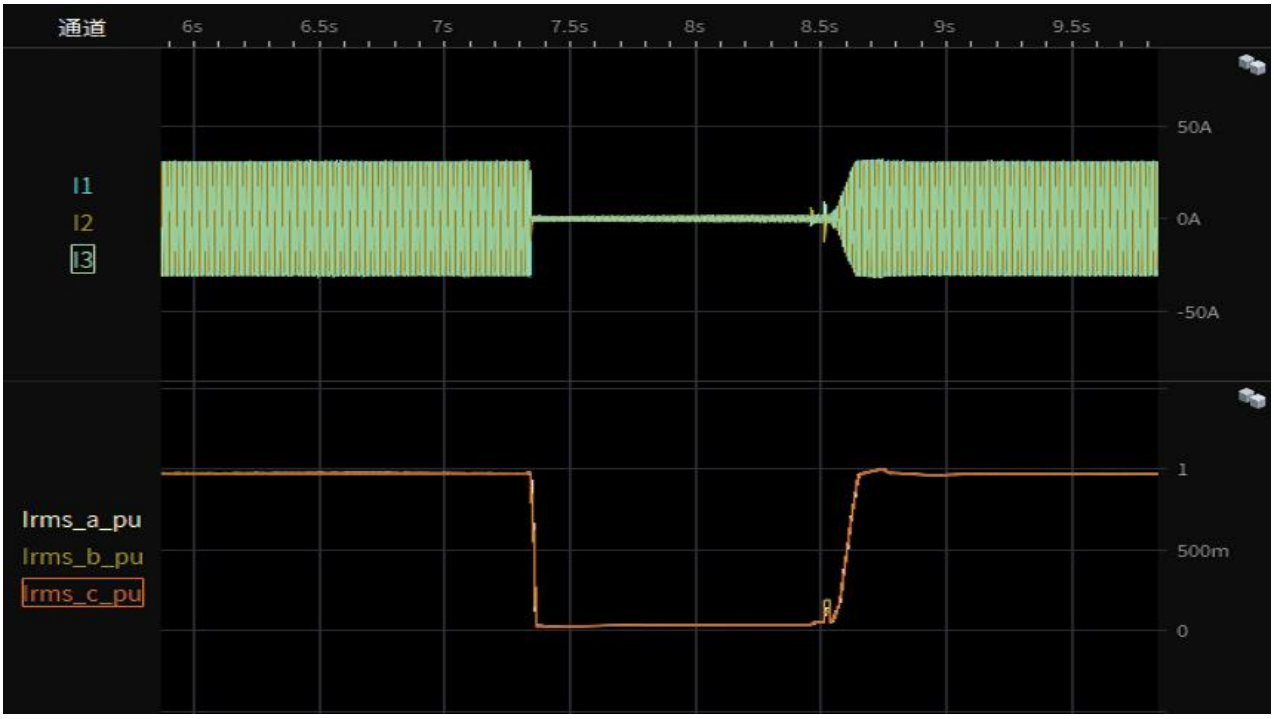


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4s-2.2 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

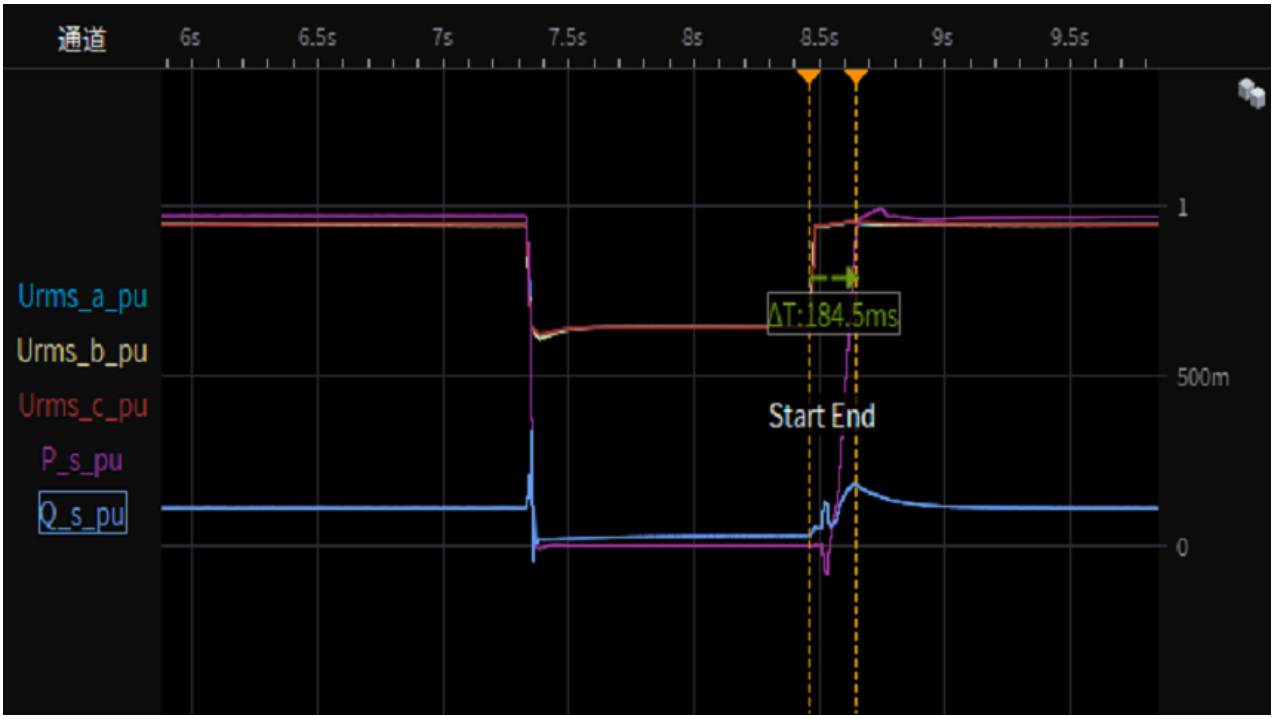


Test 4s-2.3 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents

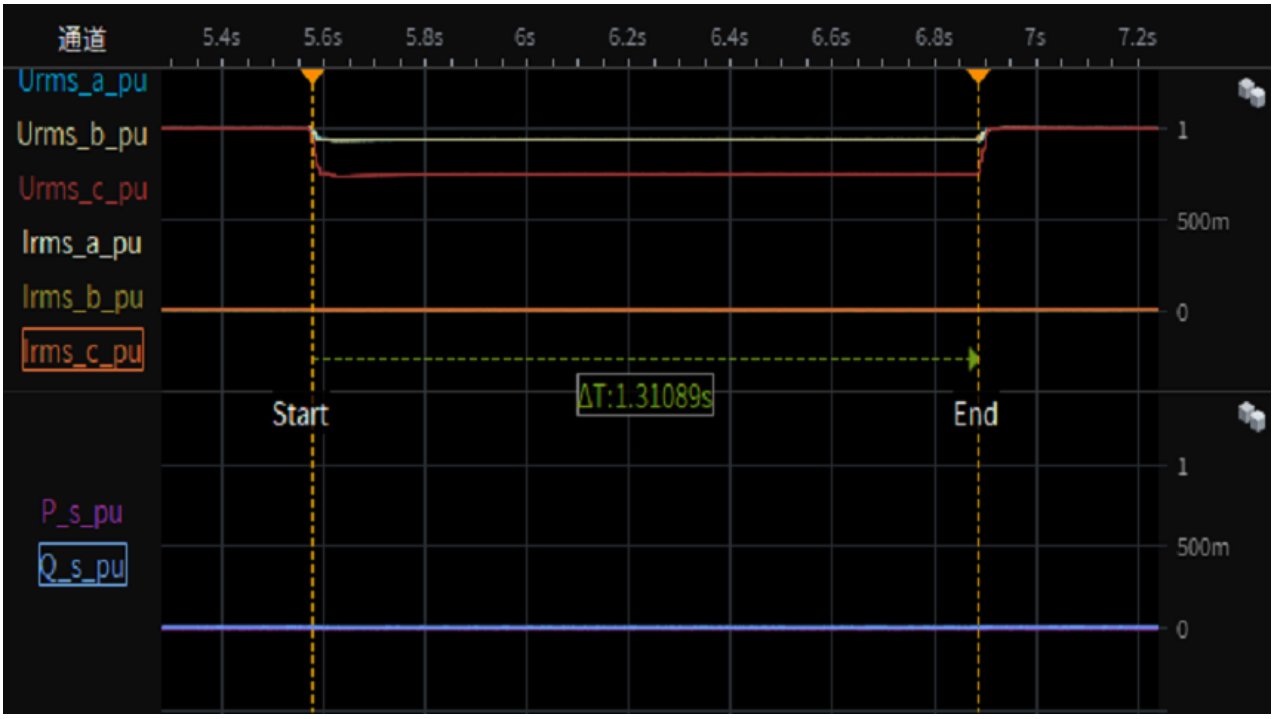


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4s-2.4 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A), 95% load restoring time

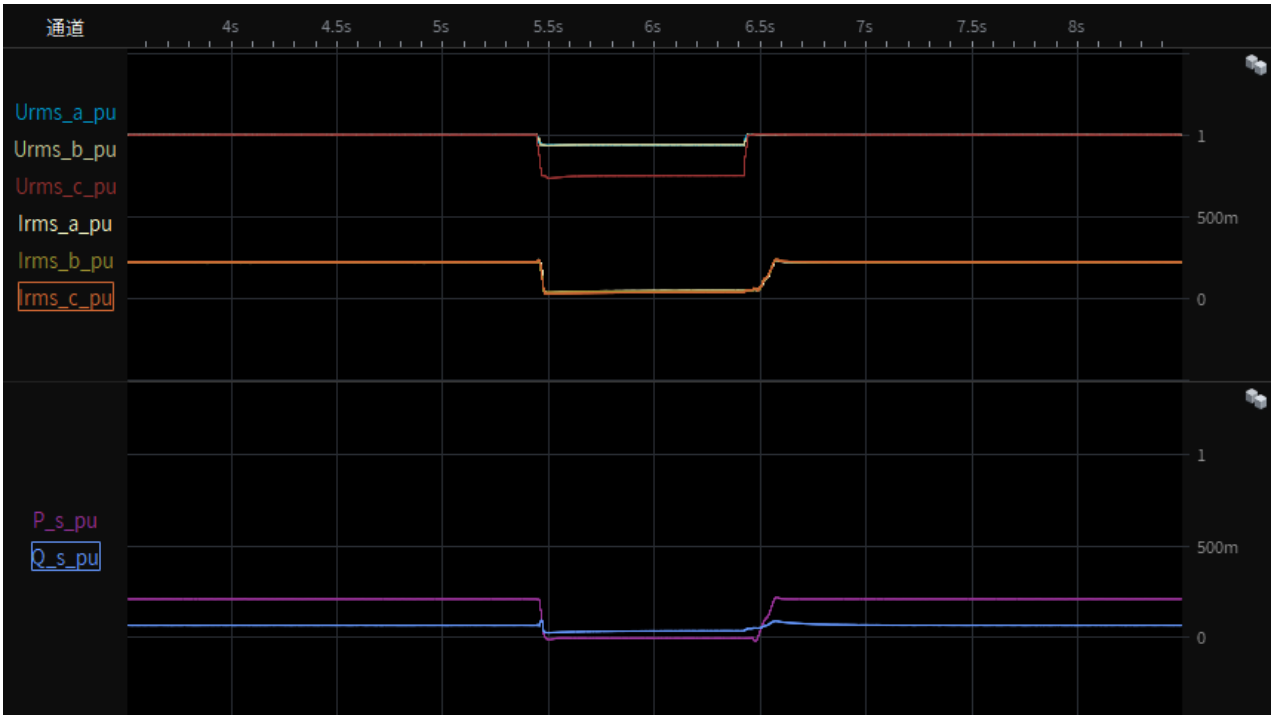


Test 4a-Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D), 0% load
Test overview(voltage,current,active and reactive power)

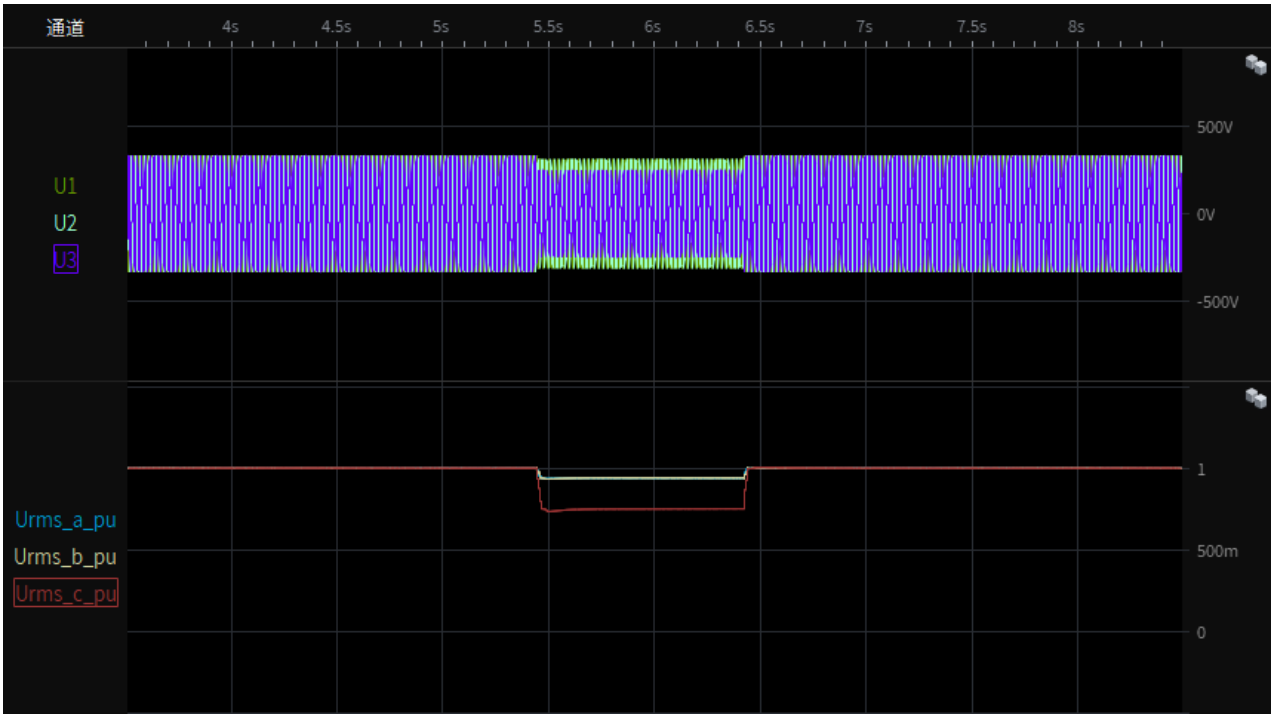


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4a-1.1 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),20% load
Test overview(voltage,current,active and reactive power)

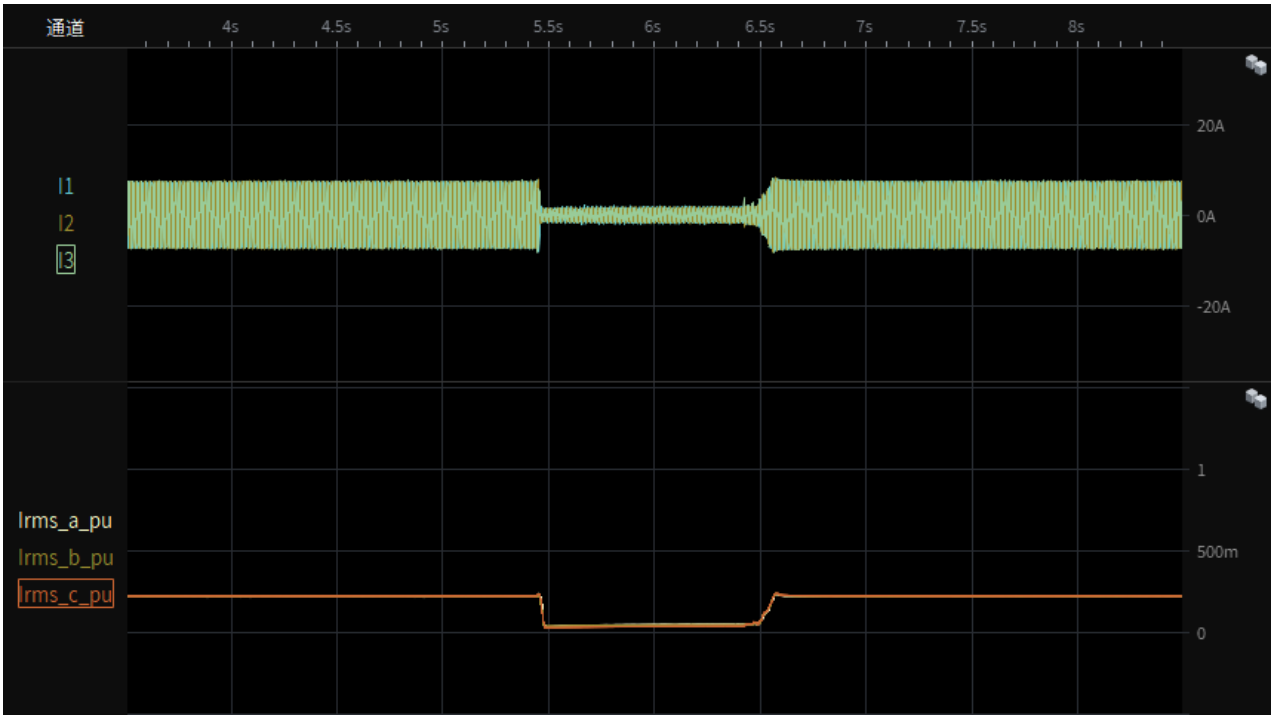


Test 4a-1.2 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

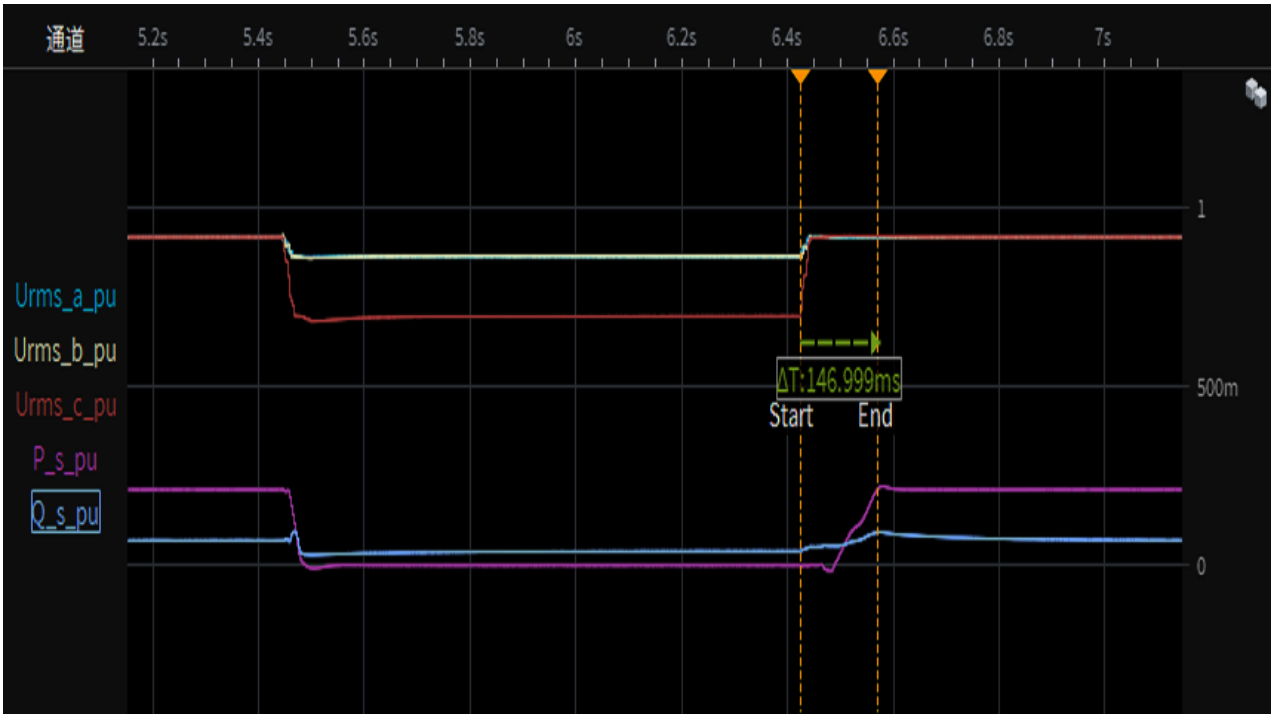


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4a-1.3 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase currents

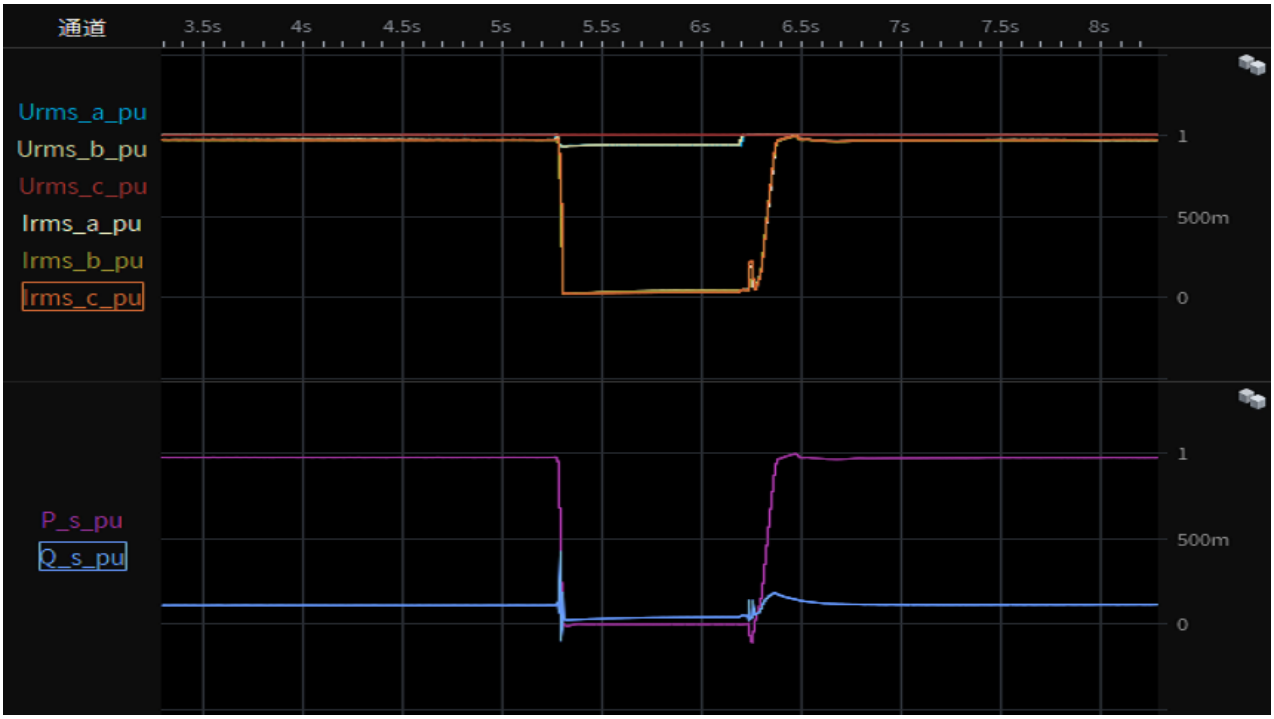


Test 4a-1.4 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),20% load
restoring time

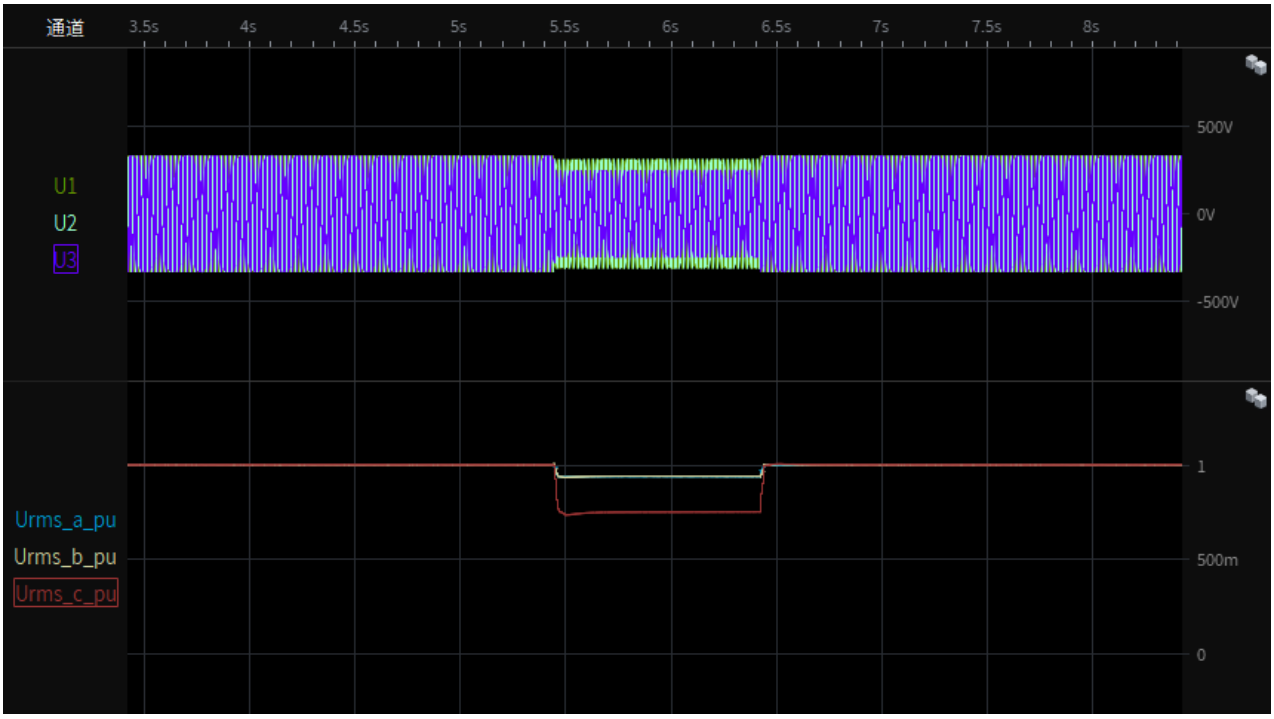


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4a-2.1 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),95% load
Test overview(voltage,current,active and reactive power)

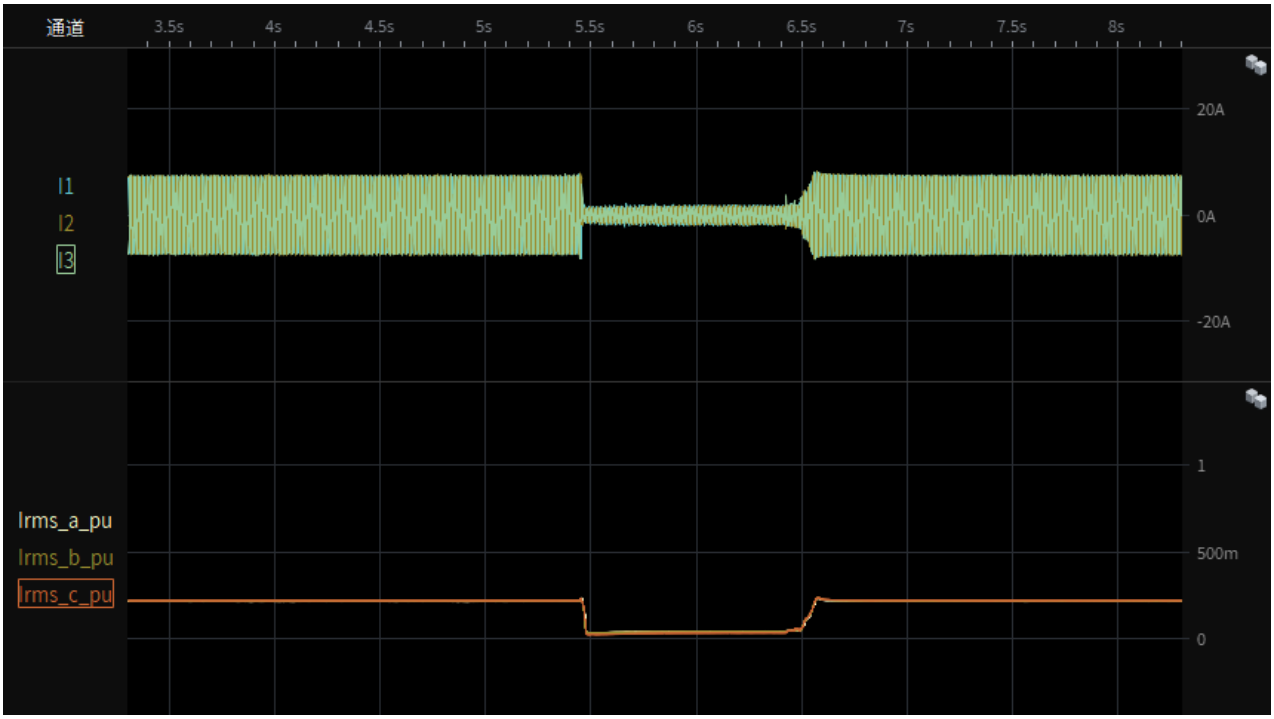


Test 4a-2.2 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

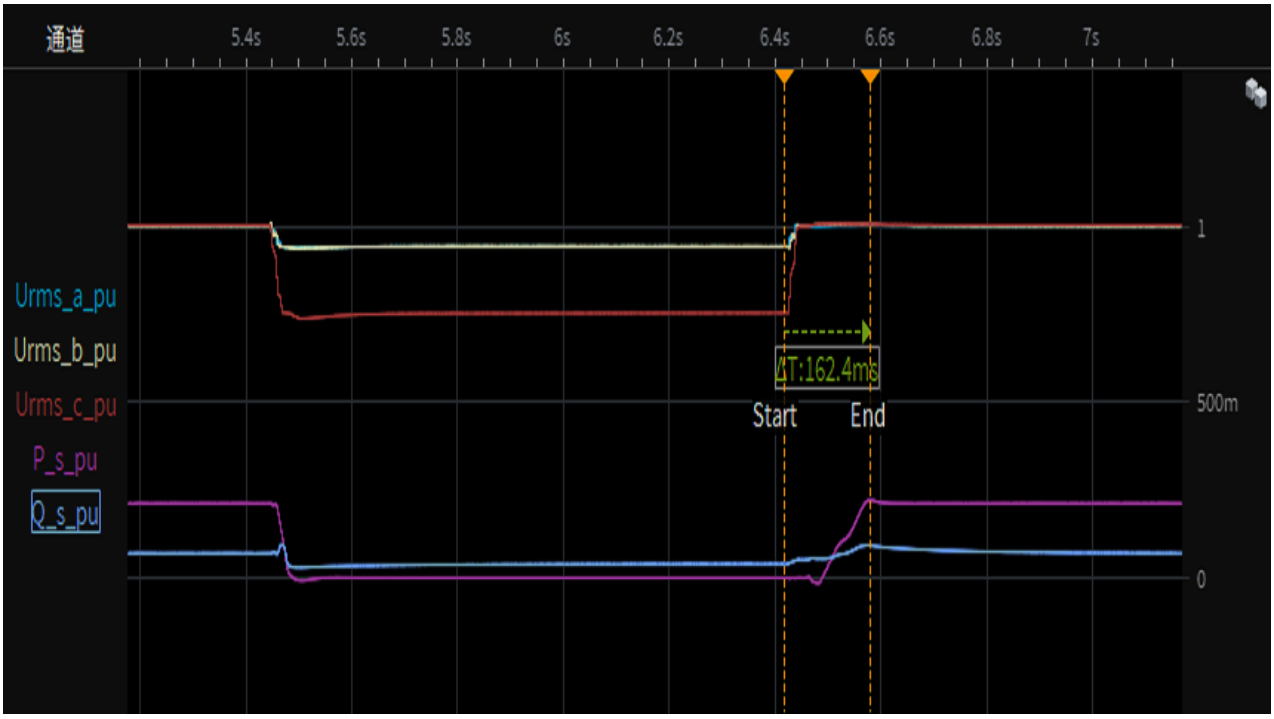


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4a-2.3 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase currents

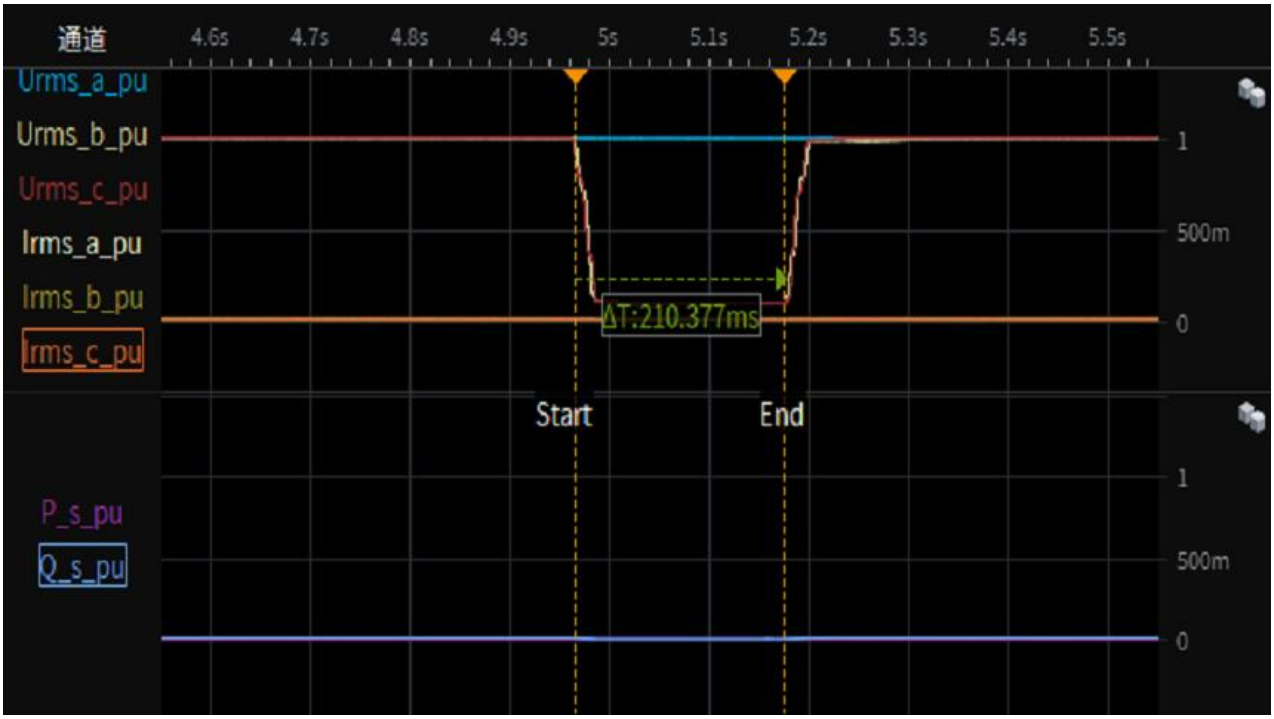


Test 4a-2.4 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D), 95% load
restoring time

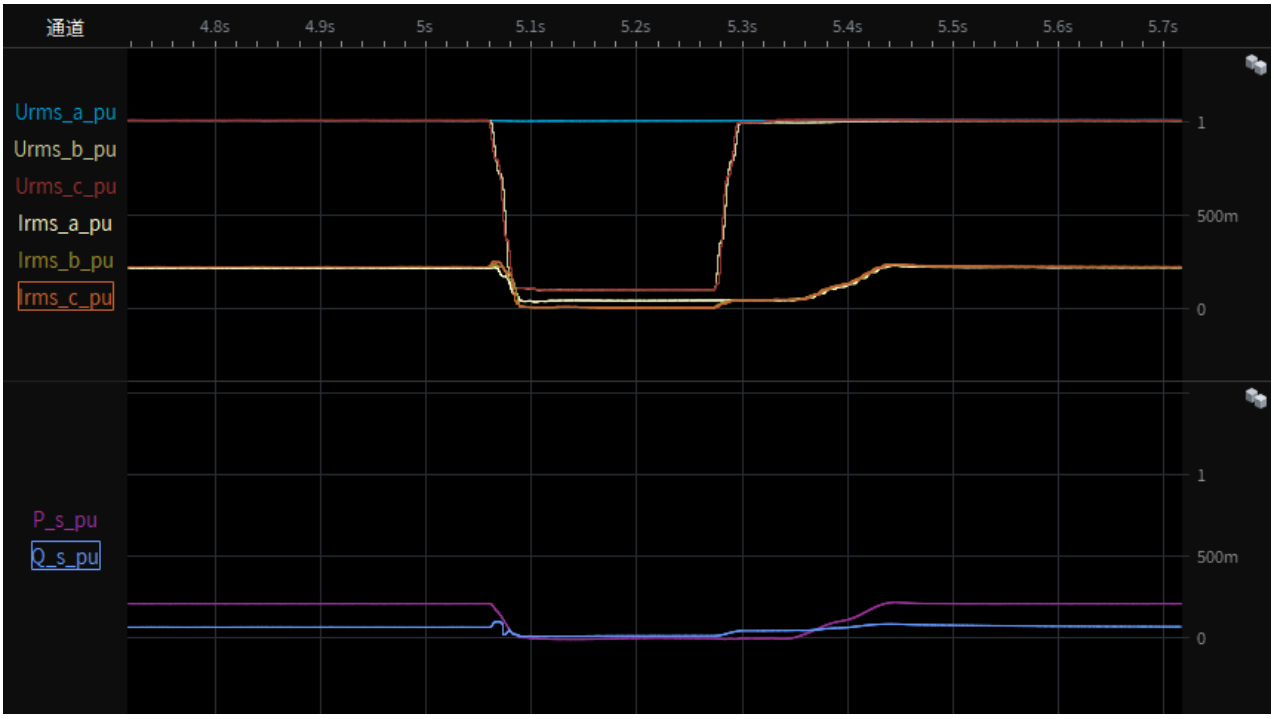


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 5-Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D), 0% load
Test overview(voltage,current,active and reactive power)

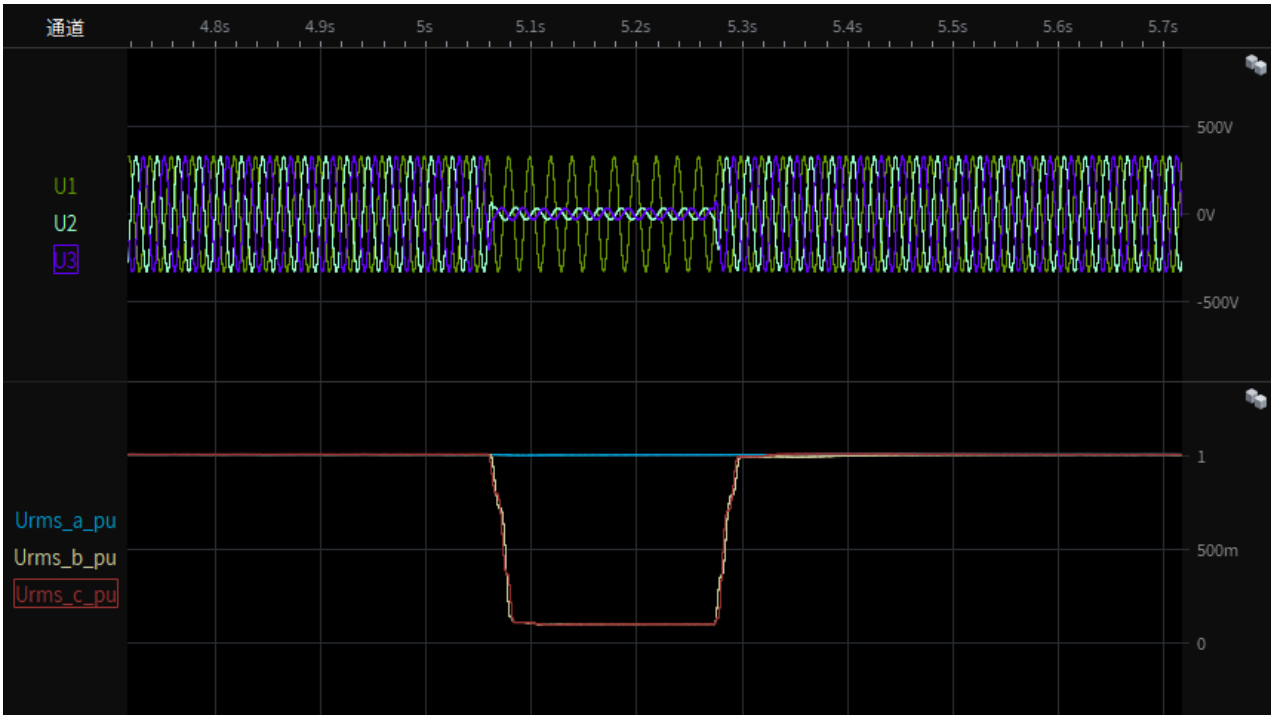


Test 5-1.1 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),20% load
Test overview(voltage,current,active and reactive power)

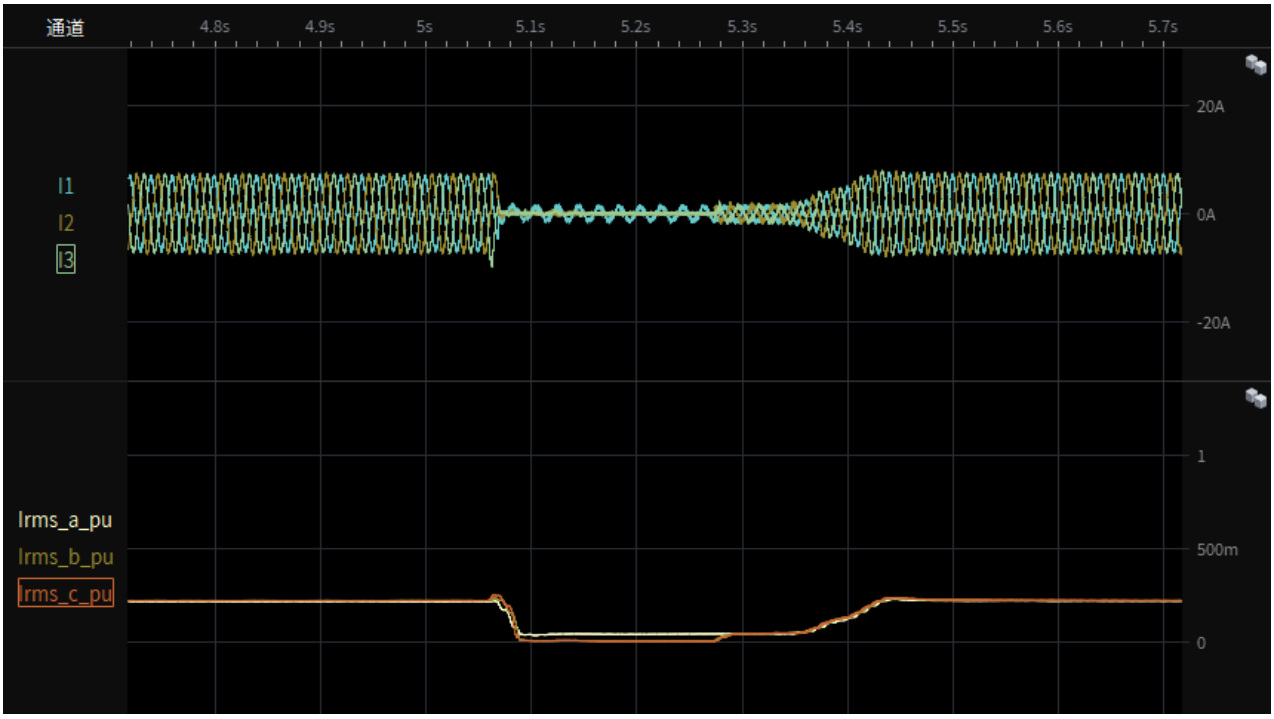


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 5-1.2 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

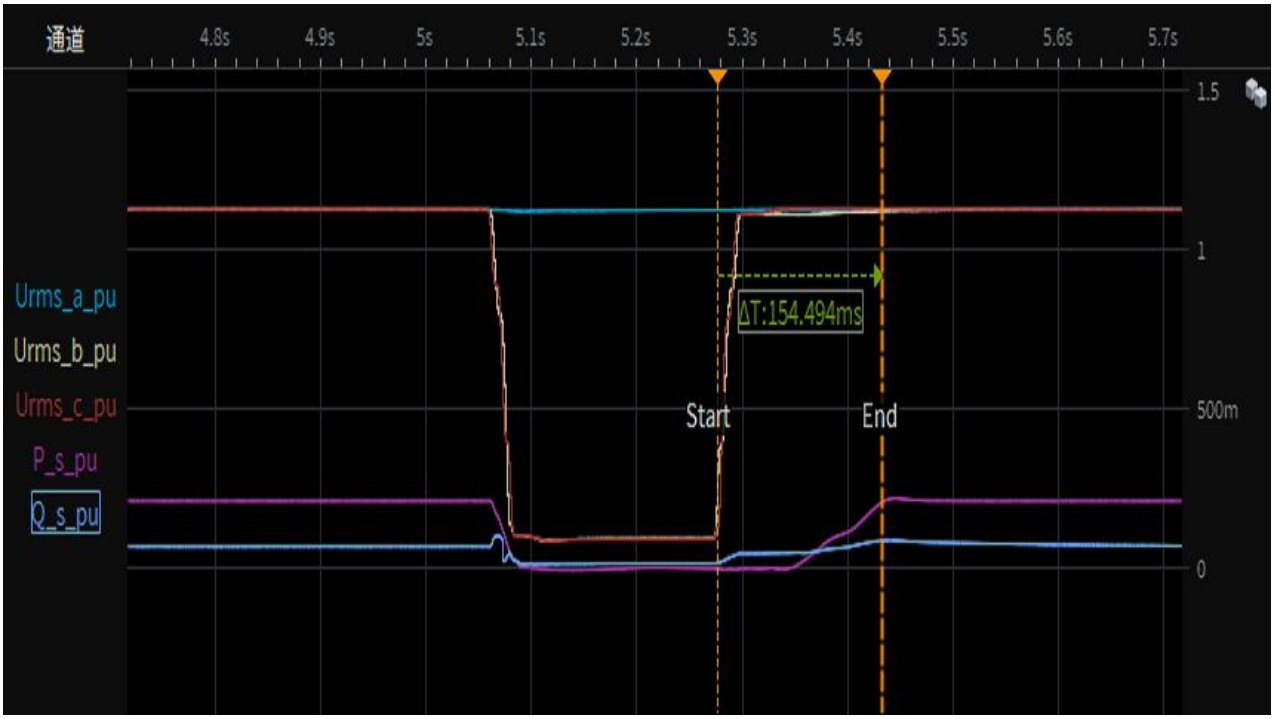


Test 5-1.3 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase currents

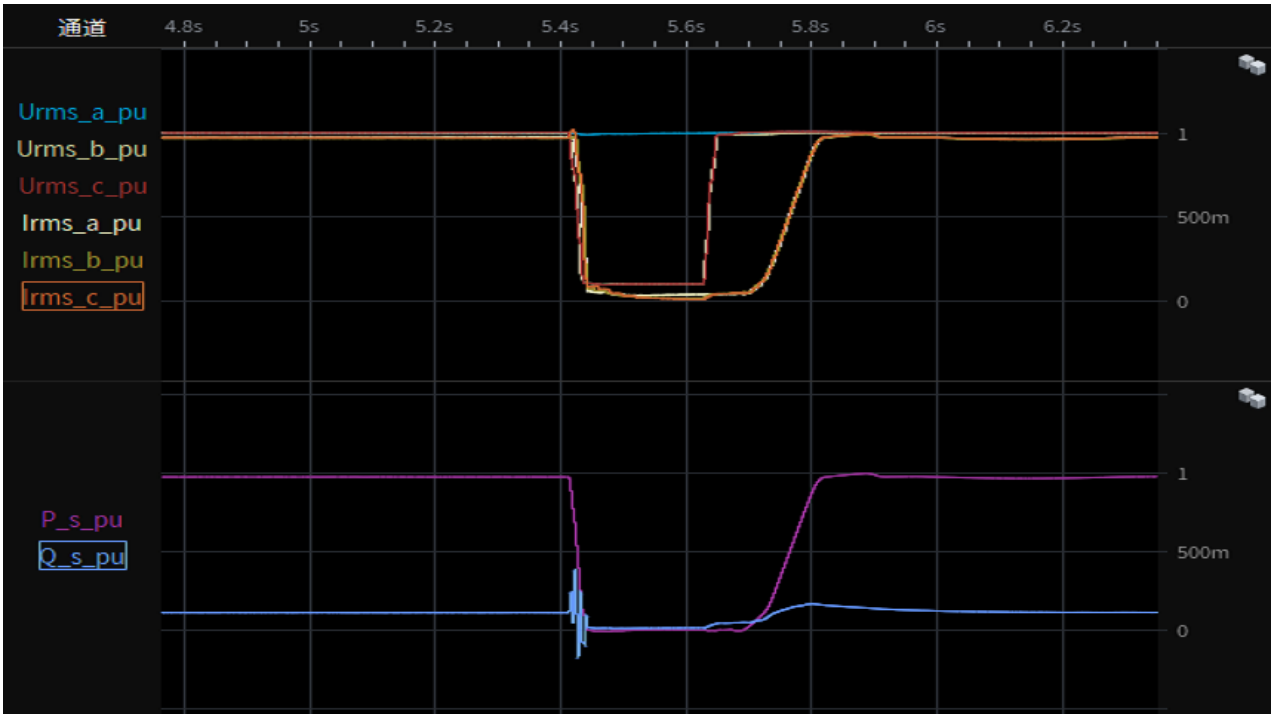


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 5-1.4 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),20% load restoring time

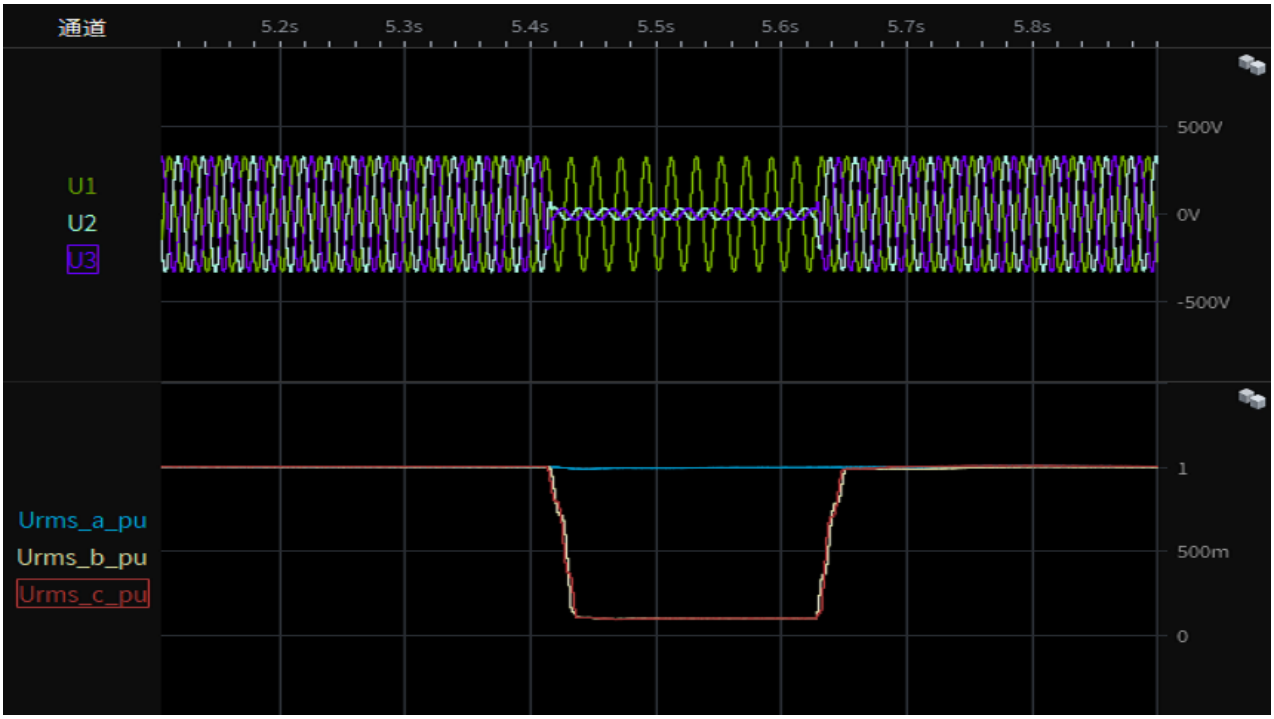


Test 5-2.1 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),95% load
Test overview(voltage,current,active and reactive power)

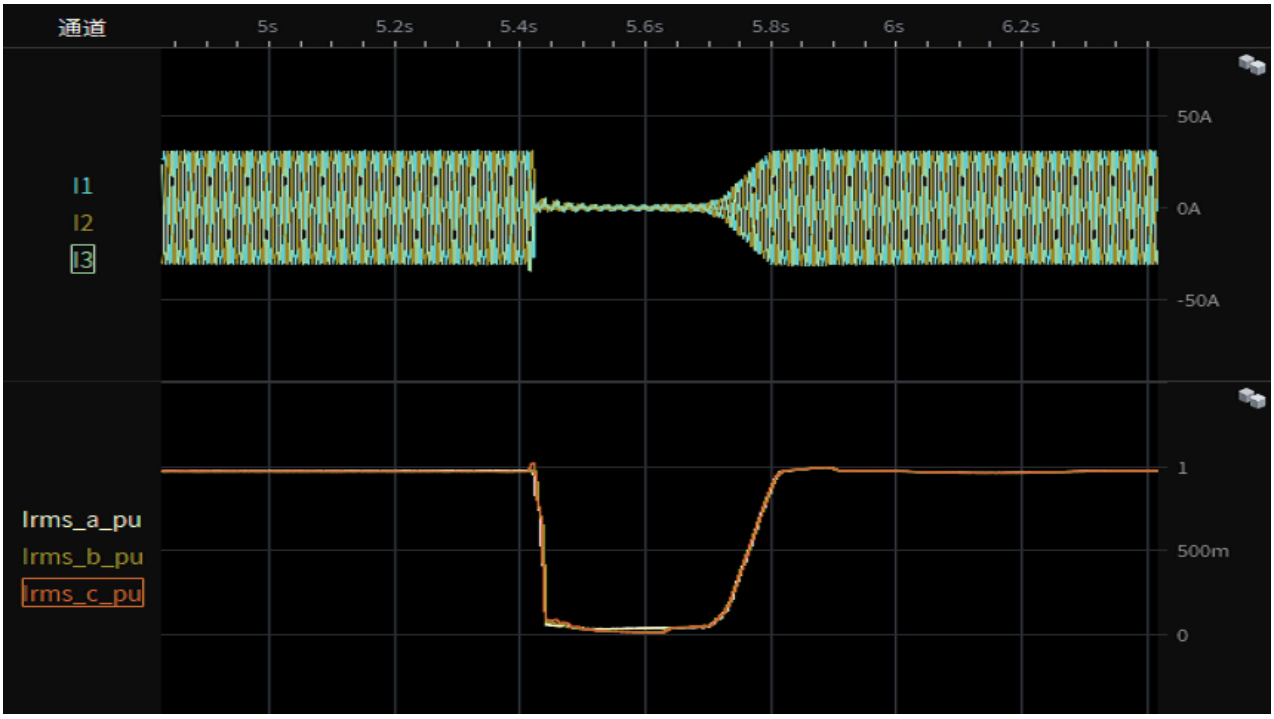


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 5-2.2 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

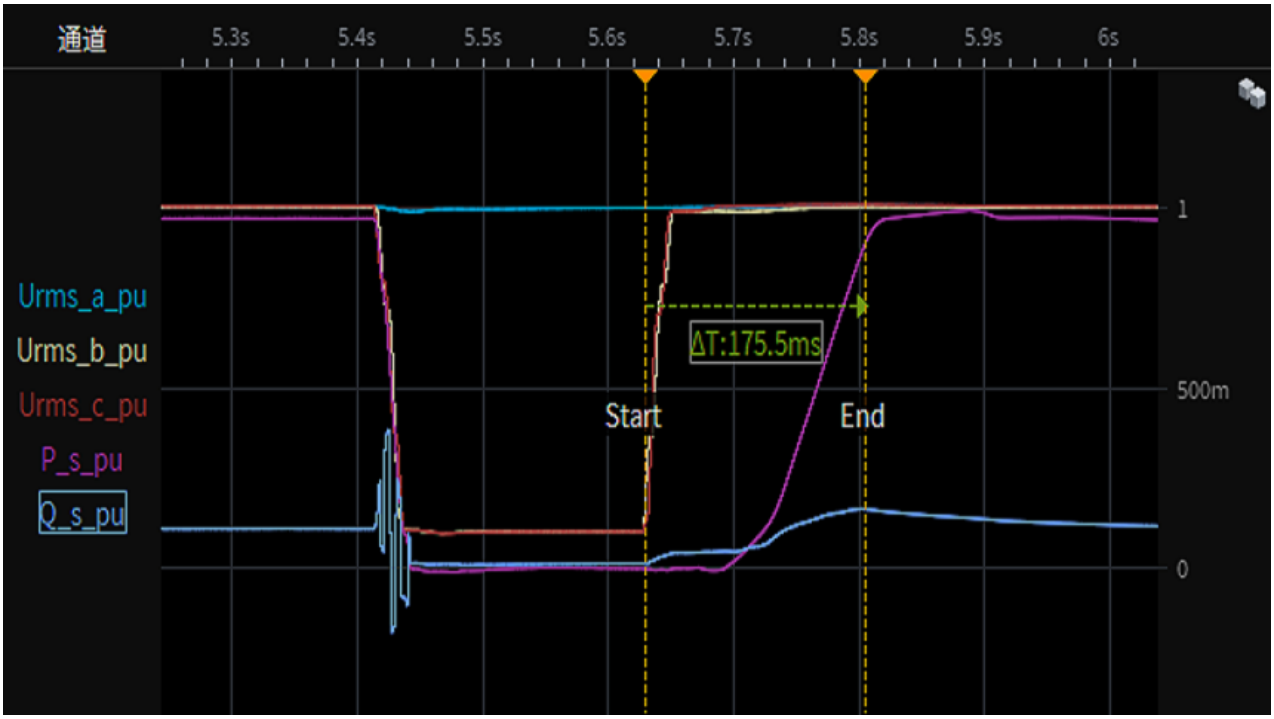


Test 5-2.3 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase currents

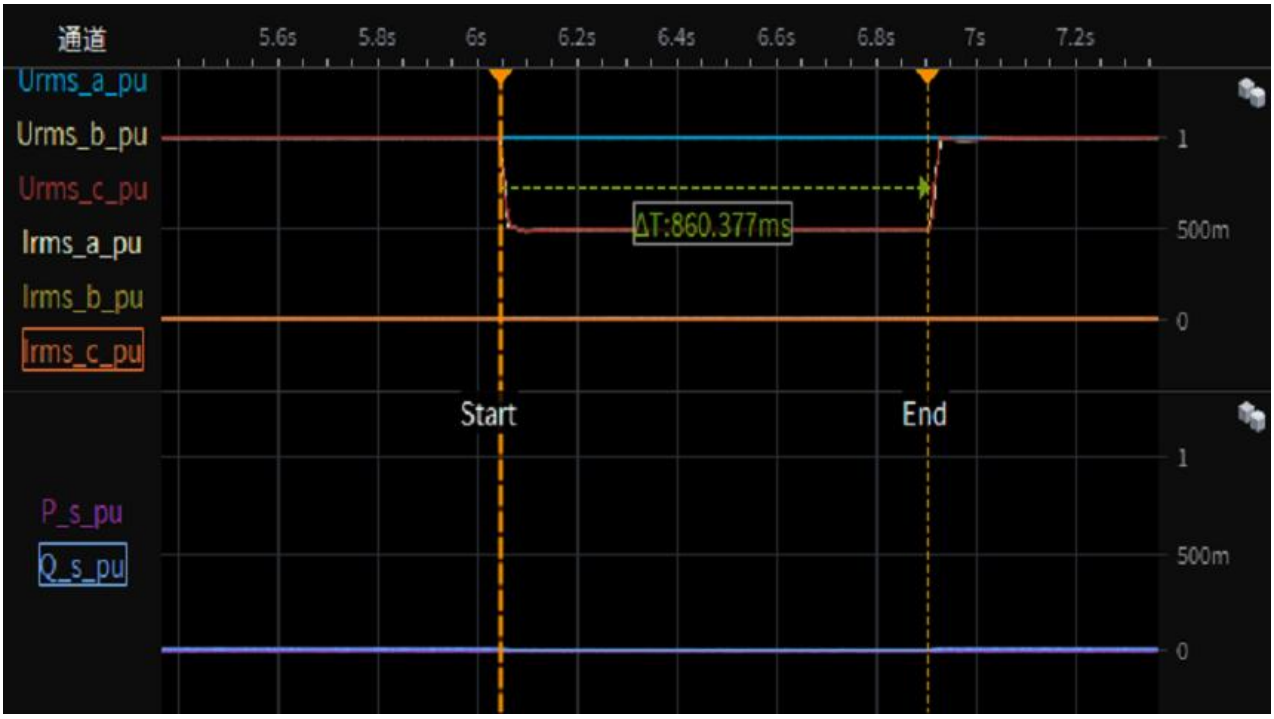


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 5-2.4 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D), 95% load restoring time

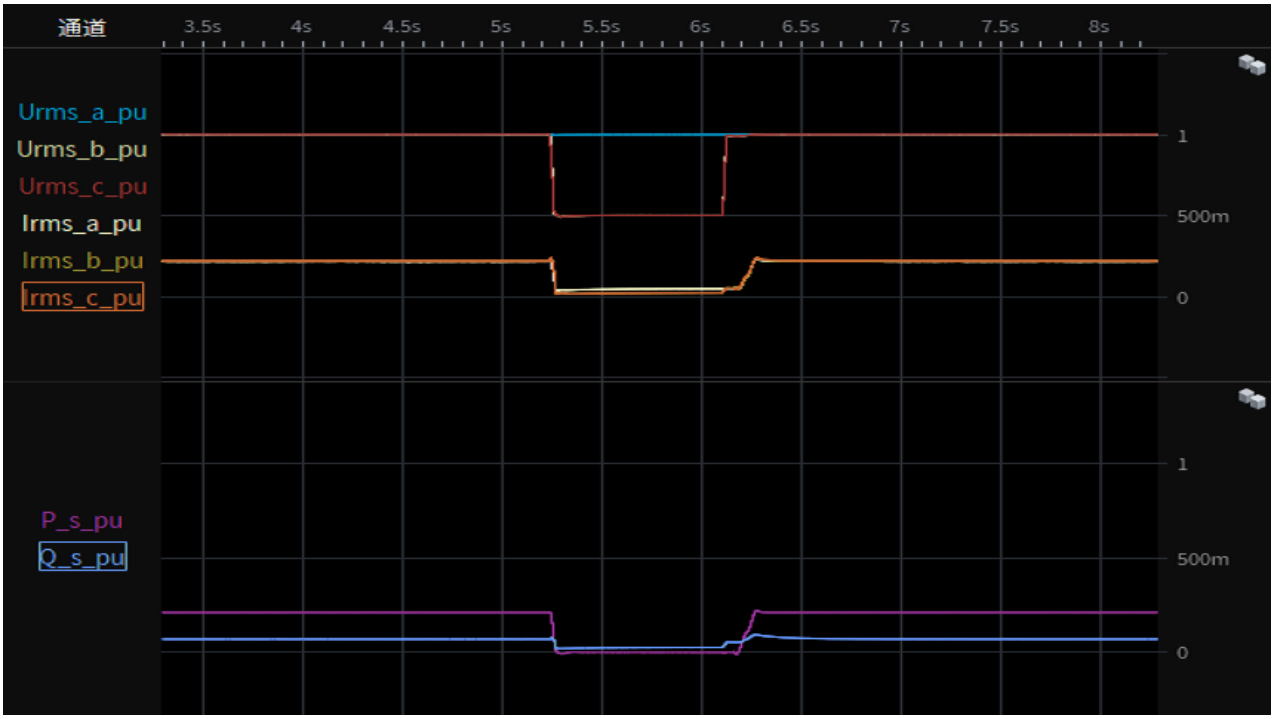


Test 6-Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D), 0% load
Test overview(voltage,current,active and reactive power)

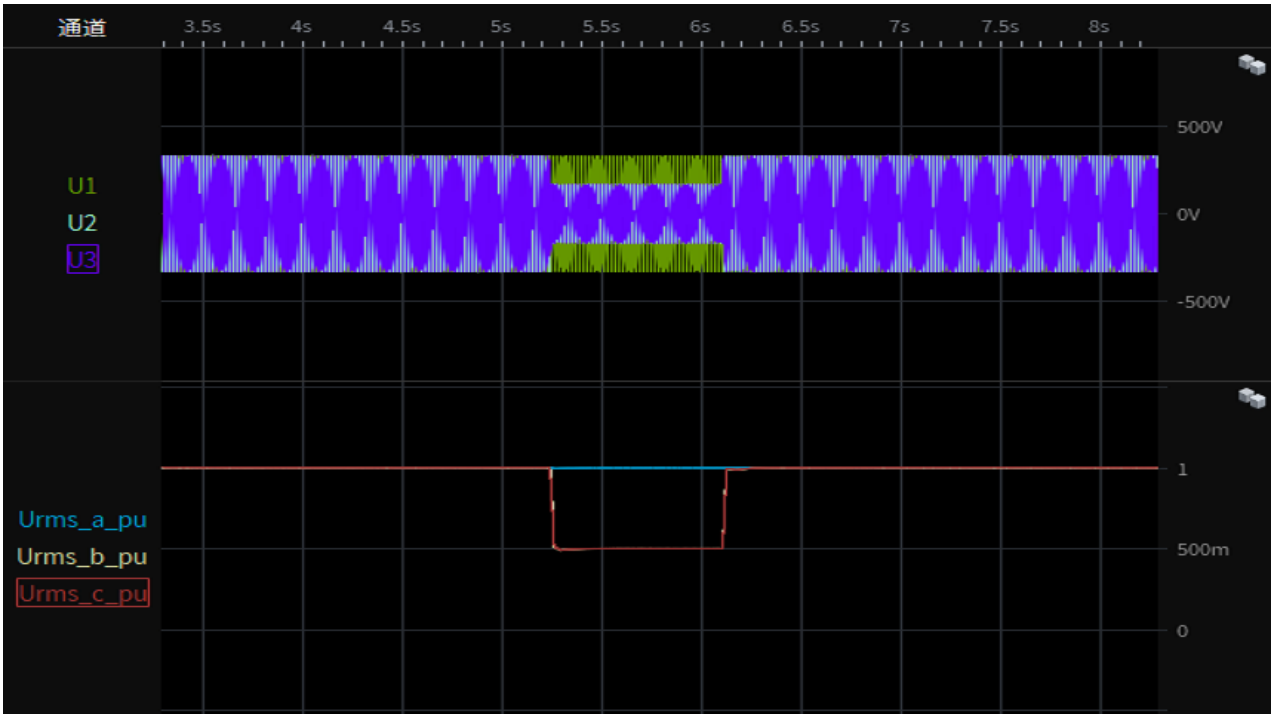


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 6-1.1 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),20% load
Test overview(voltage,current,active and reactive power)

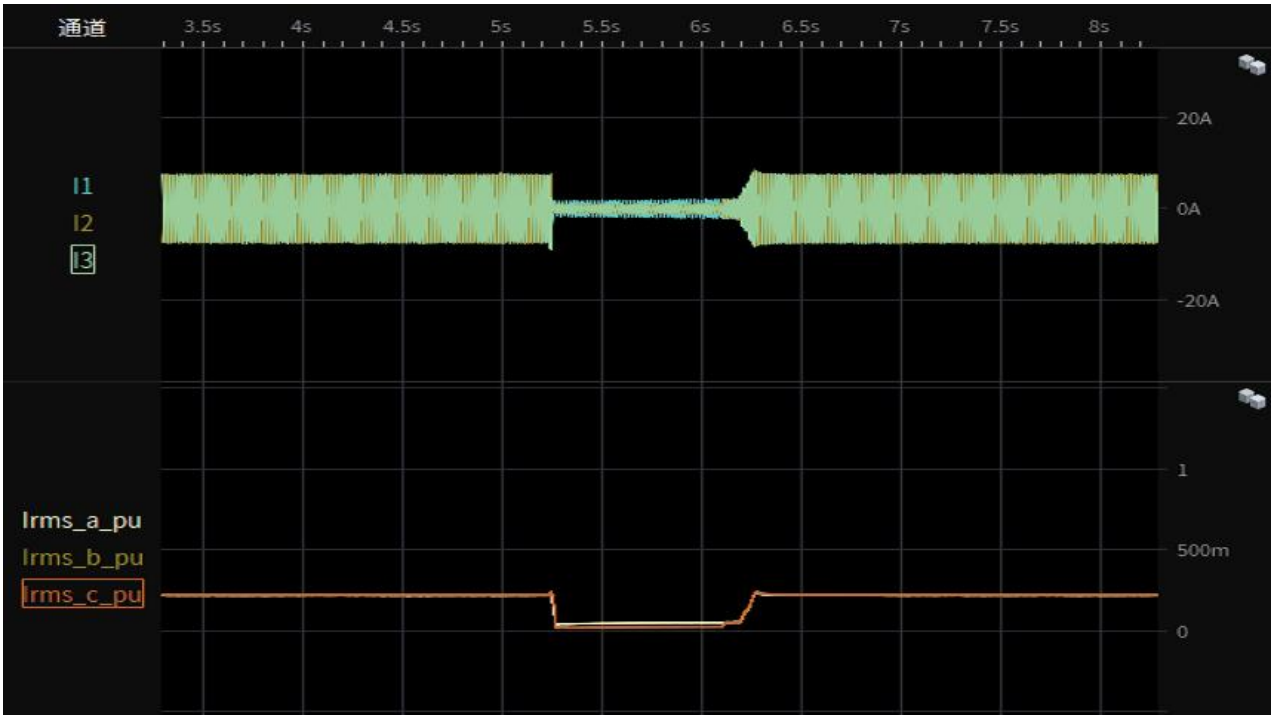


Test 6-1.2 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 6-1.3 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase currents

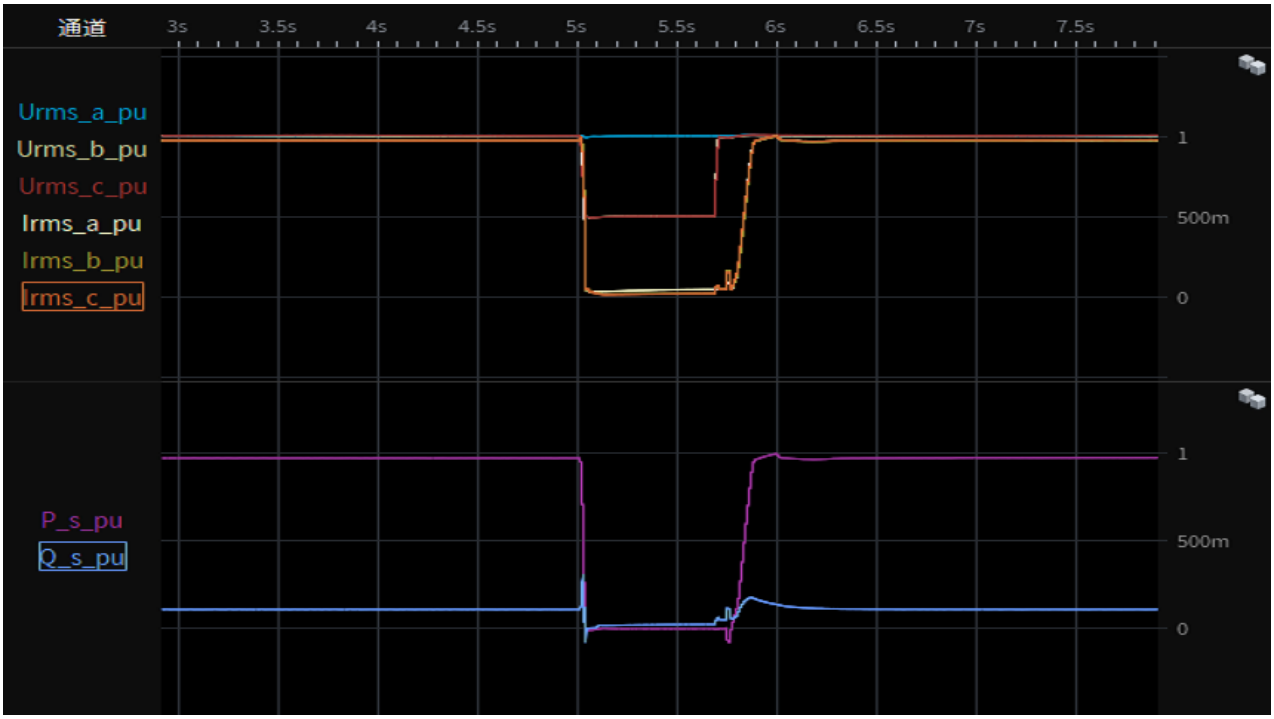


Test 6-1.4 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),20% load
restoring time

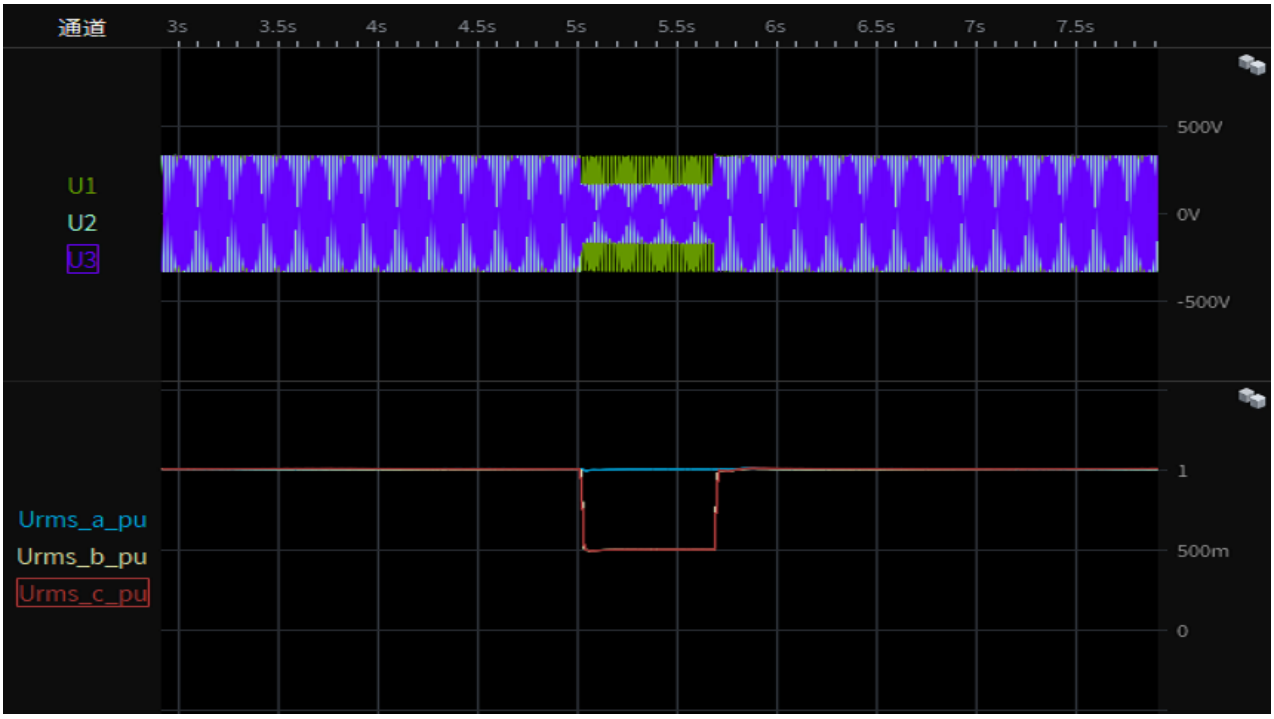


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 6-2.1 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),95% load
Test overview(voltage,current,active and reactive power)

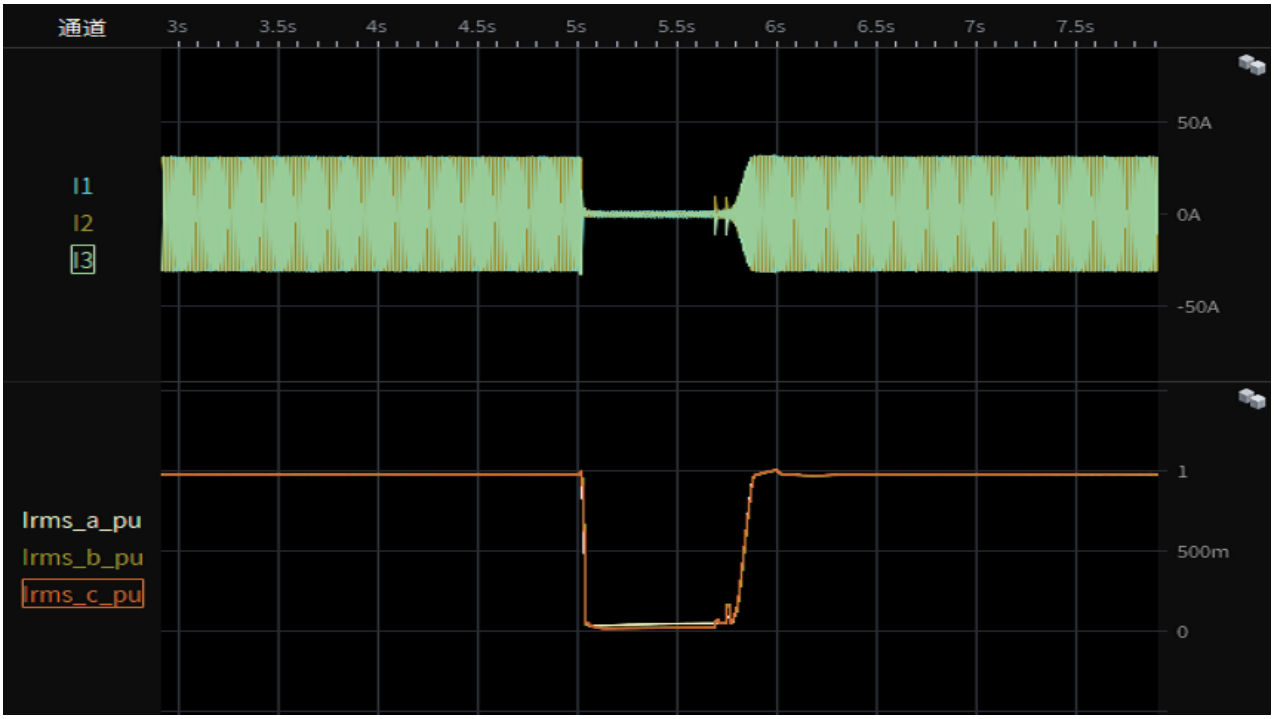


Test 6-2.2 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

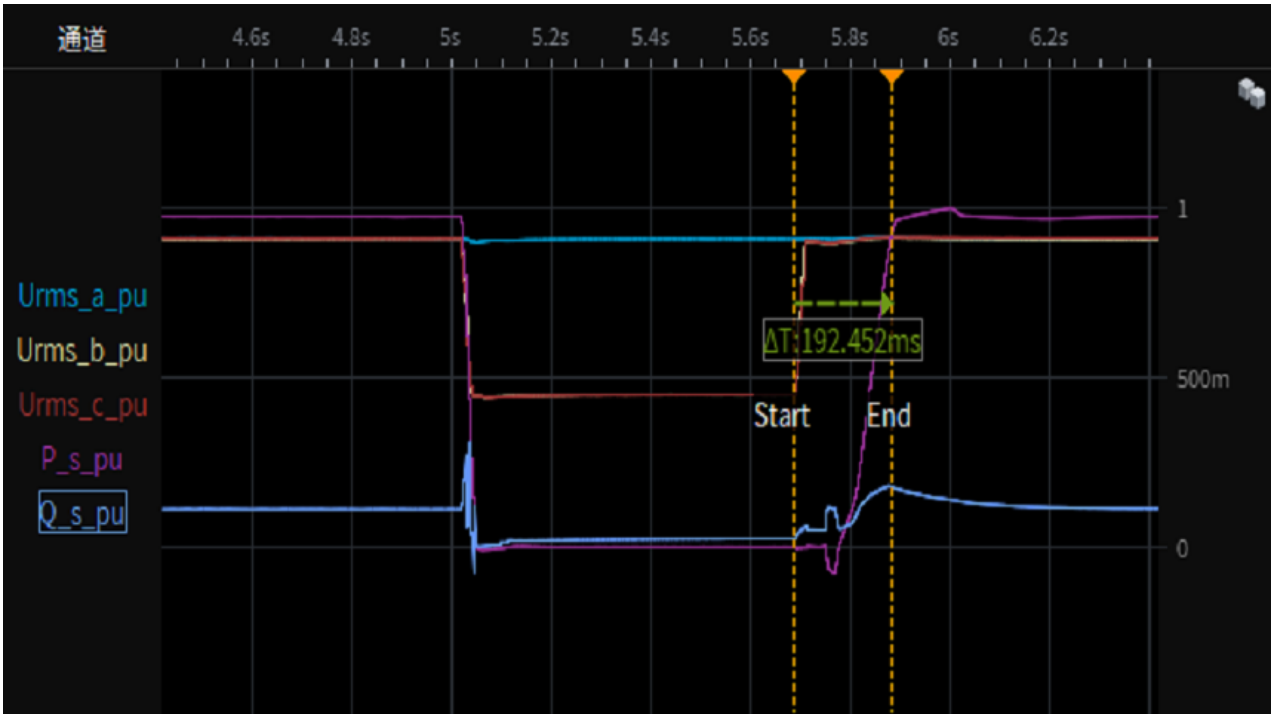


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 6-2.3 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase currents

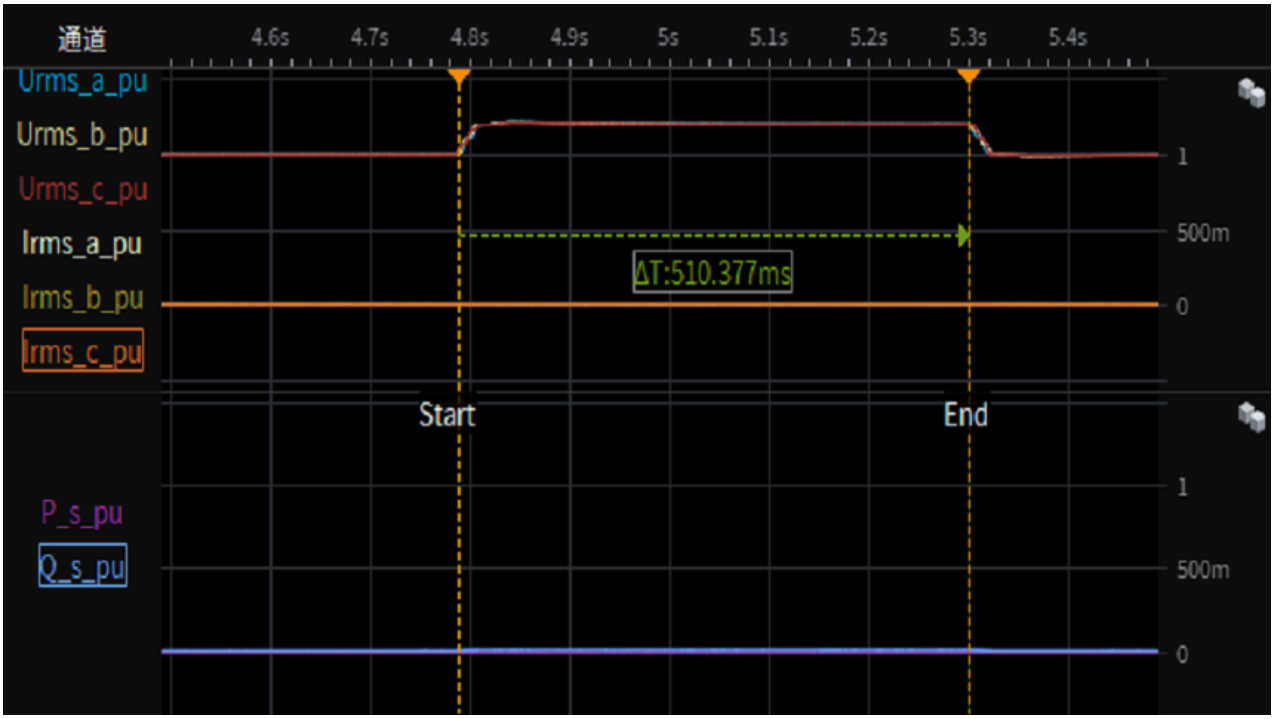


Test 6-2.4 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D), 95% load
restoring time

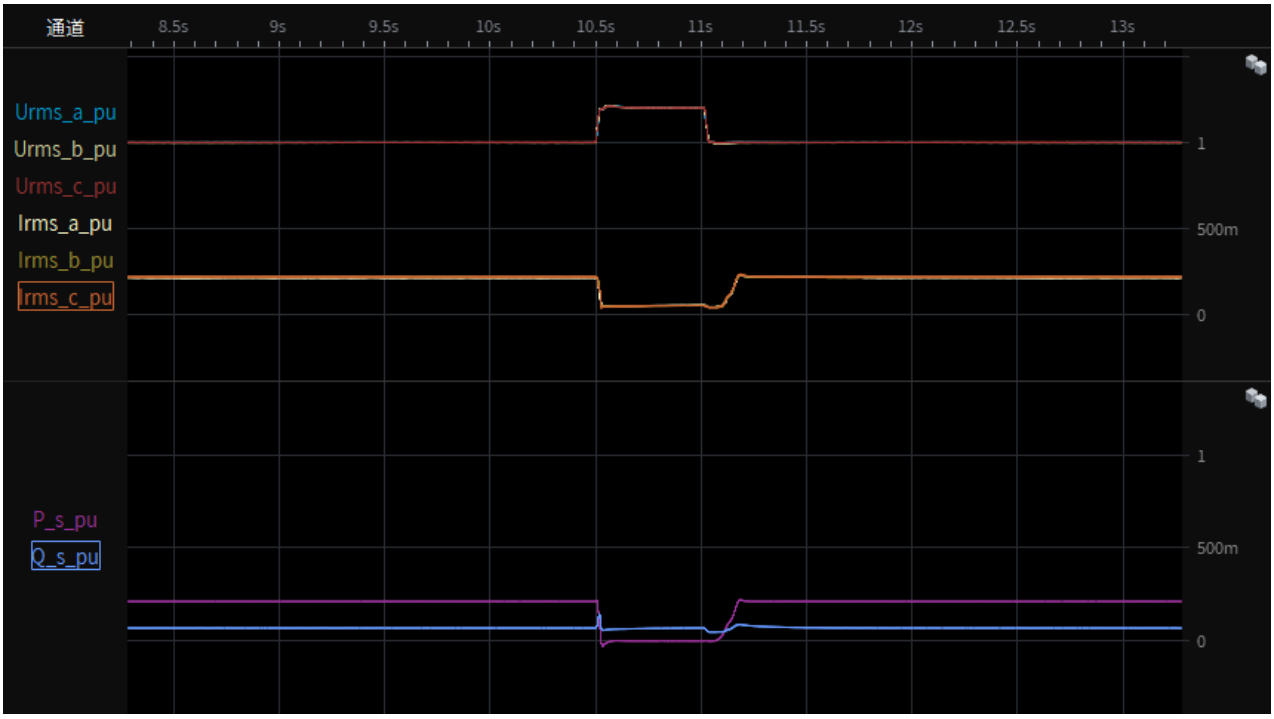


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 7-Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A), 0% load
Test overview(voltage,current,active and reactive power)

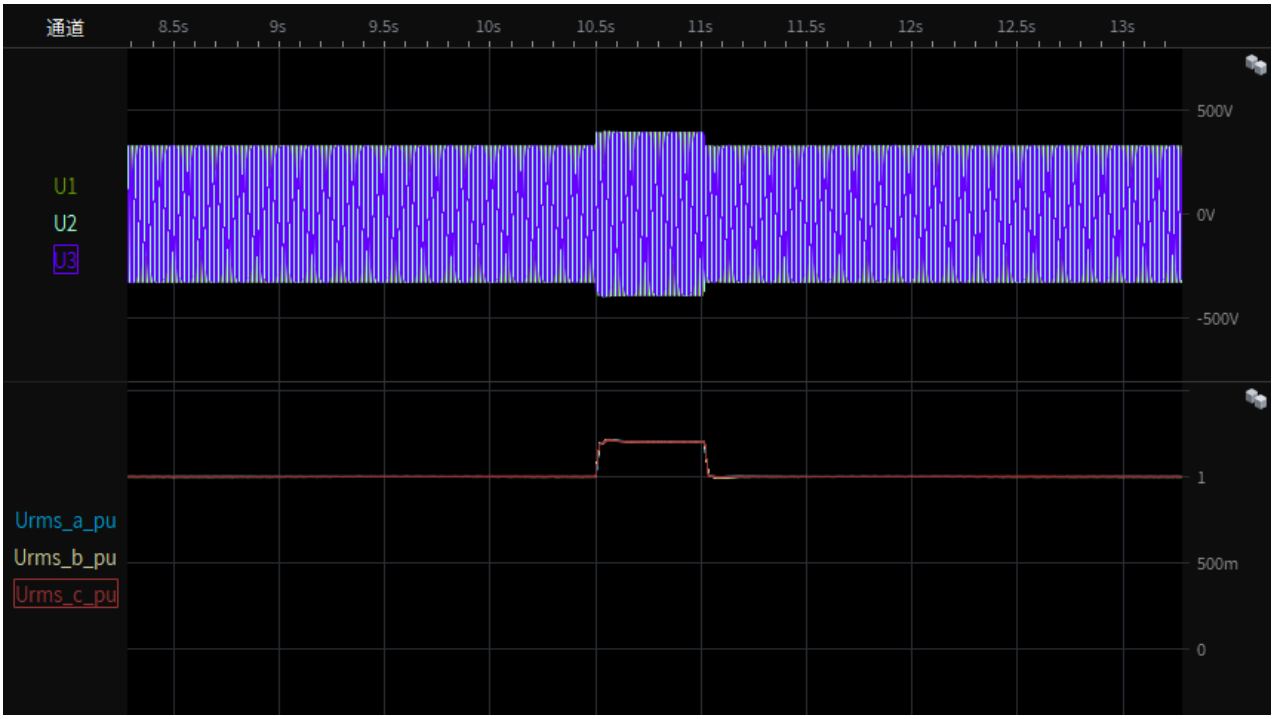


Test 7-1.1 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)

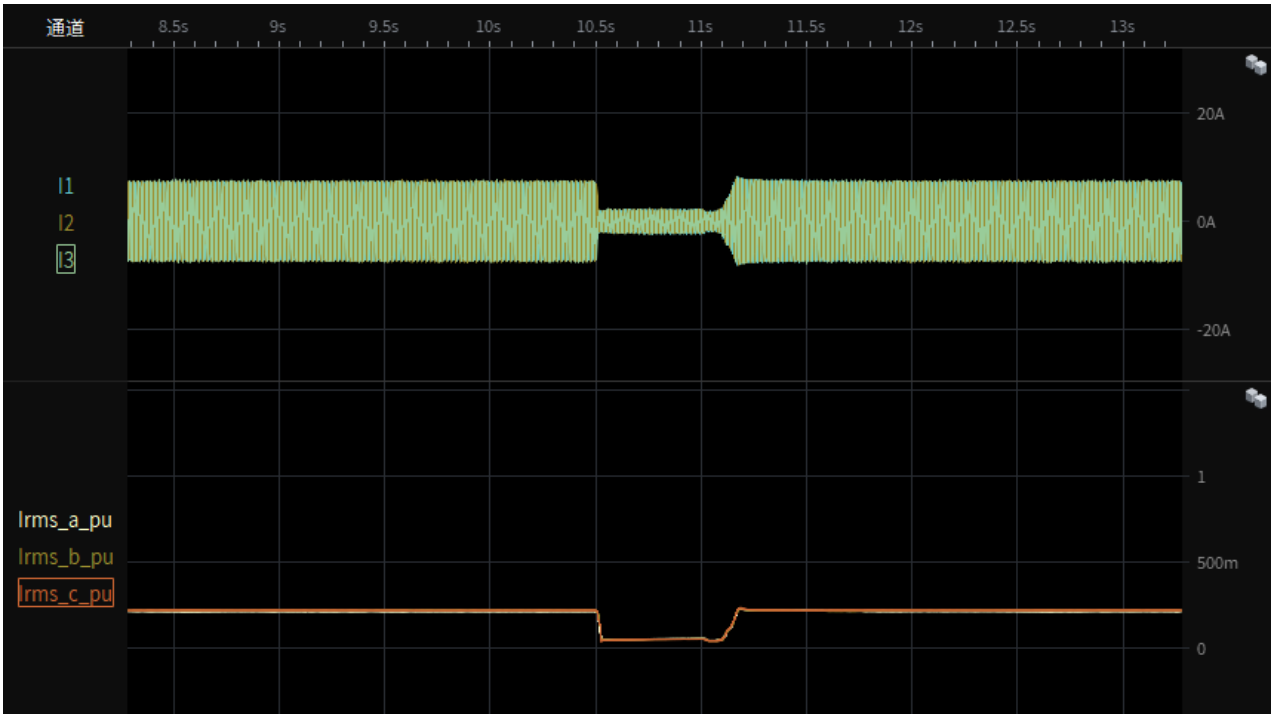


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 7-1.2 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

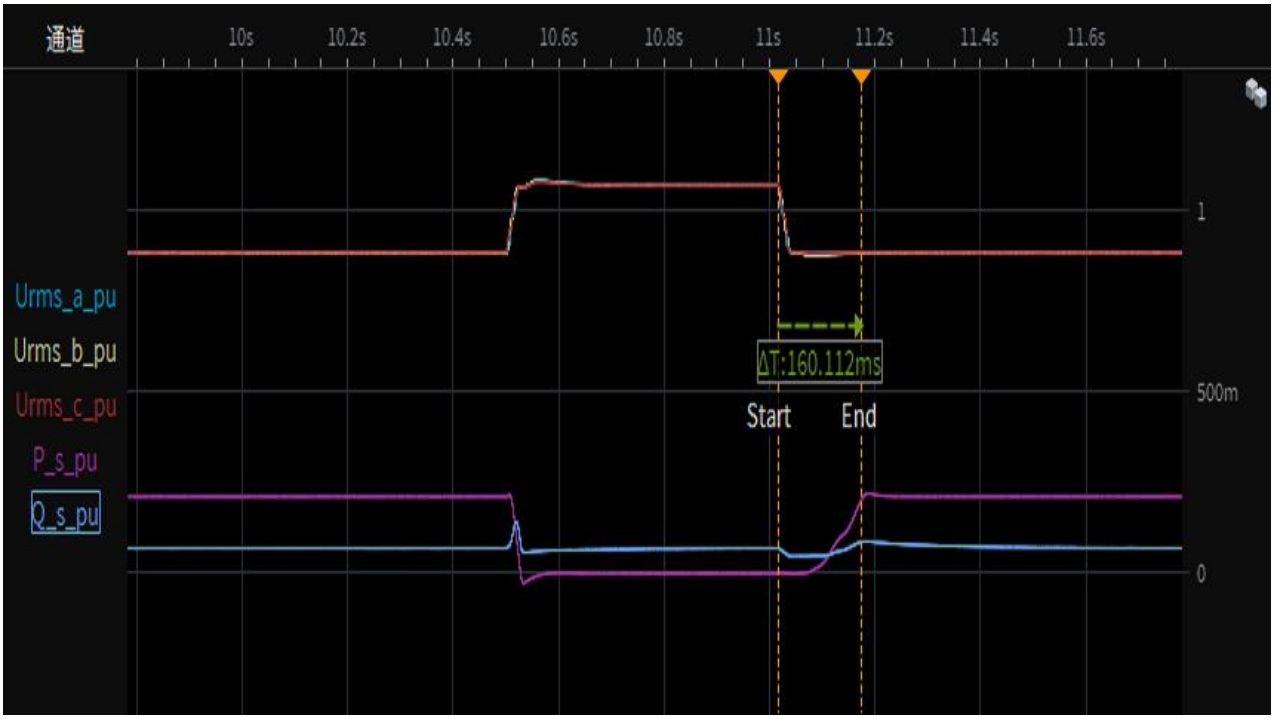


Test 7-1.3 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents

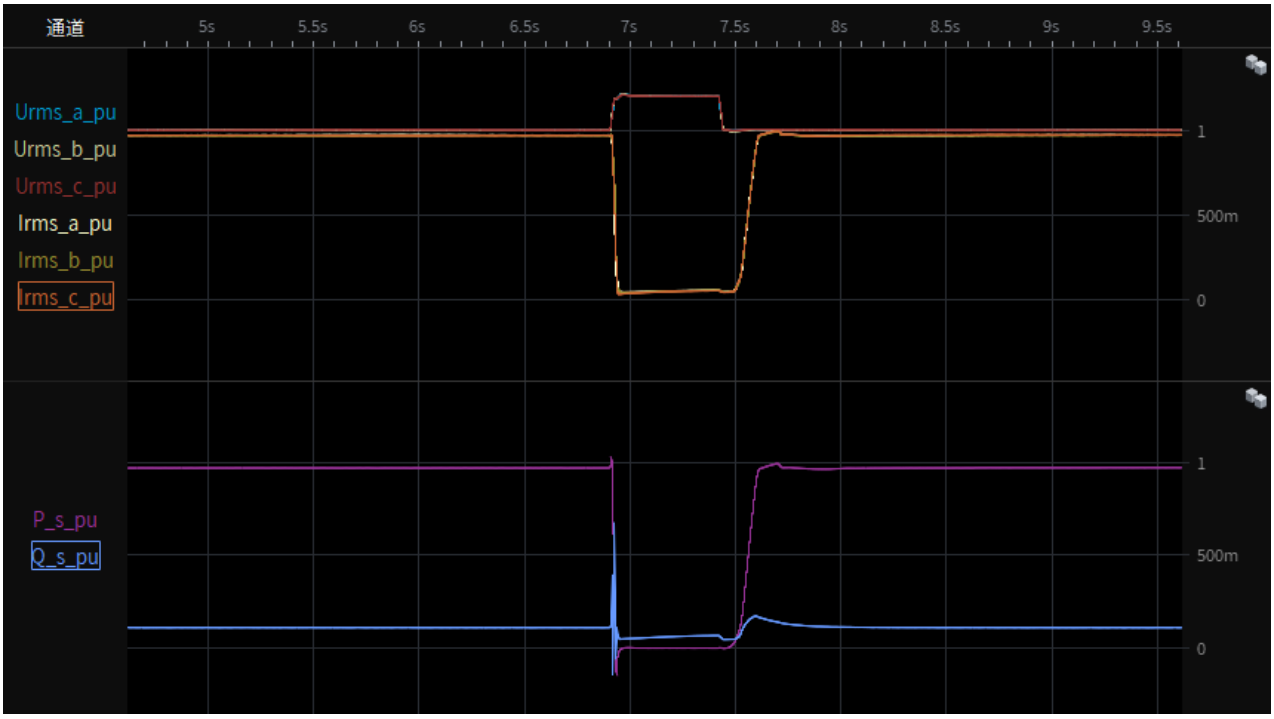


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 7-1.4 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),20% load restoring time

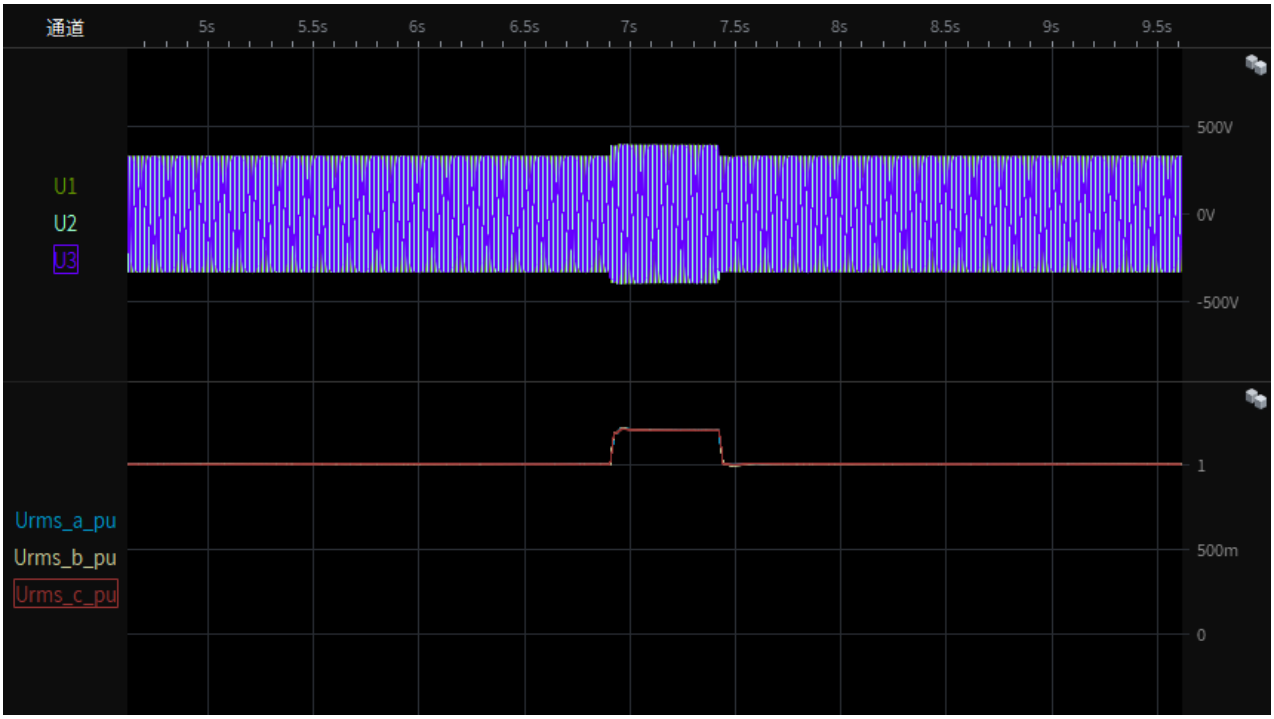


Test 7-2.1 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),95% load
Test overview(voltage,current,active and reactive power)

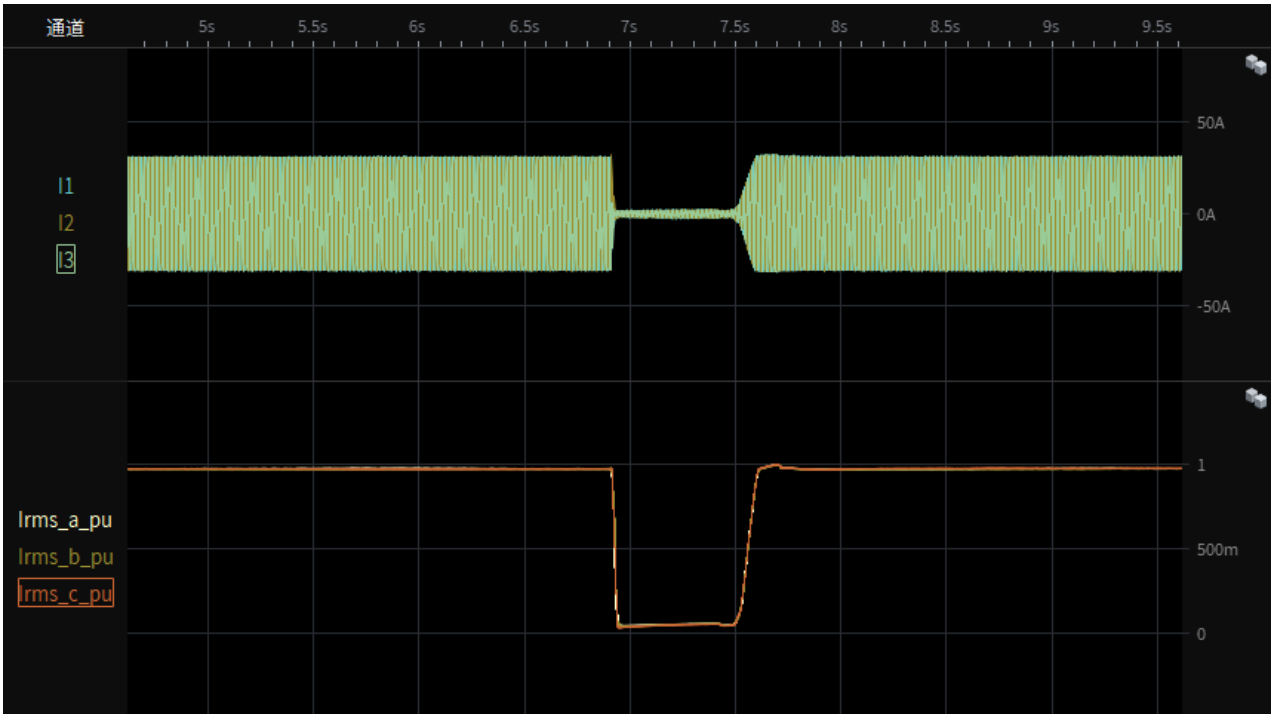


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 7-2.2 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

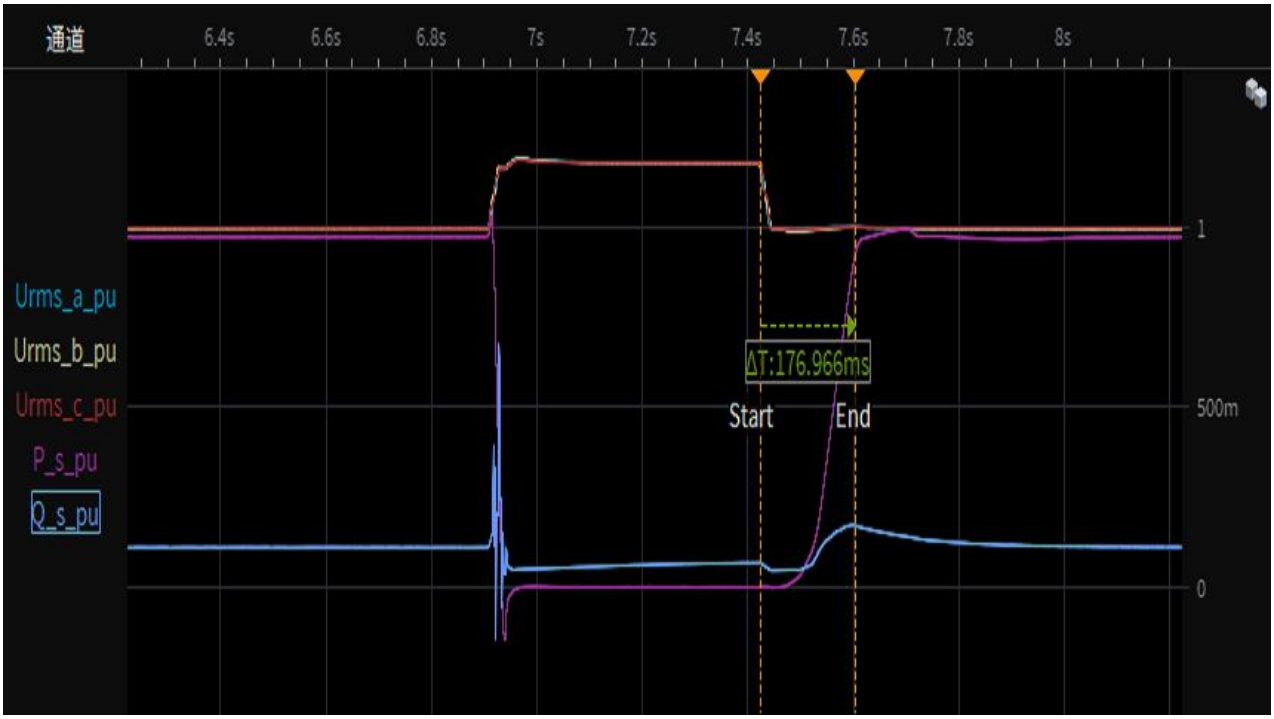


Test 7-2.3 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents

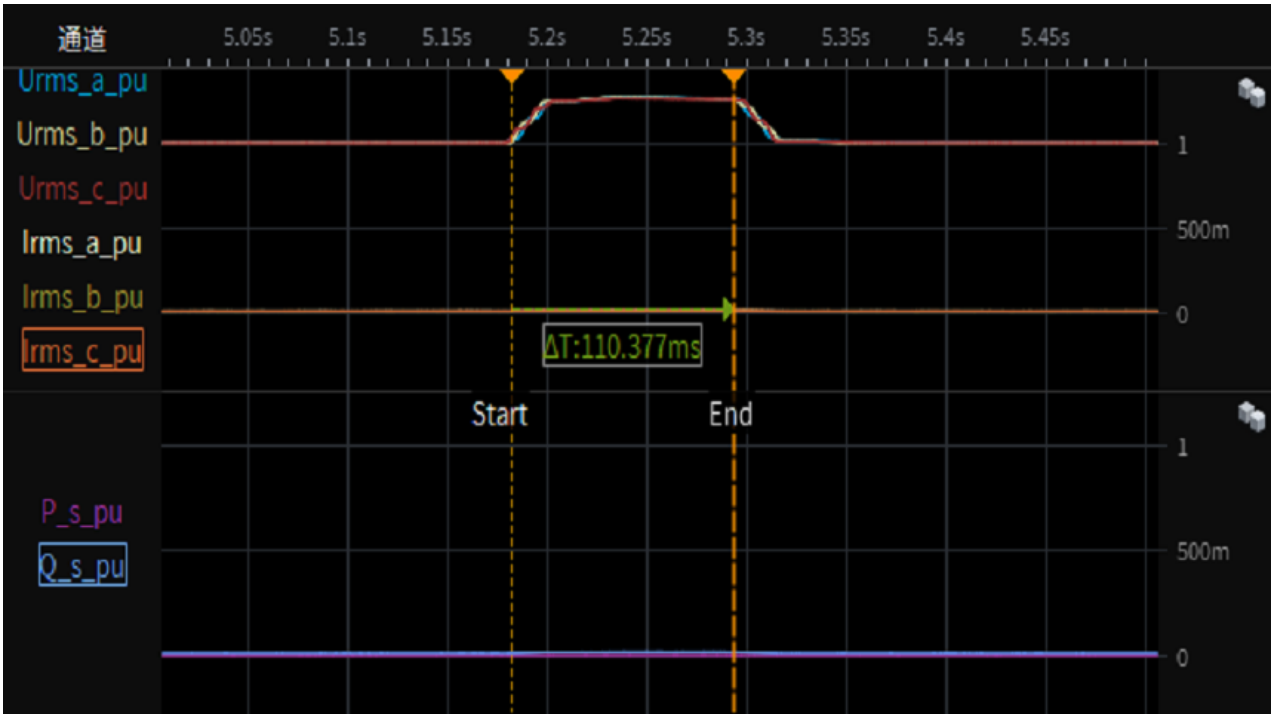


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 7-2.4 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A), 95% load restoring time

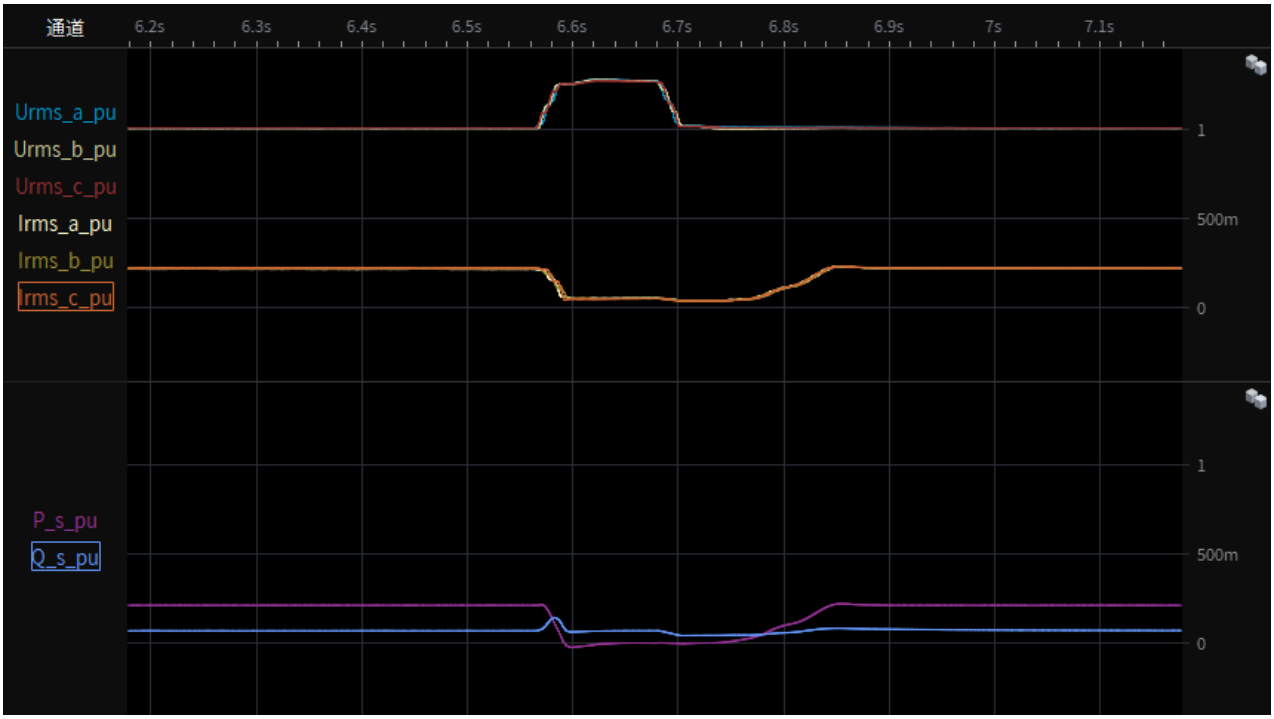


Test 8-Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A), 0% load
Test overview(voltage,current,active and reactive power)

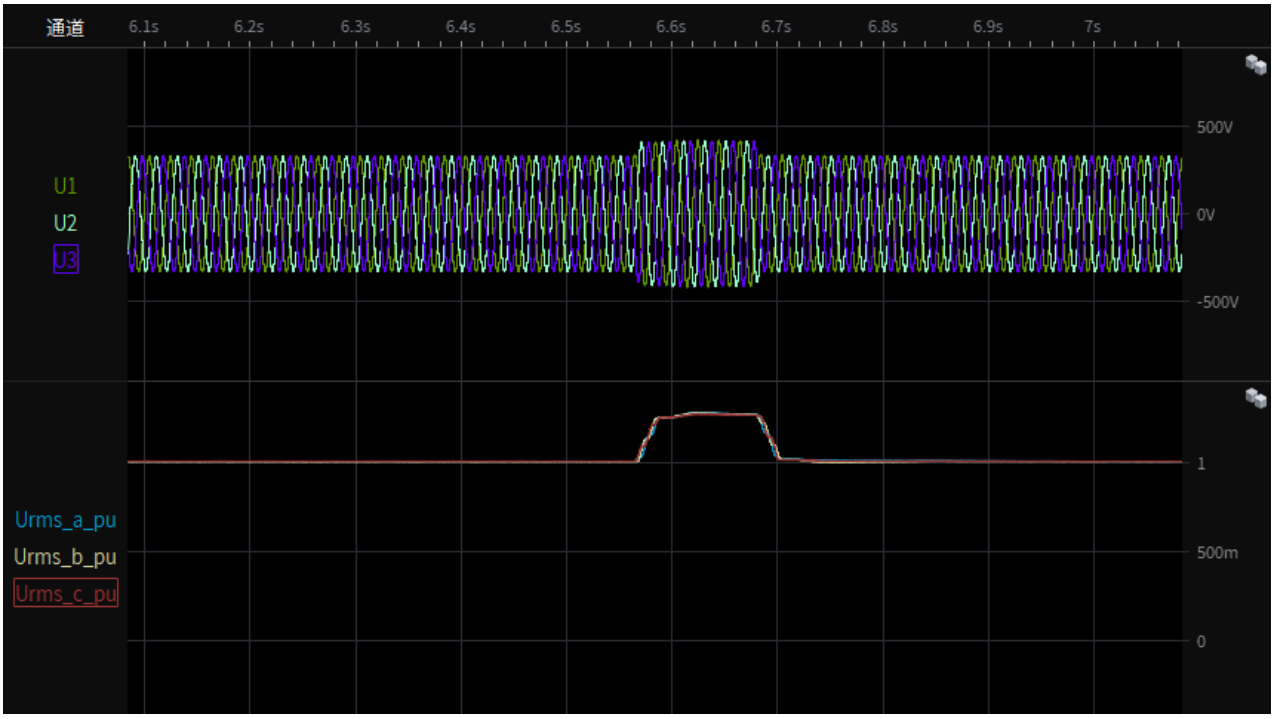


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 8-1.1 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)

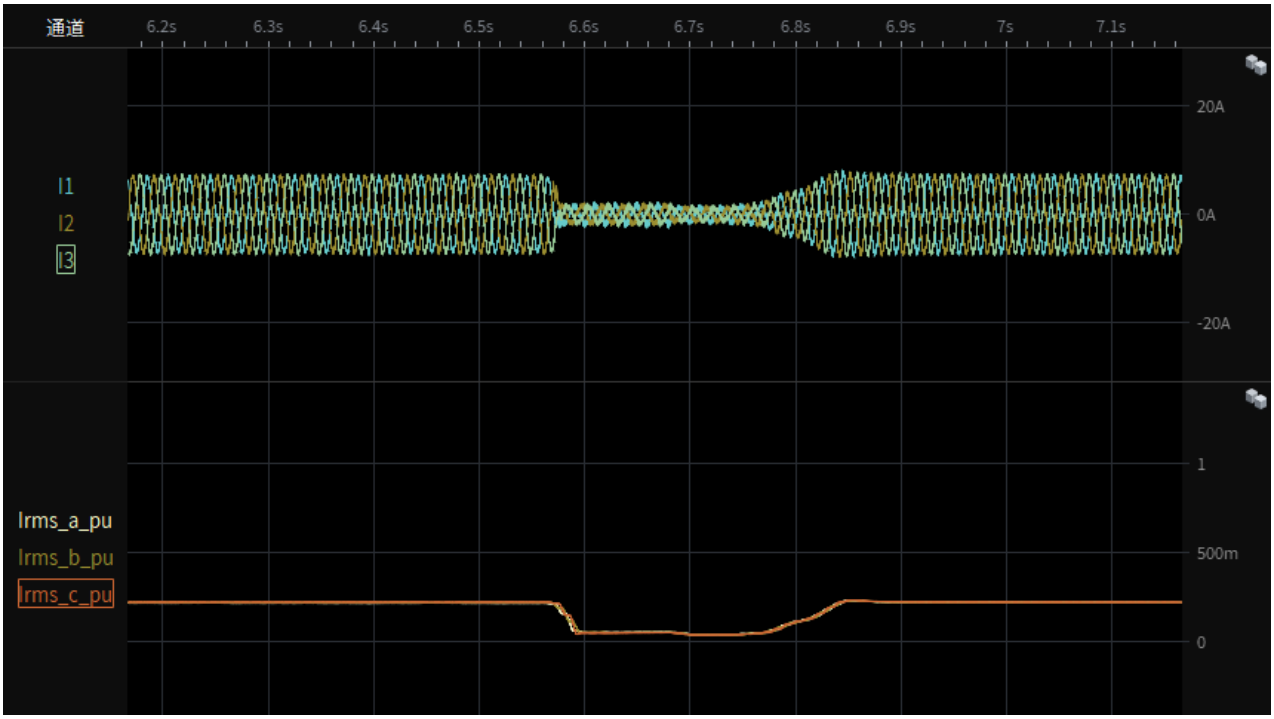


Test 8-1.2 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

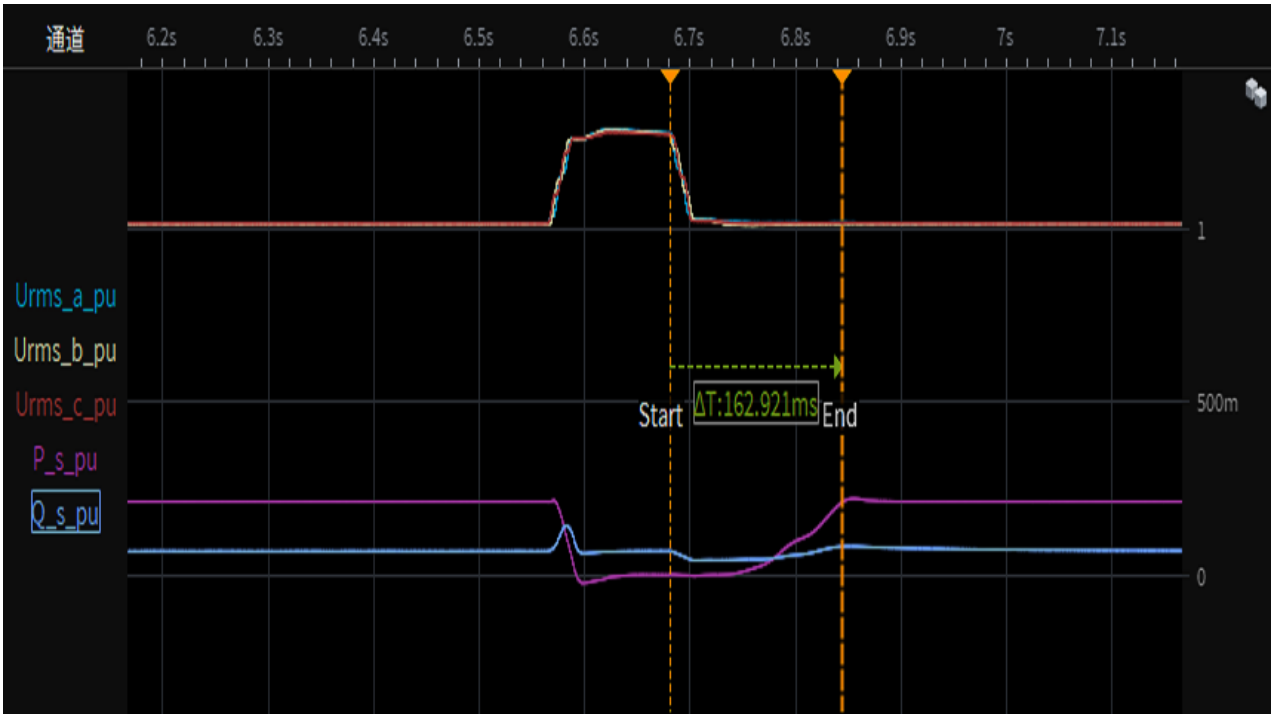


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 8-1.3 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents

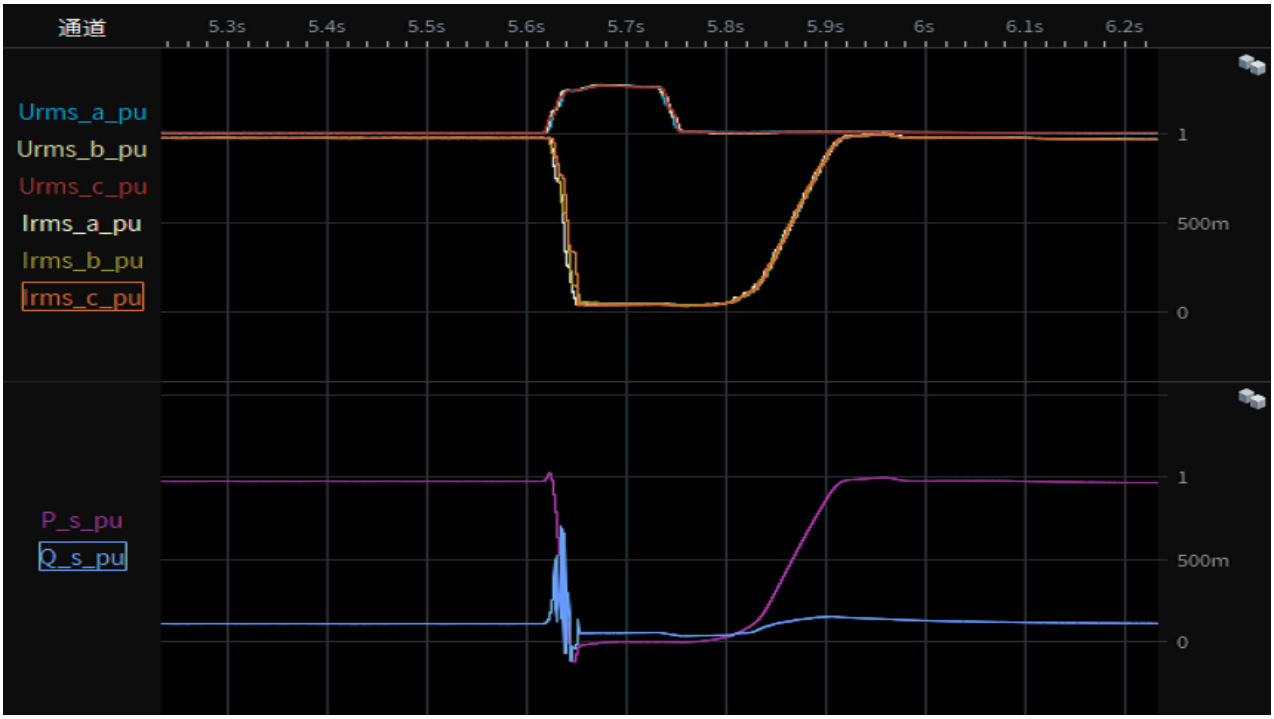


Test 8-1.4 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),20% load
restoring time

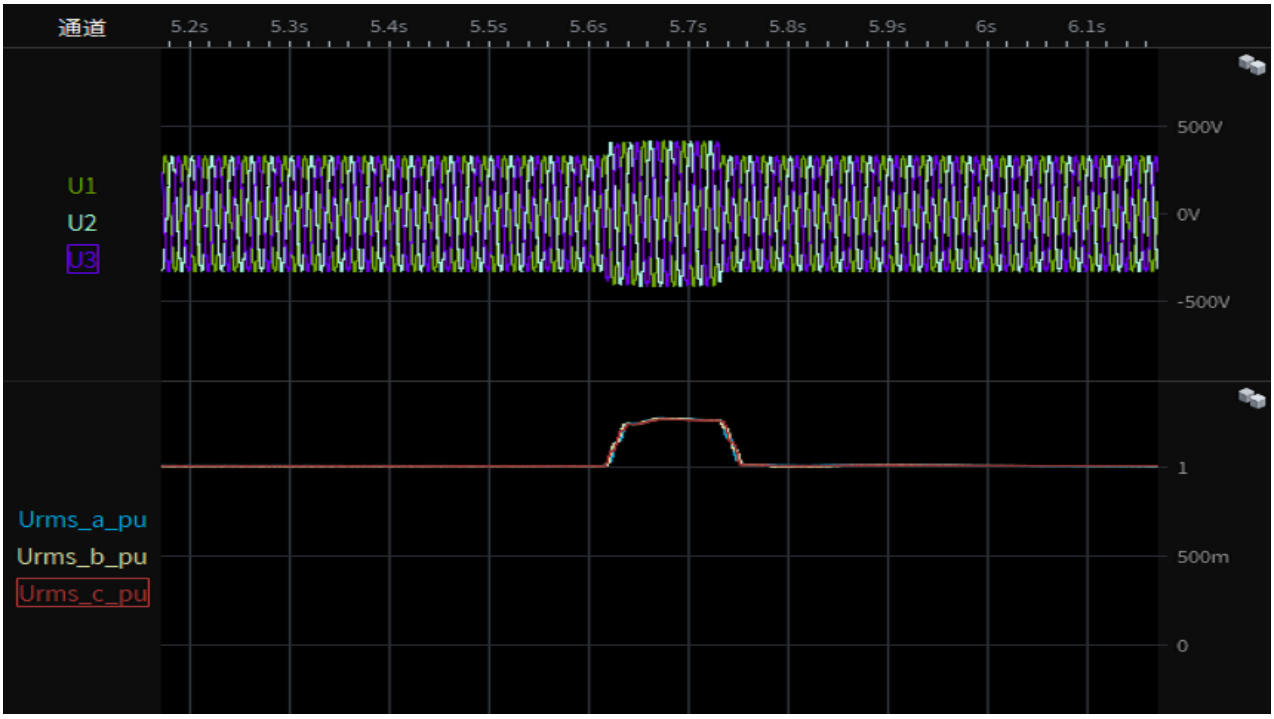


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 8-2.1 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),95% load
Test overview(voltage,current,active and reactive power)

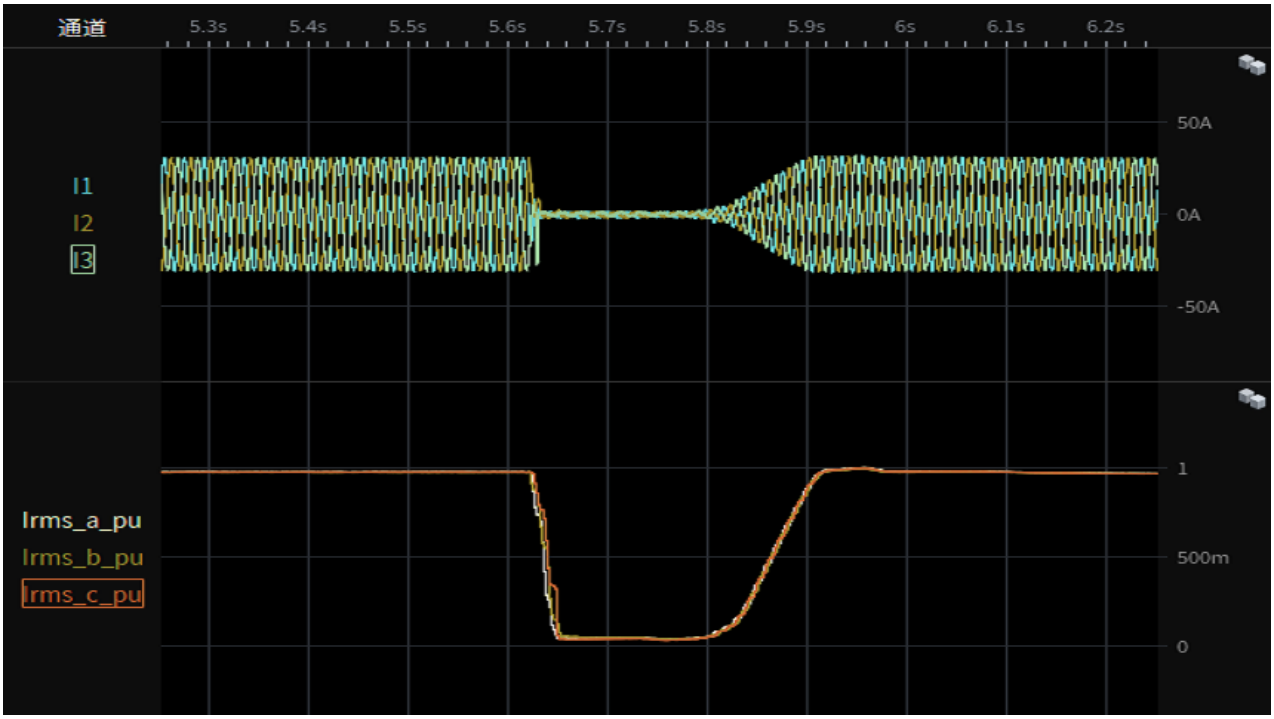


Test 8-2.2 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

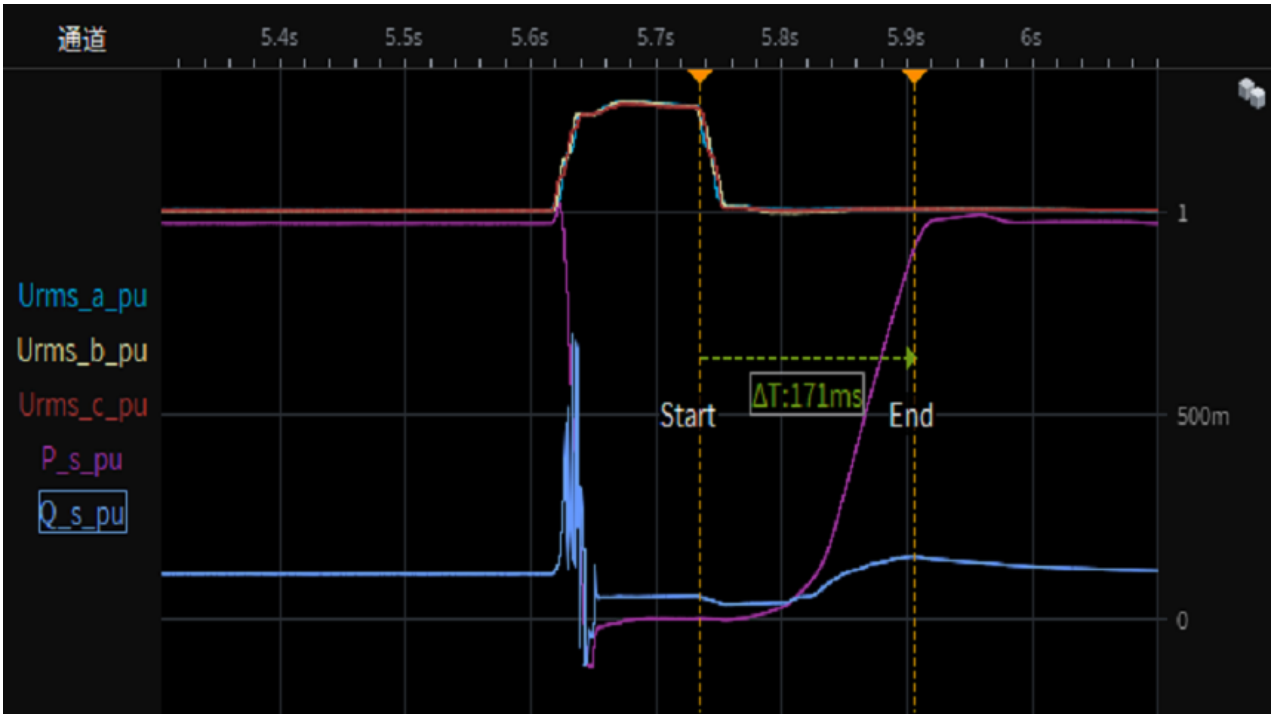


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 8-2.3 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents



Test 8-2.4 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A), 95% load
restoring time



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.6	**TABLE: Checking the insensitivity to automatic reclosing during phase discordance**				**P**
Model	AF15K-MTH				
Test 1: Phase angle shift of 90°					
Power level	Cos φ	Phase shift angle (°)	Current 20 ms before phase shift (A)	Current 200ms after phase shif (A)	Result
100%	0.9998	90	20.81	0	The inverter is protected off the grid after performing the phase angle conversion and then reconnected to the grid to continue supplying power to the grid. No damage, no danger.
Test 2: Phase angle shift of 180°					
Power level (%)	Cos φ	Phase shift angle (°)	Current 20 ms before phase shift (A)	Current 200ms after phase shif (A)	Result
100%	0.9996	180	20.85	0	The inverter is protected off the grid after performing the phase angle conversion and then reconnected to the grid to continue supplying power to the grid. No damage, no danger.

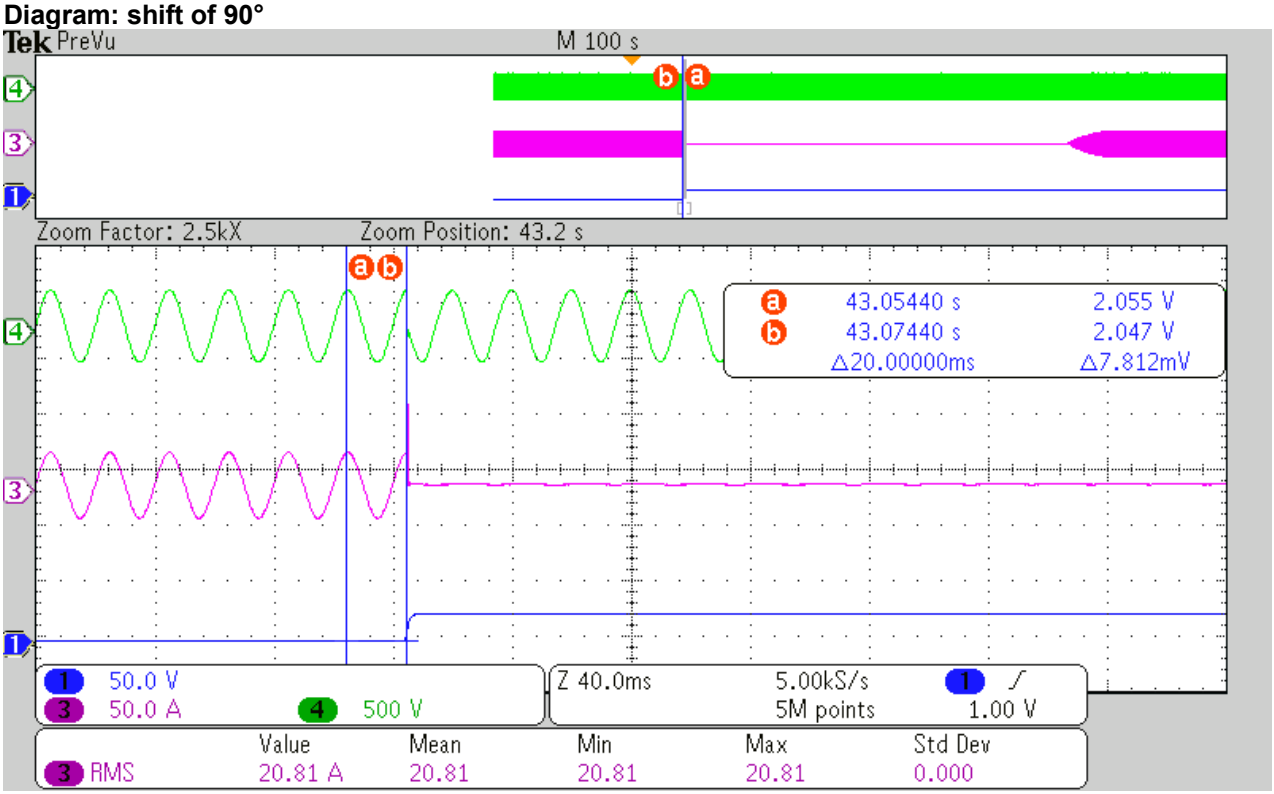
Note:

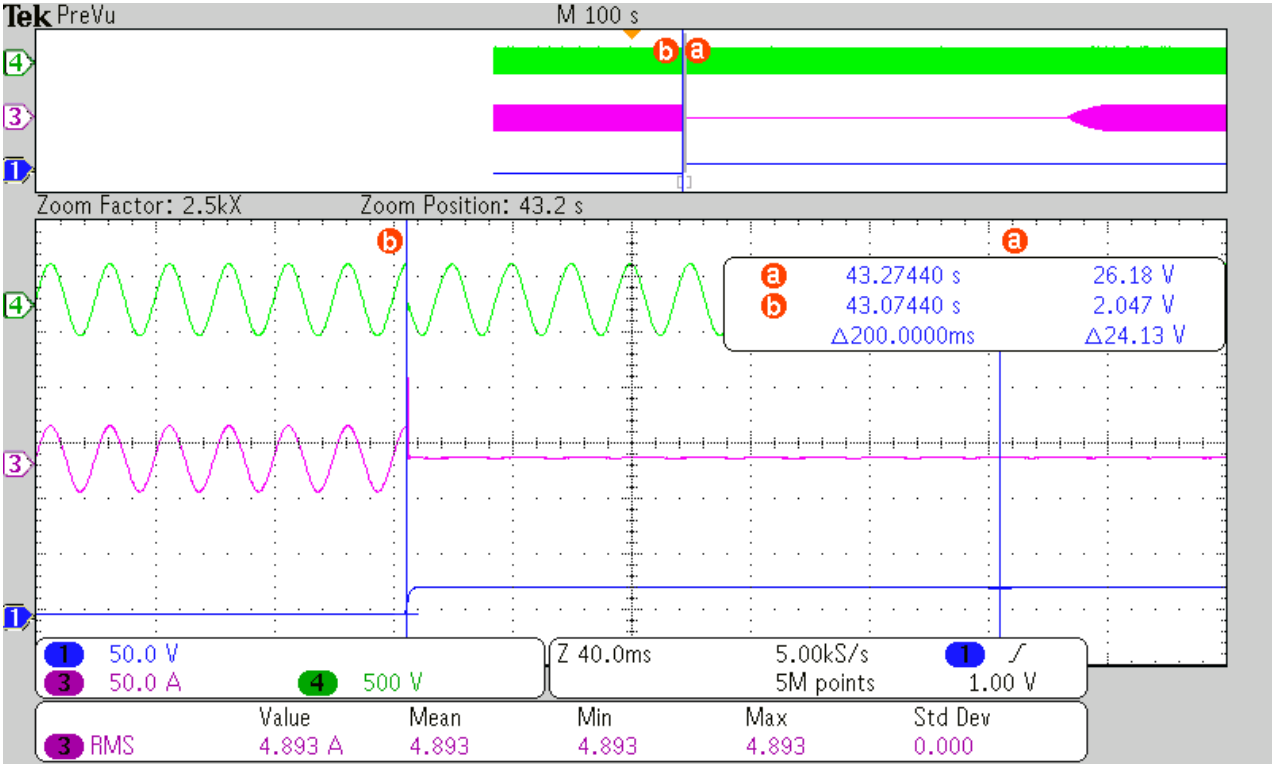
The generator must be brought into operation at rated power. Let the system operate under the set conditions for at least 5 min or the time necessary for the temperature inside the converter to stabilize.

The inverter should be operated with cos φ = 1 and nominal output power. The network simulator should create voltage phase shifts of 90° and 180°. As a result, 20ms before and 200ms after the voltage phase shift, should be documented.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

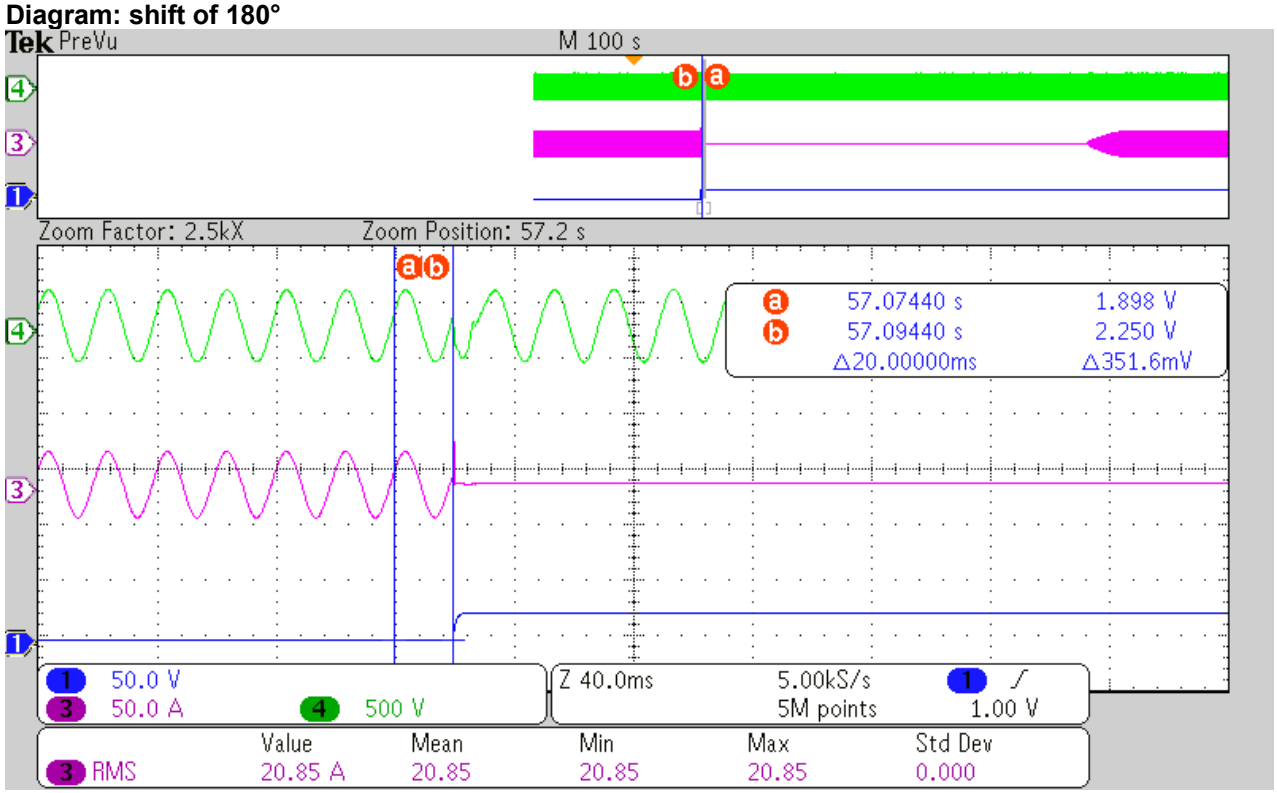
Diagram: shift of 90°

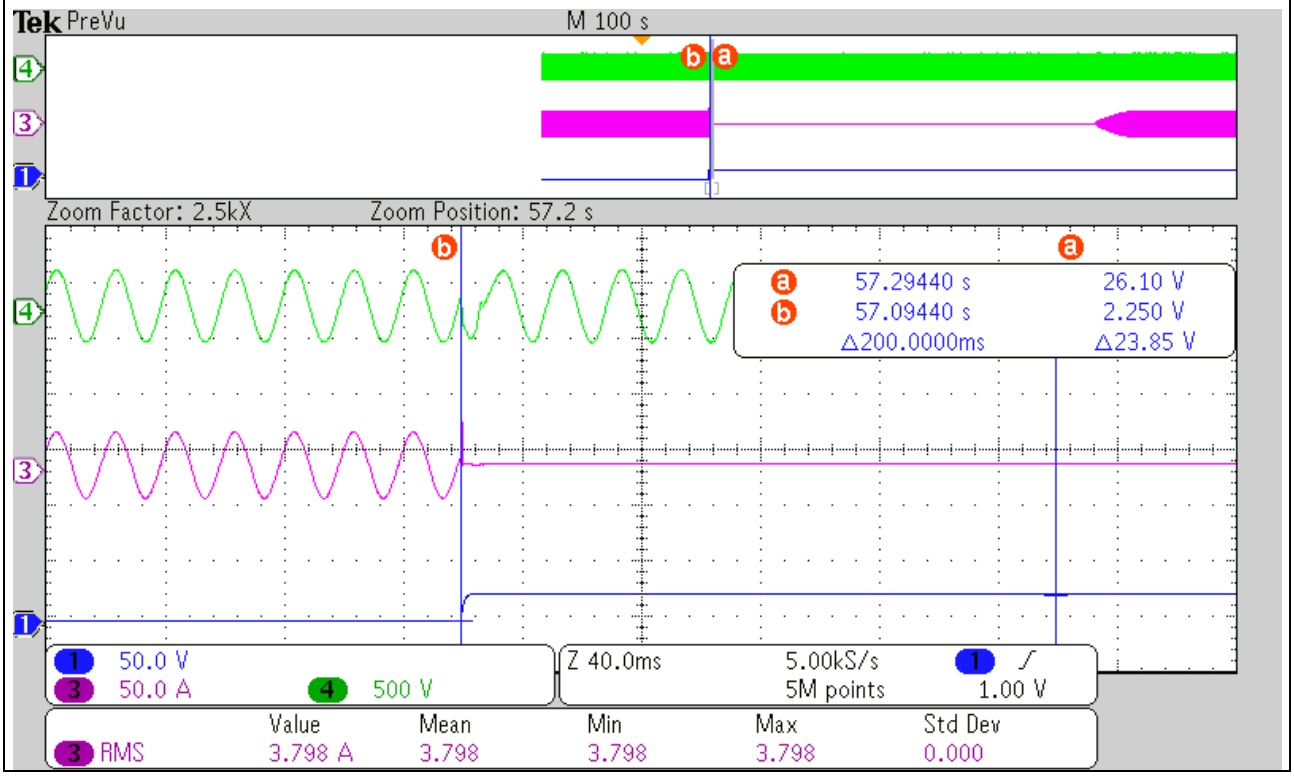




CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Diagram: shift of 180°





CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3 a)/b)	**TABLE: Harmonics measurement**	**P**
Mode	AF15K-MTH	
☒ CEI EN 61000-3-2 ☒ CEI EN 61000-3-12		
☒ Ambient temperature ☒ -25°C temperature ☒ +60°C temperature		
☒ Full power, 66% and 33% of P_{SMAX} / P_{NINV} ☒ Full power, 66% and 33% of P_{CMAX}		
a) harmonic emission limits, for class A (CEI EN 61000-3-2 or CEI EN 61000-3-12); they must be repeated, for storage systems connected to bidirectional converters, in 6 sessions (at 33%, 66% and 100% of the P_{SMAX}, or P_{NINV} for integrated EESS, and at 33%, 66% and 100% of the P_{CMAX}), and for storage systems connected to unidirectional converters in 3 sessions (at 33%, 66% and 100% of the maximum available discharge power); b) for devices with phase currents higher than 75 A, it is possible to carry out harmonic emission tests with the same criteria provided for by CEI EN 61000-3-12; they must be repeated, for storage systems connected to bidirectional converters, in 6 sessions (at 33%, 66% and 100% of the P_{SMAX}, or P_{NINV} for integrated EESS, and at 33%, 66% and 100% of the P_{CMAX}), and for storage systems connected to unidirectional converters in 3 sessions (at 33%, 66% and 100% of the maximum available discharge power)		
Supplementary information: *If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test.		

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C,100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)	

Active power (W)	15000 (100%, 25°C)
Voltage (V)	230
Current (A)	21.7
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	21.75	21.76	21.77	--	--	--	--
2nd	0.012	0.016	0.024	0.055	0.074	0.111	8
3rd	0.251	0.192	0.247	1.157	0.885	1.138	N/A
4th	0.005	0.006	0.010	0.023	0.028	0.046	4
5th	0.085	0.078	0.072	0.392	0.359	0.332	10.7
6th	0.016	0.006	0.004	0.074	0.028	0.018	2.7
7th	0.142	0.137	0.151	0.654	0.631	0.696	7.2
8th	0.005	0.007	0.008	0.023	0.032	0.037	2
9th	0.087	0.073	0.086	0.401	0.336	0.396	N/A
10th	0.004	0.005	0.006	0.018	0.023	0.028	1.6
11th	0.058	0.057	0.056	0.267	0.263	0.258	3.1
12th	0.003	0.006	0.004	0.014	0.028	0.018	1.3
13th	0.051	0.052	0.049	0.235	0.240	0.226	2
14th	0.003	0.003	0.003	0.014	0.014	0.014	N/A
15th	0.038	0.043	0.040	0.175	0.198	0.184	N/A
16th	0.003	0.004	0.003	0.014	0.018	0.014	N/A
17th	0.035	0.036	0.035	0.161	0.166	0.161	N/A
18th	0.002	0.003	0.003	0.009	0.014	0.014	N/A
19th	0.029	0.030	0.031	0.134	0.138	0.143	N/A
20th	0.002	0.002	0.002	0.009	0.009	0.009	N/A
21st	0.025	0.025	0.025	0.115	0.115	0.115	N/A
22nd	0.002	0.002	0.002	0.009	0.009	0.009	N/A
23rd	0.019	0.018	0.019	0.088	0.083	0.088	N/A
24th	0.003	0.002	0.002	0.014	0.009	0.009	N/A
25th	0.015	0.016	0.015	0.069	0.074	0.069	N/A
26th	0.002	0.002	0.002	0.009	0.009	0.009	N/A
27th	0.015	0.016	0.013	0.069	0.074	0.060	N/A
28th	0.002	0.002	0.002	0.009	0.009	0.009	N/A
29th	0.012	0.013	0.011	0.055	0.060	0.051	N/A
30th	0.002	0.002	0.002	0.009	0.009	0.009	N/A
31st	0.010	0.001	0.001	0.046	0.005	0.005	N/A
32nd	0.002	0.002	0.002	0.009	0.009	0.009	N/A
33rd	0.006	0.005	0.010	0.028	0.023	0.046	N/A
34th	0.002	0.002	0.002	0.009	0.009	0.009	N/A
35th	0.008	0.007	0.008	0.037	0.032	0.037	N/A
36th	0.002	0.002	0.002	0.009	0.009	0.009	N/A
37th	0.006	0.006	0.007	0.028	0.028	0.032	N/A
38th	0.002	0.002	0.002	0.009	0.009	0.009	N/A
39th	0.009	0.007	0.008	0.041	0.032	0.037	N/A
40th	0.002	0.002	0.002	0.009	0.009	0.009	N/A
THD	--	--	--	1.534	1.304	1.523	13
PWHD	--	--	--	2.607	2.216	2.589	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C,100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)	

Active power (W)	15000 (100%, -25°C)
Voltage (V)	230
Current (A)	21.7
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	21.74	21.76	21.75				--
2nd	0.011	0.017	0.025	0.051	0.078	0.115	8
3rd	0.252	0.192	0.247	1.159	0.883	1.136	N/A
4th	0.005	0.005	0.010	0.023	0.023	0.046	4
5th	0.084	0.077	0.071	0.386	0.354	0.326	10.7
6th	0.016	0.006	0.004	0.074	0.028	0.018	2.7
7th	0.142	0.137	0.151	0.653	0.630	0.694	7.2
8th	0.004	0.007	0.007	0.018	0.032	0.032	2
9th	0.087	0.073	0.086	0.400	0.336	0.395	N/A
10th	0.003	0.005	0.006	0.014	0.023	0.028	1.6
11th	0.058	0.056	0.056	0.267	0.257	0.257	3.1
12th	0.003	0.006	0.004	0.014	0.028	0.018	1.3
13th	0.050	0.051	0.048	0.230	0.234	0.221	2
14th	0.003	0.003	0.004	0.014	0.014	0.018	N/A
15th	0.038	0.043	0.040	0.175	0.198	0.184	N/A
16th	0.002	0.003	0.003	0.009	0.014	0.014	N/A
17th	0.036	0.036	0.035	0.166	0.166	0.161	N/A
18th	0.002	0.002	0.002	0.009	0.009	0.009	N/A
19th	0.029	0.030	0.031	0.133	0.138	0.143	N/A
20th	0.002	0.002	0.002	0.009	0.009	0.009	N/A
21st	0.025	0.025	0.025	0.115	0.115	0.115	N/A
22nd	0.001	0.002	0.002	0.005	0.009	0.009	N/A
23rd	0.019	0.018	0.019	0.087	0.083	0.087	N/A
24th	0.002	0.002	0.002	0.009	0.009	0.009	N/A
25th	0.015	0.015	0.014	0.069	0.069	0.064	N/A
26th	0.001	0.001	0.002	0.005	0.005	0.009	N/A
27th	0.015	0.015	0.013	0.069	0.069	0.060	N/A
28th	0.001	0.001	0.001	0.005	0.005	0.005	N/A
29th	0.011	0.012	0.011	0.051	0.055	0.051	N/A
30th	0.001	0.002	0.001	0.005	0.009	0.005	N/A
31st	0.010	0.009	0.009	0.046	0.041	0.041	N/A
32nd	0.001	0.001	0.001	0.005	0.005	0.005	N/A
33rd	0.005	0.005	0.009	0.023	0.023	0.041	N/A
34th	0.001	0.001	0.001	0.005	0.005	0.005	N/A
35th	0.008	0.007	0.007	0.037	0.032	0.032	N/A
36th	0.001	0.001	0.001	0.005	0.005	0.005	N/A
37th	0.006	0.006	0.007	0.028	0.028	0.032	N/A
38th	0.001	0.001	0.001	0.005	0.005	0.005	N/A
39th	0.009	0.007	0.007	0.041	0.032	0.032	N/A
40th	0.001	0.001	0.001	0.005	0.005	0.005	N/A
THD	--	--	--	1.535	1.301	1.523	13
PWHD	--	--	--	2.609	2.212	2.604	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C, 100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)	

Active power (W)	15000 (100%, 60°C)
Voltage (V)	230
Current (A)	21.7
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	21.73	21.75	21.74	--	--	--	--
2nd	0.012	0.015	0.024	0.055	0.069	0.110	8
3rd	0.251	0.193	0.248	1.154	0.887	1.140	N/A
4th	0.005	0.005	0.009	0.023	0.023	0.041	4
5th	0.085	0.076	0.070	0.391	0.349	0.322	10.7
6th	0.016	0.006	0.004	0.074	0.028	0.018	2.7
7th	0.141	0.137	0.150	0.648	0.630	0.690	7.2
8th	0.004	0.006	0.007	0.018	0.028	0.032	2
9th	0.087	0.072	0.087	0.400	0.331	0.400	N/A
10th	0.003	0.005	0.006	0.014	0.023	0.028	1.6
11th	0.057	0.056	0.055	0.262	0.257	0.253	3.1
12th	0.003	0.006	0.004	0.014	0.028	0.018	1.3
13th	0.050	0.051	0.049	0.230	0.234	0.225	2
14th	0.003	0.003	0.003	0.014	0.014	0.014	N/A
15th	0.038	0.044	0.040	0.175	0.202	0.184	N/A
16th	0.002	0.003	0.003	0.009	0.014	0.014	N/A
17th	0.035	0.036	0.035	0.161	0.166	0.161	N/A
18th	0.002	0.002	0.003	0.009	0.009	0.014	N/A
19th	0.029	0.030	0.030	0.133	0.138	0.138	N/A
20th	0.002	0.002	0.002	0.009	0.009	0.009	N/A
21st	0.025	0.025	0.024	0.115	0.115	0.110	N/A
22nd	0.002	0.001	0.002	0.009	0.005	0.009	N/A
23rd	0.019	0.018	0.019	0.087	0.083	0.087	N/A
24th	0.002	0.002	0.002	0.009	0.009	0.009	N/A
25th	0.015	0.015	0.014	0.069	0.069	0.064	N/A
26th	0.001	0.001	0.002	0.005	0.005	0.009	N/A
27th	0.014	0.015	0.013	0.064	0.069	0.060	N/A
28th	0.001	0.001	0.002	0.005	0.005	0.009	N/A
29th	0.011	0.012	0.011	0.051	0.055	0.051	N/A
30th	0.001	0.002	0.001	0.005	0.009	0.005	N/A
31st	0.010	0.009	0.009	0.046	0.041	0.041	N/A
32nd	0.001	0.001	0.002	0.005	0.005	0.009	N/A
33rd	0.005	0.006	0.009	0.023	0.028	0.041	N/A
34th	0.001	0.001	0.001	0.005	0.005	0.005	N/A
35th	0.008	0.007	0.008	0.037	0.032	0.037	N/A
36th	0.001	0.001	0.001	0.005	0.005	0.005	N/A
37th	0.006	0.006	0.006	0.028	0.028	0.028	N/A
38th	0.001	0.001	0.001	0.005	0.005	0.005	N/A
39th	0.009	0.007	0.008	0.041	0.032	0.037	N/A
40th	0.001	0.002	0.001	0.005	0.009	0.005	N/A
THD	--	--	--	1.533	1.302	1.523	13
PWHD	--	--	--	2.606	2.213	2.589	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C,100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**

Model	AF15K-MTH + ATOM HVS-20.48 (4P)
Active power (W)	9950 (66%, 25°C)
Voltage (V)	230
Current (A)	14.4
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	14.43	14.44	14.45	--	--	--	--
2nd	0.010	0.015	0.019	0.069	0.104	0.132	8
3rd	0.215	0.168	0.021	1.493	1.167	0.146	N/A
4th	0.007	0.005	0.011	0.049	0.035	0.076	4
5th	0.058	0.051	0.045	0.403	0.354	0.313	10.7
6th	0.013	0.005	0.004	0.090	0.035	0.028	2.7
7th	0.093	0.093	0.096	0.646	0.646	0.667	7.2
8th	0.005	0.006	0.005	0.035	0.042	0.035	2
9th	0.071	0.063	0.069	0.493	0.438	0.479	N/A
10th	0.007	0.004	0.004	0.049	0.028	0.028	1.6
11th	0.049	0.048	0.046	0.340	0.333	0.319	3.1
12th	0.003	0.004	0.004	0.021	0.028	0.028	1.3
13th	0.043	0.046	0.044	0.299	0.319	0.306	2
14th	0.003	0.003	0.003	0.021	0.021	0.021	N/A
15th	0.033	0.036	0.037	0.229	0.250	0.257	N/A
16th	0.003	0.003	0.003	0.021	0.021	0.021	N/A
17th	0.026	0.025	0.026	0.181	0.174	0.181	N/A
18th	0.003	0.002	0.003	0.021	0.014	0.021	N/A
19th	0.019	0.021	0.021	0.132	0.146	0.146	N/A
20th	0.002	0.002	0.003	0.014	0.014	0.021	N/A
21st	0.018	0.018	0.016	0.125	0.125	0.111	N/A
22nd	0.002	0.002	0.002	0.014	0.014	0.014	N/A
23rd	0.014	0.014	0.014	0.097	0.097	0.097	N/A
24th	0.003	0.002	0.002	0.021	0.014	0.014	N/A
25th	0.012	0.011	0.012	0.083	0.076	0.083	N/A
26th	0.002	0.002	0.002	0.014	0.014	0.014	N/A
27th	0.011	0.010	0.012	0.076	0.069	0.083	N/A
28th	0.002	0.002	0.002	0.014	0.014	0.014	N/A
29th	0.011	0.011	0.012	0.076	0.076	0.083	N/A
30th	0.002	0.003	0.001	0.014	0.021	0.007	N/A
31st	0.012	0.011	0.012	0.083	0.076	0.083	N/A
32nd	0.002	0.002	0.002	0.014	0.014	0.014	N/A
33rd	0.013	0.012	0.014	0.090	0.083	0.097	N/A
34th	0.002	0.002	0.001	0.014	0.014	0.007	N/A
35th	0.014	0.012	0.014	0.097	0.083	0.097	N/A
36th	0.002	0.002	0.005	0.014	0.014	0.035	N/A
37th	0.015	0.014	0.015	0.104	0.097	0.104	N/A
38th	0.002	0.002	0.001	0.014	0.014	0.007	N/A
39th	0.015	0.015	0.017	0.104	0.104	0.118	N/A
40th	0.002	0.002	0.001	0.014	0.014	0.007	N/A
THD	--	--	--	1.894	1.621	1.833	13
PWHD	--	--	--	3.219	2.755	3.116	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C,100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)	

Active power (W)	9950 (66%, -25°C)
Voltage (V)	230
Current (A)	14.4
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	14.42	14.44	14.43	--	--	--	--
2nd	0.009	0.015	0.015	0.063	0.104	0.104	8
3rd	0.215	0.168	0.168	1.493	1.167	1.167	N/A
4th	0.006	0.005	0.005	0.042	0.035	0.035	4
5th	0.057	0.051	0.051	0.396	0.354	0.354	10.7
6th	0.013	0.005	0.005	0.090	0.035	0.035	2.7
7th	0.094	0.093	0.093	0.653	0.646	0.646	7.2
8th	0.005	0.006	0.005	0.035	0.042	0.035	2
9th	0.071	0.063	0.063	0.493	0.438	0.438	N/A
10th	0.003	0.004	0.003	0.021	0.028	0.021	1.6
11th	0.049	0.048	0.048	0.340	0.333	0.333	3.1
12th	0.003	0.004	0.004	0.021	0.028	0.028	1.3
13th	0.042	0.046	0.046	0.292	0.319	0.319	2
14th	0.003	0.003	0.003	0.021	0.021	0.021	N/A
15th	0.033	0.036	0.036	0.229	0.250	0.250	N/A
16th	0.002	0.003	0.003	0.014	0.021	0.021	N/A
17th	0.025	0.025	0.024	0.174	0.174	0.167	N/A
18th	0.002	0.002	0.002	0.014	0.014	0.014	N/A
19th	0.019	0.021	0.021	0.132	0.146	0.146	N/A
20th	0.002	0.002	0.002	0.014	0.014	0.014	N/A
21st	0.017	0.018	0.018	0.118	0.125	0.125	N/A
22nd	0.001	0.002	0.001	0.007	0.014	0.007	N/A
23rd	0.013	0.014	0.014	0.090	0.097	0.097	N/A
24th	0.003	0.002	0.002	0.021	0.014	0.014	N/A
25th	0.012	0.011	0.011	0.083	0.076	0.076	N/A
26th	0.001	0.002	0.001	0.007	0.014	0.007	N/A
27th	0.011	0.010	0.010	0.076	0.069	0.069	N/A
28th	0.001	0.002	0.001	0.007	0.014	0.007	N/A
29th	0.010	0.011	0.010	0.069	0.076	0.069	N/A
30th	0.001	0.003	0.002	0.007	0.021	0.014	N/A
31st	0.011	0.011	0.011	0.076	0.076	0.076	N/A
32nd	0.001	0.002	0.001	0.007	0.014	0.007	N/A
33rd	0.013	0.012	0.011	0.090	0.083	0.076	N/A
34th	0.001	0.002	0.001	0.007	0.014	0.007	N/A
35th	0.013	0.012	0.012	0.090	0.083	0.083	N/A
36th	0.001	0.002	0.001	0.007	0.014	0.007	N/A
37th	0.014	0.014	0.014	0.097	0.097	0.097	N/A
38th	0.001	0.002	0.001	0.007	0.014	0.007	N/A
39th	0.015	0.015	0.015	0.104	0.104	0.104	N/A
40th	0.001	0.002	0.001	0.007	0.014	0.007	N/A
THD	--	--	--	1.896	1.621	1.837	13
PWHD	--	--	--	3.223	2.755	3.122	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C, 100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**

Model	AF15K-MTH + ATOM HVS-20.48 (4P)
Active power (W)	9950 (66%, 60°C)
Voltage (V)	230
Current (A)	14.4
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	14.44	14.43	14.42	--	--	--	--
2nd	0.010	0.015	0.019	0.069	0.104	0.132	8
3rd	0.215	0.168	0.021	1.493	1.167	0.146	N/A
4th	0.007	0.005	0.011	0.049	0.035	0.076	4
5th	0.058	0.051	0.045	0.403	0.354	0.313	10.7
6th	0.013	0.005	0.004	0.090	0.035	0.028	2.7
7th	0.093	0.093	0.096	0.646	0.646	0.667	7.2
8th	0.005	0.006	0.005	0.035	0.042	0.035	2
9th	0.071	0.063	0.069	0.493	0.438	0.479	N/A
10th	0.007	0.004	0.004	0.049	0.028	0.028	1.6
11th	0.049	0.048	0.046	0.340	0.333	0.319	3.1
12th	0.003	0.004	0.004	0.021	0.028	0.028	1.3
13th	0.043	0.046	0.044	0.299	0.319	0.306	2
14th	0.003	0.003	0.003	0.021	0.021	0.021	N/A
15th	0.033	0.036	0.037	0.229	0.250	0.257	N/A
16th	0.003	0.003	0.003	0.021	0.021	0.021	N/A
17th	0.026	0.025	0.026	0.181	0.174	0.181	N/A
18th	0.003	0.002	0.003	0.021	0.014	0.021	N/A
19th	0.019	0.021	0.021	0.132	0.146	0.146	N/A
20th	0.002	0.002	0.003	0.014	0.014	0.021	N/A
21st	0.018	0.018	0.016	0.125	0.125	0.111	N/A
22nd	0.002	0.002	0.002	0.014	0.014	0.014	N/A
23rd	0.014	0.014	0.014	0.097	0.097	0.097	N/A
24th	0.003	0.002	0.002	0.021	0.014	0.014	N/A
25th	0.012	0.011	0.012	0.083	0.076	0.083	N/A
26th	0.002	0.002	0.002	0.014	0.014	0.014	N/A
27th	0.011	0.010	0.012	0.076	0.069	0.083	N/A
28th	0.002	0.002	0.002	0.014	0.014	0.014	N/A
29th	0.011	0.011	0.012	0.076	0.076	0.083	N/A
30th	0.002	0.003	0.001	0.014	0.021	0.007	N/A
31st	0.012	0.011	0.012	0.083	0.076	0.083	N/A
32nd	0.002	0.002	0.002	0.014	0.014	0.014	N/A
33rd	0.013	0.012	0.014	0.090	0.083	0.097	N/A
34th	0.002	0.002	0.001	0.014	0.014	0.007	N/A
35th	0.014	0.012	0.014	0.097	0.083	0.097	N/A
36th	0.002	0.002	0.005	0.014	0.014	0.035	N/A
37th	0.015	0.014	0.015	0.104	0.097	0.104	N/A
38th	0.002	0.002	0.001	0.014	0.014	0.007	N/A
39th	0.015	0.015	0.017	0.104	0.104	0.118	N/A
40th	0.002	0.002	0.001	0.014	0.014	0.007	N/A
THD	--	--	--	1.894	1.621	1.833	13
PWHD	--	--	--	3.219	2.755	3.116	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C,100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**

Model	AF15K-MTH + ATOM HVS-20.48 (4P)
Active power (W)	4963 (33%, 25°C)
Voltage (V)	230
Current (A)	7.22
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	7.20	7.20	7.20	--	--	--	--
2nd	0.001	0.013	0.013	0.014	0.180	0.180	8
3rd	0.186	0.164	0.182	2.576	2.271	2.521	N/A
4th	0.013	0.005	0.001	0.180	0.069	0.014	4
5th	0.056	0.050	0.047	0.776	0.693	0.651	10.7
6th	0.008	0.004	0.005	0.111	0.055	0.069	2.7
7th	0.054	0.058	0.047	0.748	0.803	0.651	7.2
8th	0.007	0.007	0.005	0.097	0.097	0.069	2
9th	0.034	0.037	0.038	0.471	0.512	0.526	N/A
10th	0.004	0.004	0.004	0.055	0.055	0.055	1.6
11th	0.018	0.020	0.022	0.249	0.277	0.305	3.1
12th	0.005	0.004	0.003	0.069	0.055	0.042	1.3
13th	0.006	0.010	0.010	0.083	0.139	0.139	2
14th	0.003	0.003	0.002	0.042	0.042	0.028	N/A
15th	0.006	0.004	0.005	0.083	0.055	0.069	N/A
16th	0.003	0.003	0.002	0.042	0.042	0.028	N/A
17th	0.006	0.006	0.005	0.083	0.083	0.069	N/A
18th	0.002	0.002	0.002	0.028	0.028	0.028	N/A
19th	0.007	0.006	0.006	0.097	0.083	0.083	N/A
20th	0.002	0.002	0.002	0.028	0.028	0.028	N/A
21st	0.006	0.005	0.006	0.083	0.069	0.083	N/A
22nd	0.002	0.002	0.002	0.028	0.028	0.028	N/A
23rd	0.005	0.004	0.004	0.069	0.055	0.055	N/A
24th	0.003	0.002	0.002	0.042	0.028	0.028	N/A
25th	0.004	0.003	0.004	0.055	0.042	0.055	N/A
26th	0.002	0.002	0.002	0.028	0.028	0.028	N/A
27th	0.007	0.005	0.006	0.097	0.069	0.083	N/A
28th	0.002	0.002	0.002	0.028	0.028	0.028	N/A
29th	0.010	0.008	0.009	0.139	0.111	0.125	N/A
30th	0.002	0.003	0.002	0.028	0.042	0.028	N/A
31st	0.014	0.012	0.012	0.194	0.166	0.166	N/A
32nd	0.002	0.002	0.001	0.028	0.028	0.014	N/A
33rd	0.017	0.015	0.016	0.235	0.208	0.222	N/A
34th	0.002	0.002	0.001	0.028	0.028	0.014	N/A
35th	0.019	0.017	0.018	0.263	0.235	0.249	N/A
36th	0.002	0.002	0.001	0.028	0.028	0.014	N/A
37th	0.020	0.019	0.020	0.277	0.263	0.277	N/A
38th	0.001	0.001	0.001	0.014	0.014	0.014	N/A
39th	0.019	0.020	0.021	0.263	0.277	0.291	N/A
40th	0.001	0.002	0.001	0.014	0.028	0.014	N/A
THD	--	--	--	3.018	2.756	2.965	13
PWHD	--	--	--	5.130	4.701	5.041	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C,100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)	

Active power (W)	4963 (33%, -25°C)
Voltage (V)	230
Current (A)	7.22
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	7.24	7.25	7.23				--
2nd	0.007	0.012	0.012	0.097	0.166	0.166	8
3rd	0.185	0.163	0.181	2.562	2.258	2.507	N/A
4th	0.011	0.004	0.009	0.152	0.055	0.125	4
5th	0.056	0.050	0.046	0.776	0.693	0.637	10.7
6th	0.007	0.003	0.004	0.097	0.042	0.055	2.7
7th	0.053	0.058	0.057	0.734	0.803	0.789	7.2
8th	0.006	0.006	0.004	0.083	0.083	0.055	2
9th	0.033	0.037	0.038	0.457	0.512	0.526	N/A
10th	0.003	0.003	0.003	0.042	0.042	0.042	1.6
11th	0.017	0.020	0.021	0.235	0.277	0.291	3.1
12th	0.004	0.003	0.003	0.055	0.042	0.042	1.3
13th	0.006	0.010	0.011	0.083	0.139	0.152	2
14th	0.002	0.002	0.002	0.028	0.028	0.028	N/A
15th	0.006	0.004	0.005	0.083	0.055	0.069	N/A
16th	0.002	0.002	0.002	0.028	0.028	0.028	N/A
17th	0.006	0.005	0.005	0.083	0.069	0.069	N/A
18th	0.001	0.002	0.001	0.014	0.028	0.014	N/A
19th	0.007	0.006	0.006	0.097	0.083	0.083	N/A
20th	0.001	0.002	0.001	0.014	0.028	0.014	N/A
21st	0.006	0.005	0.006	0.083	0.069	0.083	N/A
22nd	0.001	0.001	0.001	0.014	0.014	0.014	N/A
23rd	0.004	0.004	0.003	0.055	0.055	0.042	N/A
24th	0.002	0.002	0.001	0.028	0.028	0.014	N/A
25th	0.004	0.003	0.003	0.055	0.042	0.042	N/A
26th	0.001	0.002	0.001	0.014	0.028	0.014	N/A
27th	0.007	0.005	0.005	0.097	0.069	0.069	N/A
28th	0.001	0.001	0.001	0.014	0.014	0.014	N/A
29th	0.010	0.008	0.009	0.139	0.111	0.125	N/A
30th	0.001	0.002	0.001	0.014	0.028	0.014	N/A
31st	0.014	0.011	0.012	0.194	0.152	0.166	N/A
32nd	0.001	0.001	0.001	0.014	0.014	0.014	N/A
33rd	0.017	0.014	0.015	0.235	0.194	0.208	N/A
34th	0.001	0.001	0.001	0.014	0.014	0.014	N/A
35th	0.018	0.017	0.018	0.249	0.235	0.249	N/A
36th	0.001	0.001	0.001	0.014	0.014	0.014	N/A
37th	0.020	0.019	0.019	0.277	0.263	0.263	N/A
38th	0.001	0.001	0.001	0.014	0.014	0.014	N/A
39th	0.019	0.020	0.021	0.263	0.277	0.291	N/A
40th	0.001	0.002	0.001	0.014	0.028	0.014	N/A
THD	--	--	--	2.997	2.742	2.950	13
PWHD	--	--	--	5.095	4.661	5.015	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C, 100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)	

Active power (W)	4963 (33%, 60°C)
Voltage (V)	230
Current (A)	7.22
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	7.21	7.23	7.22	--	--	--	--
2nd	0.008	0.011	0.012	0.111	0.153	0.166	8
3rd	0.184	0.163	0.181	2.552	2.261	2.510	N/A
4th	0.012	0.004	0.008	0.166	0.055	0.111	4
5th	0.056	0.049	0.046	0.777	0.680	0.638	10.7
6th	0.007	0.003	0.004	0.097	0.042	0.055	2.7
7th	0.053	0.057	0.057	0.735	0.791	0.791	7.2
8th	0.006	0.006	0.004	0.083	0.083	0.055	2
9th	0.033	0.037	0.038	0.458	0.513	0.527	N/A
10th	0.003	0.003	0.003	0.042	0.042	0.042	1.6
11th	0.017	0.020	0.021	0.236	0.277	0.291	3.1
12th	0.004	0.003	0.002	0.055	0.042	0.028	1.3
13th	0.006	0.010	0.011	0.083	0.139	0.153	2
14th	0.002	0.002	0.002	0.028	0.028	0.028	N/A
15th	0.006	0.004	0.005	0.083	0.055	0.069	N/A
16th	0.002	0.002	0.002	0.028	0.028	0.028	N/A
17th	0.006	0.005	0.005	0.083	0.069	0.069	N/A
18th	0.001	0.002	0.002	0.014	0.028	0.028	N/A
19th	0.007	0.006	0.006	0.097	0.083	0.083	N/A
20th	0.001	0.002	0.001	0.014	0.028	0.014	N/A
21st	0.006	0.005	0.005	0.083	0.069	0.069	N/A
22nd	0.001	0.002	0.001	0.014	0.028	0.014	N/A
23rd	0.004	0.004	0.003	0.055	0.055	0.042	N/A
24th	0.002	0.002	0.001	0.028	0.028	0.014	N/A
25th	0.004	0.003	0.003	0.055	0.042	0.042	N/A
26th	0.002	0.002	0.001	0.028	0.028	0.014	N/A
27th	0.007	0.005	0.005	0.097	0.069	0.069	N/A
28th	0.002	0.001	0.001	0.028	0.014	0.014	N/A
29th	0.010	0.008	0.009	0.139	0.111	0.125	N/A
30th	0.001	0.002	0.001	0.014	0.028	0.014	N/A
31st	0.014	0.011	0.012	0.194	0.153	0.166	N/A
32nd	0.001	0.001	0.001	0.014	0.014	0.014	N/A
33rd	0.017	0.014	0.015	0.236	0.194	0.208	N/A
34th	0.001	0.001	0.001	0.014	0.014	0.014	N/A
35th	0.018	0.017	0.018	0.250	0.236	0.250	N/A
36th	0.001	0.001	0.001	0.014	0.014	0.014	N/A
37th	0.020	0.019	0.019	0.277	0.264	0.264	N/A
38th	0.001	0.001	0.001	0.014	0.014	0.014	N/A
39th	0.019	0.020	0.021	0.264	0.277	0.291	N/A
40th	0.001	0.001	0.001	0.014	0.014	0.014	N/A
THD	--	--	--	2.991	2.741	2.944	13
PWHD	--	--	--	5.084	4.659	5.005	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C,100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**

Model	AF15K-MTH + ATOM HVS-20.48 (4P)
Active power (W)	-10259 (100%, 25°C)
Voltage (V)	230
Current (A)	14.9
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	14.8	14.8	14.8	--	--	--	--
2nd	0.015	0.007	0.018	0.101	0.047	0.122	8
3rd	0.330	0.296	0.341	2.230	2.000	2.304	N/A
4th	0.015	0.010	0.012	0.101	0.068	0.081	4
5th	0.234	0.239	0.239	1.581	1.615	1.615	10.7
6th	0.004	0.008	0.006	0.027	0.054	0.041	2.7
7th	0.117	0.114	0.114	0.791	0.770	0.770	7.2
8th	0.005	0.006	0.002	0.034	0.041	0.014	2
9th	0.108	0.108	0.106	0.730	0.730	0.716	N/A
10th	0.003	0.005	0.003	0.020	0.034	0.020	1.6
11th	0.097	0.095	0.097	0.655	0.642	0.655	3.1
12th	0.002	0.004	0.002	0.014	0.027	0.014	1.3
13th	0.086	0.086	0.088	0.581	0.581	0.595	2
14th	0.002	0.004	0.002	0.014	0.027	0.014	N/A
15th	0.078	0.078	0.080	0.527	0.527	0.541	N/A
16th	0.002	0.004	0.002	0.014	0.027	0.014	N/A
17th	0.076	0.076	0.079	0.514	0.514	0.534	N/A
18th	0.002	0.004	0.002	0.014	0.027	0.014	N/A
19th	0.073	0.072	0.075	0.493	0.486	0.507	N/A
20th	0.002	0.005	0.001	0.014	0.034	0.007	N/A
21st	0.063	0.063	0.068	0.426	0.426	0.459	N/A
22nd	0.001	0.005	0.001	0.007	0.034	0.007	N/A
23rd	0.060	0.059	0.062	0.405	0.399	0.419	N/A
24th	0.002	0.004	0.001	0.014	0.027	0.007	N/A
25th	0.057	0.056	0.058	0.385	0.378	0.392	N/A
26th	0.002	0.004	0.001	0.014	0.027	0.007	N/A
27th	0.054	0.053	0.053	0.365	0.358	0.358	N/A
28th	0.002	0.005	0.002	0.014	0.034	0.014	N/A
29th	0.050	0.048	0.051	0.338	0.324	0.345	N/A
30th	0.002	0.004	0.001	0.014	0.027	0.007	N/A
31st	0.047	0.045	0.047	0.318	0.304	0.318	N/A
32nd	0.002	0.005	0.001	0.014	0.034	0.007	N/A
33rd	0.042	0.041	0.045	0.284	0.277	0.304	N/A
34th	0.002	0.005	0.001	0.014	0.034	0.007	N/A
35th	0.042	0.040	0.041	0.284	0.270	0.277	N/A
36th	0.002	0.006	0.001	0.014	0.041	0.007	N/A
37th	0.040	0.038	0.038	0.270	0.257	0.257	N/A
38th	0.002	0.005	0.002	0.014	0.034	0.014	N/A
39th	0.037	0.036	0.036	0.250	0.243	0.243	N/A
40th	0.002	0.005	0.001	0.014	0.034	0.007	N/A
THD	--	--	--	3.412	3.253	3.454	13
PWHD	--	--	--	6.713	6.323	6.685	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C,100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)	

Active power (W)	-10259 (100%, -25°C)
Voltage (V)	230
Current (A)	14.9
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	14.85	14.84	14.86	--	--	--	--
2nd	0.015	0.006	0.019	0.101	0.040	0.128	8
3rd	0.331	0.298	0.340	2.232	2.009	2.293	N/A
4th	0.016	0.011	0.012	0.108	0.074	0.081	4
5th	0.235	0.239	0.239	1.585	1.612	1.612	10.7
6th	0.005	0.009	0.007	0.034	0.061	0.047	2.7
7th	0.117	0.115	0.114	0.789	0.775	0.769	7.2
8th	0.005	0.006	0.002	0.034	0.040	0.013	2
9th	0.108	0.108	0.106	0.728	0.728	0.715	N/A
10th	0.003	0.005	0.003	0.020	0.034	0.020	1.6
11th	0.097	0.095	0.097	0.654	0.641	0.654	3.1
12th	0.002	0.004	0.002	0.013	0.027	0.013	1.3
13th	0.086	0.086	0.088	0.580	0.580	0.593	2
14th	0.002	0.004	0.002	0.013	0.027	0.013	N/A
15th	0.078	0.078	0.080	0.526	0.526	0.539	N/A
16th	0.002	0.004	0.001	0.013	0.027	0.007	N/A
17th	0.076	0.077	0.079	0.512	0.519	0.533	N/A
18th	0.002	0.004	0.001	0.013	0.027	0.007	N/A
19th	0.073	0.072	0.075	0.492	0.486	0.506	N/A
20th	0.002	0.005	0.001	0.013	0.034	0.007	N/A
21st	0.063	0.063	0.068	0.425	0.425	0.459	N/A
22nd	0.002	0.005	0.001	0.013	0.034	0.007	N/A
23rd	0.061	0.059	0.062	0.411	0.398	0.418	N/A
24th	0.001	0.004	0.001	0.007	0.027	0.007	N/A
25th	0.057	0.056	0.059	0.384	0.378	0.398	N/A
26th	0.001	0.004	0.001	0.007	0.027	0.007	N/A
27th	0.054	0.053	0.053	0.364	0.357	0.357	N/A
28th	0.002	0.005	0.001	0.013	0.034	0.007	N/A
29th	0.050	0.048	0.051	0.337	0.324	0.344	N/A
30th	0.002	0.004	0.001	0.013	0.027	0.007	N/A
31st	0.047	0.045	0.047	0.317	0.303	0.317	N/A
32nd	0.001	0.005	0.001	0.007	0.034	0.007	N/A
33rd	0.042	0.042	0.045	0.283	0.283	0.303	N/A
34th	0.002	0.005	0.001	0.013	0.034	0.007	N/A
35th	0.042	0.040	0.041	0.283	0.270	0.276	N/A
36th	0.002	0.006	0.001	0.013	0.040	0.007	N/A
37th	0.039	0.038	0.039	0.263	0.256	0.263	N/A
38th	0.001	0.005	0.001	0.007	0.034	0.007	N/A
39th	0.038	0.036	0.036	0.256	0.243	0.243	N/A
40th	0.001	0.005	0.001	0.007	0.034	0.007	N/A
THD	--	--	--	3.415	3.259	3.452	13
PWHD	--	--	--	5.805	5.540	5.868	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C, 100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**

Model	AF15K-MTH + ATOM HVS-20.48 (4P)
Active power (W)	-10259 (100%, 60°C)
Voltage (V)	230
Current (A)	14.9
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	14.85	14.83	14.84				--
2nd	0.015	0.006	0.019	0.101	0.040	0.128	8
3rd	0.331	0.299	0.338	2.232	2.016	2.279	N/A
4th	0.016	0.011	0.012	0.108	0.074	0.081	4
5th	0.235	0.239	0.239	1.585	1.612	1.612	10.7
6th	0.005	0.009	0.007	0.034	0.061	0.047	2.7
7th	0.117	0.115	0.114	0.789	0.775	0.769	7.2
8th	0.006	0.006	0.002	0.040	0.040	0.013	2
9th	0.108	0.109	0.106	0.728	0.735	0.715	N/A
10th	0.002	0.005	0.003	0.013	0.034	0.020	1.6
11th	0.097	0.095	0.098	0.654	0.641	0.661	3.1
12th	0.002	0.004	0.002	0.013	0.027	0.013	1.3
13th	0.086	0.086	0.088	0.580	0.580	0.593	2
14th	0.002	0.004	0.001	0.013	0.027	0.007	N/A
15th	0.078	0.078	0.080	0.526	0.526	0.539	N/A
16th	0.002	0.004	0.001	0.013	0.027	0.007	N/A
17th	0.076	0.077	0.079	0.512	0.519	0.533	N/A
18th	0.002	0.004	0.001	0.013	0.027	0.007	N/A
19th	0.073	0.072	0.075	0.492	0.486	0.506	N/A
20th	0.002	0.005	0.001	0.013	0.034	0.007	N/A
21st	0.064	0.063	0.068	0.432	0.425	0.459	N/A
22nd	0.002	0.005	0.001	0.013	0.034	0.007	N/A
23rd	0.061	0.059	0.062	0.411	0.398	0.418	N/A
24th	0.001	0.004	0.001	0.007	0.027	0.007	N/A
25th	0.057	0.056	0.059	0.384	0.378	0.398	N/A
26th	0.001	0.004	0.001	0.007	0.027	0.007	N/A
27th	0.054	0.053	0.054	0.364	0.357	0.364	N/A
28th	0.002	0.005	0.001	0.013	0.034	0.007	N/A
29th	0.050	0.048	0.051	0.337	0.324	0.344	N/A
30th	0.002	0.004	0.001	0.013	0.027	0.007	N/A
31st	0.047	0.045	0.047	0.317	0.303	0.317	N/A
32nd	0.001	0.005	0.001	0.007	0.034	0.007	N/A
33rd	0.042	0.042	0.045	0.283	0.283	0.303	N/A
34th	0.002	0.005	0.001	0.013	0.034	0.007	N/A
35th	0.042	0.040	0.041	0.283	0.270	0.276	N/A
36th	0.002	0.006	0.001	0.013	0.040	0.007	N/A
37th	0.040	0.037	0.039	0.270	0.249	0.263	N/A
38th	0.001	0.005	0.001	0.007	0.034	0.007	N/A
39th	0.038	0.036	0.036	0.256	0.243	0.243	N/A
40th	0.001	0.005	0.001	0.007	0.034	0.007	N/A
THD	--	--	--	3.417	3.264	3.445	13
PWHD	--	--	--	5.809	5.549	5.856	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C,100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**

Model	AF15K-MTH + ATOM HVS-20.48 (4P)
Active power (W)	-6795 (66%, 25°C)
Voltage (V)	230
Current (A)	9.8
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	9.73	9.75	9.74	--	--	--	--
2nd	0.012	0.007	0.016	0.124	0.072	0.165	8
3rd	0.300	0.276	0.302	3.093	2.845	3.113	N/A
4th	0.016	0.008	0.013	0.165	0.082	0.134	4
5th	0.216	0.216	0.218	2.227	2.227	2.247	10.7
6th	0.003	0.010	0.005	0.031	0.103	0.052	2.7
7th	0.111	0.112	0.111	1.144	1.155	1.144	7.2
8th	0.005	0.007	0.003	0.052	0.072	0.031	2
9th	0.087	0.088	0.087	0.897	0.907	0.897	N/A
10th	0.002	0.006	0.002	0.021	0.062	0.021	1.6
11th	0.067	0.066	0.068	0.691	0.680	0.701	3.1
12th	0.002	0.005	0.002	0.021	0.052	0.021	1.3
13th	0.054	0.057	0.059	0.557	0.588	0.608	2
14th	0.002	0.005	0.002	0.021	0.052	0.021	N/A
15th	0.043	0.043	0.046	0.443	0.443	0.474	N/A
16th	0.001	0.004	0.002	0.010	0.041	0.021	N/A
17th	0.033	0.034	0.037	0.340	0.351	0.381	N/A
18th	0.002	0.004	0.001	0.021	0.041	0.010	N/A
19th	0.029	0.030	0.032	0.299	0.309	0.330	N/A
20th	0.002	0.004	0.002	0.021	0.041	0.021	N/A
21st	0.025	0.024	0.028	0.258	0.247	0.289	N/A
22nd	0.002	0.003	0.001	0.021	0.031	0.010	N/A
23rd	0.025	0.024	0.025	0.258	0.247	0.258	N/A
24th	0.001	0.003	0.002	0.010	0.031	0.021	N/A
25th	0.027	0.026	0.027	0.278	0.268	0.278	N/A
26th	0.001	0.002	0.001	0.010	0.021	0.010	N/A
27th	0.028	0.028	0.027	0.289	0.289	0.278	N/A
28th	0.001	0.002	0.002	0.010	0.021	0.021	N/A
29th	0.030	0.029	0.029	0.309	0.299	0.299	N/A
30th	0.002	0.002	0.001	0.021	0.021	0.010	N/A
31st	0.033	0.031	0.030	0.340	0.320	0.309	N/A
32nd	0.001	0.002	0.001	0.010	0.021	0.010	N/A
33rd	0.034	0.032	0.032	0.351	0.330	0.330	N/A
34th	0.001	0.002	0.001	0.010	0.021	0.010	N/A
35th	0.035	0.033	0.032	0.361	0.340	0.330	N/A
36th	0.002	0.002	0.002	0.021	0.021	0.021	N/A
37th	0.035	0.033	0.034	0.361	0.340	0.351	N/A
38th	0.001	0.002	0.001	0.010	0.021	0.010	N/A
39th	0.035	0.034	0.034	0.361	0.351	0.351	N/A
40th	0.001	0.002	0.001	0.010	0.021	0.010	N/A
THD	--	--	--	4.380	4.201	4.386	13
PWHD	--	--	--	7.875	7.142	7.465	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C,100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)	

Active power (W)	-6795 (66%, -25°C)
Voltage (V)	230
Current (A)	9.8
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	9.81	9.83	9.82	--	--	--	--
2nd	0.015	0.006	0.018	0.153	0.061	0.183	8
3rd	0.300	0.274	0.302	3.058	2.793	3.078	N/A
4th	0.016	0.008	0.014	0.163	0.082	0.143	4
5th	0.216	0.218	0.218	2.202	2.222	2.222	10.7
6th	0.003	0.010	0.006	0.031	0.102	0.061	2.7
7th	0.111	0.112	0.110	1.131	1.142	1.121	7.2
8th	0.005	0.007	0.003	0.051	0.071	0.031	2
9th	0.087	0.088	0.087	0.887	0.897	0.887	N/A
10th	0.002	0.006	0.003	0.020	0.061	0.031	1.6
11th	0.067	0.066	0.068	0.683	0.673	0.693	3.1
12th	0.002	0.005	0.002	0.020	0.051	0.020	1.3
13th	0.054	0.057	0.059	0.550	0.581	0.601	2
14th	0.002	0.006	0.002	0.020	0.061	0.020	N/A
15th	0.043	0.042	0.046	0.438	0.428	0.469	N/A
16th	0.001	0.005	0.001	0.010	0.051	0.010	N/A
17th	0.033	0.034	0.037	0.336	0.347	0.377	N/A
18th	0.001	0.004	0.001	0.010	0.041	0.010	N/A
19th	0.029	0.030	0.032	0.296	0.306	0.326	N/A
20th	0.001	0.004	0.001	0.010	0.041	0.010	N/A
21st	0.024	0.024	0.028	0.245	0.245	0.285	N/A
22nd	0.001	0.003	0.001	0.010	0.031	0.010	N/A
23rd	0.025	0.025	0.025	0.255	0.255	0.255	N/A
24th	0.001	0.003	0.001	0.010	0.031	0.010	N/A
25th	0.027	0.026	0.027	0.275	0.265	0.275	N/A
26th	0.001	0.002	0.001	0.010	0.020	0.010	N/A
27th	0.028	0.028	0.027	0.285	0.285	0.275	N/A
28th	0.001	0.002	0.001	0.010	0.020	0.010	N/A
29th	0.030	0.029	0.028	0.306	0.296	0.285	N/A
30th	0.001	0.002	0.002	0.010	0.020	0.020	N/A
31st	0.033	0.031	0.030	0.336	0.316	0.306	N/A
32nd	0.001	0.002	0.001	0.010	0.020	0.010	N/A
33rd	0.033	0.032	0.031	0.336	0.326	0.316	N/A
34th	0.001	0.001	0.001	0.010	0.010	0.010	N/A
35th	0.034	0.033	0.032	0.347	0.336	0.326	N/A
36th	0.002	0.002	0.001	0.020	0.020	0.010	N/A
37th	0.035	0.033	0.033	0.357	0.336	0.336	N/A
38th	0.001	0.002	0.001	0.010	0.020	0.010	N/A
39th	0.035	0.034	0.034	0.357	0.347	0.347	N/A
40th	0.001	0.002	0.001	0.010	0.020	0.010	N/A
THD	--	--	--	4.378	4.192	4.387	13
PWHD	--	--	--	7.443	7.126	7.457	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C, 100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)	

Active power (W)	-6795 (66%, 60°C)
Voltage (V)	230
Current (A)	9.8
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	9.81	9.83	9.82	--	--	--	--
2nd	0.013	0.007	0.017	0.133	0.071	0.173	8
3rd	0.301	0.276	0.302	3.068	2.813	3.078	N/A
4th	0.015	0.008	0.013	0.153	0.082	0.133	4
5th	0.216	0.216	0.218	2.202	2.202	2.222	10.7
6th	0.003	0.010	0.005	0.031	0.102	0.051	2.7
7th	0.111	0.112	0.111	1.131	1.142	1.131	7.2
8th	0.006	0.007	0.003	0.061	0.071	0.031	2
9th	0.087	0.088	0.087	0.887	0.897	0.887	N/A
10th	0.002	0.006	0.003	0.020	0.061	0.031	1.6
11th	0.067	0.066	0.068	0.683	0.673	0.693	3.1
12th	0.002	0.005	0.002	0.020	0.051	0.020	1.3
13th	0.054	0.057	0.059	0.550	0.581	0.601	2
14th	0.002	0.005	0.002	0.020	0.051	0.020	N/A
15th	0.043	0.043	0.046	0.438	0.438	0.469	N/A
16th	0.002	0.004	0.001	0.020	0.041	0.010	N/A
17th	0.033	0.034	0.037	0.336	0.347	0.377	N/A
18th	0.002	0.004	0.001	0.020	0.041	0.010	N/A
19th	0.029	0.030	0.032	0.296	0.306	0.326	N/A
20th	0.001	0.004	0.001	0.010	0.041	0.010	N/A
21st	0.024	0.024	0.028	0.245	0.245	0.285	N/A
22nd	0.001	0.003	0.001	0.010	0.031	0.010	N/A
23rd	0.025	0.024	0.025	0.255	0.245	0.255	N/A
24th	0.001	0.003	0.001	0.010	0.031	0.010	N/A
25th	0.027	0.026	0.027	0.275	0.265	0.275	N/A
26th	0.001	0.002	0.001	0.010	0.020	0.010	N/A
27th	0.028	0.028	0.027	0.285	0.285	0.275	N/A
28th	0.001	0.002	0.001	0.010	0.020	0.010	N/A
29th	0.030	0.029	0.029	0.306	0.296	0.296	N/A
30th	0.001	0.002	0.001	0.010	0.020	0.010	N/A
31st	0.033	0.031	0.030	0.336	0.316	0.306	N/A
32nd	0.001	0.002	0.001	0.010	0.020	0.010	N/A
33rd	0.033	0.032	0.032	0.336	0.326	0.326	N/A
34th	0.001	0.002	0.001	0.010	0.020	0.010	N/A
35th	0.034	0.033	0.032	0.347	0.336	0.326	N/A
36th	0.002	0.002	0.001	0.020	0.020	0.010	N/A
37th	0.035	0.033	0.033	0.357	0.336	0.336	N/A
38th	0.001	0.002	0.001	0.010	0.020	0.010	N/A
39th	0.035	0.034	0.034	0.357	0.347	0.347	N/A
40th	0.001	0.002	0.001	0.010	0.020	0.010	N/A
THD	--	--	--	4.382	4.202	4.385	13
PWHD	--	--	--	7.450	7.143	7.454	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C,100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**

Model	AF15K-MTH + ATOM HVS-20.48 (4P)
Active power (W)	-3392 (33%, 25°C)
Voltage (V)	230
Current (A)	4.9
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	4.91	4.93	4.92	--	--	--	--
2nd	0.013	0.007	0.018	0.265	0.143	0.367	8
3rd	0.230	0.227	0.239	4.694	4.633	4.878	N/A
4th	0.014	0.001	0.015	0.286	0.020	0.306	4
5th	0.152	0.155	0.159	3.102	3.163	3.245	10.7
6th	0.003	0.007	0.005	0.061	0.143	0.102	2.7
7th	0.049	0.054	0.056	1.000	1.102	1.143	7.2
8th	0.004	0.003	0.003	0.082	0.061	0.061	2
9th	0.027	0.027	0.025	0.551	0.551	0.510	N/A
10th	0.002	0.002	0.002	0.041	0.041	0.041	1.6
11th	0.038	0.034	0.034	0.776	0.694	0.694	3.1
12th	0.002	0.003	0.003	0.041	0.061	0.061	1.3
13th	0.045	0.042	0.041	0.918	0.857	0.837	2
14th	0.002	0.003	0.002	0.041	0.061	0.041	N/A
15th	0.042	0.042	0.040	0.857	0.857	0.816	N/A
16th	0.002	0.002	0.002	0.041	0.041	0.041	N/A
17th	0.032	0.034	0.034	0.653	0.694	0.694	N/A
18th	0.002	0.002	0.002	0.041	0.041	0.041	N/A
19th	0.018	0.022	0.022	0.367	0.449	0.449	N/A
20th	0.001	0.002	0.002	0.020	0.041	0.041	N/A
21st	0.009	0.009	0.012	0.184	0.184	0.245	N/A
22nd	0.001	0.002	0.002	0.020	0.041	0.041	N/A
23rd	0.015	0.012	0.011	0.306	0.245	0.224	N/A
24th	0.002	0.002	0.002	0.041	0.041	0.041	N/A
25th	0.021	0.019	0.018	0.429	0.388	0.367	N/A
26th	0.002	0.002	0.001	0.041	0.041	0.020	N/A
27th	0.023	0.023	0.023	0.469	0.469	0.469	N/A
28th	0.002	0.002	0.001	0.041	0.041	0.020	N/A
29th	0.022	0.023	0.023	0.449	0.469	0.469	N/A
30th	0.002	0.002	0.001	0.041	0.041	0.020	N/A
31st	0.020	0.022	0.022	0.408	0.449	0.449	N/A
32nd	0.002	0.001	0.001	0.041	0.020	0.020	N/A
33rd	0.021	0.022	0.021	0.429	0.449	0.429	N/A
34th	0.001	0.001	0.001	0.020	0.020	0.020	N/A
35th	0.025	0.024	0.023	0.510	0.490	0.469	N/A
36th	0.001	0.002	0.002	0.020	0.041	0.041	N/A
37th	0.030	0.029	0.027	0.612	0.592	0.551	N/A
38th	0.00	0.002	0.001	0.000	0.041	0.020	N/A
39th	0.035	0.034	0.030	0.714	0.694	0.612	N/A
40th	0.001	0.002	0.001	0.020	0.041	0.020	N/A
THD	--	--	--	6.410	6.354	6.546	13
PWHD	--	--	--	10.897	10.802	11.128	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C,100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)	

Active power (W)	-3392 (33%, -25°C)
Voltage (V)	230
Current (A)	4.9
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	4.91	4.93	4.92	--	--	--	--
2nd	0.014	0.007	0.017	0.286	0.143	0.347	8
3rd	0.231	0.227	0.240	4.714	4.633	4.898	N/A
4th	0.015	0.009	0.016	0.306	0.184	0.327	4
5th	0.151	0.154	0.159	3.082	3.143	3.245	10.7
6th	0.002	0.007	0.005	0.041	0.143	0.102	2.7
7th	0.049	0.054	0.056	1.000	1.102	1.143	7.2
8th	0.005	0.003	0.004	0.102	0.061	0.082	2
9th	0.026	0.027	0.025	0.531	0.551	0.510	N/A
10th	0.002	0.002	0.002	0.041	0.041	0.041	1.6
11th	0.038	0.033	0.034	0.776	0.673	0.694	3.1
12th	0.002	0.003	0.002	0.041	0.061	0.041	1.3
13th	0.045	0.043	0.041	0.918	0.878	0.837	2
14th	0.002	0.003	0.002	0.041	0.061	0.041	N/A
15th	0.042	0.042	0.040	0.857	0.857	0.816	N/A
16th	0.002	0.003	0.002	0.041	0.061	0.041	N/A
17th	0.032	0.034	0.034	0.653	0.694	0.694	N/A
18th	0.002	0.002	0.002	0.041	0.041	0.041	N/A
19th	0.018	0.022	0.022	0.367	0.449	0.449	N/A
20th	0.001	0.002	0.001	0.020	0.041	0.020	N/A
21st	0.009	0.009	0.011	0.184	0.184	0.224	N/A
22nd	0.001	0.001	0.002	0.020	0.020	0.041	N/A
23rd	0.014	0.012	0.011	0.286	0.245	0.224	N/A
24th	0.001	0.001	0.002	0.020	0.020	0.041	N/A
25th	0.021	0.019	0.018	0.429	0.388	0.367	N/A
26th	0.001	0.001	0.001	0.020	0.020	0.020	N/A
27th	0.023	0.023	0.023	0.469	0.469	0.469	N/A
28th	0.001	0.001	0.001	0.020	0.020	0.020	N/A
29th	0.022	0.023	0.023	0.449	0.469	0.469	N/A
30th	0.002	0.001	0.001	0.041	0.020	0.020	N/A
31st	0.020	0.022	0.022	0.408	0.449	0.449	N/A
32nd	0.001	0.001	0.001	0.020	0.020	0.020	N/A
33rd	0.021	0.022	0.021	0.429	0.449	0.429	N/A
34th	0.001	0.001	0.001	0.020	0.020	0.020	N/A
35th	0.025	0.024	0.023	0.510	0.490	0.469	N/A
36th	0.001	0.001	0.001	0.020	0.020	0.020	N/A
37th	0.030	0.029	0.027	0.612	0.592	0.551	N/A
38th	0.001	0.002	0.001	0.020	0.041	0.020	N/A
39th	0.035	0.034	0.031	0.714	0.694	0.633	N/A
40th	0.001	0.002	0.001	0.020	0.041	0.020	N/A
THD	--	--	--	6.418	6.348	6.562	13
PWHD	--	--	--	10.910	10.791	11.155	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3	**TABLE: Harmonics measurement under test condition 25°C /-25°C / 60°C, 100% / 66% / 33% P_{SMAX} and P_{CMAX} (CEI EN 61000-3-12)**	**P**

Model	AF15K-MTH + ATOM HVS-20.48 (4P)
Active power (W)	-3392 (33%, 60°C)
Voltage (V)	230
Current (A)	4.9
Power Factor	0.999
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)			Current Percent of Fundamental (%)			Harmonic Current Limits (%)
	L1 phase	L2 phase	L3 phase	L1 phase	L2 phase	L3 phase	
1st	4.92	4.91	4.93	--	--	--	--
2nd	0.013	0.005	0.017	0.265	0.102	0.347	8
3rd	0.231	0.227	0.239	4.714	4.633	4.878	N/A
4th	0.015	0.009	0.016	0.306	0.184	0.327	4
5th	0.151	0.154	0.159	3.082	3.143	3.245	10.7
6th	0.003	0.007	0.005	0.061	0.143	0.102	2.7
7th	0.049	0.053	0.056	1.000	1.082	1.143	7.2
8th	0.005	0.003	0.004	0.102	0.061	0.082	2
9th	0.026	0.027	0.025	0.531	0.551	0.510	N/A
10th	0.002	0.002	0.002	0.041	0.041	0.041	1.6
11th	0.038	0.034	0.034	0.776	0.694	0.694	3.1
12th	0.002	0.003	0.002	0.041	0.061	0.041	1.3
13th	0.045	0.043	0.041	0.918	0.878	0.837	2
14th	0.002	0.003	0.002	0.041	0.061	0.041	N/A
15th	0.042	0.042	0.040	0.857	0.857	0.816	N/A
16th	0.002	0.003	0.002	0.041	0.061	0.041	N/A
17th	0.032	0.034	0.034	0.653	0.694	0.694	N/A
18th	0.002	0.002	0.002	0.041	0.041	0.041	N/A
19th	0.018	0.022	0.022	0.367	0.449	0.449	N/A
20th	0.001	0.002	0.001	0.020	0.041	0.020	N/A
21st	0.009	0.009	0.011	0.184	0.184	0.224	N/A
22nd	0.001	0.001	0.002	0.020	0.020	0.041	N/A
23rd	0.015	0.012	0.011	0.306	0.245	0.224	N/A
24th	0.001	0.001	0.002	0.020	0.020	0.041	N/A
25th	0.021	0.019	0.018	0.429	0.388	0.367	N/A
26th	0.001	0.001	0.001	0.020	0.020	0.020	N/A
27th	0.023	0.023	0.023	0.469	0.469	0.469	N/A
28th	0.001	0.001	0.001	0.020	0.020	0.020	N/A
29th	0.022	0.023	0.023	0.449	0.469	0.469	N/A
30th	0.002	0.001	0.001	0.041	0.020	0.020	N/A
31st	0.020	0.022	0.022	0.408	0.449	0.449	N/A
32nd	0.001	0.001	0.001	0.020	0.020	0.020	N/A
33rd	0.021	0.022	0.021	0.429	0.449	0.429	N/A
34th	0.001	0.001	0.001	0.020	0.020	0.020	N/A
35th	0.025	0.024	0.023	0.510	0.490	0.469	N/A
36th	0.001	0.001	0.001	0.020	0.020	0.020	N/A
37th	0.030	0.029	0.027	0.612	0.592	0.551	N/A
38th	0.001	0.002	0.001	0.020	0.041	0.020	N/A
39th	0.035	0.034	0.031	0.714	0.694	0.633	N/A
40th	0.001	0.002	0.001	0.020	0.041	0.020	N/A
THD	--	--	--	6.425	6.352	6.557	13
PWHD	--	--	--	10.922	10.798	11.146	22

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3 a) Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2)				
25°C, 100% P_{SMAX} power condition: AF15K-MTH + ATOM HVS-7.68				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.010	0.010	0.011	1.080
3rd	0.191	0.156	0.186	2.300
4th	0.005	0.004	0.009	0.430
5th	0.052	0.044	0.038	1.140
6th	0.010	0.004	0.004	0.300
7th	0.078	0.077	0.079	0.770
8th	0.004	0.005	0.006	0.230
9th	0.059	0.059	0.060	0.400
10th	0.002	0.002	0.003	0.184
11th	0.045	0.047	0.044	0.330
12th	0.002	0.003	0.002	0.153
13th	0.035	0.037	0.037	0.210
14th	0.002	0.002	0.002	0.131
15th	0.025	0.026	0.025	0.150
16th	0.002	0.002	0.002	0.115
17th	0.021	0.021	0.021	0.132
18th	0.002	0.002	0.003	0.102
19th	0.014	0.015	0.016	0.118
20th	0.001	0.002	0.002	0.092
21th	0.010	0.012	0.012	0.107
22th	0.001	0.002	0.002	0.084
23th	0.010	0.010	0.011	0.098
24th	0.001	0.001	0.001	0.077
25th	0.010	0.010	0.010	0.090
26th	0.001	0.001	0.002	0.071
27th	0.011	0.011	0.012	0.083
28th	0.001	0.001	0.001	0.066
29th	0.011	0.011	0.012	0.078
30th	0.001	0.002	0.001	0.061
31th	0.012	0.012	0.013	0.073
32th	0.001	0.001	0.001	0.058
33th	0.013	0.014	0.014	0.068
34th	0.001	0.001	0.001	0.054
35th	0.015	0.014	0.015	0.064
36th	0.001	0.001	0.001	0.051
37th	0.015	0.015	0.015	0.061
38th	0.001	0.001	0.001	0.048
39th	0.017	0.016	0.016	0.058
40th	0.017	0.001	0.001	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2)				
25°C, 66% P_{SMAX} power condition: AF15K-MTH + ATOM HVS-7.68				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.007	0.010	0.010	1.080
3rd	0.173	0.151	0.171	2.300
4th	0.011	0.006	0.010	0.430
5th	0.048	0.042	0.038	1.140
6th	0.008	0.003	0.004	0.300
7th	0.055	0.058	0.058	0.770
8th	0.004	0.005	0.005	0.230
9th	0.038	0.041	0.042	0.400
10th	0.003	0.003	0.002	0.184
11th	0.023	0.025	0.026	0.330
12th	0.003	0.003	0.002	0.153
13th	0.012	0.016	0.015	0.210
14th	0.002	0.002	0.002	0.131
15th	0.007	0.007	0.008	0.150
16th	0.002	0.002	0.002	0.115
17th	0.004	0.005	0.006	0.132
18th	0.001	0.002	0.002	0.102
19th	0.005	0.006	0.006	0.118
20th	0.001	0.002	0.002	0.092
21th	0.007	0.006	0.006	0.107
22th	0.001	0.002	0.002	0.084
23th	0.005	0.006	0.006	0.098
24th	0.002	0.002	0.002	0.077
25th	0.003	0.005	0.005	0.090
26th	0.001	0.002	0.002	0.071
27th	0.004	0.005	0.006	0.083
28th	0.001	0.001	0.001	0.066
29th	0.005	0.005	0.005	0.078
30th	0.001	0.001	0.001	0.061
31th	0.007	0.007	0.007	0.073
32th	0.001	0.001	0.001	0.058
33th	0.010	0.009	0.009	0.068
34th	0.001	0.001	0.001	0.054
35th	0.014	0.011	0.012	0.064
36th	0.001	0.001	0.001	0.051
37th	0.016	0.014	0.014	0.061
38th	0.001	0.001	0.001	0.048
39th	0.019	0.016	0.017	0.058
40th	0.001	0.001	0.001	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2)				
25°C, 33% P_{SMAX} power condition: AF15K-MTH + ATOM HVS-7.68				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.006	0.008	0.007	1.080
3rd	0.135	0.134	0.139	2.300
4th	0.010	0.006	0.009	0.430
5th	0.089	0.088	0.093	1.140
6th	0.002	0.003	0.003	0.300
7th	0.017	0.016	0.015	0.770
8th	0.003	0.004	0.002	0.230
9th	0.031	0.022	0.021	0.400
10th	0.002	0.002	0.003	0.184
11th	0.031	0.026	0.025	0.330
12th	0.004	0.003	0.002	0.153
13th	0.023	0.023	0.023	0.210
14th	0.003	0.002	0.002	0.131
15th	0.018	0.017	0.017	0.150
16th	0.003	0.003	0.002	0.115
17th	0.012	0.016	0.016	0.132
18th	0.001	0.002	0.002	0.102
19th	0.006	0.010	0.010	0.118
20th	0.002	0.002	0.001	0.092
21th	0.006	0.006	0.007	0.107
22th	0.002	0.002	0.002	0.084
23th	0.015	0.012	0.011	0.098
24th	0.002	0.001	0.001	0.077
25th	0.021	0.019	0.019	0.090
26th	0.002	0.002	0.001	0.071
27th	0.020	0.022	0.022	0.083
28th	0.001	0.002	0.001	0.066
29th	0.017	0.020	0.020	0.078
30th	0.001	0.002	0.001	0.061
31th	0.016	0.017	0.017	0.073
32th	0.001	0.001	0.001	0.058
33th	0.022	0.019	0.018	0.068
34th	0.001	0.001	0.001	0.054
35th	0.026	0.023	0.023	0.064
36th	0.001	0.001	0.001	0.051
37th	0.026	0.026	0.026	0.061
38th	0.001	0.001	0.001	0.048
39th	0.022	0.025	0.026	0.058
40th	0.001	0.002	0.001	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2)				
25°C, 100% P_{CMAX} power condition: AF15K-MTH + ATOM HVS-7.68				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.013	0.007	0.017	1.080
3rd	0.252	0.244	0.258	2.300
4th	0.015	0.009	0.016	0.430
5th	0.170	0.174	0.178	1.140
6th	0.004	0.008	0.005	0.300
7th	0.065	0.070	0.072	0.770
8th	0.005	0.003	0.003	0.230
9th	0.029	0.034	0.033	0.400
10th	0.002	0.002	0.002	0.184
11th	0.028	0.025	0.025	0.330
12th	0.002	0.003	0.002	0.153
13th	0.037	0.033	0.037	0.210
14th	0.002	0.003	0.002	0.131
15th	0.040	0.038	0.040	0.150
16th	0.002	0.002	0.002	0.115
17th	0.038	0.038	0.038	0.132
18th	0.002	0.002	0.002	0.102
19th	0.030	0.030	0.030	0.118
20th	0.002	0.002	0.002	0.092
21th	0.019	0.019	0.019	0.107
22th	0.002	0.002	0.002	0.084
23th	0.012	0.012	0.012	0.098
24th	0.001	0.001	0.001	0.077
25th	0.014	0.014	0.014	0.090
26th	0.002	0.002	0.002	0.071
27th	0.020	0.020	0.020	0.083
28th	0.001	0.001	0.001	0.066
29th	0.025	0.025	0.025	0.078
30th	0.002	0.002	0.001	0.061
31th	0.028	0.027	0.026	0.073
32th	0.001	0.002	0.001	0.058
33th	0.027	0.029	0.028	0.068
34th	0.001	0.001	0.001	0.054
35th	0.026	0.028	0.028	0.064
36th	0.001	0.002	0.001	0.051
37th	0.027	0.028	0.028	0.061
38th	0.001	0.002	0.001	0.048
39th	0.003	0.030	0.029	0.058
40th	0.001	0.002	0.001	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2)				
25°C, 66% P_{CMAX} power condition: AF15K-MTH + ATOM HVS-7.68				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.014	0.005	0.016	1.080
3rd	0.201	0.204	0.213	2.300
4th	0.017	0.009	0.017	0.430
5th	0.120	0.121	0.128	1.140
6th	0.004	0.006	0.005	0.300
7th	0.047	0.042	0.042	0.770
8th	0.004	0.003	0.005	0.230
9th	0.055	0.051	0.048	0.400
10th	0.002	0.003	0.003	0.184
11th	0.059	0.058	0.058	0.330
12th	0.002	0.003	0.003	0.153
13th	0.044	0.044	0.044	0.210
14th	0.002	0.002	0.002	0.131
15th	0.022	0.022	0.022	0.150
16th	0.002	0.002	0.002	0.115
17th	0.009	0.009	0.009	0.132
18th	0.002	0.002	0.002	0.102
19th	0.021	0.021	0.021	0.118
20th	0.002	0.002	0.002	0.092
21th	0.022	0.022	0.022	0.107
22th	0.001	0.001	0.001	0.084
23th	0.016	0.016	0.016	0.098
24th	0.002	0.002	0.002	0.077
25th	0.009	0.009	0.009	0.090
26th	0.002	0.002	0.002	0.071
27th	0.017	0.017	0.017	0.083
28th	0.002	0.002	0.002	0.066
29th	0.025	0.025	0.025	0.078
30th	0.002	0.002	0.001	0.061
31th	0.026	0.028	0.027	0.073
32th	0.001	0.002	0.001	0.058
33th	0.023	0.026	0.027	0.068
34th	0.001	0.001	0.001	0.054
35th	0.025	0.026	0.025	0.064
36th	0.001	0.001	0.001	0.051
37th	0.031	0.029	0.028	0.061
38th	0.001	0.002	0.001	0.048
39th	0.038	0.036	0.032	0.058
40th	0.001	0.002	0.002	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2)				
25°C, 33% P_{CMAX} power condition: AF15K-MTH + ATOM HVS-7.68				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.012	0.004	0.015	1.080
3rd	0.094	0.117	0.122	2.300
4th	0.015	0.011	0.017	0.430
5th	0.091	0.097	0.105	1.140
6th	0.003	0.003	0.003	0.300
7th	0.097	0.091	0.091	0.770
8th	0.007	0.003	0.002	0.230
9th	0.075	0.068	0.068	0.400
10th	0.004	0.003	0.003	0.184
11th	0.033	0.026	0.027	0.330
12th	0.004	0.002	0.002	0.153
13th	0.042	0.033	0.032	0.210
14th	0.002	0.003	0.002	0.131
15th	0.025	0.029	0.028	0.150
16th	0.002	0.002	0.002	0.115
17th	0.003	0.003	0.003	0.132
18th	0.003	0.003	0.003	0.102
19th	0.013	0.013	0.013	0.118
20th	0.001	0.001	0.001	0.092
21th	0.013	0.013	0.013	0.107
22th	0.002	0.002	0.002	0.084
23th	0.008	0.008	0.008	0.098
24th	0.001	0.001	0.001	0.077
25th	0.019	0.019	0.019	0.090
26th	0.002	0.002	0.002	0.071
27th	0.021	0.021	0.021	0.083
28th	0.002	0.002	0.002	0.066
29th	0.018	0.018	0.018	0.078
30th	0.002	0.002	0.001	0.061
31th	0.025	0.026	0.024	0.073
32th	0.001	0.002	0.002	0.058
33th	0.028	0.031	0.031	0.068
34th	0.001	0.002	0.002	0.054
35th	0.029	0.031	0.030	0.064
36th	0.001	0.002	0.001	0.051
37th	0.032	0.032	0.031	0.061
38th	0.002	0.001	0.001	0.048
39th	0.037	0.038	0.034	0.058
40th	0.001	0.002	0.001	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3 a) Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2)				
25°C, 100% P_{SMAX} power condition: AF3K-MTH + ATOM HVS-7.68				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.012	0.011	0.009	1.080
3rd	0.189	0.178	0.185	2.300
4th	0.004	0.003	0.005	0.430
5th	0.081	0.079	0.076	1.140
6th	0.003	0.002	0.003	0.300
7th	0.055	0.056	0.055	0.770
8th	0.002	0.002	0.002	0.230
9th	0.033	0.034	0.033	0.400
10th	0.002	0.001	0.001	0.184
11th	0.023	0.024	0.024	0.330
12th	0.002	0.002	0.001	0.153
13th	0.016	0.017	0.016	0.210
14th	0.002	0.001	0.001	0.131
15th	0.012	0.012	0.012	0.150
16th	0.001	0.001	0.001	0.115
17th	0.008	0.009	0.008	0.132
18th	0.001	0.001	0.001	0.102
19th	0.007	0.008	0.008	0.118
20th	0.001	0.001	0.001	0.092
21th	0.008	0.009	0.009	0.107
22th	0.001	0.001	0.001	0.084
23th	0.011	0.011	0.011	0.098
24th	0.001	0.001	0.001	0.077
25th	0.013	0.013	0.013	0.090
26th	0.001	0.001	0.001	0.071
27th	0.015	0.015	0.015	0.083
28th	0.001	0.001	0.001	0.066
29th	0.016	0.016	0.016	0.078
30th	0.001	0.001	0.001	0.061
31th	0.017	0.017	0.017	0.073
32th	0.001	0.001	0.001	0.058
33th	0.017	0.017	0.017	0.068
34th	0.001	0.001	0.001	0.054
35th	0.015	0.016	0.016	0.064
36th	0.001	0.001	0.001	0.051
37th	0.014	0.014	0.014	0.061
38th	0.001	0.001	0.001	0.048
39th	0.013	0.014	0.014	0.058
40th	0.001	0.001	0.001	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2)				
25°C, 66% P_{SMAX} power condition: AF3K-MTH + ATOM HVS-7.68				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.009	0.010	0.009	1.080
3rd	0.170	0.172	0.169	2.300
4th	0.003	0.003	0.003	0.430
5th	0.083	0.083	0.083	1.140
6th	0.002	0.002	0.002	0.300
7th	0.035	0.035	0.035	0.770
8th	0.002	0.002	0.002	0.230
9th	0.011	0.011	0.011	0.400
10th	0.001	0.001	0.001	0.184
11th	0.004	0.004	0.004	0.330
12th	0.001	0.001	0.001	0.153
13th	0.015	0.015	0.015	0.210
14th	0.002	0.002	0.002	0.131
15th	0.022	0.022	0.022	0.150
16th	0.001	0.001	0.001	0.115
17th	0.025	0.025	0.025	0.132
18th	0.001	0.001	0.001	0.102
19th	0.023	0.023	0.023	0.118
20th	0.001	0.001	0.001	0.092
21th	0.018	0.018	0.018	0.107
22th	0.001	0.001	0.001	0.084
23th	0.015	0.015	0.015	0.098
24th	0.001	0.001	0.001	0.077
25th	0.016	0.016	0.016	0.090
26th	0.001	0.001	0.001	0.071
27th	0.019	0.019	0.019	0.083
28th	0.001	0.001	0.001	0.066
29th	0.020	0.020	0.020	0.078
30th	0.001	0.001	0.001	0.061
31th	0.019	0.019	0.019	0.073
32th	0.001	0.001	0.001	0.058
33th	0.018	0.018	0.018	0.068
34th	0.001	0.001	0.001	0.054
35th	0.015	0.015	0.015	0.064
36th	0.001	0.001	0.001	0.051
37th	0.015	0.015	0.015	0.061
38th	0.001	0.001	0.002	0.048
39th	0.016	0.017	0.016	0.058
40th	0.001	0.002	0.001	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2)				
25°C, 33% P_{SMAX} power condition: AF3K-MTH + ATOM HVS-7.68				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.007	0.006	0.008	1.080
3rd	0.144	0.142	0.146	2.300
4th	0.003	0.002	0.003	0.430
5th	0.053	0.051	0.053	1.140
6th	0.003	0.002	0.003	0.300
7th	0.039	0.039	0.039	0.770
8th	0.003	0.003	0.003	0.230
9th	0.056	0.056	0.056	0.400
10th	0.002	0.002	0.002	0.184
11th	0.045	0.045	0.045	0.330
12th	0.001	0.001	0.001	0.153
13th	0.019	0.019	0.019	0.210
14th	0.002	0.002	0.002	0.131
15th	0.030	0.030	0.030	0.150
16th	0.002	0.002	0.002	0.115
17th	0.035	0.035	0.035	0.132
18th	0.001	0.001	0.001	0.102
19th	0.023	0.023	0.023	0.118
20th	0.001	0.001	0.001	0.092
21th	0.020	0.020	0.020	0.107
22th	0.001	0.001	0.001	0.084
23th	0.025	0.024	0.025	0.098
24th	0.001	0.001	0.001	0.077
25th	0.020	0.021	0.020	0.090
26th	0.001	0.002	0.001	0.071
27th	0.015	0.016	0.015	0.083
28th	0.001	0.002	0.001	0.066
29th	0.020	0.021	0.020	0.078
30th	0.001	0.001	0.001	0.061
31th	0.019	0.010	0.019	0.073
32th	0.001	0.002	0.001	0.058
33th	0.016	0.015	0.016	0.068
34th	0.001	0.002	0.001	0.054
35th	0.019	0.018	0.019	0.064
36th	0.001	0.002	0.001	0.051
37th	0.021	0.020	0.021	0.061
38th	0.001	0.002	0.001	0.048
39th	0.019	0.018	0.019	0.058
40th	0.001	0.002	0.001	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2)				
25°C, 100% P_{CMAX} power condition: AF3K-MTH + ATOM HVS-7.68				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.012	0.011	0.010	1.080
3rd	0.189	0.178	0.185	2.300
4th	0.004	0.003	0.005	0.430
5th	0.081	0.079	0.076	1.140
6th	0.003	0.002	0.003	0.300
7th	0.055	0.056	0.055	0.770
8th	0.002	0.002	0.002	0.230
9th	0.033	0.034	0.033	0.400
10th	0.002	0.001	0.001	0.184
11th	0.023	0.024	0.024	0.330
12th	0.002	0.002	0.001	0.153
13th	0.016	0.017	0.016	0.210
14th	0.002	0.001	0.001	0.131
15th	0.012	0.012	0.012	0.150
16th	0.001	0.001	0.001	0.115
17th	0.008	0.009	0.008	0.132
18th	0.001	0.001	0.001	0.102
19th	0.007	0.008	0.008	0.118
20th	0.001	0.001	0.001	0.092
21th	0.008	0.009	0.009	0.107
22th	0.001	0.001	0.001	0.084
23th	0.011	0.011	0.011	0.098
24th	0.001	0.001	0.001	0.077
25th	0.013	0.013	0.013	0.090
26th	0.001	0.001	0.001	0.071
27th	0.015	0.015	0.015	0.083
28th	0.001	0.001	0.001	0.066
29th	0.016	0.016	0.016	0.078
30th	0.001	0.001	0.001	0.061
31th	0.017	0.017	0.017	0.073
32th	0.001	0.001	0.001	0.058
33th	0.017	0.017	0.017	0.068
34th	0.001	0.001	0.001	0.054
35th	0.015	0.016	0.016	0.064
36th	0.001	0.001	0.001	0.051
37th	0.014	0.014	0.014	0.061
38th	0.001	0.001	0.001	0.048
39th	0.013	0.014	0.014	0.058
40th	0.001	0.002	0.002	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2)				
25°C, 66% P_{CMAX} power condition: AF3K-MTH + ATOM HVS-7.68				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.009	0.010	0.009	1.080
3rd	0.170	0.172	0.169	2.300
4th	0.003	0.003	0.003	0.430
5th	0.083	0.083	0.083	1.140
6th	0.002	0.002	0.002	0.300
7th	0.035	0.035	0.035	0.770
8th	0.002	0.002	0.002	0.230
9th	0.011	0.011	0.011	0.400
10th	0.001	0.001	0.001	0.184
11th	0.004	0.004	0.004	0.330
12th	0.001	0.001	0.001	0.153
13th	0.015	0.015	0.015	0.210
14th	0.002	0.002	0.002	0.131
15th	0.022	0.022	0.022	0.150
16th	0.001	0.001	0.001	0.115
17th	0.025	0.025	0.025	0.132
18th	0.001	0.001	0.001	0.102
19th	0.023	0.023	0.023	0.118
20th	0.001	0.001	0.001	0.092
21th	0.018	0.018	0.018	0.107
22th	0.001	0.001	0.001	0.084
23th	0.015	0.015	0.015	0.098
24th	0.001	0.001	0.001	0.077
25th	0.016	0.016	0.016	0.090
26th	0.001	0.001	0.001	0.071
27th	0.019	0.019	0.019	0.083
28th	0.001	0.001	0.001	0.066
29th	0.020	0.020	0.020	0.078
30th	0.001	0.001	0.001	0.061
31th	0.019	0.019	0.019	0.073
32th	0.001	0.001	0.001	0.058
33th	0.018	0.018	0.018	0.068
34th	0.001	0.001	0.001	0.054
35th	0.015	0.015	0.015	0.064
36th	0.001	0.001	0.001	0.051
37th	0.015	0.015	0.015	0.061
38th	0.001	0.001	0.002	0.048
39th	0.016	0.017	0.016	0.058
40th	0.001	0.002	0.001	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2)				
25°C, 33% P_{CMAX} power condition: AF3K-MTH + ATOM HVS-7.68				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.006	0.007	0.008	1.080
3rd	0.144	0.142	0.146	2.300
4th	0.003	0.002	0.003	0.430
5th	0.053	0.051	0.053	1.140
6th	0.003	0.002	0.003	0.300
7th	0.039	0.039	0.039	0.770
8th	0.003	0.003	0.003	0.230
9th	0.056	0.056	0.056	0.400
10th	0.002	0.002	0.002	0.184
11th	0.045	0.045	0.045	0.330
12th	0.001	0.001	0.001	0.153
13th	0.019	0.019	0.019	0.210
14th	0.002	0.002	0.002	0.131
15th	0.030	0.030	0.030	0.150
16th	0.002	0.002	0.002	0.115
17th	0.035	0.035	0.035	0.132
18th	0.001	0.001	0.001	0.102
19th	0.023	0.023	0.023	0.118
20th	0.001	0.001	0.001	0.092
21th	0.020	0.020	0.020	0.107
22th	0.001	0.001	0.001	0.084
23th	0.025	0.024	0.025	0.098
24th	0.001	0.001	0.001	0.077
25th	0.020	0.021	0.020	0.090
26th	0.001	0.002	0.001	0.071
27th	0.015	0.016	0.015	0.083
28th	0.001	0.002	0.001	0.066
29th	0.020	0.021	0.020	0.078
30th	0.001	0.001	0.001	0.061
31th	0.019	0.010	0.019	0.073
32th	0.001	0.002	0.001	0.058
33th	0.016	0.015	0.016	0.068
34th	0.001	0.002	0.001	0.054
35th	0.019	0.018	0.019	0.064
36th	0.001	0.002	0.001	0.051
37th	0.021	0.020	0.021	0.061
38th	0.001	0.002	0.001	0.048
39th	0.018	0.018	0.019	0.058
40th	0.001	0.002	0.002	0.046

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.3 c)	**TABLE: Flicker measurement**	**P**
☒ CEI EN 61000-3-3 ☒ CEI EN 61000-3-11		
☒ Ambient temperature ☒ -25°C temperature ☒ +60°C temperature		
☒ Full power, 66% and 33% of P_{SMAX} / P_{NINV} ☒ Full power, 66% and 33% of P_{CMAX}		
c) limits of voltage fluctuations and flicker (CEI EN 61000-3-3 or CEI EN 61000-3-11); they must be repeated in 6 sessions (at 33%, 66% and 100% of the P_{SMAX}, or P_{NINV} for integrated EESS, and at 33%, 66% and 100% of the P_{CMAX}), and for storage systems connected to unidirectional converters in 3 sessions (at 33%, 66% and 100% of the maximum available power in discharge)		
Supplementary information: *If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test.		

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Model	AF15K-MTH + ATOM HVS-20.48 (4P) --Discharge									
Normal ambient										
Output power:	Flicker limits according to*:	Result:								
		Plt			Pst			dc%		
		L1	L2	L3	L1	L2	L3	L1	L2	L3
33%	EN61000-3-3 / EN61000-3-11	0.09	0.08	0.08	0.09	0.08	0.08	0.16	0.22	0.20
66%	EN61000-3-3 / EN61000-3-11	0.16	0.15	0.15	0.16	0.15	0.15	0.10	0.10	0.09
100%	EN61000-3-3 / EN61000-3-11	0.22	0.22	0.21	0.24	0.23	0.23	0.14	0.33	0.23
Minimum ambient rating -25°C										
Output power:	Flicker limits according to*:	Result:								
		Plt			Pst			dc%		
		L1	L2	L3	L1	L2	L3	L1	L2	L3
33%	EN61000-3-3 / EN61000-3-11	0.09	0.08	0.08	0.11	0.10	0.10	0.22	0.13	0.15
66%	EN61000-3-3 / EN61000-3-11	0.16	0.15	0.15	0.16	0.16	0.16	0.14	0.13	0.10
100%	EN61000-3-3 / EN61000-3-11	0.22	0.22	0.22	0.24	0.23	0.24	0.19	0.16	0.17
Maximum ambient rating +60°C										
Output power:	Flicker limits according to*:	Result:								
		Plt			Pst			dc%		
		L1	L2	L3	L1	L2	L3	L1	L2	L3
33%	EN61000-3-3 / EN61000-3-11	0.09	0.08	0.08	0.09	0.08	0.09	0.18	0.10	0.17
66%	EN61000-3-3 / EN61000-3-11	0.16	0.15	0.15	0.17	0.16	0.16	0.11	0.12	0.10
100%	EN61000-3-3 / EN61000-3-11	0.22	0.22	0.21	0.23	0.23	0.23	0.13	0.40	0.23

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Note:
* Mains Impedance according EN61000-3-3 / EN61000-3-11: **R_{max} = Ω; jX_{max}= Ω @50Hz (|Z_{max}| = Ω)**
Calculation of the maximum permissible grid impedance at the point of common coupling based on d_c:
$Z_{max} = Z_{ref} * 3{,}3\% / d_c(P_n)$

The tests should be based on the limits of the EN61000-3-3 for less than 16A and on EN 61000-3-11 for more than 16A.



Count 12/12
Interval 10m00s/10m00s

Element 3
Volt Range 600V (230V/50Hz)
Un3 230.076 V
FreqU3 50.004 Hz

Element 3 Judgement: ✓Pass
Total Judgement: ✓Pass
(Element 1,2,3)

	dc[%]	dmax[%]	Tmax[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30(%)	0.60	0.60 N:12
No. 1	0.06 ✓Pass	0.57 ✓Pass	0 ✓Pass	0.21 ✓Pass	
2	0.11 ✓Pass	1.23 ✓Pass	0 ✓Pass	0.23 ✓Pass	
3	0.11 ✓Pass	0.96 ✓Pass	0 ✓Pass	0.22 ✓Pass	
4	0.15 ✓Pass	0.60 ✓Pass	0 ✓Pass	0.21 ✓Pass	
5	0.17 ✓Pass	0.62 ✓Pass	0 ✓Pass	0.21 ✓Pass	
6	0.15 ✓Pass	1.24 ✓Pass	0 ✓Pass	0.23 ✓Pass	
7	0.10 ✓Pass	0.51 ✓Pass	0 ✓Pass	0.21 ✓Pass	
8	0.07 ✓Pass	0.96 ✓Pass	0 ✓Pass	0.21 ✓Pass	
9	0.01 ✓Pass	0.78 ✓Pass	0 ✓Pass	0.21 ✓Pass	
10	0.10 ✓Pass	0.41 ✓Pass	0 ✓Pass	0.21 ✓Pass	
11	0.17 ✓Pass	0.56 ✓Pass	0 ✓Pass	0.21 ✓Pass	
12	0.23 ✓Pass	0.61 ✓Pass	0 ✓Pass	0.21 ✓Pass	
Result	✓Pass	✓Pass	✓Pass	✓Pass	0.21 ✓Pass

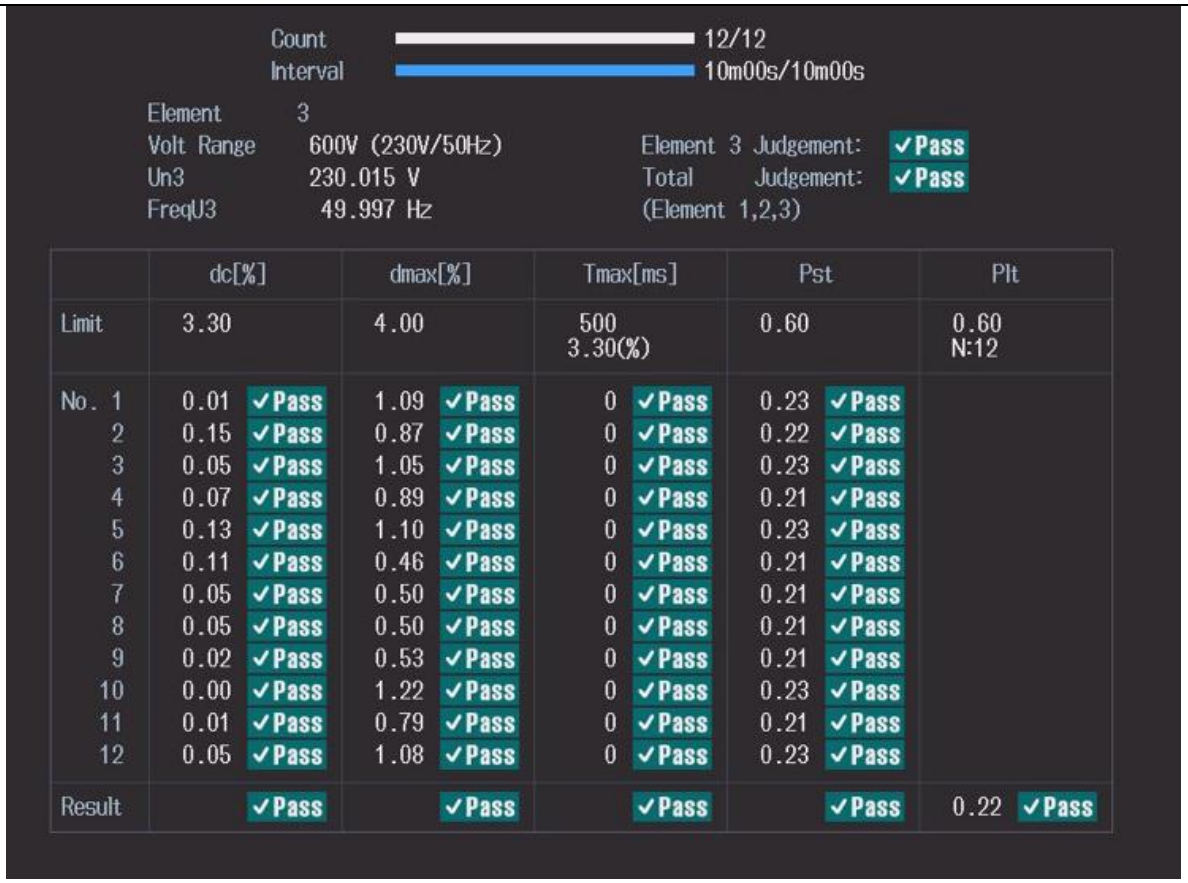
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Model	AF15K-MTH + ATOM HVS-20.48 (4P)-Charge									
Normal ambient										
Output power:	Flicker limits according to*:	Result:								
		Plt			Pst			dc%		
		L1	L2	L3	L1	L2	L3	L1	L2	L3
33%	EN61000-3-3 / EN61000-3-11	0.09	0.08	0.08	0.09	0.08	0.08	0.20	0.15	0.13
66%	EN61000-3-3 / EN61000-3-11	0.16	0.15	0.15	0.16	0.16	0.15	0.12	0.12	0.12
100%	EN61000-3-3 / EN61000-3-11	0.22	0.22	0.22	0.24	0.23	0.23	0.12	0.41	0.25
Minimum ambient rating -25°C										
Output power:	Flicker limits according to*:	Result:								
		Plt			Pst			dc%		
		L1	L2	L3	L1	L2	L3	L1	L2	L3
33%	EN61000-3-3 / EN61000-3-11	0.09	0.08	0.08	0.09	0.08	0.09	0.15	0.35	0.18
66%	EN61000-3-3 / EN61000-3-11	0.16	0.15	0.15	0.16	0.16	0.15	0.15	0.37	0.11
100%	EN61000-3-3 / EN61000-3-11	0.22	0.22	0.22	0.23	0.23	0.23	0.17	0.16	0.13
Maximum ambient rating +60°C										
Output power:	Flicker limits according to*:	Result:								
		Plt			Pst			dc%		
		L1	L2	L3	L1	L2	L3	L1	L2	L3
33%	EN61000-3-3 / EN61000-3-11	0.09	0.08	0.08	0.09	0.08	0.09	0.22	0.13	0.21
66%	EN61000-3-3 / EN61000-3-11	0.16	0.15	0.15	0.17	0.16	0.15	0.16	0.17	0.13
100%	EN61000-3-3 / EN61000-3-11	0.22	0.21	0.22	0.24	0.23	0.23	0.16	0.10	0.13

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Note:
* Mains Impedance according EN61000-3-3 / EN61000-3-11: **R_{max} = Ω; jX_{max}= Ω @50Hz (|Z_{max}| = Ω)**

Calculation of the maximum permissible grid impedance at the point of common coupling based on d_c:
$Z_{max} = Z_{ref} * 3,3\% / d_c(P_n)$



	dc[%]	dmax[%]	Tmax[ms]	Pst	Plt
Limit	3.30	4.00	500 3.30(%)	0.60	0.60 N:12
No. 1	0.01 ✓Pass	1.09 ✓Pass	0 ✓Pass	0.23 ✓Pass	
2	0.15 ✓Pass	0.87 ✓Pass	0 ✓Pass	0.22 ✓Pass	
3	0.05 ✓Pass	1.05 ✓Pass	0 ✓Pass	0.23 ✓Pass	
4	0.07 ✓Pass	0.89 ✓Pass	0 ✓Pass	0.21 ✓Pass	
5	0.13 ✓Pass	1.10 ✓Pass	0 ✓Pass	0.23 ✓Pass	
6	0.11 ✓Pass	0.46 ✓Pass	0 ✓Pass	0.21 ✓Pass	
7	0.05 ✓Pass	0.50 ✓Pass	0 ✓Pass	0.21 ✓Pass	
8	0.05 ✓Pass	0.50 ✓Pass	0 ✓Pass	0.21 ✓Pass	
9	0.02 ✓Pass	0.53 ✓Pass	0 ✓Pass	0.21 ✓Pass	
10	0.00 ✓Pass	1.22 ✓Pass	0 ✓Pass	0.23 ✓Pass	
11	0.01 ✓Pass	0.79 ✓Pass	0 ✓Pass	0.21 ✓Pass	
12	0.05 ✓Pass	1.08 ✓Pass	0 ✓Pass	0.23 ✓Pass	
Result	✓Pass	✓Pass	✓Pass	✓Pass	0.22 ✓Pass

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Model	AF15K-MTH + ATOM HVS-7.68--Discharge

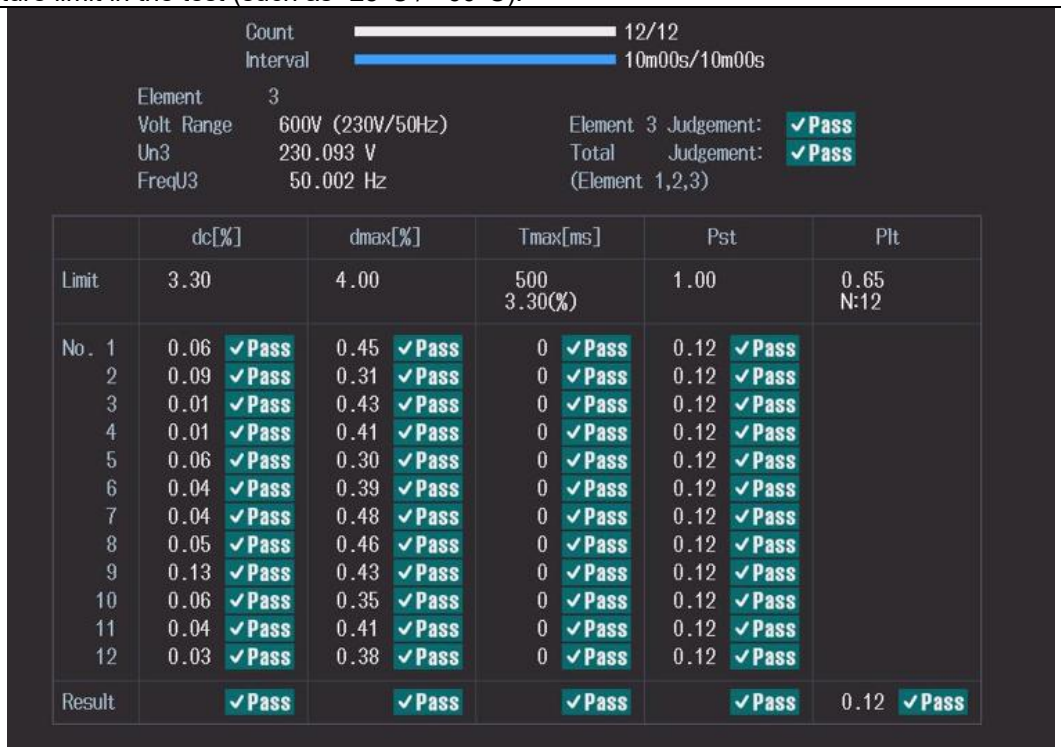
Normal ambient

Output power:	Flicker limits according to*:	Result:								
		Plt			Pst			dc%		
		L1	L2	L3	L1	L2	L3	L1	L2	L3
33%	EN61000-3-3 / EN61000-3-11	0.07	0.05	0.05	0.07	0.05	0.06	0.12	0.32	0.05
66%	EN61000-3-3 / EN61000-3-11	0.10	0.09	0.09	0.11	0.10	0.10	0.18	0.05	0.20
100%	EN61000-3-3 / EN61000-3-11	0.13	0.12	0.12	0.13	0.12	0.12	0.11	0.12	0.13

Note:
* Mains Impedance according EN61000-3-3 / EN61000-3-11: **R_{max} = Ω; jX_{max}= Ω @50Hz (|Z_{max}| = Ω)**

Calculation of the maximum permissible grid impedance at the point of common coupling based on d_c:
$Z_{max} = Z_{ref} * 3,3\% / d_c(P_n)$

The tests should be based on the limits of the EN61000-3-3 for less than 16A and on EN 61000-3-11 for more than 16A.
If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test (such as -25°C / +60°C).



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Model	AF15K-MTH + ATOM HVS-7.68--Charge

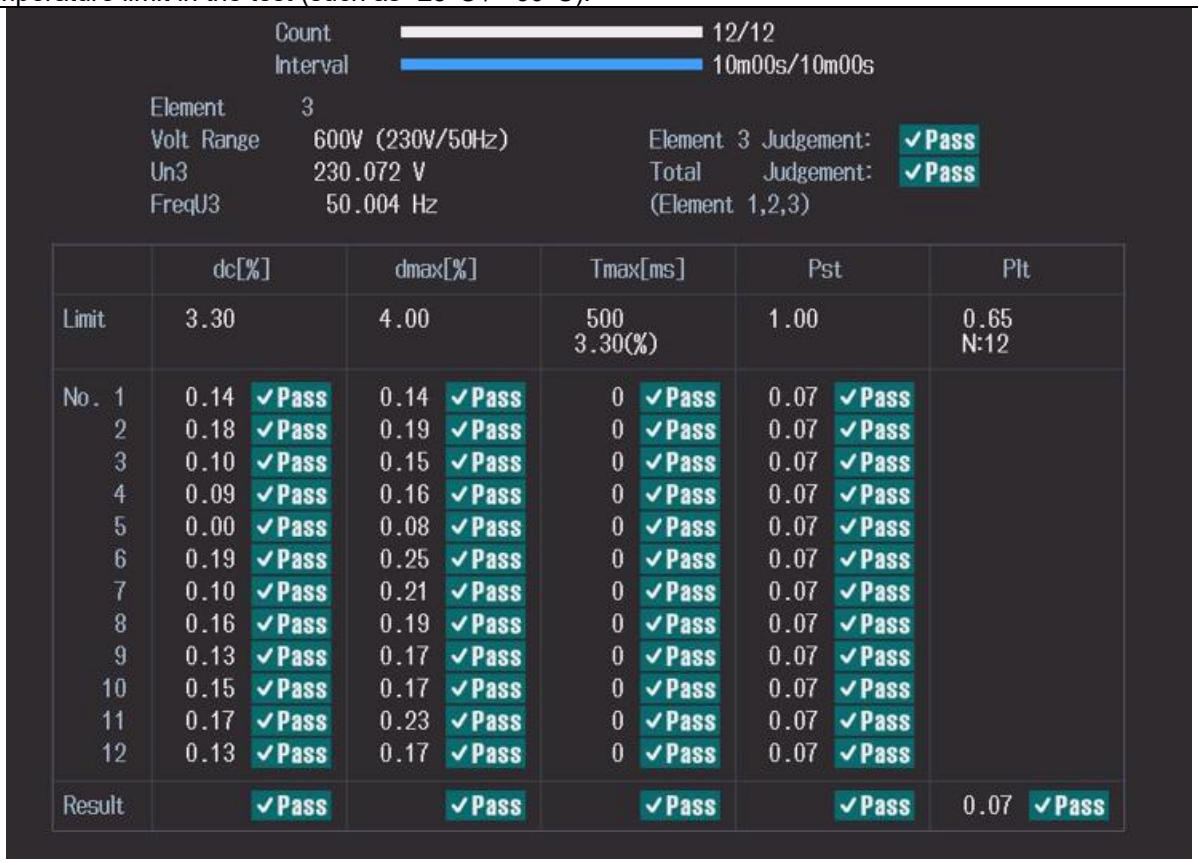
Normal ambient

Output power:	Flicker limits according to*:	Result:								
		Plt			Pst			dc%		
		L1	L2	L3	L1	L2	L3	L1	L2	L3
33%	EN61000-3-3 / EN61000-3-11	0.05	0.04	0.04	0.06	0.04	0.04	0.15	0.29	0.16
66%	EN61000-3-3 / EN61000-3-11	0.07	0.05	0.05	0.07	0.06	0.06	0.07	0.04	0.01
100%	EN61000-3-3 / EN61000-3-11	0.08	0.07	0.07	0.08	0.07	0.07	0.31	0.17	0.18

Note:
* Mains Impedance according EN61000-3-3 / EN61000-3-11: **R_{max} = Ω; jX_{max}= Ω @50Hz (|Z_{max}| = Ω)**

Calculation of the maximum permissible grid impedance at the point of common coupling based on d_c:
$Z_{max} = Z_{ref} * 3,3\% / d_c(P_n)$

The tests should be based on the limits of the EN61000-3-3 for less than 16A and on EN 61000-3-11 for more than 16A.
If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test (such as -25°C / +60°C).



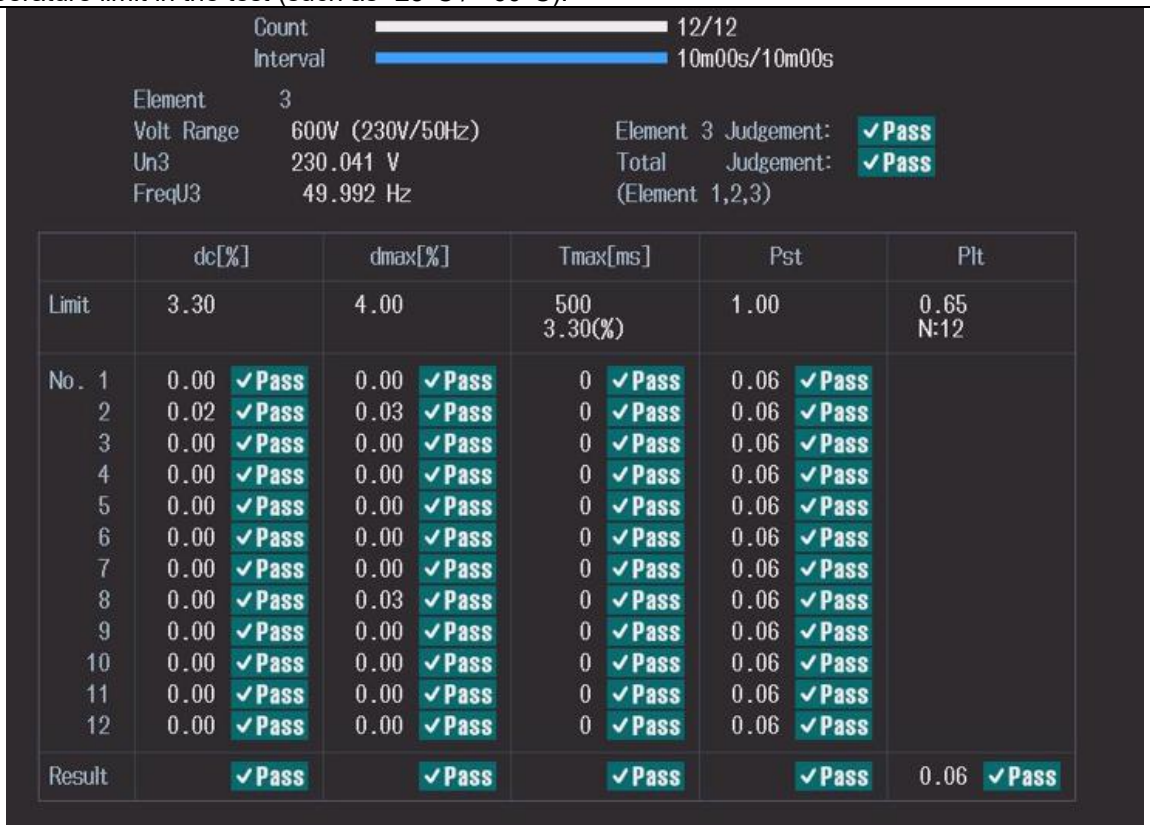
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Model	AF3K-MTH + ATOM HVS-7.68--Discharge									
Normal ambient										
Output power:	Flicker limits according to*:	Result:								
		Plt			Pst			dc%		
		L1	L2	L3	L1	L2	L3	L1	L2	L3
33%	EN61000-3-3 / EN61000-3-11	0.05	0.04	0.04	0.05	0.04	0.06	0.01	0.01	0.01
66%	EN61000-3-3 / EN61000-3-11	0.06	0.05	0.05	0.06	0.05	0.06	0.01	0.19	0.03
100%	EN61000-3-3 / EN61000-3-11	0.07	0.06	0.06	0.06	0.06	0.07	0.07	0.01	0.02

Note:
* Mains Impedance according EN61000-3-3 / EN61000-3-11: **R_{max} = Ω; jX_{max}= Ω @50Hz (|Z_{max}| = Ω)**

Calculation of the maximum permissible grid impedance at the point of common coupling based on d_c:
$Z_{max} = Z_{ref} * 3,3\% / d_c(P_n)$

The tests should be based on the limits of the EN61000-3-3 for less than 16A and on EN 61000-3-11 for more than 16A.
If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test (such as -25°C / +60°C).



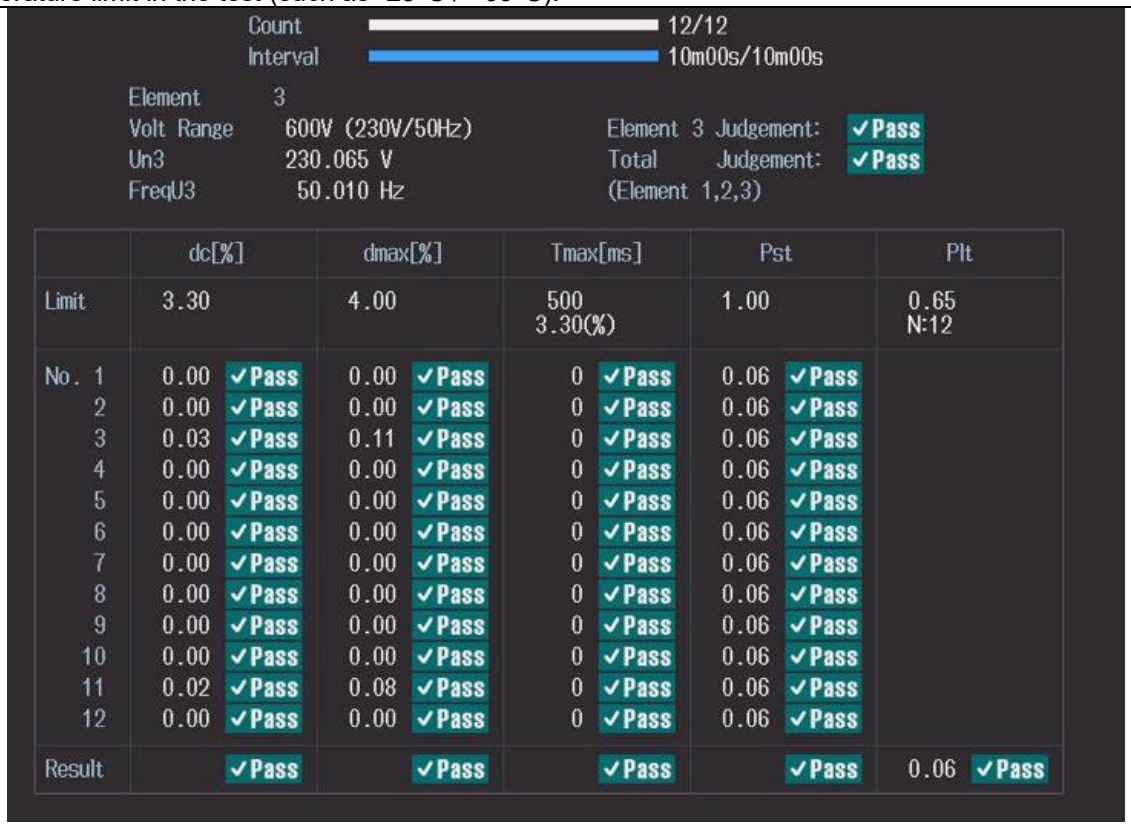
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Model	AF3K-MTH + ATOM HVS-7.68--Charge									
Normal ambient										
Output power:	Flicker limits according to*:	Result:								
		Plt			Pst			dc%		
		L1	L2	L3	L1	L2	L3	L1	L2	L3
33%	EN61000-3-3 / EN61000-3-11	0.05	0.04	0.04	0.05	0.04	0.06	0.01	0.01	0.01
66%	EN61000-3-3 / EN61000-3-11	0.06	0.04	0.05	0.05	0.06	0.05	0.07	0.34	0.10
100%	EN61000-3-3 / EN61000-3-11	0.07	0.06	0.06	0.07	0.06	0.06	0.01	0.01	0.03

Note:
* Mains Impedance according EN61000-3-3 / EN61000-3-11: **R_{max} = Ω; jX_{max}= Ω @50Hz (|Z_{max}| = Ω)**

Calculation of the maximum permissible grid impedance at the point of common coupling based on d_c:
$Z_{max} = Z_{ref} * 3,3\% / d_c(P_n)$

The tests should be based on the limits of the EN61000-3-3 for less than 16A and on EN 61000-3-11 for more than 16A.
If the EUT operating temperature out of -10°C to 55°C, please use the upper and lower operating temperature limit in the test (such as -25°C / +60°C).



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.4	**TABLE: Check the operating range in voltage and frequency**					**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)					
Supplementary information: P_{SMAX} =15.0 kW P_{CMAX} =10.24 kW						
Test Point	Voltage (%)	Frequency(Hz)	P (W)	cos φ	Time (s)	Result
Test 1	85.0	47.5	13707	1.00	>5min	No disconnection
Test 2	110.0	51.5	15029	1.00	>5min	No disconnection
Test 3	85.0	47.5	-10297	1.00	>5min	No disconnection
Test 4	110.0	51.5	-10262	1.00	>5min	No disconnection
Test 1: V = 85 % * Vn; f = 47,5 Hz; P = 100 % * PSMAX (PNINV for integrated EESS); cos φ = 1 Test 2: V = 110 % * Vn; f = 51,5 Hz; P = 100 % * PSMAX (PNINV for integrated EESS); cos φ= 1 Test 3: V = 85 % * Vn; f = 47,5 Hz; P = 100 % * PCMAX; cos φ = 1 Test 4: V= 110 % * Vn; f = 51,5 Hz; P = 100 % * PCMAX; cos φ =1 During the tests it is necessary to disable the automatic regulation in reduction / increase of the power in case of over / under frequency.						

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Diagram of Test 1

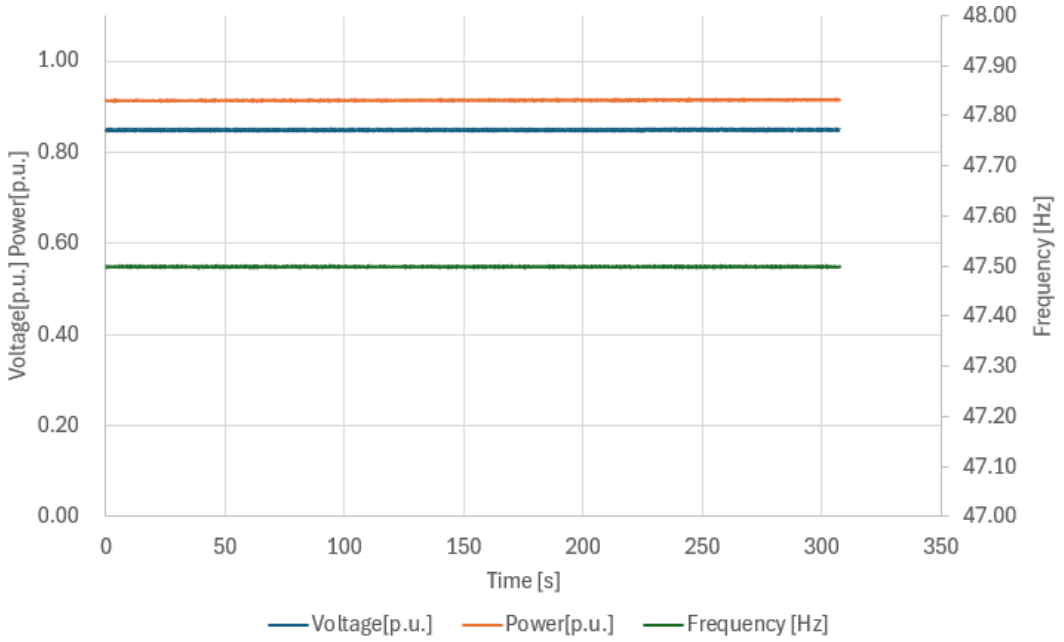
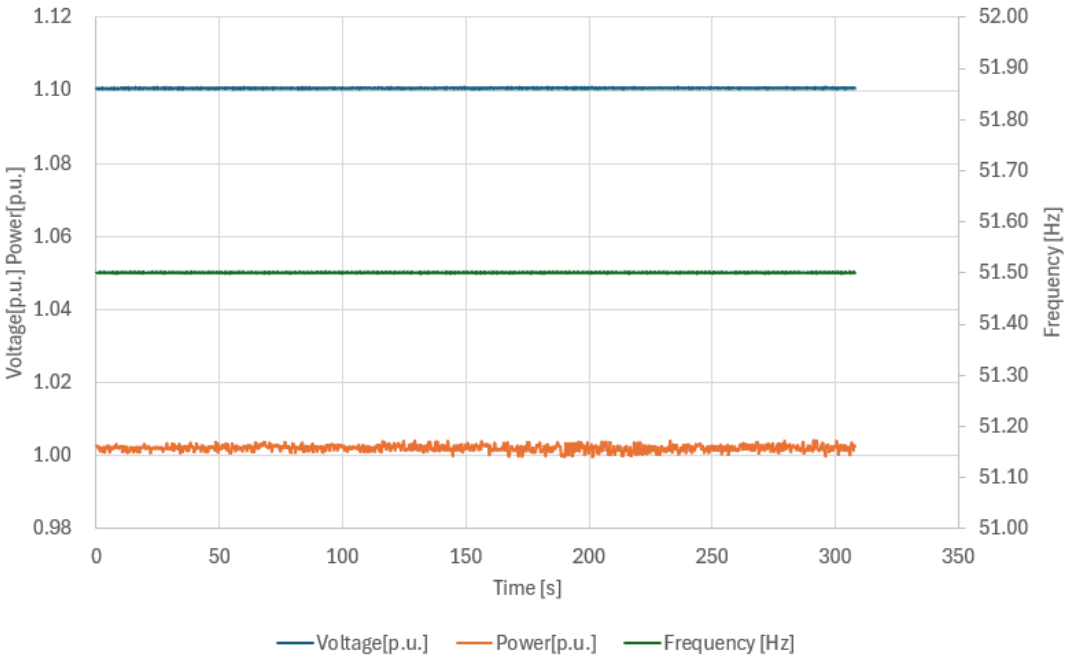


Diagram of Test 2



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Diagram of Test 3

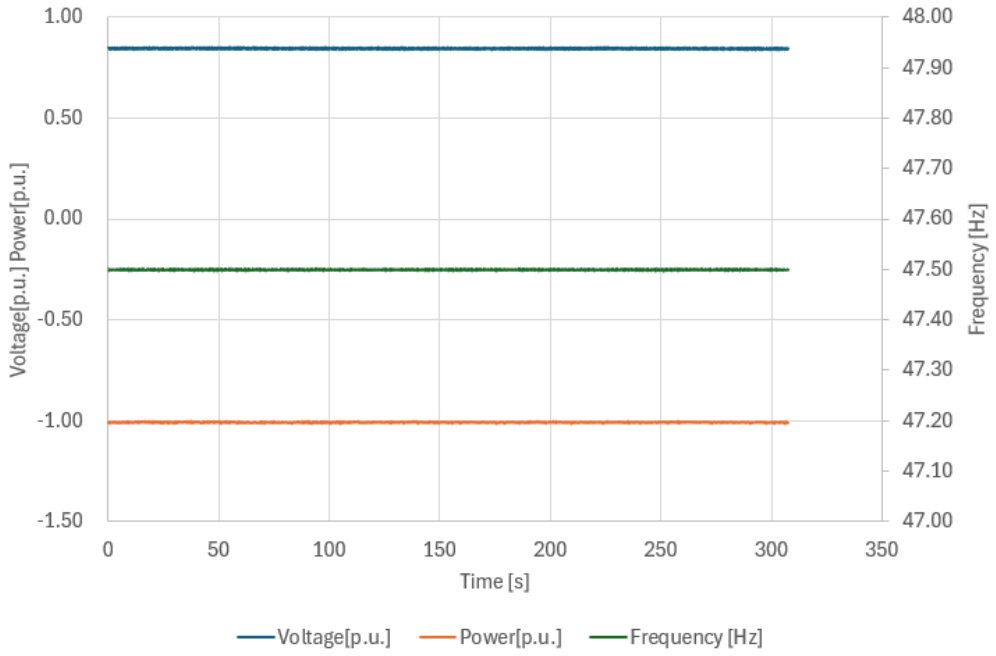
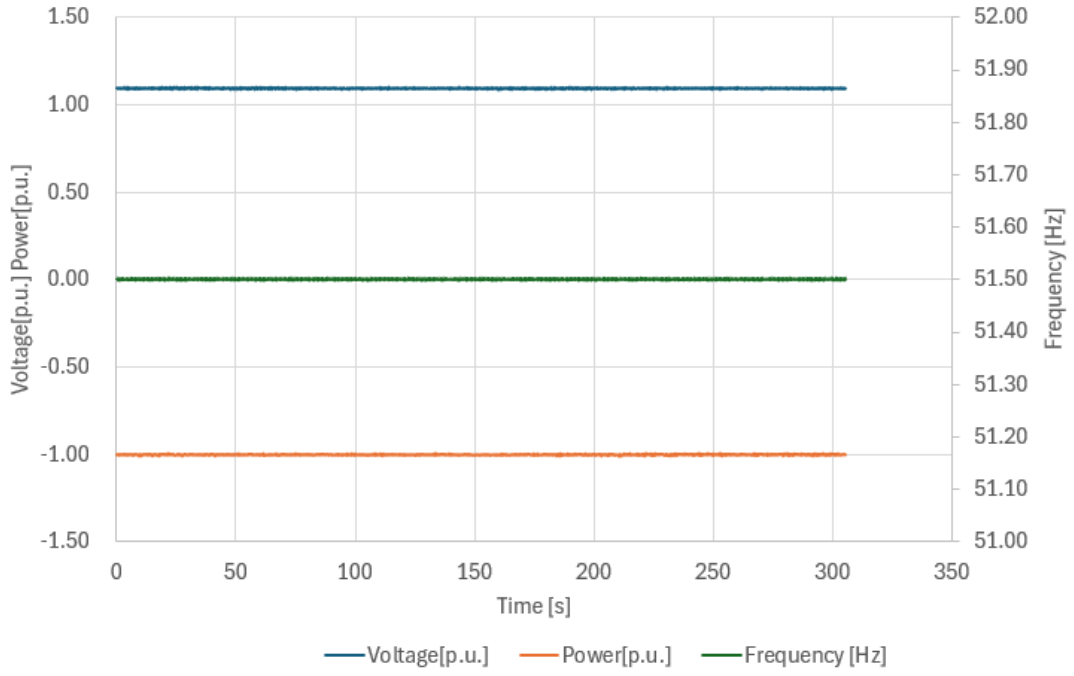


Diagram of Test 4



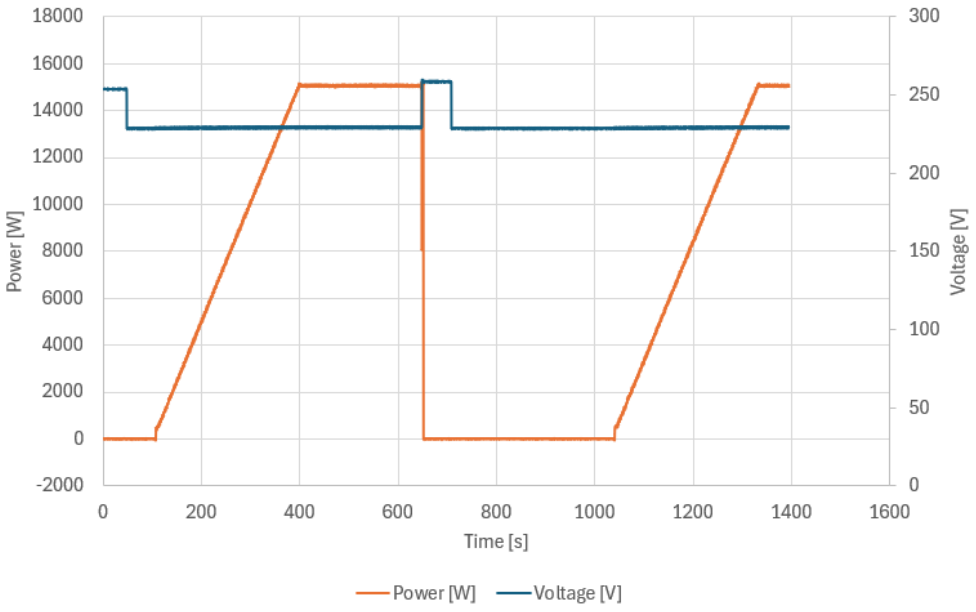
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.5	**TABLE: Conditions of connection, reconnection and gradual power supply**		**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)		
Test:			
Power meter measurment-data:	Sample-Rate:	0.2 s	
	Sample time:		
	Voltage conditons		
a) Out of voltage range	84% U_n for 30s	111% U_n for 30s	
Connection:	No connection	No connection	
Limit	No connection allowed		
b) In voltage range at start-up	85% U_n < U <110% U_n		
Reconnection time [s]	43.6	62	
Limit:	Reconnection after 30s		
Gradient:	Gradient schould be recorded for at least 300s until the inverter has the full output power. Max gradient: 20%% P_{SMAX} or P_{NINV} / min For recorded gradient see diagram underneath		
c) In voltage range after voltage failture	85% U_n < U <110% U_n		
Reconnection time [s]	311	326	
Limit:	Reconnection after 300s		
Gradient:	Gradient schould be recorded for at least 300s until the inverter has the full output power. Max gradient: 20%% P_{SMAX} or P_{NINV} / min For recorded gradient see diagram underneath		
	Frequency conditions		
d) Out of frequency range	49.88 ± 0.01	50.12 ± 0.01	
Connection:	No connection	No connection	
Limit	No connection allowed		
e) In frequency range at start-up	49.90 Hz < f < 50.10		
Reconnection time [s]	39	42	
Limit:	Reconnection after 30s		
Gradient:	Gradient schould be recorded for at least 300s until the inverter has the full output power. Max gradient: 20%% P_{SMAX} or P_{NINV} / min For recorded gradient see diagram underneath		
f) In frequency range after frequency failture	49.90 Hz < f < 50.10		
Reconnection time [s]	377	370	
Limit:	Reconnection after 300s		
Gradient:	Gradient schould be recorded for at least 300s until the inverter has the full output power. Max gradient: 20%% P_{SMAX} or P_{NINV} / min For recorded gradient see diagram underneath		
Changable reconnection conditions:	Frequency range: 49Hz-51Hz in 0,05Hz steps (default value: 49.90 and 50.10Hz)		

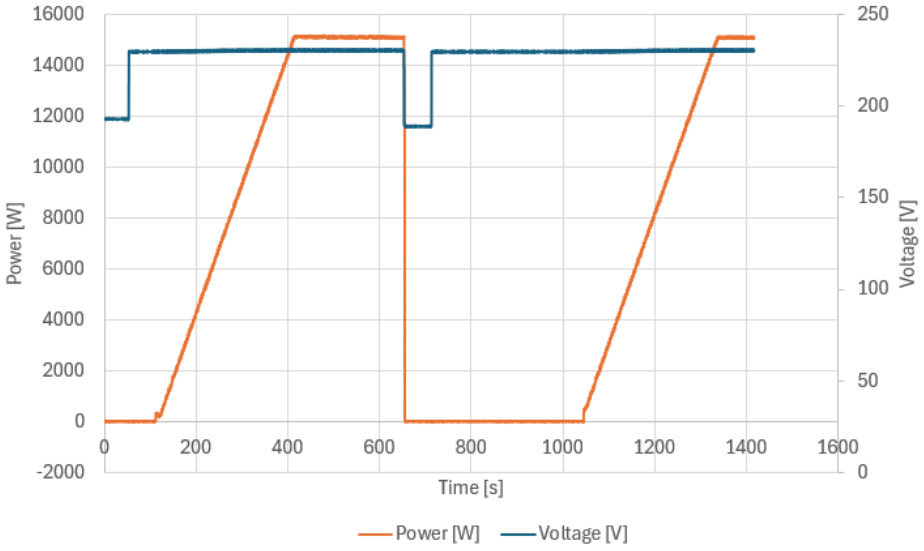
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test: Test condition b) and c): voltage within the limits of 85% to 110%U_n Test condition e) and f): frequency within the limits of 49,90Hz to 50,10Hz Max deviation of the gradient: +2,5%P_{SMAX} or P_{NINV}		Reconnection time range: 0-900s in steps of 5s (default value: 300s)

Over Voltage

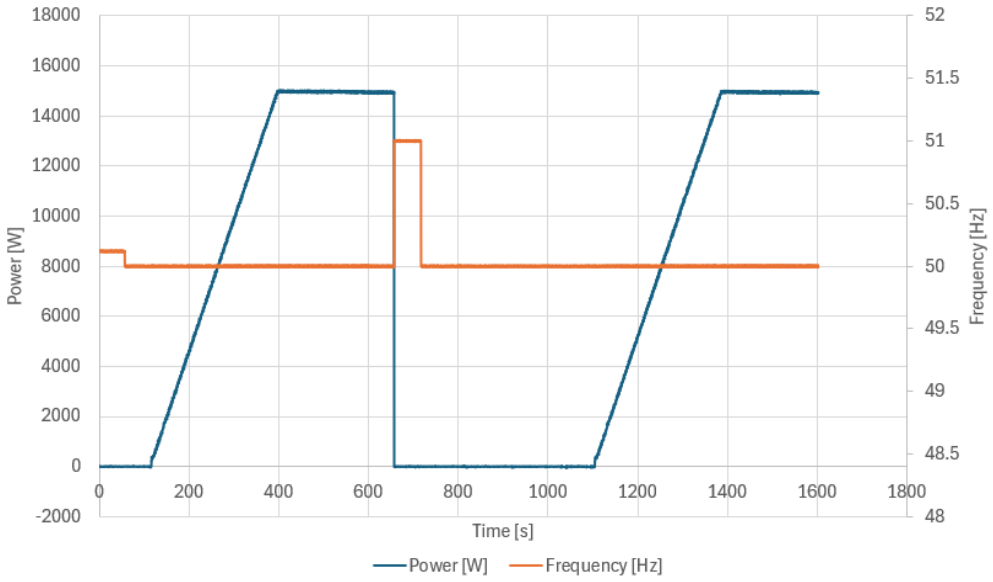


Under Voltage

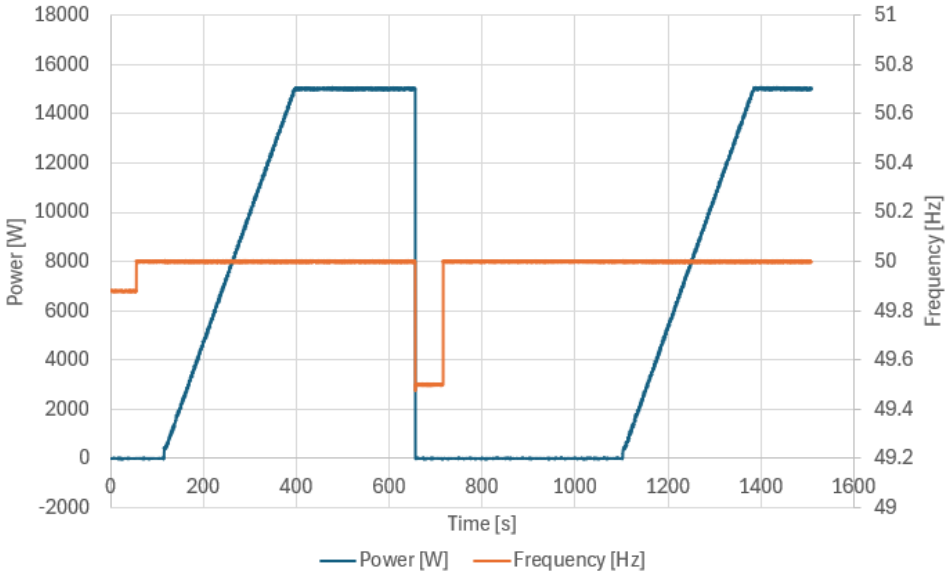


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Over Frequency



Under Frequency



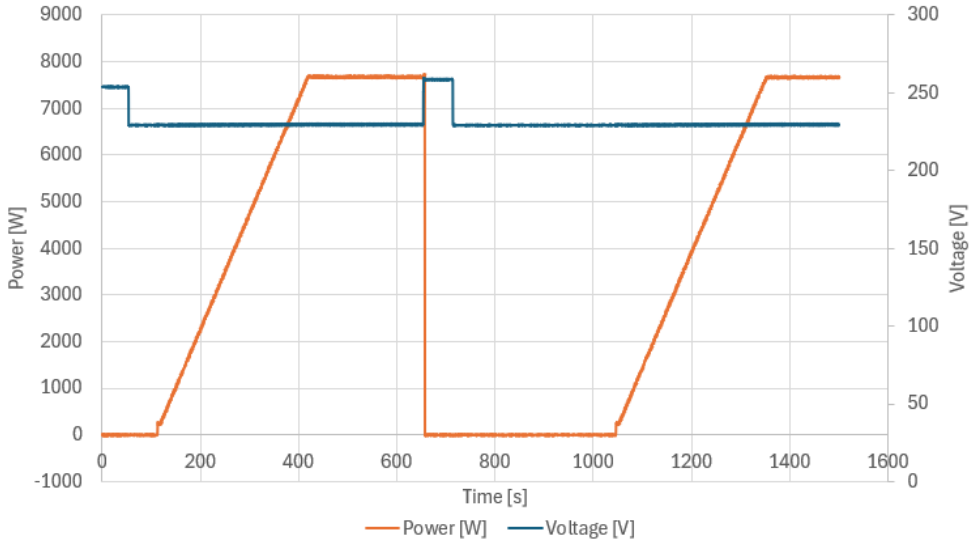
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.5	**TABLE: Conditions of connection, reconnection and gradual power supply**		**P**
Model	AF15K-MTH + ATOM HVS-7.68		
Test:			
Power meter measurment-data:	Sample-Rate:	0.2 s	
	Sample time:	-	
	Voltage conditons		
a) Out of voltage range	84% U_n for 30s	111% U_n for 30s	
Connection:	No connection	No connection	
Limit	No connection allowed		
b) In voltage range at start-up	85% U_n < U <110% U_n		
Reconnection time [s]	46	45	
Limit:	Reconnection after 30s		
Gradient:	Gradient schould be recorded for at least 300s until the inverter has the full output power. Max gradient: 20%% P_{SMAX} or P_{NINV} / min For recorded gradient see diagram underneath		
c) In voltage range after voltage failture	85% U_n < U <110% U_n		
Reconnection time [s]	380	315	
Limit:	Reconnection after 300s		
Gradient:	Gradient schould be recorded for at least 300s until the inverter has the full output power. Max gradient: 20%% P_{SMAX} or P_{NINV} / min For recorded gradient see diagram underneath		
	Frequency conditions		
d) Out of frequency range	49.88 ± 0.01	50,12 ± 0,01	
Connection:	No connection	No connection	
Limit	No connection allowed		
e) In frequency range at start-up	49.90 Hz < f < 50.10		
Reconnection time [s]	42	46	
Limit:	Reconnection after 30s		
Gradient:	Gradient schould be recorded for at least 300s until the inverter has the full output power. Max gradient: 20%% P_{SMAX} or P_{NINV} / min For recorded gradient see diagram underneath		
f) In frequency range after frequency failture	49.90 Hz < f < 50.10		
Reconnection time [s]	375	370	
Limit:	Reconnection after 300s		
Gradient:	Gradient schould be recorded for at least 300s until the inverter has the full output power. Max gradient: 20%% P_{SMAX} or P_{NINV} / min For recorded gradient see diagram underneath		
Changable reconnection conditions:	Frequency range: 49Hz-51Hz in 0.05Hz steps (default value: 49.90 and 50.10Hz)		

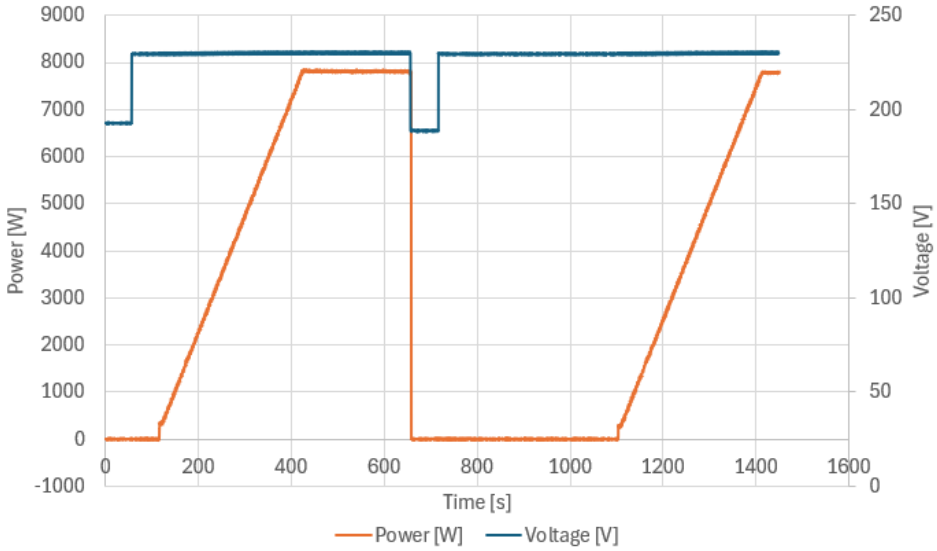
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test: Test condition b) and c): voltage within the limits of 85% to 110%U_n Test condition e) and f): frequency within the limits of 49,90Hz to 50,10Hz Max deviation of the gradient: +2.5%P_{SMAX} or P_{NINV}		Reconnection time range: 0-900s in steps of 5s (default value: 300s)

Over Voltage

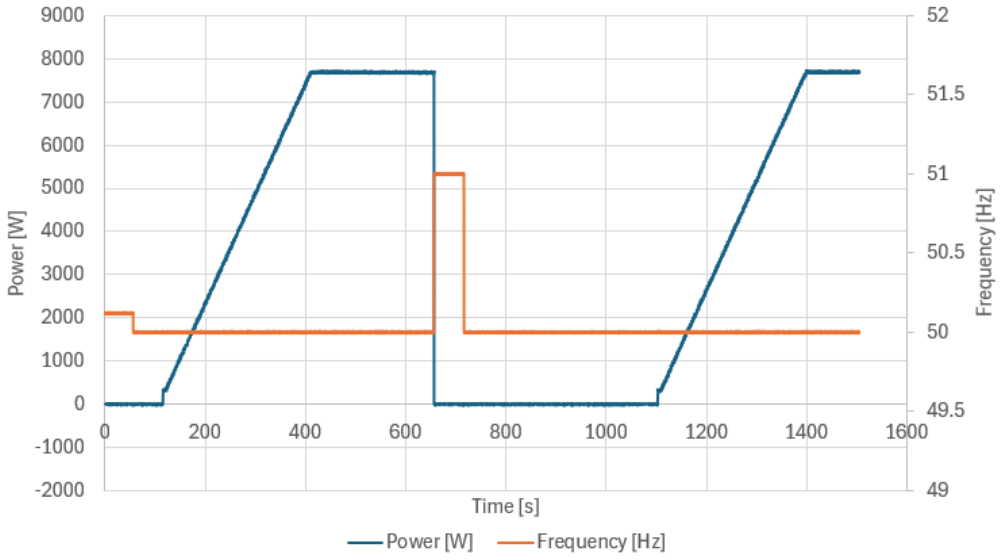


Under Voltage

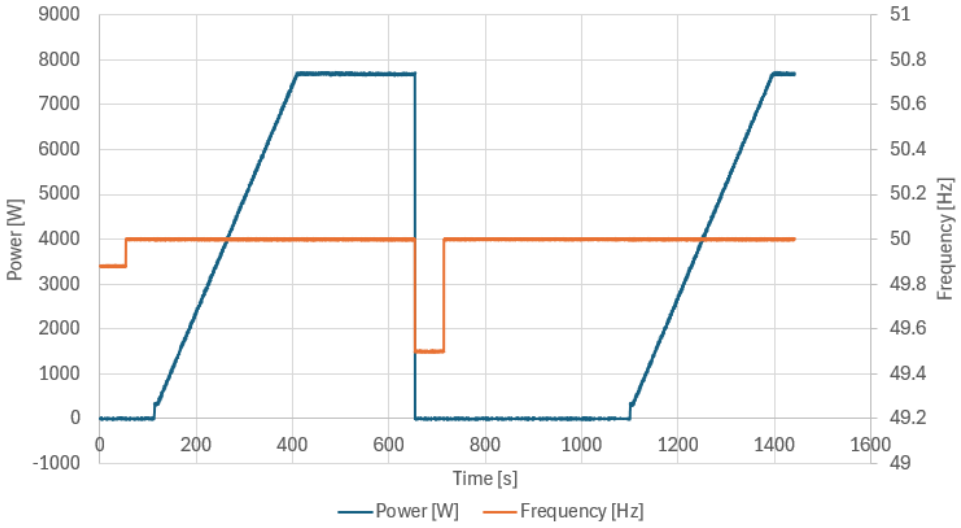


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Over Frequency



Under Frequency



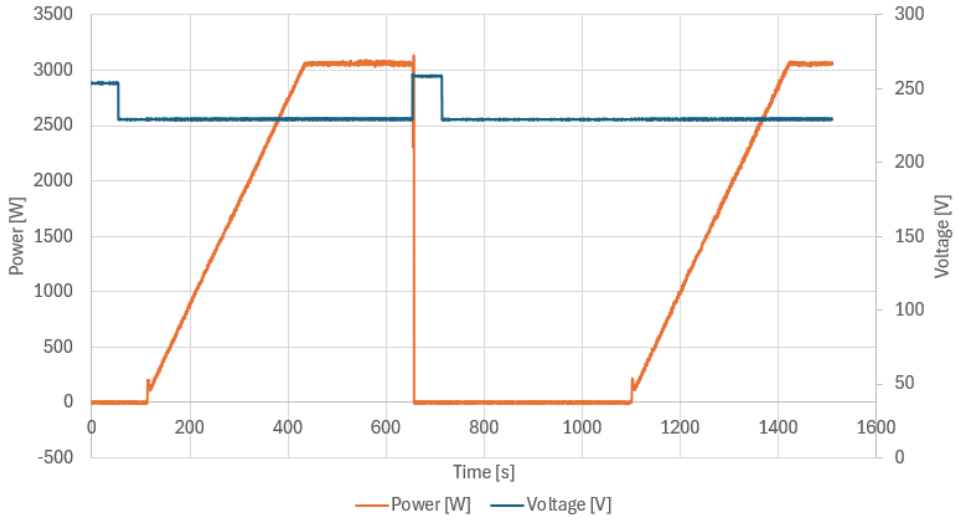
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.5	**TABLE: Conditions of connection, reconnection and gradual power supply**		**P**
Model	AF3K-MTH + ATOM HVS-7.68		
Test:			
Power meter measurment-data:	Sample-Rate:	0.2 s	
	Sample time:	-	
	Voltage conditons		
a) Out of voltage range	84% U_n for 30s	111% U_n for 30s	
Connection:	No connection	No connection	
Limit	No connection allowed		
b) In voltage range at start-up	85% U_n < U <110% U_n		
Reconnection time [s]	50	47	
Limit:	Reconnection after 30s		
Gradient:	Gradient schould be recorded for at least 300s until the inverter has the full output power. Max gradient: 20%% P_{SMAX} or P_{NINV} / min For recorded gradient see diagram underneath		
c) In voltage range after voltage failture	85% U_n < U <110% U_n		
Reconnection time [s]	380	370	
Limit:	Reconnection after 300s		
Gradient:	Gradient schould be recorded for at least 300s until the inverter has the full output power. Max gradient: 20%% P_{SMAX} or P_{NINV} / min For recorded gradient see diagram underneath		
	Frequency conditions		
d) Out of frequency range	49.88 ± 0.01	50,12 ± 0,01	
Connection:	No connection	No connection	
Limit	No connection allowed		
e) In frequency range at start-up	49.90 Hz < f < 50.10		
Reconnection time [s]	34	43	
Limit:	Reconnection after 30s		
Gradient:	Gradient schould be recorded for at least 300s until the inverter has the full output power. Max gradient: 20%% P_{SMAX} or P_{NINV} / min For recorded gradient see diagram underneath		
f) In frequency range after frequency failture	49.90 Hz < f < 50.10		
Reconnection time [s]	373	390	
Limit:	Reconnection after 300s		
Gradient:	Gradient schould be recorded for at least 300s until the inverter has the full output power. Max gradient: 20%% P_{SMAX} or P_{NINV} / min For recorded gradient see diagram underneath		
Changable reconnection conditions:	Frequency range: 49Hz-51Hz in 0.05Hz steps (default value: 49.90 and 50.10Hz)		

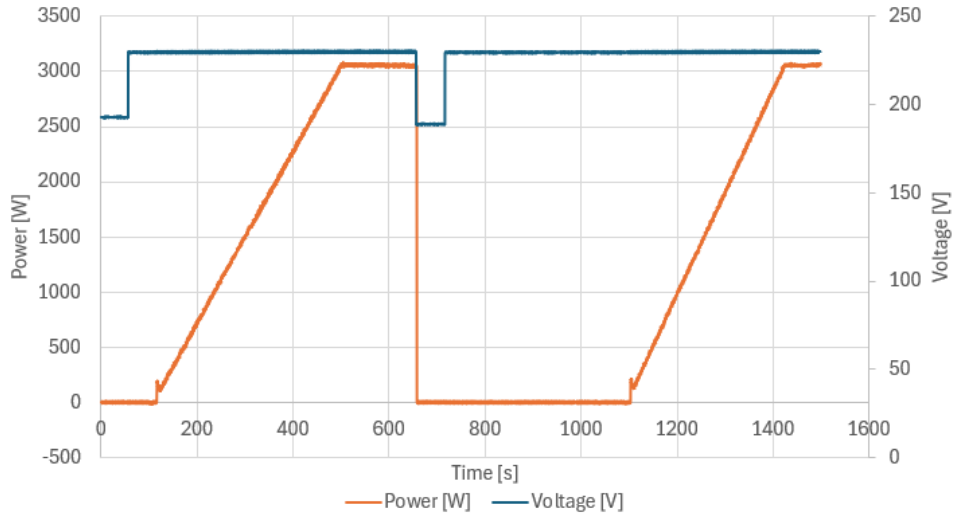
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test: Test condition b) and c): voltage within the limits of 85% to 110%U_n Test condition e) and f): frequency within the limits of 49,90Hz to 50,10Hz Max deviation of the gradient: +2.5%P_{SMAX} or P_{NINV}		Reconnection time range: 0-900s in steps of 5s (default value: 300s)

Over Voltage

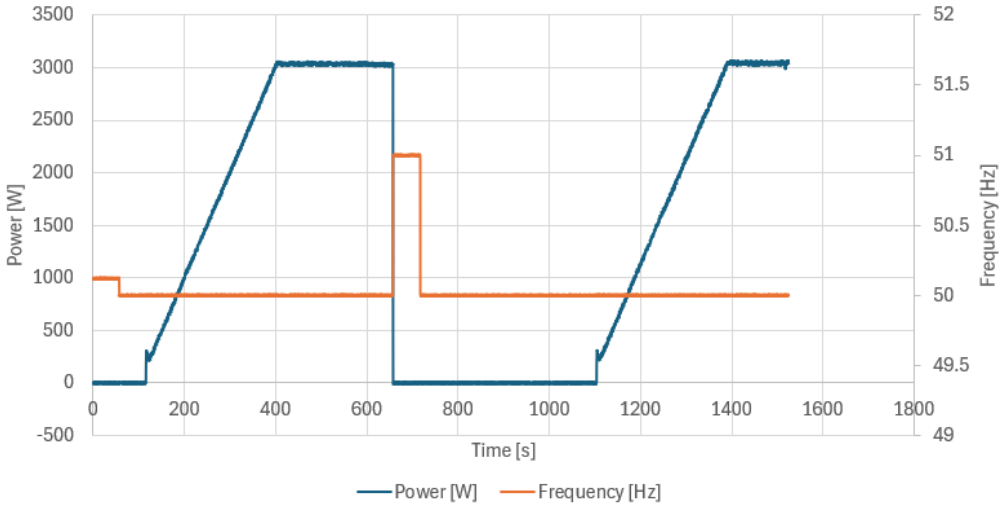


Under Voltage

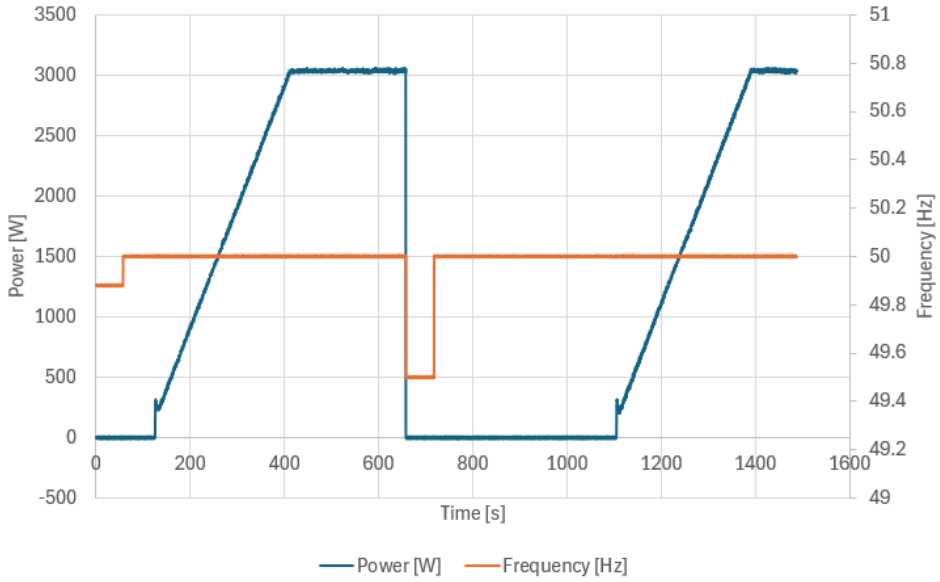


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Over Frequency



Under Frequency



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.6.1 Bbis.6.2	**TABLE: Checking construction requirements: reactive power capability**	**P**
Max. cos φ / Q setting point:	☐ **P_{SMAX} ≤ 11.08 kW: Cos φ = 0.9** ☒ **P_{SMAX} > 11.08 kW: Q/P_n% = 48.43%**	

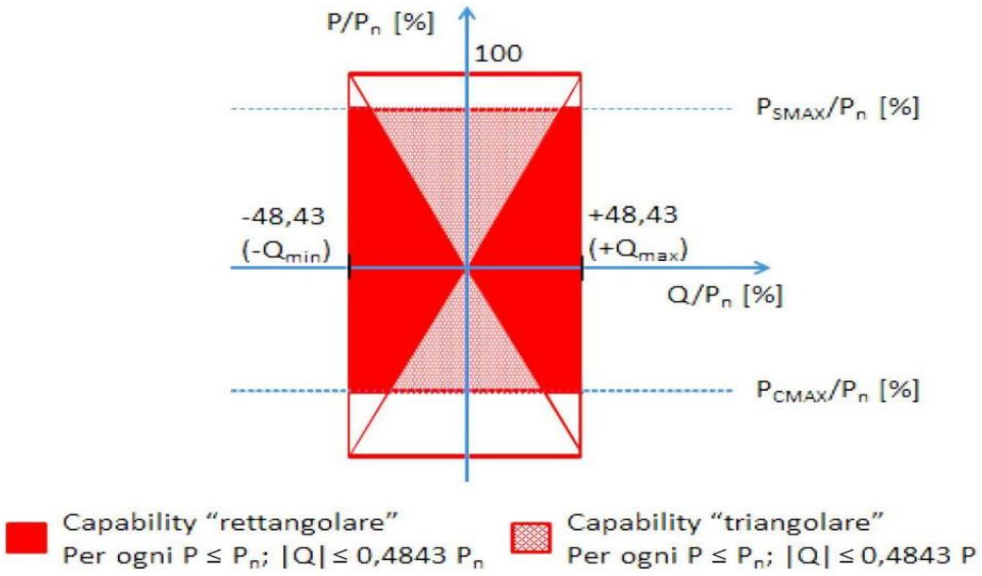


Figure 62 - Capability for a storage system with bidirectional inverter

Supplementary information:
For each of the 10 levels of active power, value of inductive reactive power and value of conductive reactive power must be registered as average values in 1 min, based on the measurements at the fundamental in a window of 200ms.

Positve active power: supply power to the grid
Negative active power: absorb power from grid
Positve DC power: charging battery
Negative DC power: battery discharging

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Model	AF15K-MTH + ATOM HVS-20.48 (4P)						
TABLE: Reactive power production with set point Q = 0							
Power-Bin	Active Power		Reactive Power		DC Power		Power Factor
	W	p.u.	VAr	p.u.	W	p.u.	Cos φ
90% -100% P_{CMAX}	-10375	1.01	5	0.03%	-10000	0.97	-0.998
80% -90% P_{CMAX}	-9210	0.90	-1	-0.01%	-8907	0.87	-0.998
70% -80% P_{CMAX}	-8189	0.80	-1	-0.01%	-7846	0.77	-0.997
60% -70% P_{CMAX}	-7173	0.70	-1	-0.01%	-6905	0.67	-0.996
50% -60% P_{CMAX}	-6150	0.60	-1	-0.01%	-5917	0.58	-0.996
40% -50% P_{CMAX}	-5127	0.50	1	0.01%	-4922	0.48	-0.995
30% -40% P_{CMAX}	-4037	0.39	3	0.02%	-3882	0.38	-0.994
20% -30% P_{CMAX}	-3068	0.30	4	0.03%	-2936	0.29	-0.995
10% -20% P_{CMAX}	-2034	0.20	4	0.03%	-1935	0.19	-0.991
0% -10% P_{CMAX}	-1070	0.10	4	0.03%	-895	0.09	-0.990
0% -10% P_{SMAX}	1517	0.10	4	0.03%	1562	0.10	0.990
10% -20% P_{SMAX}	3041	0.20	3	0.02%	3096	0.21	0.990
20% -30% P_{SMAX}	4500	0.30	5	0.03%	4582	0.31	0.995
30% -40% P_{SMAX}	6031	0.40	3	0.02%	6063	0.41	0.997
40% -50% P_{SMAX}	7489	0.50	13	0.09%	7553	0.50	0.998
50% -60% P_{SMAX}	9044	0.60	12	0.08%	9147	0.62	0.998
60% -70% P_{SMAX}	10638	0.71	10	0.07%	10677	0.73	0.999
70% -80% P_{SMAX}	12094	0.81	8	0.05%	12142	0.82	0.999
80% -90% P_{SMAX}	13570	0.90	7	0.05%	13649	0.93	0.999
90% -100% P_{SMAX}	15033	1.00	5	0.03%	15185	1.01	0.999
TABLE: Reactive power production with set point Q = -Q_{max} (>11.08 kW)							
Power-Bin	Active Power		Reactive Power		DC Power		Power Factor
	W	p.u.	VAr	p.u.	W	p.u.	Cos φ
90% -100% P_{CMAX}	-10186	1.01	-7242	-0.483	-9762	0.97	-0.899
80% -90% P_{CMAX}	-9195	0.90	-7242	-0.483	-8796	0.87	-0.899
70% -80% P_{CMAX}	-8206	0.80	-7240	-0.483	-7804	0.77	-0.899
60% -70% P_{CMAX}	-7172	0.70	-7240	-0.483	-6845	0.67	-0.899
50% -60% P_{CMAX}	-6140	0.60	-7240	-0.483	-5858	0.58	-0.899
40% -50% P_{CMAX}	-5112	0.50	-7239	-0.483	-4863	0.48	-0.899
30% -40% P_{CMAX}	-4084	0.39	-7239	-0.483	-3857	0.38	-0.900
20% -30% P_{CMAX}	-3060	0.30	-7238	-0.483	-2855	0.29	-0.897

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

10% -20% P_{CMAX}	-2021	0.20	-7236	-0.482	-1854	0.19	-0.898
0% -10% P_{CMAX}	-1018	0.10	-7237	-0.482	-840	0.09	-0.892
0% -10% P_{SMAX}	1534	0.10	-7240	-0.483	1610	0.10	0.898
10% -20% P_{SMAX}	3040	0.20	-7240	-0.483	3071	0.21	0.899
20% -30% P_{SMAX}	4522	0.30	-7240	-0.483	4623	0.31	0.900
30% -40% P_{SMAX}	6930	0.40	-7241	-0.483	6149	0.41	0.900
40% -50% P_{SMAX}	7525	0.50	-7243	-0.483	7640	0.50	0.900
50% -60% P_{SMAX}	9079	0.60	-7245	-0.483	9138	0.62	0.900
60% -70% P_{SMAX}	10537	0.71	-7238	-0.483	10671	0.73	0.900
70% -80% P_{SMAX}	12083	0.81	-7250	-0.483	12131	0.82	0.900
80% -90% P_{SMAX}	13537	0.90	-7252	-0.483	13736	0.93	0.900
90% -100% P_{SMAX}	14132	1.00	-7246	-0.483	15171	1.00	0.900

TABLE: Reactive power production with set point Q =+Q_{max} (>11.08 kW)

Power-Bin	Active Power		Reactive Power		DC Power		Power Factor
	W	p.u.	VAr	p.u.	W	p.u.	Cos φ
90% -100% P_{CMAX}	-10187	1.01	7265	0.484	-9787	0.97	-0.899
80% -90% P_{CMAX}	-9198	0.90	7264	0.484	-8843	0.87	-0.899
70% -80% P_{CMAX}	-8211	0.80	7263	0.484	-7898	0.77	-0.899
60% -70% P_{CMAX}	-7174	0.70	7262	0.484	-6904	0.67	-0.899
50% -60% P_{CMAX}	-6140	0.60	7261	0.484	-5910	0.58	-0.899
40% -50% P_{CMAX}	-5101	0.50	7260	0.484	-4912	0.48	-0.899
30% -40% P_{CMAX}	-4083	0.39	7262	0.484	-3929	0.38	-0.899
20% -30% P_{CMAX}	-3092	0.30	7260	0.484	-2931	0.29	-0.899
10% -20% P_{CMAX}	-2021	0.20	7261	0.484	-1930	0.19	-0.898
0% -10% P_{CMAX}	-1022	0.10	7262	0.484	-963	0.09	-0.898
0% -10% P_{SMAX}	1518	0.10	7263	0.484	1559	0.10	0.892
10% -20% P_{SMAX}	3025	0.20	7261	0.484	3086	0.21	0.897
20% -30% P_{SMAX}	4493	0.30	7262	0.484	4574	0.31	0.896
30% -40% P_{SMAX}	5989	0.40	7260	0.484	6095	0.41	0.899
40% -50% P_{SMAX}	7494	0.50	7263	0.484	7634	0.50	0.898
50% -60% P_{SMAX}	8990	0.60	7261	0.484	9165	0.62	0.897
60% -70% P_{SMAX}	10443	0.71	7261	0.484	10659	0.73	0.897
70% -80% P_{SMAX}	12043	0.81	7263	0.484	12308	0.82	0.897
80% -90% P_{SMAX}	13483	0.90	7260	0.484	13795	0.93	0.899
90% -100% P_{SMAX}	14555	1.00	7262	0.484	14919	1.00	0.899

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Model	AF15K-MTH + ATOM HVS-7.68						
TABLE: Reactive power production with set point Q = 0							
Power-Bin	Active Power		Reactive Power		DC Power		Power Factor
	W	p.u.	VAr	p.u.	W	p.u.	Cos φ
90% -100% P_{CMAX}	-3844	1.01	3	0.00	-3670	0.97	-0.998
80% -90% P_{CMAX}	-3453	0.90	4	0.00	-3303	0.87	-0.997
70% -80% P_{CMAX}	-3073	0.80	4	0.00	-2920	0.77	-0.997
60% -70% P_{CMAX}	-2670	0.70	3	0.00	-2530	0.67	-0.997
50% -60% P_{CMAX}	-2298	0.60	3	0.00	-2170	0.58	-0.997
40% -50% P_{CMAX}	-1924	0.50	4	0.00	-1809	0.48	-0.996
30% -40% P_{CMAX}	-1533	0.39	4	0.00	-1420	0.38	-0.996
20% -30% P_{CMAX}	-1150	0.30	3	0.00	-1051	0.29	-0.994
10% -20% P_{CMAX}	-766	0.20	4	0.00	-670	0.19	-0.993
0% -10% P_{CMAX}	-382	0.10	4	0.00	-305	0.09	-0.992
0% -10% P_{SMAX}	761	0.10	5	0.00	820	0.10	0.991
10% -20% P_{SMAX}	1520	0.20	5	0.00	1579	0.21	0.992
20% -30% P_{SMAX}	2302	0.30	5	0.00	2360	0.31	0.993
30% -40% P_{SMAX}	3084	0.40	3	0.00	3030	0.41	0.994
40% -50% P_{SMAX}	3849	0.50	2	0.00	3904	0.50	0.995
50% -60% P_{SMAX}	4607	0.60	2	0.00	4656	0.62	0.996
60% -70% P_{SMAX}	5391	0.71	3	0.00	5440	0.73	0.997
70% -80% P_{SMAX}	6147	0.81	5	0.00	6190	0.82	0.998
80% -90% P_{SMAX}	6921	0.90	6	0.00	6972	0.93	0.998
90% -100% P_{SMAX}	7672	1.00	6	0.00	7730	1.00	0.998
TABLE: Reactive power production with set point Q = -Q_{max} (>11.08 kW)							
Power-Bin	Active Power		Reactive Power		DC Power		Power Factor
	W	p.u.	VAr	p.u.	W	p.u.	Cos φ
90% -100% P_{CMAX}	-3842	1.01	-7238	-0.483	-3697	0.97	-0.899
80% -90% P_{CMAX}	-3430	0.90	-7237	-0.482	-3299	0.87	-0.899
70% -80% P_{CMAX}	-3077	0.80	-7236	-0.482	-2956	0.77	-0.898
60% -70% P_{CMAX}	-2678	0.70	-7236	-0.482	-2570	0.67	-0.899
50% -60% P_{CMAX}	-2299	0.60	-7237	-0.482	-2202	0.58	-0.899
40% -50% P_{CMAX}	-1919	0.50	-7236	-0.482	-1833	0.48	-0.898
30% -40% P_{CMAX}	-1525	0.39	-7236	-0.482	-1458	0.38	-0.898
20% -30% P_{CMAX}	-1152	0.30	-7235	-0.482	-1093	0.29	-0.897

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

10% -20% P_{CMAX}	-767	0.20	-7234	-0.482	-717	0.19	-0.897
0% -10% P_{CMAX}	-390	0.10	-7234	-0.482	-346	0.09	-0.892
0% -10% P_{SMAX}	781	0.10	-7232	-0.482	822	0.10	0.898
10% -20% P_{SMAX}	1531	0.20	-7232	-0.482	1575	0.21	0.899
20% -30% P_{SMAX}	2300	0.30	-7234	-0.482	2356	0.31	0.899
30% -40% P_{SMAX}	3056	0.40	-7233	-0.482	3120	0.41	0.899
40% -50% P_{SMAX}	3861	0.50	-7230	-0.482	3934	0.50	0.899
50% -60% P_{SMAX}	4608	0.60	-7232	-0.482	4693	0.62	0.899
60% -70% P_{SMAX}	5383	0.71	-7229	-0.482	5481	0.73	0.899
70% -80% P_{SMAX}	6153	0.81	-7229	-0.482	6265	0.82	0.899
80% -90% P_{SMAX}	6908	0.90	-7229	-0.482	7035	0.93	0.899
90% -100% P_{SMAX}	7673	1.00	-7230	-0.482	7814	1.01	0.899

TABLE: Reactive power production with set point Q =+Q_{max} (>11.08 kW)

Power-Bin	Active Power		Reactive Power		DC Power		Power Factor
	W	p.u.	VAr	p.u.	W	p.u.	Cos φ
90% -100% P_{CMAX}	-3838	1.01	7262	0.484	-3695	0.97	-0.899
80% -90% P_{CMAX}	-3447	0.90	7260	0.484	-3316	0.87	-0.899
70% -80% P_{CMAX}	-3086	0.80	7260	0.484	-2966	0.77	-0.899
60% -70% P_{CMAX}	-2677	0.70	7261	0.484	-2569	0.67	-0.899
50% -60% P_{CMAX}	-2297	0.60	7260	0.484	-2200	0.58	-0.898
40% -50% P_{CMAX}	-1923	0.50	7262	0.484	-1835	0.48	-0.898
30% -40% P_{CMAX}	-1515	0.39	7260	0.484	-1444	0.38	-0.898
20% -30% P_{CMAX}	-1149	0.30	7262	0.484	-1087	0.29	-0.898
10% -20% P_{CMAX}	-779	0.20	7260	0.484	-726	0.19	-0.897
0% -10% P_{CMAX}	-380	0.10	7261	0.484	-336	0.09	-0.897
0% -10% P_{SMAX}	795	0.10	7260	0.484	831	0.10	0.892
10% -20% P_{SMAX}	1537	0.20	7261	0.484	1579	0.21	0.897
20% -30% P_{SMAX}	2296	0.30	7261	0.484	2351	0.31	0.897
30% -40% P_{SMAX}	3059	0.40	7260	0.484	3121	0.41	0.899
40% -50% P_{SMAX}	3845	0.50	7259	0.484	3917	0.50	0.899
50% -60% P_{SMAX}	4613	0.60	7261	0.484	4696	0.62	0.899
60% -70% P_{SMAX}	5378	0.71	7258	0.484	5474	0.73	0.899
70% -80% P_{SMAX}	6126	0.81	7256	0.484	6236	0.82	0.899
80% -90% P_{SMAX}	6898	0.90	7255	0.484	7025	0.93	0.899
90% -100% P_{SMAX}	7688	1.00	7256	0.484	7832	1.00	0.899

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Model	AF3K-MTH + ATOM HVS-7.68						
TABLE: Reactive power production with set point Q = 0							
Power-Bin	Active Power		Reactive Power		DC Power		Power Factor
	W	p.u.	VAr	p.u.	W	p.u.	Cos φ
90% -100% P_{CMAX}	-3021	1.01	3	0.00	-2870	0.97	-0.998
80% -90% P_{CMAX}	-2704	0.90	3	0.00	-2560	0.87	-0.997
70% -80% P_{CMAX}	-2403	0.80	3	0.00	-2270	0.77	-0.996
60% -70% P_{CMAX}	-2095	0.70	4	0.00	-1975	0.67	-0.996
50% -60% P_{CMAX}	-1797	0.60	3	0.00	-1690	0.58	-0.995
40% -50% P_{CMAX}	-1501	0.50	3	0.00	-1390	0.48	-0.994
30% -40% P_{CMAX}	-1211	0.39	3	0.00	-1120	0.38	-0.993
20% -30% P_{CMAX}	-904	0.30	3	0.00	-810	0.29	-0.992
10% -20% P_{CMAX}	-601	0.20	4	0.00	-520	0.19	-0.991
0% -10% P_{CMAX}	-301	0.10	3	0.00	-230	0.09	-0.990
0% -10% P_{SMAX}	298	0.10	5	0.00	356	0.10	0.990
10% -20% P_{SMAX}	602	0.20	5	0.00	650	0.21	0.991
20% -30% P_{SMAX}	906	0.30	4	0.00	955	0.31	0.992
30% -40% P_{SMAX}	1206	0.40	5	0.00	1262	0.41	0.093
40% -50% P_{SMAX}	1498	0.50	6	0.00	1560	0.50	0.994
50% -60% P_{SMAX}	1798	0.60	5	0.00	1860	0.62	0.996
60% -70% P_{SMAX}	2109	0.71	5	0.00	2160	0.73	0.997
70% -80% P_{SMAX}	2394	0.81	6	0.00	2450	0.82	0.998
80% -90% P_{SMAX}	2699	0.90	5	0.00	2751	0.93	0.998
90% -100% P_{SMAX}	3026	1.00	5	0.00	3080	1.01	0.998
TABLE: Reactive power production with set point Q = -Q_{max} (>11.08 kW)							
Power-Bin	Active Power		Reactive Power		DC Power		Power Factor
	W	p.u.	VAr	p.u.	W	p.u.	Cos φ
90% -100% P_{CMAX}	-3015	1.01	-1447	-0.482	-2897	0.97	-0.899
80% -90% P_{CMAX}	-2712	0.90	-1448	-0.483	-2603	0.87	-0.899
70% -80% P_{CMAX}	-2402	0.80	-1447	-0.482	-2303	0.77	-0.899
60% -70% P_{CMAX}	-2099	0.70	-1446	-0.482	-2008	0.67	-0.899
50% -60% P_{CMAX}	-1804	0.60	-1447	-0.482	-1723	0.58	-0.899
40% -50% P_{CMAX}	-1491	0.50	-1447	-0.482	-1425	0.48	-0.898
30% -40% P_{CMAX}	-1204	0.39	-1446	-0.482	-1143	0.38	-0.898
20% -30% P_{CMAX}	-898	0.30	-1446	-0.482	-845	0.29	-0.897

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

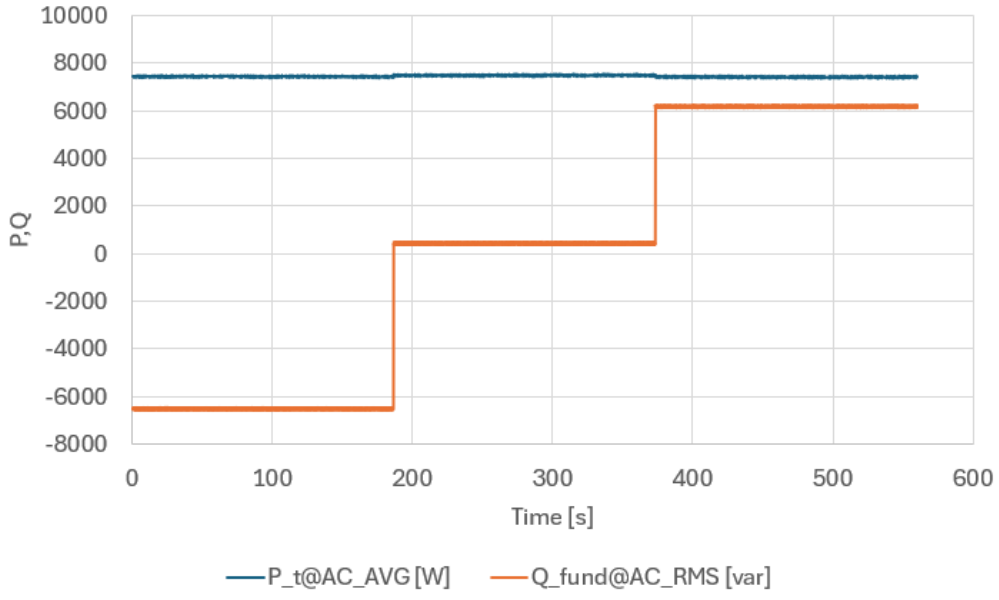
10% -20% P_{CMAX}	-595	0.20	-1447	-0.482	-574	0.19	-0.897
0% -10% P_{CMAX}	-299	0.10	-1446	-0.482	-255	0.09	-0.892
0% -10% P_{SMAX}	306	0.10	-1448	-0.483	345	0.10	0.898
10% -20% P_{SMAX}	602	0.20	-1448	-0.483	642	0.21	0.899
20% -30% P_{SMAX}	905	0.30	-1448	-0.483	947	0.31	0.900
30% -40% P_{SMAX}	1213	0.40	-1447	-0.482	1255	0.41	0.900
40% -50% P_{SMAX}	1517	0.50	-1448	-0.483	1562	0.50	0.900
50% -60% P_{SMAX}	1817	0.60	-1448	-0.483	1870	0.62	0.900
60% -70% P_{SMAX}	2090	0.71	-1447	-0.482	2145	0.73	0.900
70% -80% P_{SMAX}	2409	0.81	-1447	-0.482	2467	0.82	0.899
80% -90% P_{SMAX}	2706	0.90	-1447	-0.482	2766	0.93	0.899
90% -100% P_{SMAX}	3000	1.00	-1448	-0.483	3063	1.00	0.899

TABLE: Reactive power production with set point Q =+Q_{max} (>11.08 kW)

Power-Bin	Active Power		Reactive Power		DC Power		Power Factor
	W	p.u.	VAr	p.u.	W	p.u.	Cos φ
90% -100% P_{CMAX}	-3013	1.01	1447	0.482	-2895	0.97	-0.899
80% -90% P_{CMAX}	-2704	0.90	1447	0.482	-2595	0.87	-0.899
70% -80% P_{CMAX}	-2393	0.80	1448	0.483	-2293	0.77	-0.899
60% -70% P_{CMAX}	-2110	0.70	1447	0.482	-2018	0.67	-0.899
50% -60% P_{CMAX}	-1812	0.60	1447	0.482	-1729	0.58	-0.898
40% -50% P_{CMAX}	-1510	0.50	1447	0.482	-1441	0.48	-0.898
30% -40% P_{CMAX}	-1202	0.39	1448	0.483	-1139	0.38	-0.898
20% -30% P_{CMAX}	-889	0.30	1447	0.482	-834	0.29	-0.898
10% -20% P_{CMAX}	-603	0.20	1447	0.482	-554	0.19	-0.898
0% -10% P_{CMAX}	-304	0.10	1447	0.482	-260	0.09	-0.897
0% -10% P_{SMAX}	306	0.10	1446	0.482	346	0.10	0.892
10% -20% P_{SMAX}	602	0.20	1446	0.482	641	0.21	0.896
20% -30% P_{SMAX}	909	0.30	1447	0.482	949	0.31	0.897
30% -40% P_{SMAX}	1205	0.40	1447	0.482	1245	0.41	0.898
40% -50% P_{SMAX}	1506	0.50	1446	0.482	1549	0.50	0.898
50% -60% P_{SMAX}	1811	0.60	1446	0.482	1862	0.62	0.897
60% -70% P_{SMAX}	2120	0.71	1446	0.482	2174	0.73	0.897
70% -80% P_{SMAX}	2417	0.81	1447	0.482	2474	0.82	0.897
80% -90% P_{SMAX}	2710	0.90	1446	0.482	2770	0.93	0.899
90% -100% P_{SMAX}	3005	1.00	1447	0.482	3069	1.00	0.899

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.6.3 **Bbis.6.4**	**TABLE: Reactive power production according to an assigned level** **(Required for inverter used in plant > 11.08 kW)**			**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)			
Power meter measurment data:	Sample-Rate:		0.2 s	
	Samples time:		3 min for each power point	
P_N in %	Qmin/cosφ min (180s)		Q=0/ cosφ=0 (180s)	Qmax/cosφ max (180s)
file: 50% P_{SMAX}				
50% Pn	Reactive power Set point Q/S_n [%]	Reactive power measured Q/S_n [%]	Deviation from set point $\Delta Q/S_n$ [%]	Limit [%]
$-Q_{min}$ (=40%S_n)	-40.00%	39.6%	0.4%	$\Delta Q \leq \pm 5\% S_n$
0	0.00%	2.0%	2.0%	$\Delta Q \leq \pm 5\% S_n$
$+Q_{max}$ (=40%S_n)	40.00%	37.0%	3.0%	$\Delta Q \leq \pm 5\% S_n$



Test procedure:

c) The test must be performed according to the following steps:
- bring the generator to 50% of the maximum active power available in discharge;
- send to the generator an inductive reactive power set-point equal to 40% of the rated power of the converter (Sn);
- maintain the set-point for a time of 60 s, compatibly with the energy capacity of the storage system;
- measure the reactive power delivered by the inverter, at least 30 seconds after the command of the new reactive power regulation set-point is sent (this is to ensure that the system has reached the steady state).

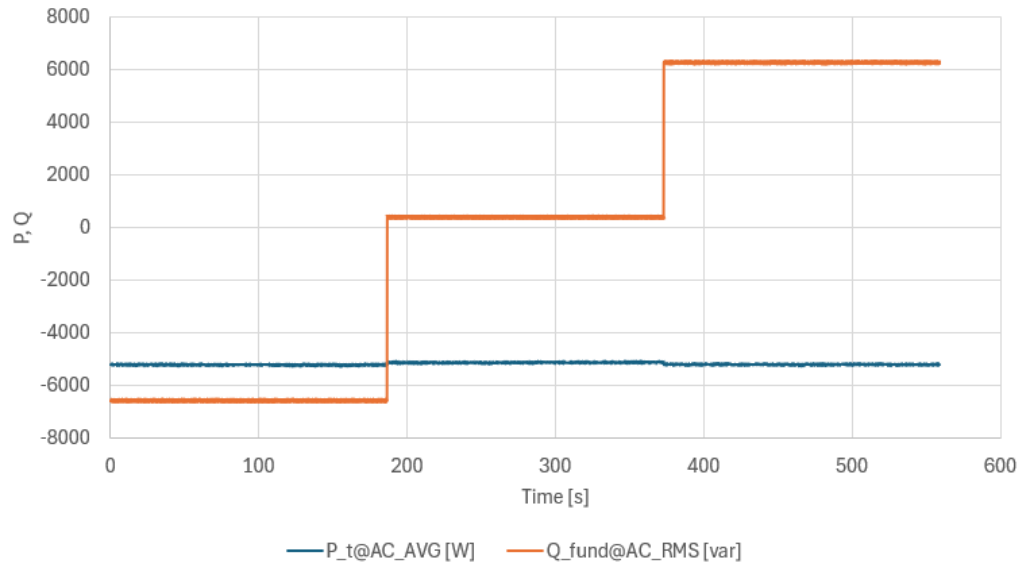
The test is considered successfully passed if the maximum deviation between the assigned level and the current measured value (average value with 1 min window) for the reactive power is equal to:
- ΔQ ≤ ±5 % the nominal apparent power of the converter (direct setting of the reactive power level);
- Δcos φ ≤ ±0,01 (setting via power factor).

d) In the case of storage systems connected to bidirectional converters, the test must also be repeated in the condition of withdrawal of energy from the grid.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.6.3 Bbis.6.4	**TABLE: reactive power production according to an assigned level (Required for inverter used in plant > 11.08 kW)**			**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)			
Power meter measurment data:	Sample-Rate:	0.2 s		
	Samples time:	3 min for each power point		
P (%)	Qmin/cosφ min (180s)	Q=0/ cosφ=0 (180s)	Qmax/cosφ max (180s)	
file: 50% P_{CMAX}				

50% Pn	Reactive power Set point Q/Sn [%]	Reactive power measured Q/Sn [%]	Deviation from set point ΔQ/Sn [%]	Limit [%]
$-Q_{min}$ (=40%S_n)	-40.00%	39.7%	0.3%	ΔQ ≤ ±5% S_n
0	0.00%	2.4%	2.4%	ΔQ ≤ ±5% S_n
$+Q_{max}$ (=40%S_n)	40.00%	38.0%	2.0%	ΔQ ≤ ±5% S_n



Test procedure:

c) The test must be performed according to the following steps:
- bring the generator to 50% of the maximum active power available in discharge;
- send to the generator an inductive reactive power set-point equal to 40% of the rated power of the converter (Sn);
- maintain the set-point for a time of 60 s, compatibly with the energy capacity of the storage system;
- measure the reactive power delivered by the inverter, at least 30 seconds after the command of the new reactive power regulation set-point is sent (this is to ensure that the system has reached the steady state).

The test is considered successfully passed if the maximum deviation between the assigned level and the current measured value (average value with 1 min window) for the reactive power is equal to:
- ΔQ ≤ ±5 % the nominal apparent power of the converter (direct setting of the reactive power level);
- Δcos φ ≤ ±0,01 (setting via power factor).

d) In the case of storage systems connected to bidirectional converters, the test must also be repeated in the condition of withdrawal of energy from the grid.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.6.5	**TABLE: Response time to a step change of the assigned level (Required for inverter used in plant > 11.08 kW)**		**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)		
Power meter measurment data:	Sample-Rate:	0,2 s	
	Samples time:	at least 2 minutes for each power point	

Test:

- From the results of the capability tests referred to in Paragraphs Bbis.6.1 and Bbis.6.2, the Qmax | cap and $Qmax|_{ind}$ values of the maximum capacitive and inductive reactive power that can be supplied by the converter at 50% and 100% of the active discharge power maximum (P_{SMAX}; for integrated storage systems, equal to P_{NINV}) and maximum charge, P_{CMAX} (for storage systems connected to bidirectional converters).
- The values measured as averages at 0.2 s of the reactive power during the execution of reactive power regulation commands with step variations, when the storage system respectively delivers a power, should be reported in a graph similar to the exemplary one in Figure 65. active equal to 50% (Test 1) and 100% of the maximum active discharge / charge power (Test 2).
- Note the response time (Tr = settling time in the graph in Figure 65), which is equivalent to the time interval that elapses from the instant of application of the new set-point to the instant in which the reactive power reaches an overall value. within an interval included within a band of ± 5% * Sn of the new assigned value.
- As shown in Figure 65, the response time must be detected in correspondence with a variation of the set-point from zero to $Qmax|_{ind}$ (step 1), from $Qmax|_{ind}$ to $Qmax|_{cap}$ (step 2) and from $Qmax|_{cap}$ to zero (step 3).

The response time values must be documented in the test report, which must also indicate the values of $Qmax|_{cap}$, $Qmax|_{ind}$, of the active power delivered / absorbed during the test and the method used to send the set control command point of reactive power.
The test is passed if the maximum response time detected is less than 10 s under all measurement conditions.

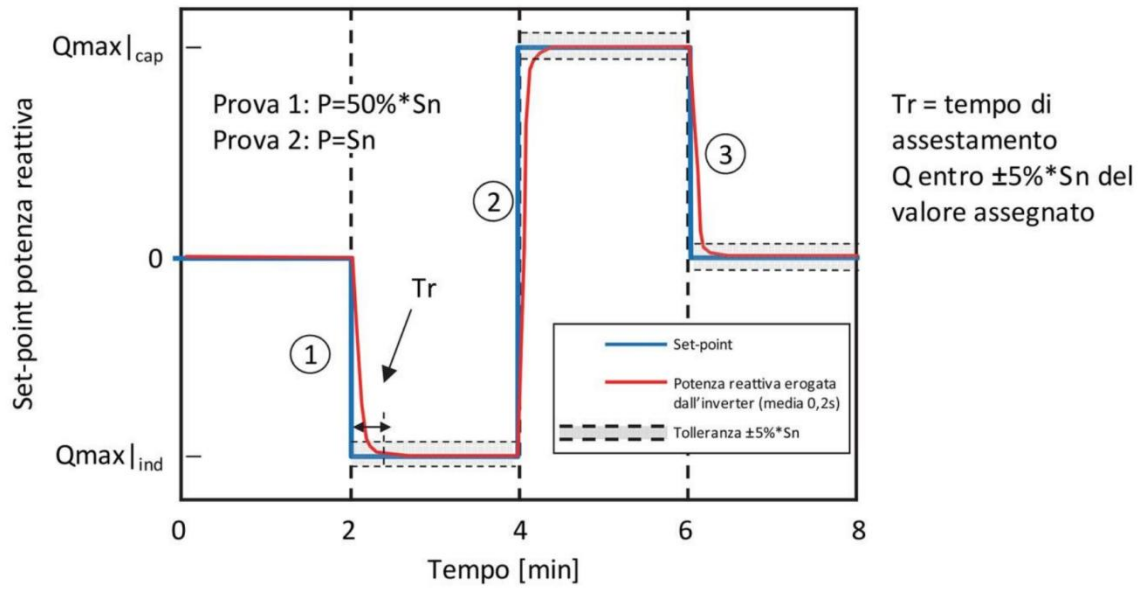
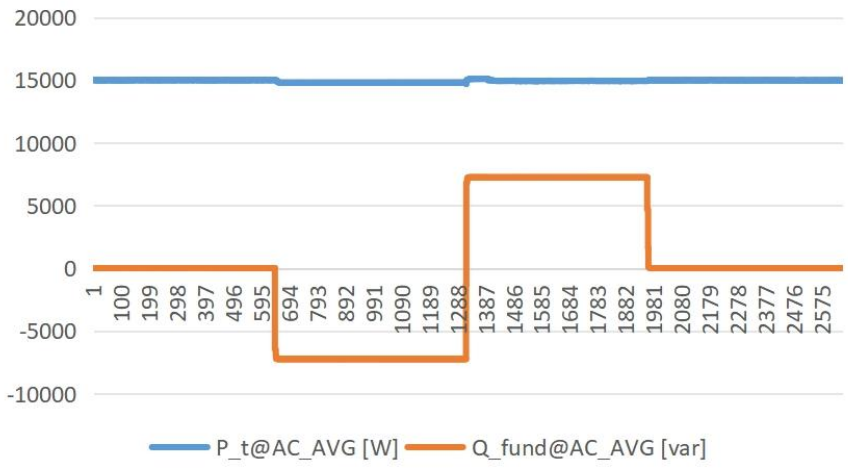


Figure 65 - Measurement of the response time to step changes of the set-point assigned for the reactive power

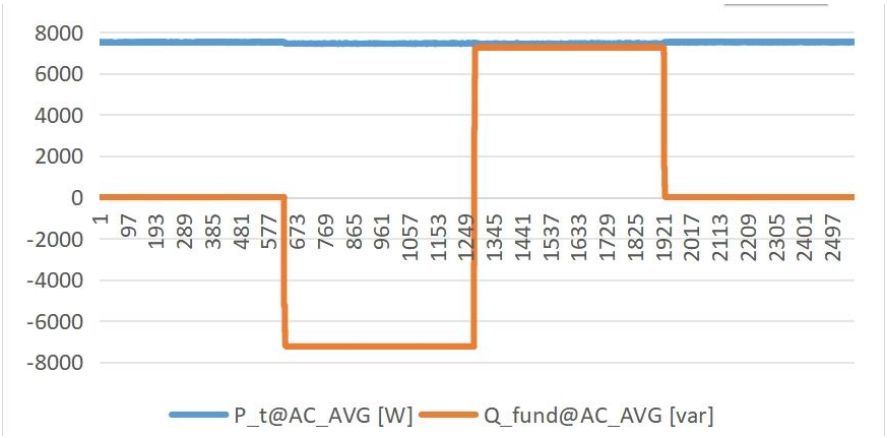
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1 (see Graph 1): 100%P_{SMAX}						
Point	Output power [W]	transient	Vac [V]	Q [VAr]	Tr [s]	Limit [s]
1	15009	0 → $Q_{max\|ind}$	230	-7246	8.7	10
2	14993	$Q_{max\|ind}$ → $Q_{max\|cap}$	230	7250	9.0	10
3	15012	$Q_{max\|cap}$ → 0	230	5	8.8	10
Test 2 (see Graph 2): 50%P_{SMAX}						
Point	Output power [W]	transient	Vac [V]	Q [VAr]	Tr [s]	Limit [s]
1	7512	0 → $Q_{max\|ind}$	230	-7233	8.8	10
2	7480	$Q_{max\|ind}$ → $Q_{max\|cap}$	230	7257	9.1	10
3	7510	$Q_{max\|cap}$ → 0	230	4	8.9	10

Graph 1of the reaction time after a step variation of the assigned level (100%-Test 1)



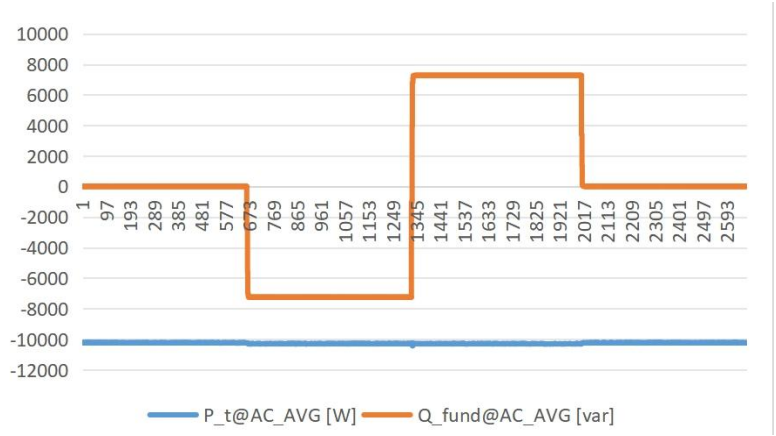
Graph 2 of the reaction time after a step variation of the assigned level (50%-Test 2)



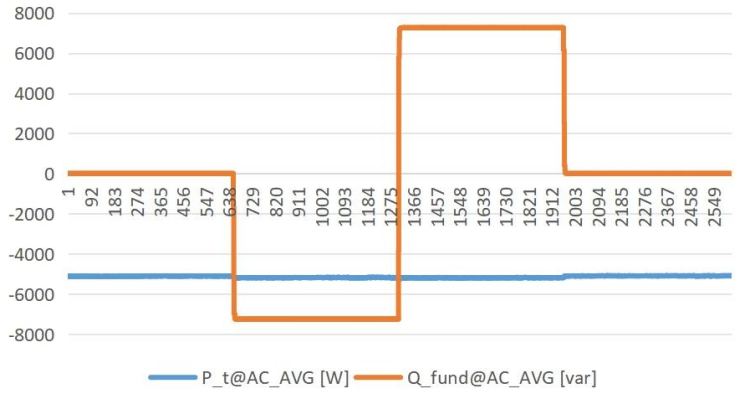
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1 (see Graph 1): 100%P_{CMAX}						
Point	Output power [W]	transient	Vac [V]	Q [VAr]	Tr [s]	Limit [s]
1	-10223	0 → $Q_{max\|ind}$	230	-7246	8.6	10
2	-10290	$Q_{max\|ind}$ → $Q_{max\|cap}$	230	7272	8.9	10
3	-10231	$Q_{max\|cap}$ → 0	230	6	8.7	10
Test 2 (see Graph 2): 50%P_{Cmax}						
Point	Output power [W]	transient	Vac [V]	Q [VAr]	Tr [s]	Limit [s]
1	-5098	0 $Q_{max\|ind}$	230	-7241	8.9	10
2	-5115	$Q_{max\|ind}$ $Q_{max\|cap}$	230	7266	9.0	10
3	-5196	$Q_{max\|cap}$ 0	230	7	8.7	10

Graph 1of the reaction time after a step variation of the assigned level (100%-Test 1)

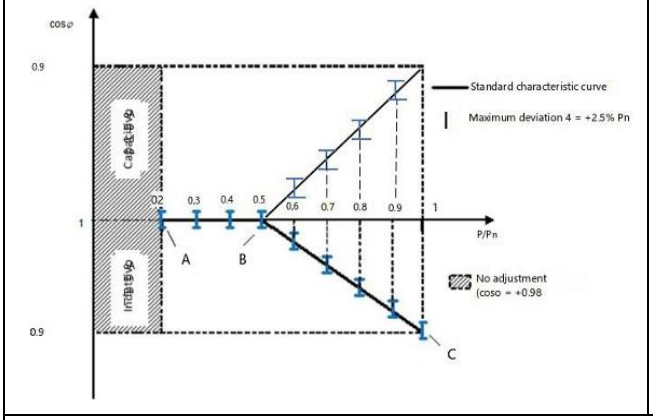


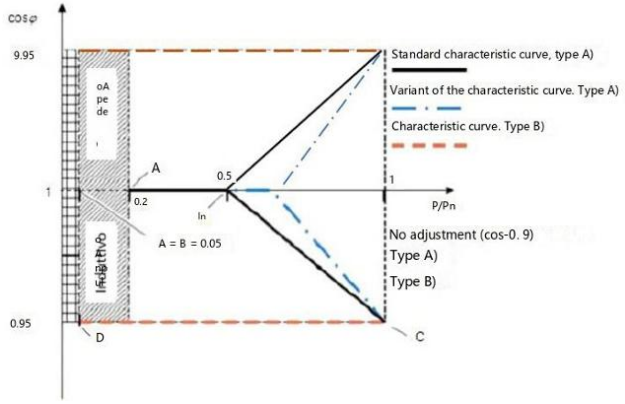
Graph 2 of the reaction time after a step variation of the assigned level (50%-Test 2)



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.6.6 Bbis.6.7	**TABLE: Automatic production of reactive power according to a characteristic curve cosφ= f(P)**	**P**
Max. cosφ declared ..... :	cosφ: 0.9	
Set value..... :	Lock-in: 1.05 Vn (Vn and 1.1 Vn with steps of 0.01) Lock-out: 0.98 Vn (0.9 Vn and Vn with steps of 0.01)	





A: P = 20%*P_{SMAX}; cos φ = 1

B: P = 50%*P_{SMAX}; cos φ = 1

C: P = P_{SMAX}; cos φ = cos φ_min

where cos φ_ is equal to 0.90 (inductive).

The automatic adjustment mode is disabled when:

the active power P delivered falls below 50% of P_{SMAX} (point B), or P_{NINV} for integrated storage systems, defined as power lock-out, independent of the voltage at the terminals, or

the voltage read at the output terminals of the converter falls below the lock-out limit, to be set at a default value equal to Vn, but which must be adjustable in the interval between 0.9 * Vn and Vn with intervals of 0.01 * Vn.

Supplementary information:

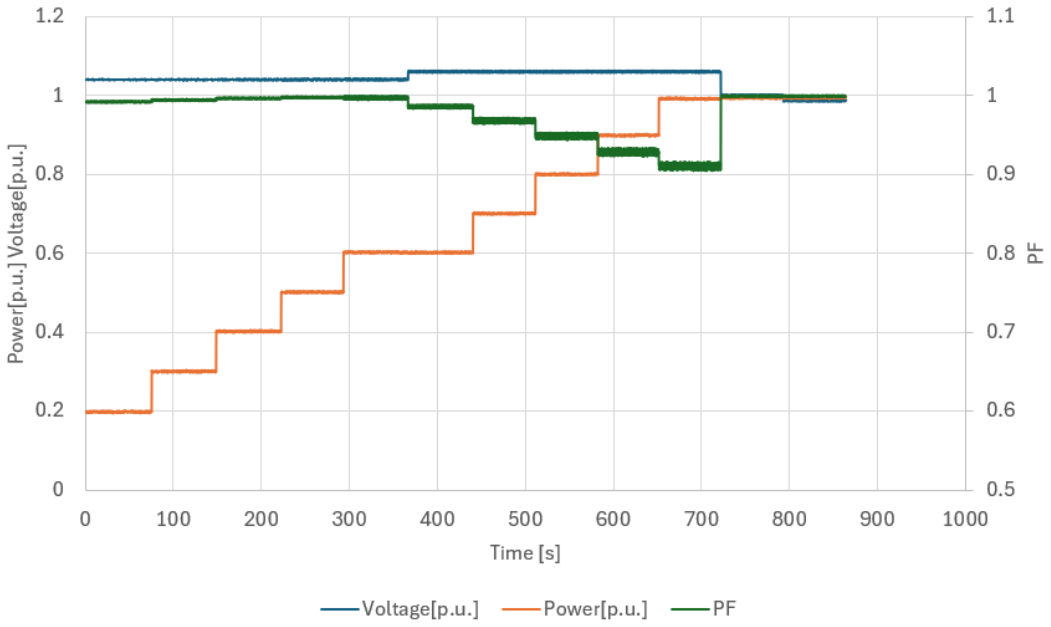
Function must be enabled by a local command of the converter.

Each value must be reach in < 10s.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Model:	AF15K-MTH + ATOM HVS-20.48 (4P) Q = +Q							
P/P_{SMAX} [%]	P[W]	Vout[%]	+Q [Var]	Cosφ Setpoint	Cosφ measured	ΔCosφ	Limit Δcosφ_max	Result
20	2978	239.2	61	1.000	0.992	0.008	≤ ± 0.01	P
30	4500	239.2	57	1.000	0.994	0.006	≤ ± 0.01	P
40	6013	239.2	82	1.000	0.996	0.006	≤ ± 0.01	P
50	7500	239.2	80	1.000	0.997	0.003	≤ ± 0.01	P
60	8926	239.2	1555	1.000	0.998	0.003	≤ ± 0.01	P
60	8930	243.8	1597	0.980	0.981	-0.001	≤ ± 0.01	P
70	10470	243.8	2875	0.960	0.962	-0.002	≤ ± 0.01	P
80	11956	243.8	3980	0.940	0.950	-0.010	≤ ± 0.01	P
90	13450	243.8	5262	0.920	0.922	-0.002	≤ ± 0.01	P
100	14895	243.8	6640	0.900	0.905	-0.005	≤ ± 0.01	P
100	14918	230	73	1.000	0.999	0.001	≤ ± 0.01	P
100	14930	226	85	1.000	0.999	0.001	≤ ± 0.01	P

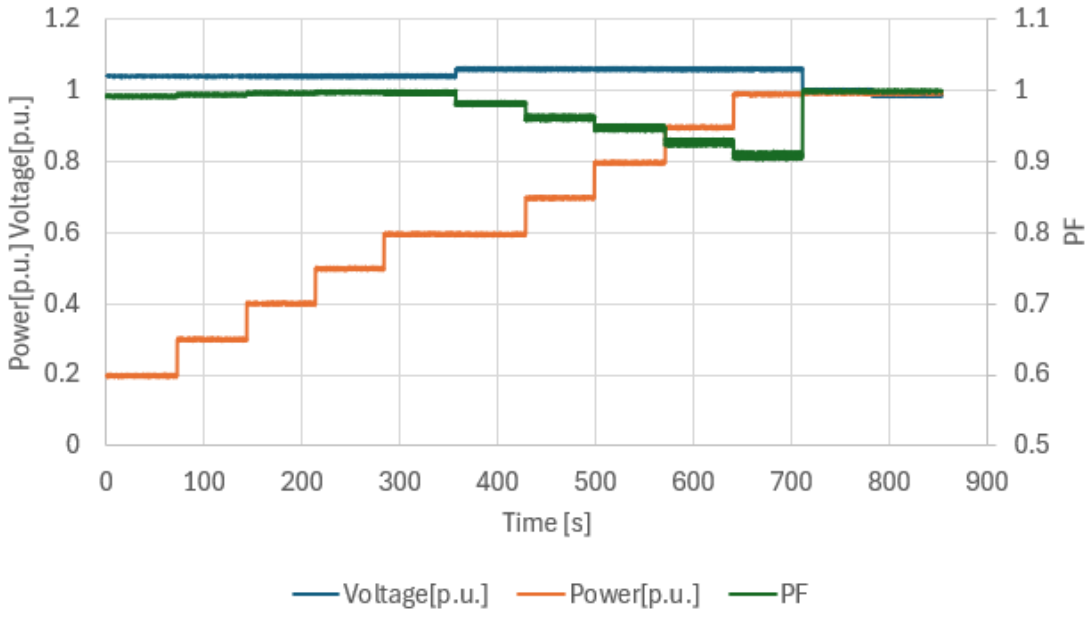
Graph reactive power production according to a characteristic curve cos(phi) = f(P)



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Model:	AF15K-MTH + ATOM HVS-20.48 (4P) Q = -Q							
P/P_{SMAX} [%]	P[W]	Vout[%]	-Q [Var]	Cos φ Setpoint	Cos φ measured	ΔCosφ	Limit Δcosφ_max	Result
20	2976	239.2	-60	1.000	0.991	0.009	≤ ± 0.01	P
30	4515	239.2	-70	1.000	0.994	0.006	≤ ± 0.01	P
40	6033	239.2	-84	1.000	0.996	0.004	≤ ± 0.01	P
50	7521	239.2	-78	1.000	0.997	0.004	≤ ± 0.01	P
60	9052	239.2	-1369	1.000	0.998	0.002	≤ ± 0.01	P
60	9023	243.8	-1428	0.980	0.988	-0.008	≤ ± 0.01	P
70	10526	243.8	-2585	0.960	0.970	-0.010	≤ ± 0.01	P
80	12000	243.8	-3960	0.940	0.950	-0.010	≤ ± 0.01	P
90	13490	243.8	-5499	0.920	0.928	-0.008	≤ ± 0.01	P
100	14830	243.8	-6557	0.900	0.910	-0.010	≤ ± 0.01	P
100	14900	230	-77	1.000	0.999	0.001	≤ ± 0.01	P
100	14910	226	-85	1.000	0.999	0.001	≤ ± 0.01	P

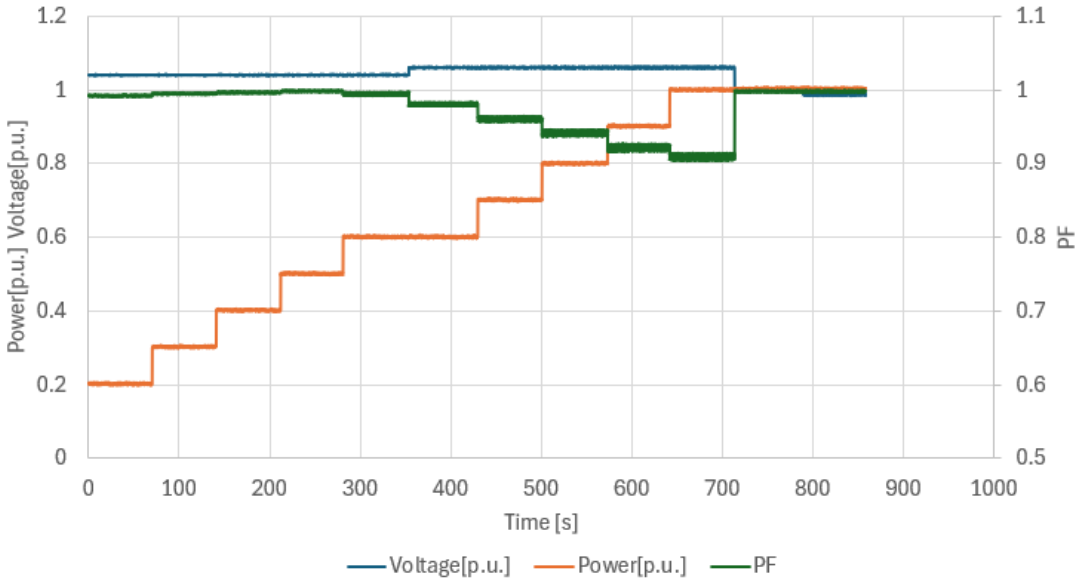
Graph reactive power production according to a characteristic curve cos(phi) = f(P)



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Model:	AF15K-MTH + ATOM HVS-7.68 Q = +Q							
P/P_{SMAX} [%]	P[W]	Vout[%]	+Q [Var]	Cosφ Setpoint	Cosφ measured	ΔCosφ	Limit Δcosφ_max	Result
20	1562	239.2	60	1.000	0.992	0.008	≤ ± 0.01	P
30	2320	239.2	75	1.000	0.994	0.006	≤ ± 0.01	P
40	3090	239.2	77	1.000	0.996	0.004	≤ ± 0.01	P
50	3850	239.2	79	1.000	0.997	0.003	≤ ± 0.01	P
60	4623	239.2	766	1.000	0.998	0.002	≤ ± 0.01	P
60	4617	243.9	825	0.980	0.981	-0.001	≤ ± 0.01	P
70	5386	243.9	1532	0.960	0.962	-0.002	≤ ± 0.01	P
80	6141	243.9	2129	0.940	0.950	-0.010	≤ ± 0.01	P
90	6930	243.9	2815	0.920	0.922	-0.002	≤ ± 0.01	P
100	7716	243.9	3478	0.900	0.905	-0.005	≤ ± 0.01	P
100	7701	230	47	1.000	0.999	0.001	≤ ± 0.01	P
100	7710	227	56	1.000	0.999	0.001	≤ ± 0.01	P

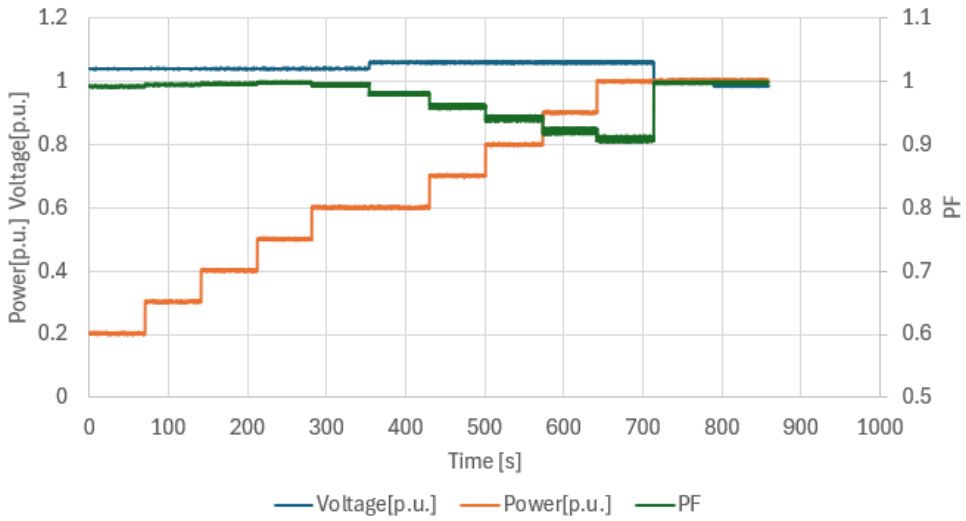
Graph reactive power production according to a characteristic curve cos(phi) = f(P)



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Model:	AF15K-MTH + ATOM HVS-7.68 Q = -Q							
P/P_{SMAX} [%]	P[W]	Vout[%]	-Q [Var]	Cos φ Setpoint	Cos φ measured	ΔCosφ	Limit Δcosφ_max	Result
20	1561	239.2	-80	1.000	0.991	0.009	≤ ± 0.01	P
30	2320	239.2	-74	1.000	0.994	0.006	≤ ± 0.01	P
40	3085	239.2	-57	1.000	0.996	0.004	≤ ± 0.01	P
50	3864	239.2	-76	1.000	0.997	0.003	≤ ± 0.01	P
60	4622	239.2	-790	1.000	0.998	0.002	≤ ± 0.01	P
60	4620	243.9	-885	0.980	0.988	-0.008	≤ ± 0.01	P
70	5403	243.9	-1464	0.960	0.970	-0.010	≤ ± 0.01	P
80	6159	243.9	-2116	0.940	0.950	-0.010	≤ ± 0.01	P
90	6920	243.9	-2904	0.920	0.928	-0.008	≤ ± 0.01	P
100	7677	243.9	-3405	0.900	0.910	-0.010	≤ ± 0.01	P
100	7707	230	-32	1.000	0.999	0.001	≤ ± 0.01	P
100	7698	227	-30	1.000	0.999	0.001	≤ ± 0.01	P

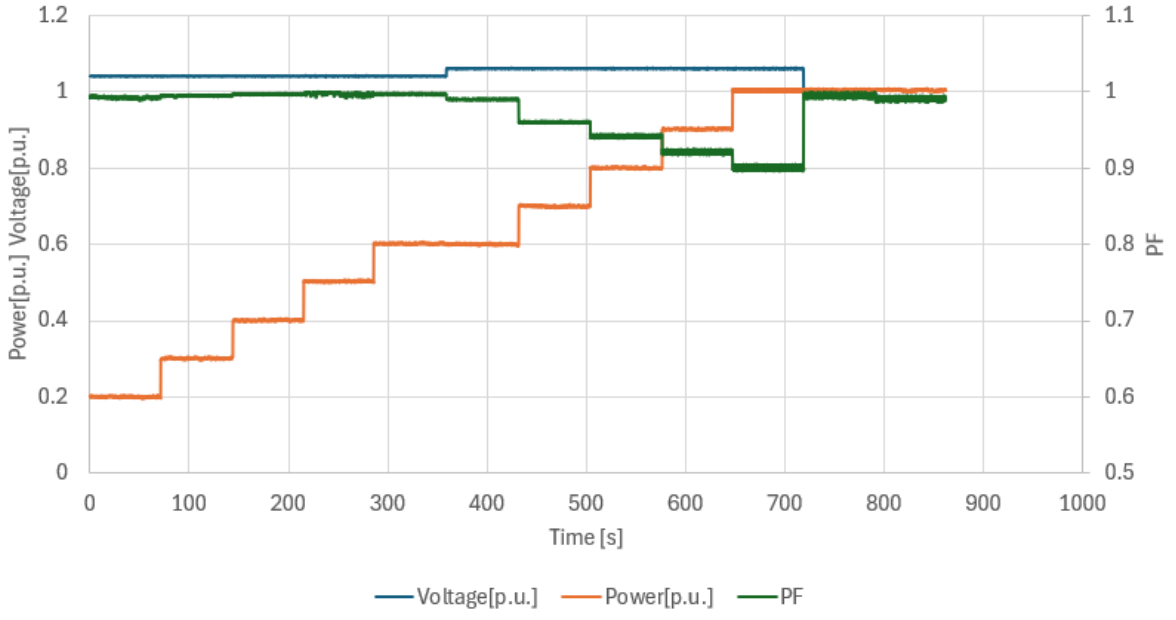
Graph reactive power production according to a characteristic curve cos(phi) = f(P)



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Model:	AF3K-MTH + ATOM HVS-7.68 Q = +Q							
P/P_{SMAX}[%]	P[W]	Vout[%]	+Q[Var]	Cos φ Setpoint	Cos φ measured	ΔCosφ	Limit Δcosφ_max	Result
20	603	239.2	17	1.000	0.992	0.008	≤ ± 0.01	P
30	900	239.2	21	1.000	0.994	0.006	≤ ± 0.01	P
40	1205	239.2	23	1.000	0.996	0.004	≤ ± 0.01	P
50	1505	239.2	29	1.000	0.997	0.003	≤ ± 0.01	P
60	1807	239.2	49	1.000	0.998	0.002	≤ ± 0.01	P
60	1802	243.8	273	0.980	0.981	-0.001	≤ ± 0.01	P
70	2105	243.8	572	0.960	0.962	-0.002	≤ ± 0.01	P
80	2402	243.8	740	0.940	0.950	-0.010	≤ ± 0.01	P
90	2704	243.8	1202	0.920	0.922	-0.002	≤ ± 0.01	P
100	3016	243.8	1401	0.900	0.905	-0.005	≤ ± 0.01	P
100	3011	230	27	1.000	0.999	0.001	≤ ± 0.01	P
100	3014	227	38	1.000	0.999	0.001	≤ ± 0.01	P

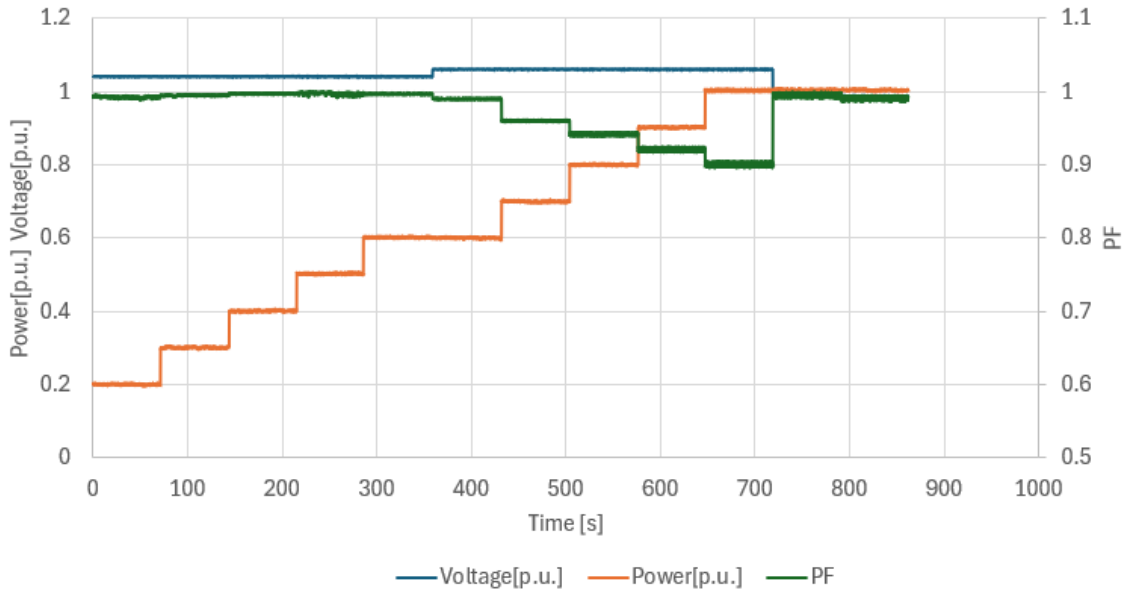
Graph reactive power production according to a characteristic curve cos(phi) = f(P)



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Model:	AF3K-MTH + ATOM HVS-7.68 Q = -Q							
P/P_{SMAX}[%]	P[W]	Vout[%]	-Q [Var]	Cos φ Setpoint	Cos φ measured	ΔCosφ	Limit Δcosφ_max	Result
20	596	239.2	-18	1.000	0.991	0.009	≤ ± 0.01	P
30	905	239.2	-20	1.000	0.994	0.006	≤ ± 0.01	P
40	1202	239.2	-22	1.000	0.996	0.004	≤ ± 0.01	P
50	1513	239.2	-35	1.000	0.997	0.003	≤ ± 0.01	P
60	1808	239.2	-32	1.000	0.998	0.002	≤ ± 0.01	P
60	1800	243.8	-270	0.980	0.988	-0.008	≤ ± 0.01	P
70	2096	243.8	-556	0.960	0.970	-0.010	≤ ± 0.01	P
80	2397	243.8	-769	0.940	0.950	-0.010	≤ ± 0.01	P
90	2712	243.8	-1170	0.920	0.928	-0.008	≤ ± 0.01	P
100	3018	243.8	-1458	0.900	0.910	-0.010	≤ ± 0.01	P
100	3016	230	-21	1.000	0.999	0.001	≤ ± 0.01	P
100	3006	227	-19	1.000	0.999	0.001	≤ ± 0.01	P

Graph reactive power production according to a characteristic curve cos(phi) = f(P)



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.6.8 Bbis.6.9	**TABLE: Automatic reactive power production according to a characteristic curve Q = f(V) (Required for inverter used in plant ≥ 11.08 kW)**	**P**

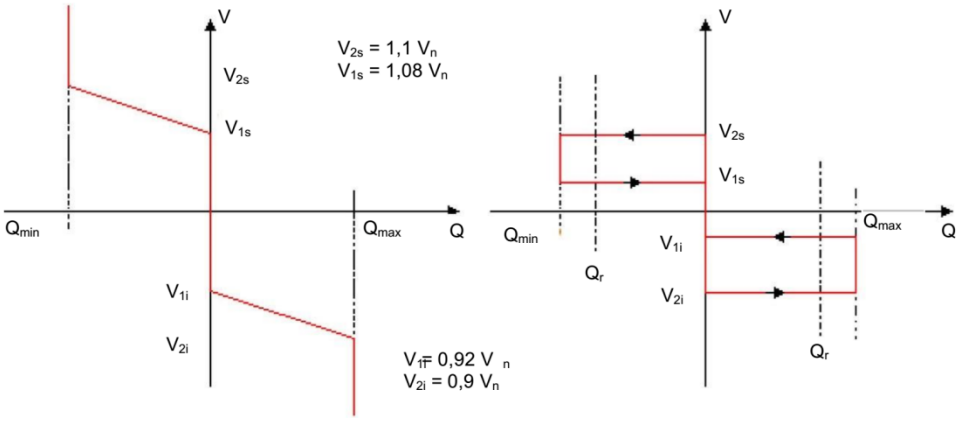


Fig. a Fig. b

Figure 51 - Standard characteristic curves Q = f (V)

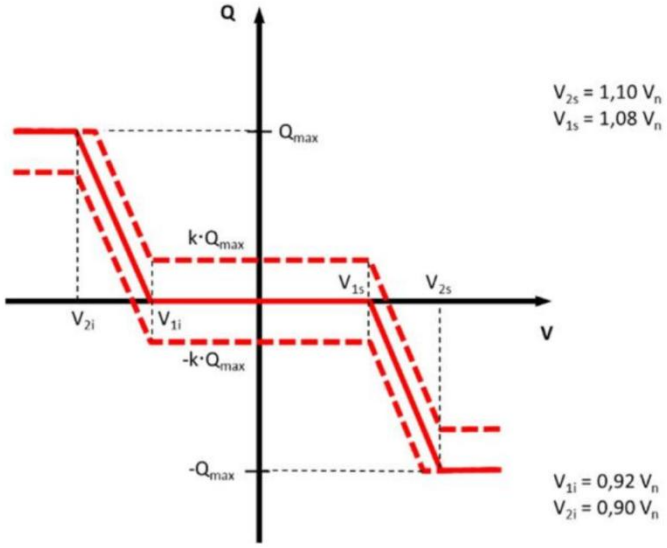


Figure 67 - Standard characteristic curve Q = f (V)

Q = f (V) standard curve default setting value:

Lock-in--> 20%P_{SMAX} (or P_{NINV}) and > 20%P_{CMAX} for bidirectional EESS

Lock-out --> ≤ 5%P_{SMAX} (or P_{NINV}) and ≤ 5%P_{CMAX} for bidirectional EESS

V1s = 1.08Vn; V2s = 1.1Vn;

V1i = 0.92Vn ; V2i = 0.9Vn;

k = 0.1

delay's time of reactive power = 3 seconds

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Curve A.1 - Test for bidirectional EESS in DISCHARGE with k = +0.1						
Setting Power [%]	Setting Volatge [V]	Output Power [W]	Voltage [V]	Reactive Power [Var]	ReactivePower expected [Var]	ΔQ
<20%P_{SMAX}	1.07Vn	2920	246.3	630	k*Qmax	≤5%Sn
<20%P_{SMAX}	1.09Vn	2927	251	624	k*Qmax	≤5%Sn
30%P_{SMAX}	1.09Vn	4506	251	-2572	-0.4*Qmax (lock-in) *within 10sec*	≤5%Sn
40%P_{SMAX}	1.09Vn	5986	251	-2588	-0.4*Qmax	≤5%Sn
50%P_{SMAX}	1.09Vn	7485	251	-2595	-0.4*Qmax	≤5%Sn
60%P_{SMAX}	1.09Vn	9005	251	-2630	-0.4*Qmax	≤5%Sn
70%P_{SMAX}	1.09Vn	10501	251	-2634	-0.4*Qmax	≤5%Sn
80%P_{SMAX}	1.09Vn	11995	251	-2606	-0.4*Qmax	≤5%Sn
90%P_{SMAX}	1.09Vn	13489	251	-2665	-0.4*Qmax	≤5%Sn
100%P_{SMAX}	1.09Vn	15002	251	-2605	-0.4*Qmax	≤5%Sn
100%P_{SMAX}	1.1Vn	15022	253	-6135	-0.9*Qmax	≤5%Sn
10%P_{SMAX}	1.1Vn	1495	253	-6225	-0.9*Qmax	≤5%Sn
≤5%P_{SMAX}	1.1Vn	689	253	670	k*Qmax (lock-out)	≤5%Sn
Curve B.1 - Test for bidirectional EESS in DISCHARGE with k = +0.1						
Setting Power [%]	Setting Volatge [V]	Output Power [W]	Voltage [V]	Reactive Power [Var]	Reactive Power expected [Var]	ΔQ
<20%P_{SMAX}	0.93Vn	2829	214	503	k*Qmax	≤5%Sn
<20%P_{SMAX}	0.91Vn	2832	209.3	515	k*Qmax	≤5%Sn
30%P_{SMAX}	0.91Vn	4486	209.3	6218	0.6*Qmax(lock-in)*within 10sec*	≤5%Sn
40%P_{SMAX}	0.91Vn	5996	209.3	4009	0.6*Qmax	≤5%Sn
50%P_{SMAX}	0.91Vn	7519	209.3	4025	0.6*Qmax	≤5%Sn
60%P_{SMAX}	0.91Vn	9005	209.3	4073	0.6*Qmax	≤5%Sn
70%P_{SMAX}	0.91Vn	10486	209.3	4035	0.6*Qmax	≤5%Sn
80%P_{SMAX}	0.91Vn	12020	209.3	4065	0.6*Qmax	≤5%Sn
90%P_{SMAX}	0.91Vn	13503	209.3	4070	0.6*Qmax	≤5%Sn
100%P_{SMAX}	0.91Vn	14117	209.3	4025	0.6*Qmax	≤5%Sn
100%P_{SMAX}	0.90Vn	13998	207	6993	Qmax	≤5%Sn
10%P_{SMAX}	0.90Vn	1512	207	6985	Qmax	≤5%Sn
≤5%P_{SMAX}	0.90Vn	640	207	490	k*Qmax(lock-out)	≤5%Sn

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Curve A.2 - Test for bidirectional EESS in DISCHARGE with k = -0.1						
Setting Power[%]	Setting Volatge [V]	Output Power [W]	Voltage [V]	Reactive Power [Var]	Reactive Power expected [Var]	ΔQ
<20%P_{SMAX}	1.07Vn	2825	246.1	672	-k*Qmax	≤5%Sn
<20%P_{SMAX}	1.09Vn	2818	250.7	679	-k*Qmax	≤5%Sn
30%P_{SMAX}	1.09Vn	4505	250.7	-4040	-0.6*Qmax (lock-in)*within 10sec*	≤5%Sn
40%P_{SMAX}	1.09Vn	6018	250.7	-4057	-0.6*Qmax	≤5%Sn
50%P_{SMAX}	1.09Vn	7515	250.7	-4026	-0.6*Qmax	≤5%Sn
60%P_{SMAX}	1.09Vn	8992	250.7	-4096	-0.6*Qmax	≤5%Sn
70%P_{SMAX}	1.09Vn	10507	250.7	-3996	-0.6*Qmax	≤5%Sn
80%P_{SMAX}	1.09Vn	12031	250.7	-4019	-0.6*Qmax	≤5%Sn
90%P_{SMAX}	1.09Vn	13509	250.7	-4045	-0.6*Qmax	≤5%Sn
100%P_{SMAX}	1.09Vn	14995	250.7	-4121	-0.6*Qmax	≤5%Sn
100%P_{SMAX}	1.1Vn	14969	253	-6671	-Qmax	≤5%Sn
10%P_{SMAX}	1.1Vn	1517	253	-6549	-Qmax	≤5%Sn
≤5%P_{SMAX}	1.1Vn	685	253	675	-k*Qmax (lock-out)	≤5%Sn
Curve B.2 - Test for bidirectional EESS in DISCHARGE with k = -0.1						
Setting Power[%]	SettingVolatge [V]	OutputPower [W]	Voltage [V]	Reactive Power [Var]	Reactive Power expected [Var]	ΔQ
<20%P_{SMAX}	0.93Vn	2825	214	645	-k*Qmax	≤5%Sn
<20%P_{SMAX}	0.91Vn	2833	209.3	640	-k*Qmax	≤5%Sn
30%P_{SMAX}	0.91Vn	4511	209.3	2737	0.4*Qmax (lock-in) *within 10sec*	≤5%Sn
40%P_{SMAX}	0.91Vn	6012	209.3	2785	0.4*Qmax	≤5%Sn
50%P_{SMAX}	0.91Vn	7402	209.3	2727	0.4*Qmax	≤5%Sn
60%P_{SMAX}	0.91Vn	9015	209.3	2852	0.4*Qmax	≤5%Sn
70%P_{SMAX}	0.91Vn	10492	209.3	2863	0.4*Qmax	≤5%Sn
80%P_{SMAX}	0.91Vn	12009	209.3	2889	0.4*Qmax	≤5%Sn
90%P_{SMAX}	0.91Vn	13489	209.3	2829	0.4*Qmax	≤5%Sn
100%P_{SMAX}	0.91Vn	14162	209.3	2884	0.4*Qmax	≤5%Sn
100%P_{SMAX}	0.90Vn	14045	207	6201	0.9*Qmax	≤5%Sn
10%P_{SMAX}	0.90Vn	1498	207	6293	0.9*Qmax	≤5%Sn
≤5%P_{SMAX}	0.90Vn	639	207	652	-k*Qmax (lock-out)	≤5%Sn

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Curve A.1 - Test for bidirectional EESS in CHARGE with k = +0.1						
Setting Power[%]	Setting Volatge [V]	Output Power [W]	Voltage [V]	Reactive Power [Var]	ReactivePower expected [Var]	ΔQ
<20%P_{CMAX}	1.07Vn	-1865	246.1	685	k*Qmax	≤5%Sn
<20%P_{CMAX}	1.09Vn	-1875	250.7	680	k*Qmax	≤5%Sn
30%P_{CMAX}	1.09Vn	-3069	250.7	-2490	-0.4*Qmax (lock-in)*within 10sec*	≤5%Sn
40%P_{CMAX}	1.09Vn	-4124	250.7	-2501	-0.4*Qmax	≤5%Sn
50%P_{CMAX}	1.09Vn	-5095	250.7	-2581	-0.4*Qmax	≤5%Sn
60%P_{CMAX}	1.09Vn	-6125	250.7	-2497	-0.4*Qmax	≤5%Sn
70%P_{CMAX}	1.09Vn	-7182	250.7	-2561	-0.4*Qmax	≤5%Sn
80%P_{CMAX}	1.09Vn	-8192	250.7	-2567	-0.4*Qmax	≤5%Sn
90%P_{CMAX}	1.09Vn	-9229	250.7	-2503	-0.4*Qmax	≤5%Sn
100%P_{CMAX}	1.09Vn	-10237	250.7	-2537	-0.4*Qmax	≤5%Sn
100%P_{CMAX}	1.1Vn	-10273	253	-6122	-0.9*Qmax	≤5%Sn
10%P_{CMAX}	1.1Vn	-1012	253	-6219	-0.9*Qmax	≤5%Sn
≤5%P_{CMAX}	1.1Vn	-483	253	677	k*Qmax (lock-out)	≤5%Sn
Curve B.1 - Test for bidirectional EESS in CHARGE with k = +0.1						
Setting Power [%]	Setting Volatge [V]	Output Power [W]	Voltage [V]	Reactive Power [Var]	Reactive Power expected [Var]	ΔQ
<20%P_{CMAX}	0.93Vn	-1507	214	659	k*Qmax	≤5%Sn
<20%P_{CMAX}	0.91Vn	-1501	209.3	664	k*Qmax	≤5%Sn
30%P_{CMAX}	0.91Vn	-3085	209.3	4020	0.6*Qmax(lock-in)*within 10sec*	≤5%Sn
40%P_{CMAX}	0.91Vn	-4126	209.3	4011	0.6*Qmax	≤5%Sn
50%P_{CMAX}	0.91Vn	-5099	209.3	4020	0.6*Qmax	≤5%Sn
60%P_{CMAX}	0.91Vn	-6122	209.3	4013	0.6*Qmax	≤5%Sn
70%P_{CMAX}	0.91Vn	-7163	209.3	4105	0.6*Qmax	≤5%Sn
80%P_{CMAX}	0.91Vn	-8200	209.3	4071	0.6*Qmax	≤5%Sn
90%P_{CMAX}	0.91Vn	-9193	209.3	4005	0.6*Qmax	≤5%Sn
100%P_{CMAX}	0.91Vn	-10243	209.3	4126	0.6*Qmax	≤5%Sn
100%P_{CMAX}	0.90Vn	-10253	207	7105	Qmax	≤5%Sn
10%P_{CMAX}	0.90Vn	-1002	207	7067	Qmax	≤5%Sn
≤5%P_{CMAX}	0.90Vn	-492	207	654	k*Qmax(lock-out)	≤5%Sn

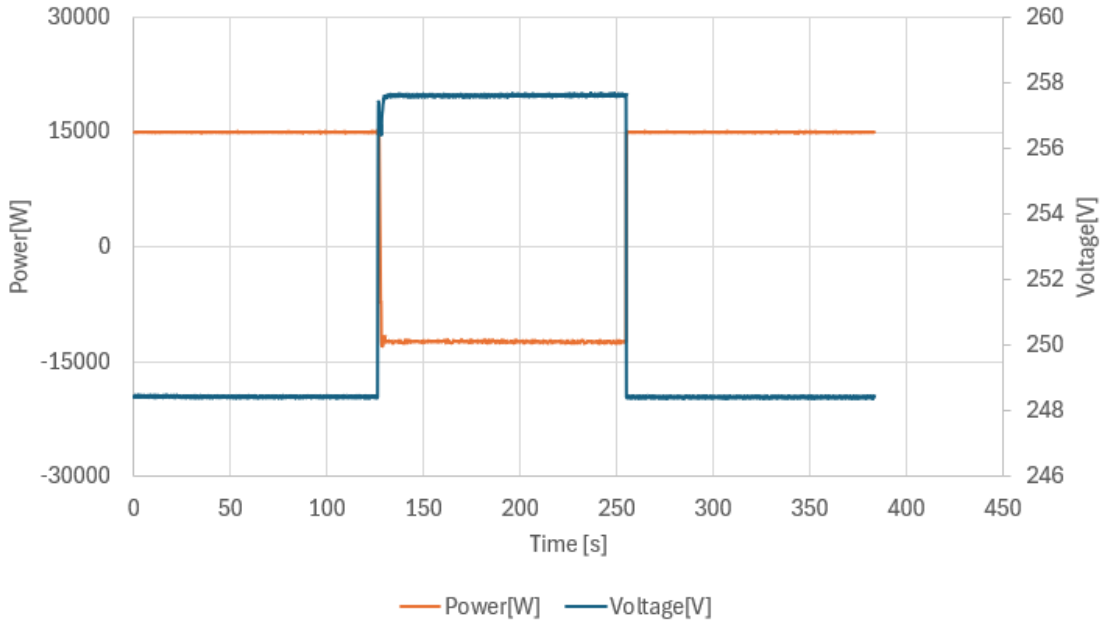
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Curve A.2 - Test for bidirectional EESS in CHARGE with k = -0.1						
Setting Power [%]	Setting Volatge [V]	Output Power [W]	Voltage [V]	Reactive Power [Var]	Reactive Power expected [Var]	ΔQ
<20%P_{CMAX}	1.07Vn	-1523	246.1	643	-k*Qmax	≤5%Sn
<20%P_{CMAX}	1.09Vn	-1536	250.7	650	-k*Qmax	≤5%Sn
30%P_{CMAX}	1.09Vn	-3087	250.7	-6286	-0.9*Qmax (lock-in)*within 10sec*	≤5%Sn
40%P_{CMAX}	1.09Vn	-4105	250.7	-3957	-0.6*Qmax	≤5%Sn
50%P_{CMAX}	1.09Vn	-5107	250.7	-3977	-0.6*Qmax	≤5%Sn
60%P_{CMAX}	1.09Vn	-6136	250.7	-4027	-0.6*Qmax	≤5%Sn
70%P_{CMAX}	1.09Vn	-7189	250.7	-4070	-0.6*Qmax	≤5%Sn
80%P_{CMAX}	1.09Vn	-8192	250.7	-4060	-0.6*Qmax	≤5%Sn
90%P_{CMAX}	1.09Vn	-9215	250.7	-4117	-0.6*Qmax	≤5%Sn
100%P_{CMAX}	1.09Vn	-10258	250.7	-4053	-0.6*Qmax	≤5%Sn
100%P_{CMAX}	1.1Vn	-10239	253	-6898	-Qmax	≤5%Sn
10%P_{CMAX}	1.1Vn	-1078	253	-6856	-Qmax	≤5%Sn
≤5%P_{CMAX}	1.1Vn	-496	253	670	-k*Qmax (lock-out)	≤5%Sn
Curve B.2 - Test for bidirectional EESS in CHARGE with k = -0.1						
Setting Power [%]	Setting Volatge [V]	Output Power [W]	Voltage [V]	Reactive Power [Var]	Reactive Power expected [Var]	ΔQ
<20%P_{CMAX}	0.93Vn	-1455	214	676	-k*Qmax	≤5%Sn
<20%P_{CMAX}	0.91Vn	-1463	209.3	658	-k*Qmax	≤5%Sn
30%P_{CMAX}	0.91Vn	-3045	209.3	2752	0.4*Qmax (lock-in)*within 10sec*	≤5%Sn
40%P_{CMAX}	0.91Vn	-4060	209.3	2668	0.4*Qmax	≤5%Sn
50%P_{CMAX}	0.91Vn	-5056	209.3	2716	0.4*Qmax	≤5%Sn
60%P_{CMAX}	0.91Vn	-6113	209.3	2682	0.4*Qmax	≤5%Sn
70%P_{CMAX}	0.91Vn	-7176	209.3	2741	0.4*Qmax	≤5%Sn
80%P_{CMAX}	0.91Vn	-8182	209.3	2760	0.4*Qmax	≤5%Sn
90%P_{CMAX}	0.91Vn	-9206	209.3	2799	0.4*Qmax	≤5%Sn
100%P_{CMAX}	0.91Vn	-10238	209.3	2745	0.4*Qmax	≤5%Sn
100%P_{CMAX}	0.90Vn	-10231	207	6358	0.9*Qmax	≤5%Sn
10%P_{CMAX}	0.90Vn	-10234	207	6331	0.9*Qmax	≤5%Sn
≤5%P_{CMAX}	0.90Vn	-486	207	665	-k*Qmax(lock-out)	≤5%Sn

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.7.1	**TABLE: Active power limitation for voltage values near to 110 % U_n**					**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)					
P_{SMAX} =15000 W P_{CMAX} =10240 W						
Set point		Activation threshold U_1			Deactivation threshold U_2	
U/U_n		110%			112%	
P/P_n		100%			20%	
Step	Set voltage [V/Vn]	Voltage [V]	Measured power [W]	Measured power [%]	Limit	Result
1	1.08	248.4	14900	99%	100%	P
2	1.12	257.6	-12215	119%	One-way: P <20%P_{SMAX} Biaxially: >80%P_{CMAX}	P
3	1.08	248.4	14888	99%	100%	P

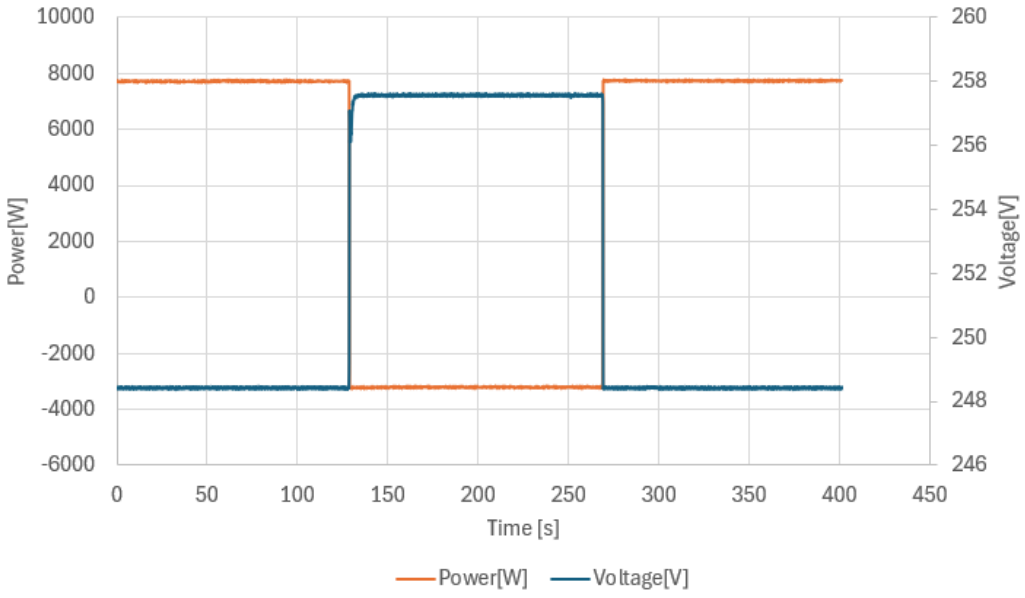
Graph curve P=f(V):



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.7.1	**TABLE: Active power limitation for voltage values near to 110 % U_n**					**P**
Model	AF15K-MTH + ATOM HVS-7.68					
P_{SMAX} =7680 W P_{CMAX} =3840 W						
Set point		Activation threshold U_1			Deactivation threshold U_2	
U/U_n		110%			112%	
P/P_n		100%			20%	
Step	Set voltage [V/Vn]	Voltage [V]	Measured power [W]	Measured power [%]	Limit	Result
1	1.08	248.4	7681	100%	100%	P
2	1.12	257.5	-3240	84%	One-way: P <20%P_{SMAX} Biaxially: >80%P_{CMAX}	P
3	1.08	248.4	7710	100%	100%	P

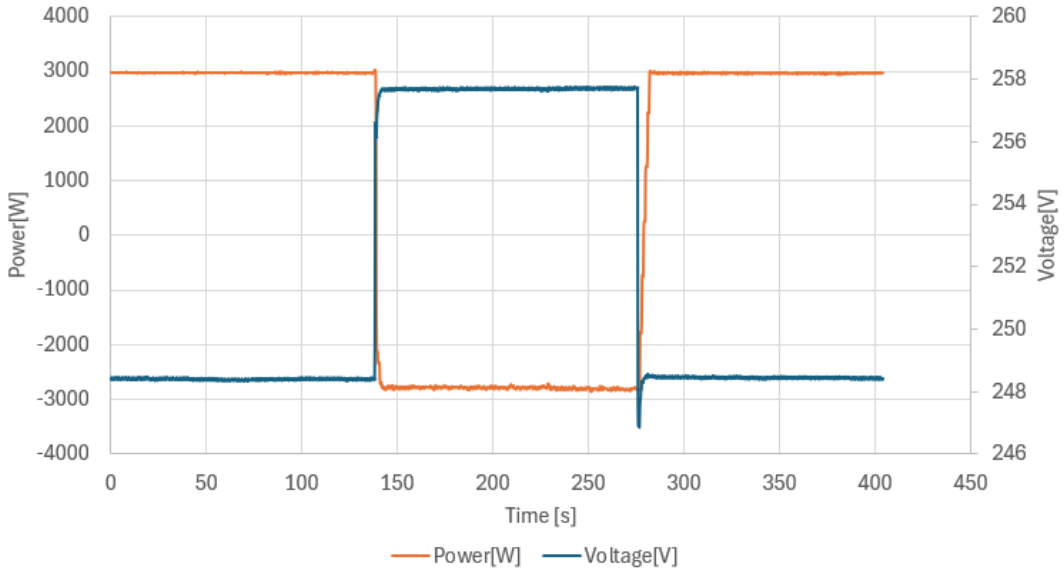
Graph curve P=f(V):



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.7.1	**TABLE: Active power limitation for voltage values near to 110 % U_n**					**P**
Model	AF3K-MTH + ATOM HVS-7.68					
P_{SMAX} =3000W P_{CMAX} =3000W						
Set point		Activation threshold U_1			Deactivation threshold U_2	
U/U_n		110%			112%	
P/P_n		100%			20%	
Step	Set voltage [V/Vn]	Voltage [V]	Measured power [W]	Measured power [%]	Limit	Result
1	1.08	248.4	2970	99%	100%	P
2	1.12	257.6	-2810	93.6%	One-way: P <20%P_{SMAX} Biaxially: >80%P_{CMAX}	P
3	1.08	248.4	2962	98.7%	100%	P

Graph curve P=f(V):



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.7.2	**TABLE: Verification of automatic reduction of active power in the presence of overfrequency transients on the network**	P
Model	AF15K-MTH + ATOM HVS-20.48 (4P)	
Activation settings..... :	Settable delay from 0s to 1s with step of 50ms (default value: no intentional delay)	

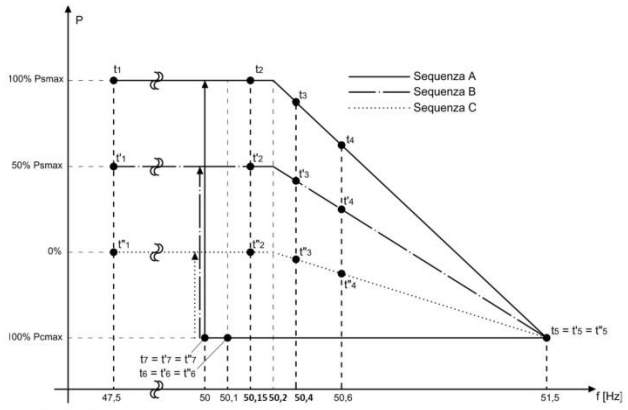


Figure 68 - Active power limitation curves for bidirectional converters

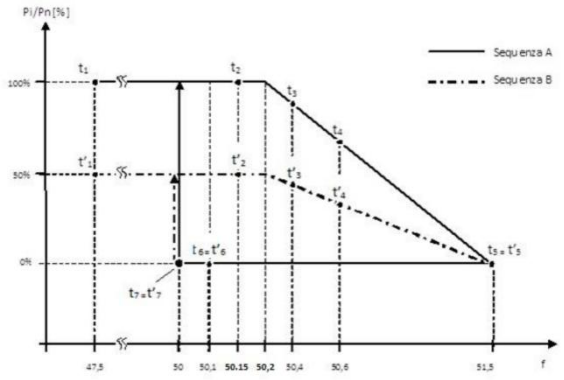


Figure 69 - Active power limitation curves for unidirectional converters

Supplementary information:

- bring all the parameters of the storage system under test to their respective normal operating values, such that the AC power delivered at the output is equal to the maximum AC power that can be delivered for sequence A, i.e. respectively at 50% and 0% in the case of the sequences B and C; energy equal to 80% of the useful capacity, CUS, must be stored in the storage system;
- perform the measurements on 7 points (the frequency value must have an uncertainty of maximum ± 10 mHz) temporally consequent to each other:
  1. f = 47,51 Hz (t_1 for sequence A, t'_1 for sequence B, t''_1 for sequence C);
  2. f = 50 Hz + 0,15 Hz (t_2 for sequence A, t'_2 for sequence B, t''_2 for sequence C);
  3. f = 50 Hz + 0,40 Hz (t_3 for sequence A, t'_3 for sequence B, t''_3 for sequence C);
  4. f = 50 Hz + 0,60 Hz (t_4 for sequence A, t'_4 for sequence B, t''_4 for sequence C);
  5. f = 50 Hz + 1,49 Hz (t_5 for sequence A, t'_5 for sequence B, t''_5 for sequence C);
  6. f = 50 Hz + 0,11 Hz (t_6 for sequence A, t'_6 for sequence B, t''^6 for sequence C);
  7. f = 50 Hz (t_7 for sequence A, t'_7 for sequence B, t''_7 for sequence C). The frequency is reported to the nominal value for the verification of the conditions of gradual restoration of the maximum supply (sequence A), that is to say at 50% or 0% of the maximum available power (respectively, sequence B and C).

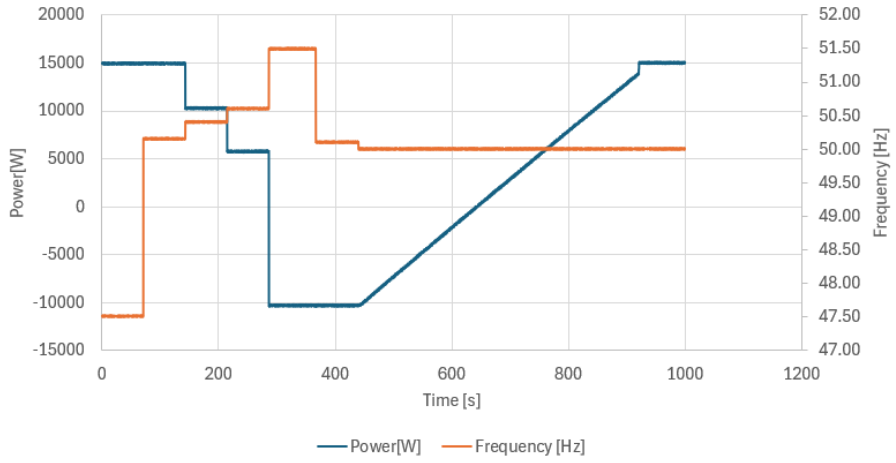
* The sequence C is applicable only for bi-directional converters.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

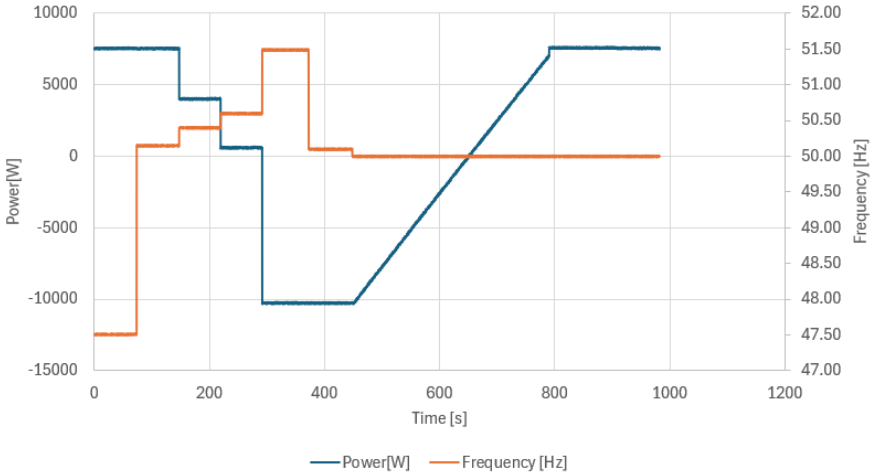
Model	AF15K-MTH + ATOM HVS-20.48 (4P)					
Sequence A						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	100	47.51	15000	14971	± 2.5% Pn	t_1
2	100	50.15	15000	14987	± 2.5% Pn	t_2
3	100	50.40	10500	10315	± 2.5% Pn	t_3
4	100	50.60	6100	5790	± 2.5% Pn	t_4
5	100	51.49	-10240	-10269	± 2.5% Pn	t_5
6	100	50.10	-10240	-10275	± 2.5% Pn	t_6
7	100	50.00	15000	15029	Pn	t_7
Sequence B						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	50	47.51	7500	7526	± 2.5% Pn	t'_1
2	50	50.15	7500	7512	± 2.5% Pn	t'_2
3	50	50.40	4050	3970	± 2.5% Pn	t'_3
4	50	50.60	610	589	± 2.5% Pn	t'_4
5	50	51.49	-10240	-10267	± 2.5% Pn	t'_5
6	50	50.10	-10240	-10285	± 2.5% Pn	t'_6
7	50	50.00	7500	7558	50% Pn	t'_7
Sequence C						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	0	47.51	0	12	± 2.5% Pn	t''_1
2	0	50.15	0	13	± 2.5% Pn	t''_2
3	0	50.40	-2300	-2260	± 2.5% Pn	t''_3
4	0	50.60	-4650	-4587	± 2.5% Pn	t''_4
5	0	51.49	-10240	-10256	± 2.5% Pn	t''_5
6	0	50.10	-10240	-10260	± 2.5% Pn	t''_6
7	0	50.00	0	-10	0% Pn	t''_7

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

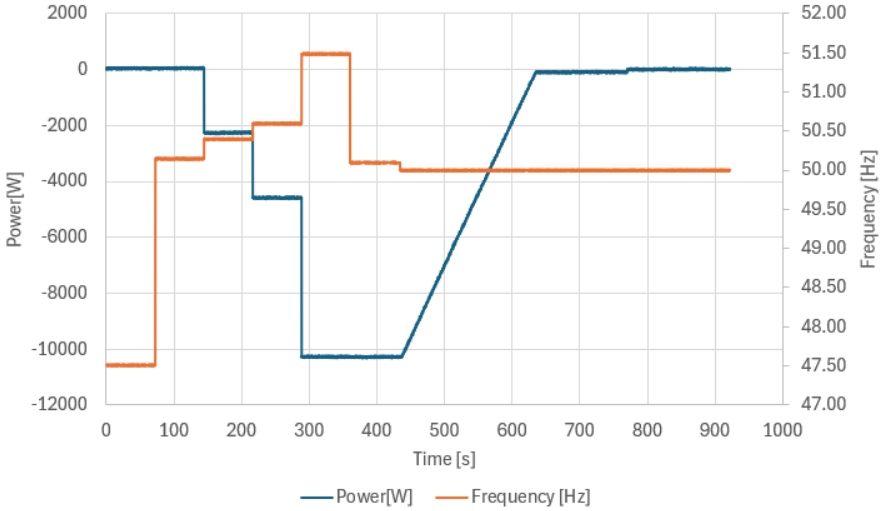
Sequence A



Sequence B



Sequence C

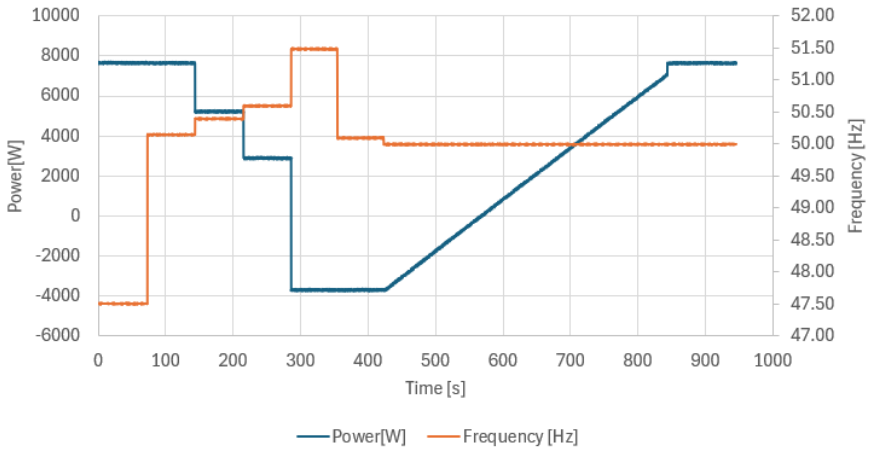


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

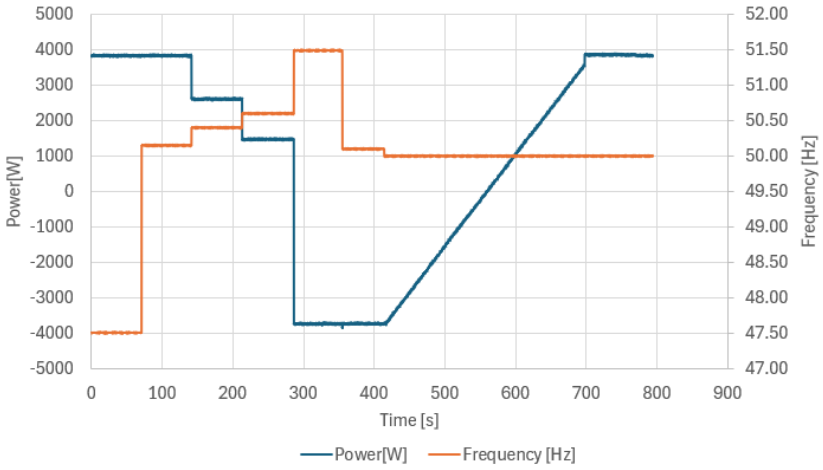
Model	AF15K-MTH + ATOM HVS-7.68					
Sequence A						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	100	47.51	7680	7660	± 2.5% Pn	t_1
2	100	50.15	7680	7658	± 2.5% Pn	t_2
3	100	50.40	5300	5239	± 2.5% Pn	t_3
4	100	50.60	2910	2883	± 2.5% Pn	t_4
5	100	51.49	-3840	-3722	± 2.5% Pn	t_5
6	100	50.10	-3840	-3715	± 2.5% Pn	t_6
7	100	50.00	7680	7638	Pn	t_7
Sequence B						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	50	47.51	3840	3837	± 2.5% Pn	t'_1
2	50	50.15	3840	3850	± 2.5% Pn	t'_2
3	50	50.40	2670	2616	± 2.5% Pn	t'_3
4	50	50.60	1530	1490	± 2.5% Pn	t'_4
5	50	51.49	-3840	-3750	± 2.5% Pn	t'_5
6	50	50.10	-3840	-3737	± 2.5% Pn	t'_6
7	50	50.00	3840	3857	50% Pn	t'_7
Sequence C						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	0	47.51	0	9	± 2.5% Pn	t''_1
2	0	50.15	0	10	± 2.5% Pn	t''_2
3	0	50.40	575	530	± 2.5% Pn	t''_3
4	0	50.60	1220	1180	± 2.5% Pn	t''_4
5	0	51.49	-3840	-3862	± 2.5% Pn	t''_5
6	0	50.10	-3840	-3846	± 2.5% Pn	t''_6
7	0	50.00	0	20	0% Pn	t''_7

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

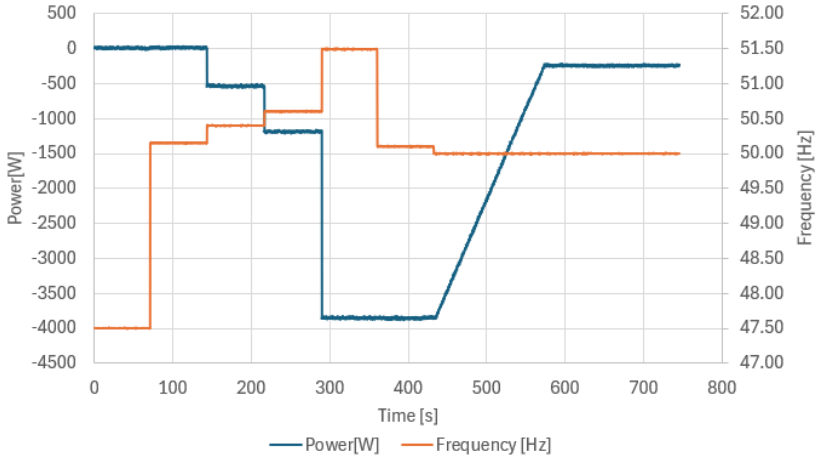
Sequence A



Sequence B



Sequence C

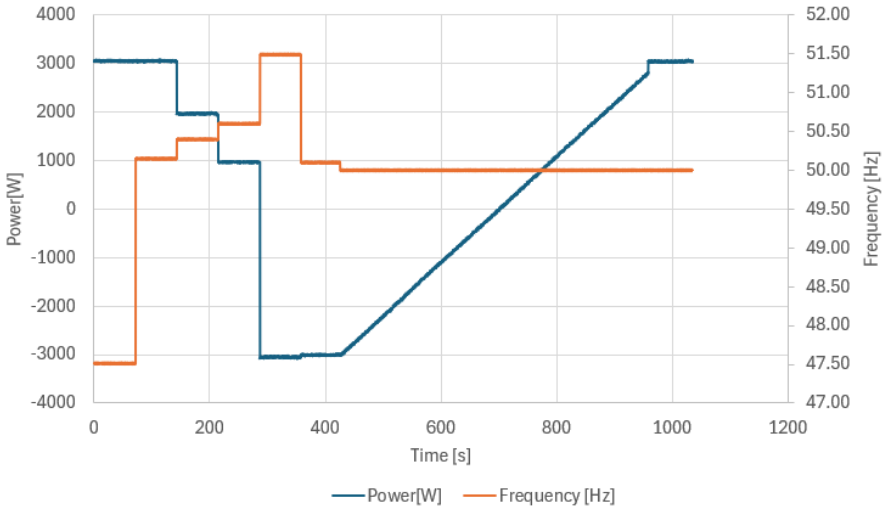


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

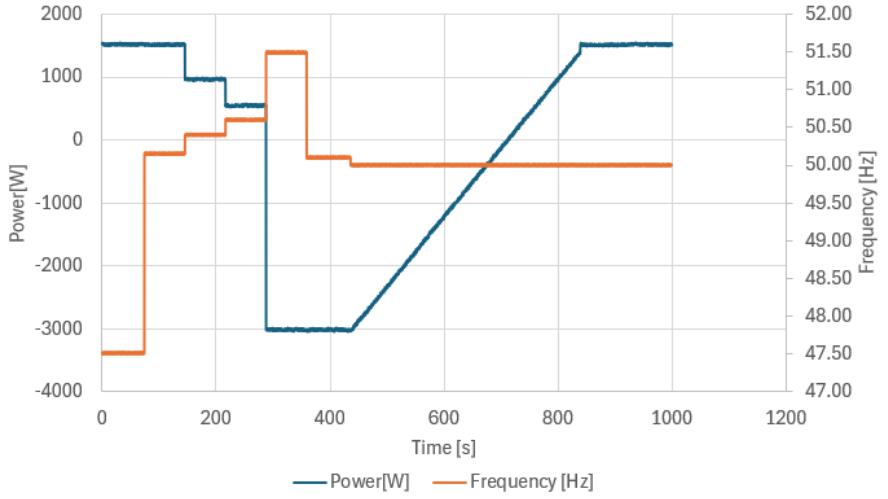
Model	AF3K-MTH + ATOM HVS-7.68					
Sequence A						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	100	47.51	3000	3056	± 2.5% Pn	t_1
2	100	50.15	3000	3062	± 2.5% Pn	t_2
3	100	50.40	2077	1960	± 2.5% Pn	t_3
4	100	50.60	1154	968	± 2.5% Pn	t_4
5	100	51.49	-2954	-3030	± 2.5% Pn	t_5
6	100	50.10	-2954	-3010	± 2.5% Pn	t_6
7	100	50.00	3000	3036	Pn	t_7
Sequence B						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	50	47.51	1500	1521	± 2.5% Pn	t'_1
2	50	50.15	1500	1518	± 2.5% Pn	t'_2
3	50	50.40	808	950	± 2.5% Pn	t'_3
4	50	50.60	115	550	± 2.5% Pn	t'_4
5	50	51.49	-2965	-3024	± 2.5% Pn	t'_5
6	50	50.10	-2965	-3021	± 2.5% Pn	t'_6
7	50	50.00	1500	1508	50% Pn	t'_7
Sequence C						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	0	47.51	0	12	± 2.5% Pn	t''_1
2	0	50.15	0	10	± 2.5% Pn	t''_2
3	0	50.40	-462	-345	± 2.5% Pn	t''_3
4	0	50.60	-923	-835	± 2.5% Pn	t''_4
5	0	51.49	-2977	-3016	± 2.5% Pn	t''_5
6	0	50.10	-2977	-3020	± 2.5% Pn	t''_6
7	0	50.00	0	-30	0% Pn	t''_7

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

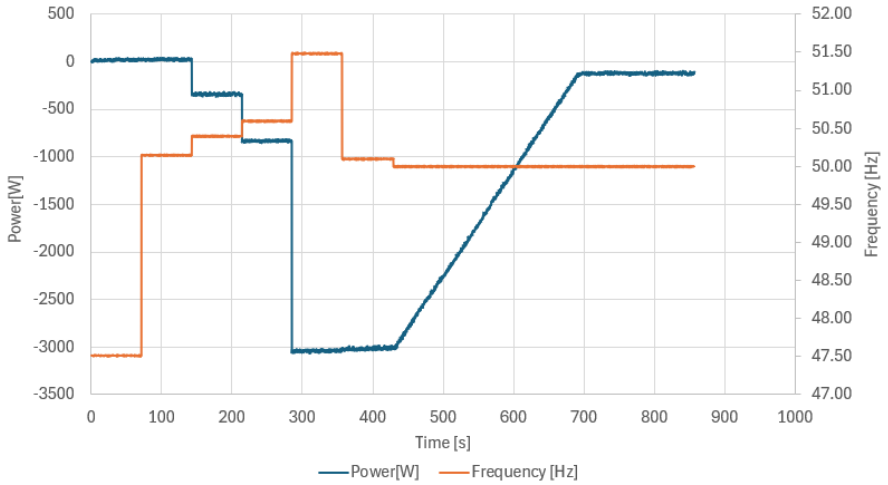
Sequence A



Sequence B

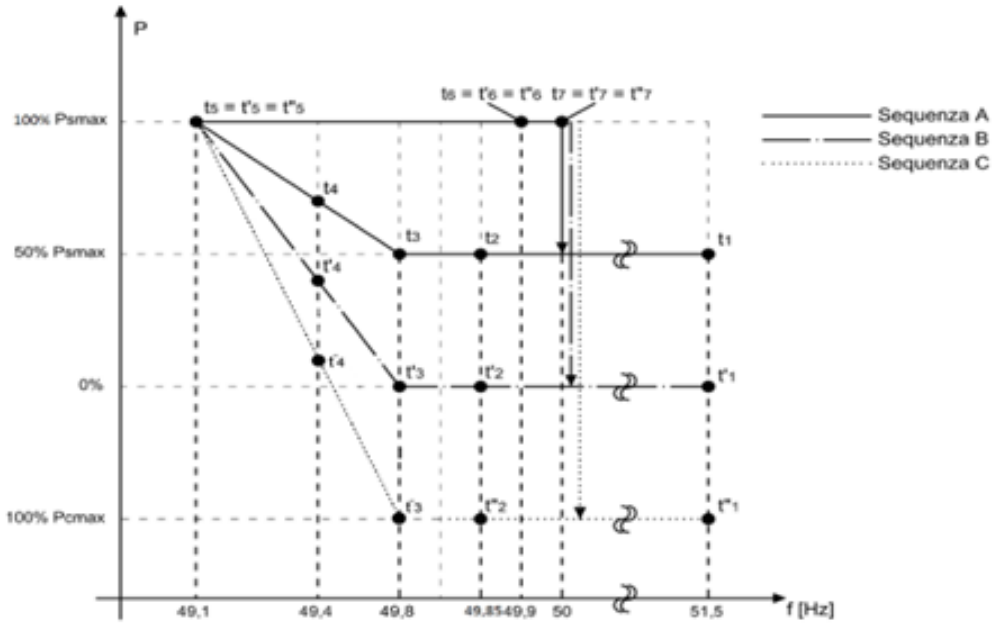


Sequence C



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.7.3	**TABLE: Verification of the automatic increase of active power in the presence of underfrequency transients on the network**	P
Activation settings..... ...:	Settable delay from 0s to 1s with step of 50ms (default value: no intentional delay)	



Supplementary information:

The function of power derating under over-frequency was disable for this test.

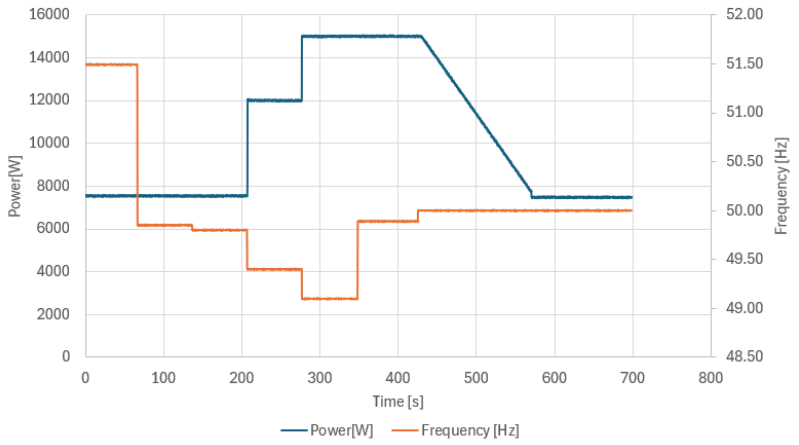
- bring all the parameters of the storage system under test to their respective normal operating values, such that the AC power delivered at the output is respectively equal, for sequences A and B, to 50% and 0% of P_{SMAX} (or P_{NINV} for integrated storage systems) and, for sequence C, 100% of the P_{CMAX}; energy equal to 20% of the useful capacity, CUS, must be stored in the storage system;
- perform the measurements on 7 points (the frequency value must have an uncertainty of maximum ± 10 mHz) temporally consequent to each other:
  1. f = 51,49 Hz (t_1 for sequence A, t'_1 for sequence B, $t"_1$ for sequence C);
  2. f = 50 Hz - 0,15 Hz (t_2 for sequence A, t'_2 for sequence B, $t"_2$ for sequence C);
  3. f = 50 Hz - 0,40 Hz (t_3 for sequence A, t'_3 for sequence B, $t"_3$ for sequence C);
  4. f = 50 Hz - 0,60 Hz (t_4 for sequence A, t'_4 for sequence B, $t"_4$ for sequence C);
  5. f = 50 Hz - 0,89 Hz (t_5 for sequence A, t'_5 for sequence B, $t"_5$ for sequence C);
  6. f = 50 Hz - 0,11 Hz (t_6 for sequence A, t'_6 for sequence B, $t"_6$ for sequence C);
  7. f = 50 Hz (t_7 for the sequence A, t'_7 for the sequence B, $t"_7$ for the sequence C). The frequency is reported at the nominal value for the verification of the gradual recovery conditions, for sequences A and B, respectively of 50% and 0% of the P_{SMAX} (or of P_{NINV} for integrated storage systems) and, for sequence C, 100% of the P_{CMAX}.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

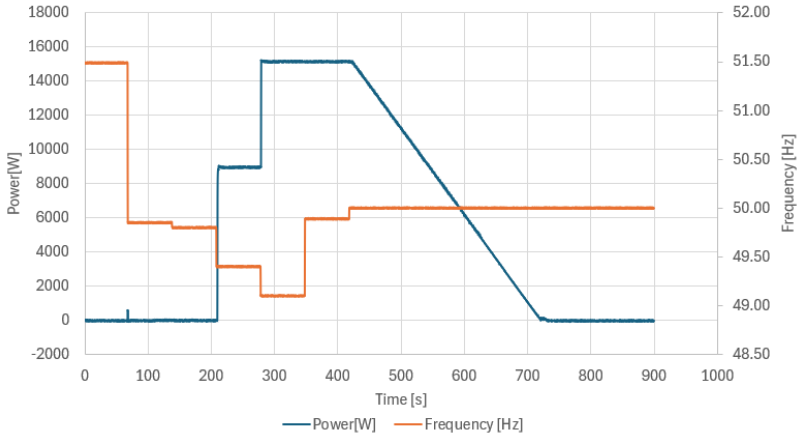
Model	AF15K-MTH + ATOM HVS-20.48 (4P)					
Sequence A						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	50	51.49	7500	7517	± 2.5% Sn	t_1
2	50	49.85	7500	7535	± 2.5% Sn	t_2
3	50	49.80	7500	7542	± 2.5% Sn	t_3
4	50	49.40	12100	11982	± 2.5% Sn	t_4
5	50	49.10	15000	15002	± 2.5% Sn	t_5
6	50	49.89	15000	14989	± 2.5% Sn	t_6
7	50	50.00	7500	7460	± 2.5% Sn	t_7
Sequence B						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	0	51.49	0	11	± 2.5% Sn	t'_1
2	0	49.85	0	13	± 2.5% Sn	t'_2
3	0	49.80	0	12	± 2.5% Sn	t'_3
4	0	49.40	9150	8955	± 2.5% Sn	t'_4
5	0	49.10	15000	15141	± 2.5% Sn	t'_5
6	0	49.89	15000	15122	± 2.5% Sn	t'_6
7	0	50.00	0	9	± 2.5% Sn	t'_7
Sequence C						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	100% P_{CMAX}	51.49	-10240	-10318	± 2.5% Sn	t''_1
2	100% P_{CMAX}	49.85	-10240	-10326	± 2.5% Sn	t''_2
3	100% P_{CMAX}	49.80	-10240	-10320	± 2.5% Sn	t''_3
4	100% P_{CMAX}	49.40	4160	4038	± 2.5% Sn	t''_4
5	100% P_{CMAX}	49.10	15000	14989	± 2.5% Sn	t''_5
6	100% P_{CMAX}	49.89	15000	15010	± 2.5% Sn	t''_6
7	100% P_{CMAX}	50.00	-10240	-10343	± 2.5% Sn	t''_7

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

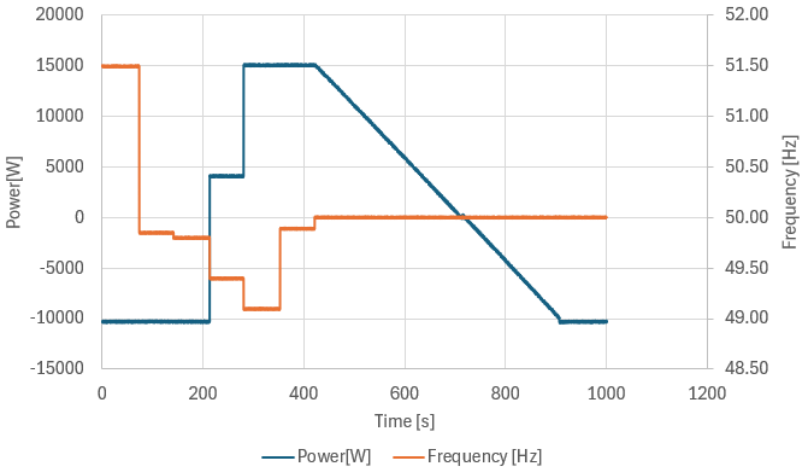
Graph Active power regulation in coincidence with transitory on the transmission grid
Sequence A



Graph Active power regulation in coincidence with transitory on the transmission grid
Sequence B



Graph Active power regulation in coincidence with transitory on the transmission grid
Sequence C

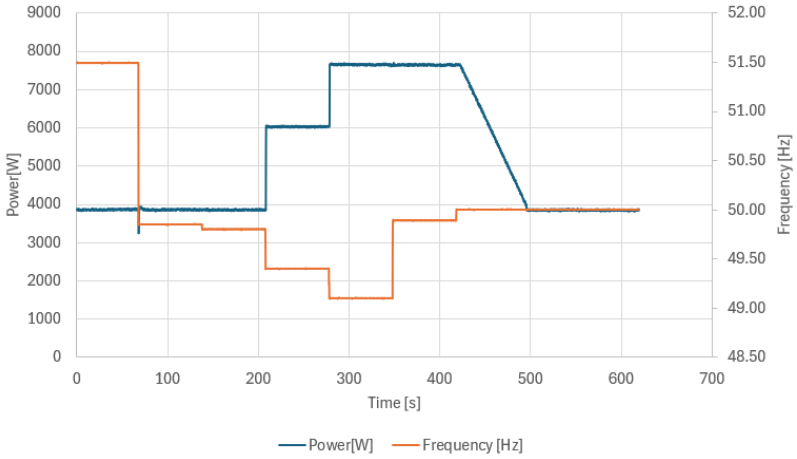


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

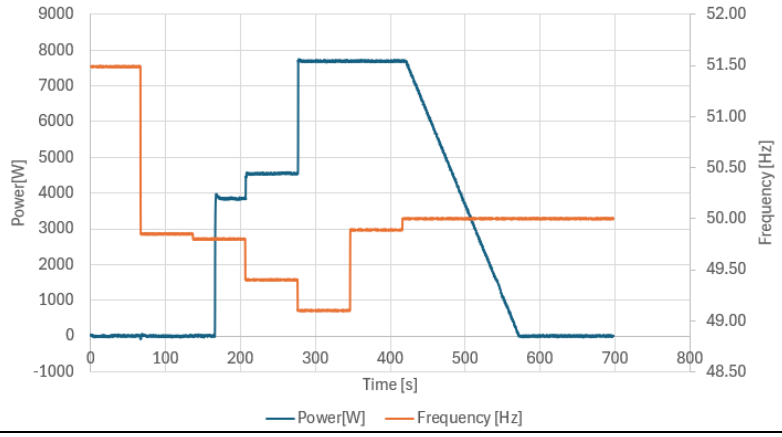
Model	AF15K-MTH + ATOM HVS-7.68					
Sequence A						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	50	51.49	3840	3863	± 2.5% Sn	t_1
2	50	49.85	3840	3860	± 2.5% Sn	t_2
3	50	49.80	3840	3862	± 2.5% Sn	t_3
4	50	49.40	5900	6035	± 2.5% Sn	t_4
5	50	49.10	7860	7663	± 2.5% Sn	t_5
6	50	49.89	7860	7670	± 2.5% Sn	t_6
7	50	50.00	3840	3860	± 2.5% Sn	t_7
Sequence B						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	0	51.49	0	12	± 2.5% Sn	t'_1
2	0	49.85	0	14	± 2.5% Sn	t'_2
3	0	49.80	0	15	± 2.5% Sn	t'_3
4	0	49.40	4670	4530	± 2.5% Sn	t'_4
5	0	49.10	7860	7697	± 2.5% Sn	t'_5
6	0	49.89	7860	7681	± 2.5% Sn	t'_6
7	0	50.00	0	12	± 2.5% Sn	t'_7
Sequence C						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	100% P_{CMAX}	51.49	-3840	-3830	± 2.5% Sn	t''_1
2	100% P_{CMAX}	49.85	-3840	-3840	± 2.5% Sn	t''_2
3	100% P_{CMAX}	49.80	-3840	-3820	± 2.5% Sn	t''_3
4	100% P_{CMAX}	49.40	2980	2830	± 2.5% Sn	t''_4
5	100% P_{CMAX}	49.10	7860	7660	± 2.5% Sn	t''_5
6	100% P_{CMAX}	49.89	7860	7656	± 2.5% Sn	t''_6
7	100% P_{CMAX}	50.00	-3840	-3852	± 2.5% Sn	t''_7

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

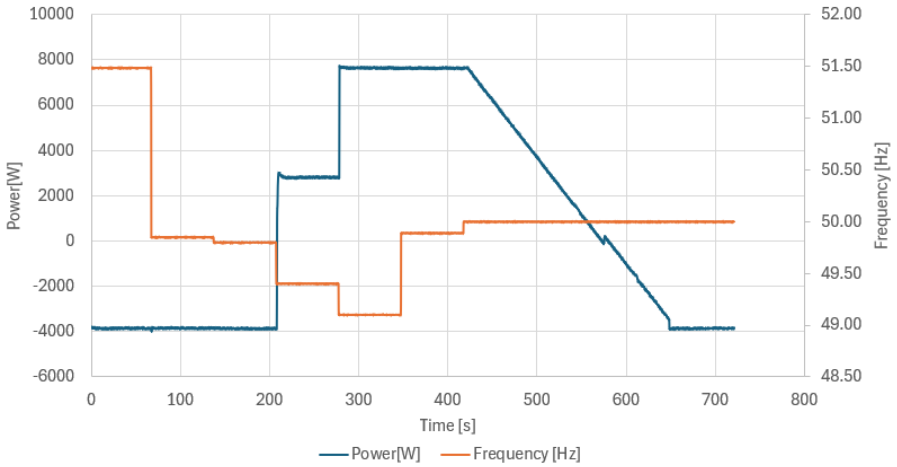
Graph Active power regulation in coincidence with transitory on the transmission grid
Sequence A



Graph Active power regulation in coincidence with transitory on the transmission grid
Sequence B



Graph Active power regulation in coincidence with transitory on the transmission grid
Sequence C

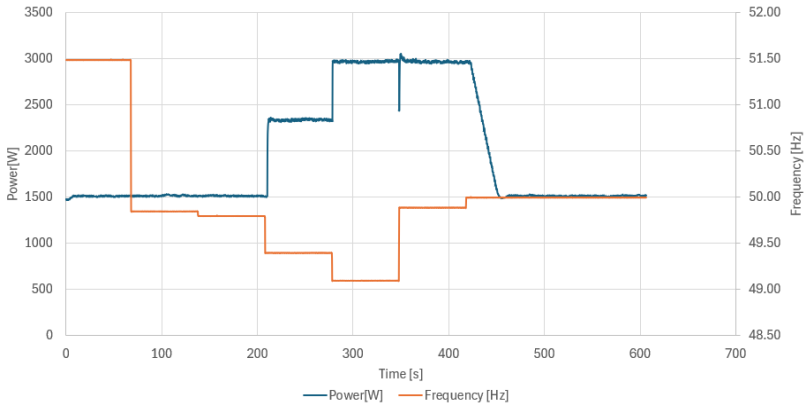


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

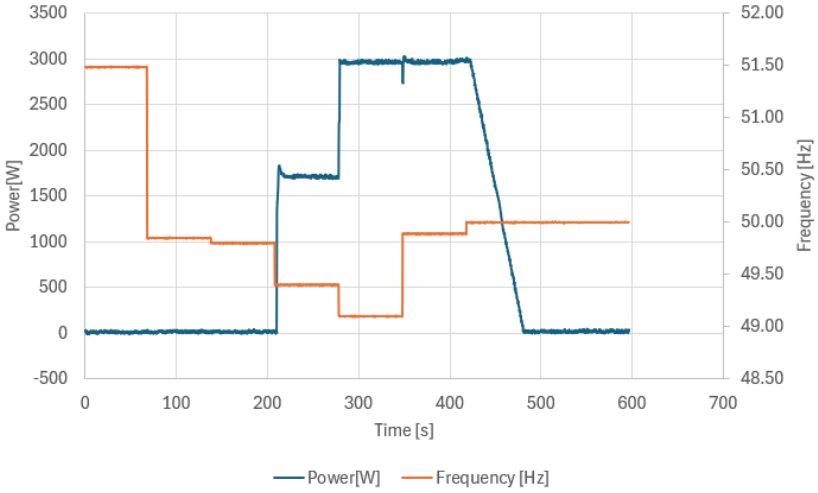
Model	AF3K-MTH + ATOM HVS-7.68					
Sequence A						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	50	51.49	1500	1507	± 2.5% Sn	t_1
2	50	49.85	1500	1512	± 2.5% Sn	t_2
3	50	49.80	1500	1513	± 2.5% Sn	t_3
4	50	49.40	2357	2317	± 2.5% Sn	t_4
5	50	49.10	3000	2975	± 2.5% Sn	t_5
6	50	49.89	3000	2963	± 2.5% Sn	t_6
7	50	50.00	1500	1510	± 2.5% Sn	t_7
Sequence B						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	0	51.49	0	5	± 2.5% Sn	t'_1
2	0	49.85	0	6	± 2.5% Sn	t'_2
3	0	49.80	0	8	± 2.5% Sn	t'_3
4	0	49.40	1714	1712	± 2.5% Sn	t'_4
5	0	49.10	3000	2980	± 2.5% Sn	t'_5
6	0	49.89	3000	2975	± 2.5% Sn	t'_6
7	0	50.00	0	7	± 2.5% Sn	t'_7
Sequence C						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	100% P_{CMAX}	51.49	-3000	-3018	± 2.5% Sn	t''_1
2	100% P_{CMAX}	49.85	-3000	-3022	± 2.5% Sn	t''_2
3	100% P_{CMAX}	49.80	-3000	-3030	± 2.5% Sn	t''_3
4	100% P_{CMAX}	49.40	429	362	± 2.5% Sn	t''_4
5	100% P_{CMAX}	49.10	3000	2970	± 2.5% Sn	t''_5
6	100% P_{CMAX}	49.89	3000	2976	± 2.5% Sn	t''_6
7	100% P_{CMAX}	50.00	-3000	-3033	± 2.5% Sn	t''_7

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

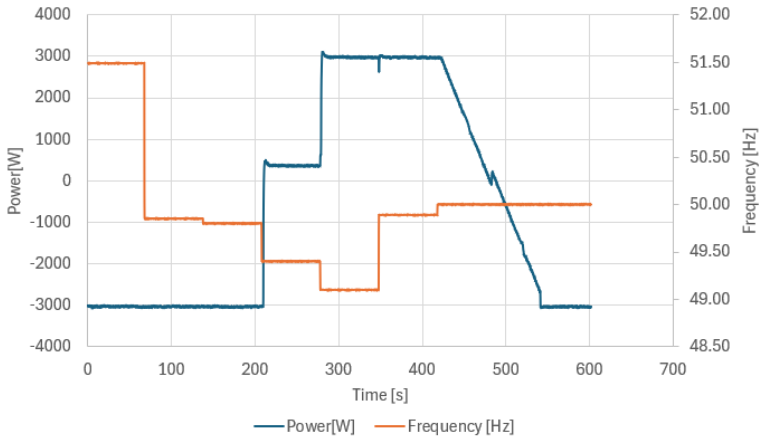
Graph Active power regulation in coincidence with transitory on the transmission grid
Sequence A



Graph Active power regulation in coincidence with transitory on the transmission grid
Sequence B



Graph Active power regulation in coincidence with transitory on the transmission grid
Sequence C



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

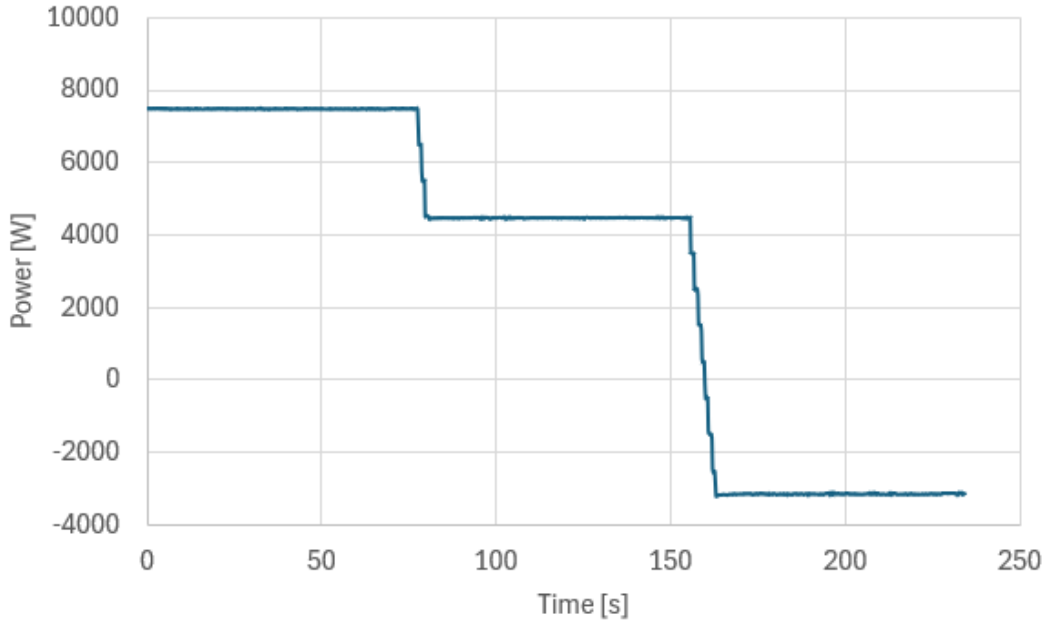
Bbis.7.4	**TABLE: Active power limitation in coincidence with external command coming from the Electricity Distributor**				**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)				
Set Point	P [W]	Actual power [W]	ΔP/Pn%	Limit [%]	Result
50% P_{SMAX}	7500	7503	0.02	--	--
30% P_{SMAX}	4500	4490	-0.07	± 2.5 % P_{SMAX}	P
30% P_{CMAX}	-3070	-3102	-0.21	± 2.5 % P_{SMAX}	P

The test must be performed according to the following steps:

–Bring the storage system to 50% of the active power available for injection.
–Send to the generator an active power set-point equal to 30% of the P_{SMAX}.
–Maintain the set-point for a time of 60 s, compatibly with the energy capacity of the storage system.
–Measure the active power delivered by the inverter, at least 30 seconds after the command of the new active power regulation set-point is sent (this is to ensure that the system has reached the steady state).

The test is considered to have been successfully passed if the maximum deviation between the assigned level and the current measured value (average value with a window of 1 min.) For the active power is less than ± 2.5%P_{SMAX}.
In the case of storage systems connected to bidirectional converters, repeat the test at 30% of the P_{CMAX}.

Diagram:



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

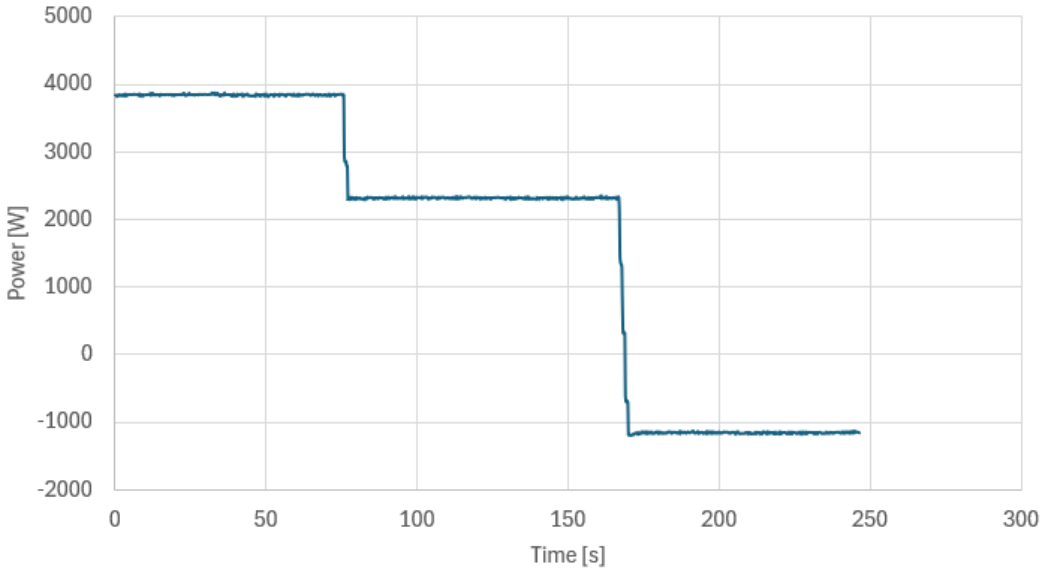
Bbis.7.4	**TABLE: Active power limitation in coincidence with external command coming from the Electricity Distributor**				**P**
Model	AF15K-MTH + ATOM HVS-7.68				
Set Point	P [W]	Actual power [W]	ΔP/Pn%	Limit [%]	Result
50% P_{SMAX}	3840	3851	0.14	--	--
30% P_{SMAX}	2304	2305	0.01	± 2.5 % P_{SMAX}	P
30% P_{CMAX}	-1152	-1160	-0.10	± 2.5 % P_{SMAX}	P

The test must be performed according to the following steps:

–Bring the storage system to 50% of the active power available for injection.
–Send to the generator an active power set-point equal to 30% of the P_{SMAX}.
–Maintain the set-point for a time of 60 s, compatibly with the energy capacity of the storage system.
–Measure the active power delivered by the inverter, at least 30 seconds after the command of the new active power regulation set-point is sent (this is to ensure that the system has reached the steady state).

The test is considered to have been successfully passed if the maximum deviation between the assigned level and the current measured value (average value with a window of 1 min.) For the active power is less than ± 2.5%P_{SMAX}.
In the case of storage systems connected to bidirectional converters, repeat the test at 30% of the P_{CMAX}.

Diagram:



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

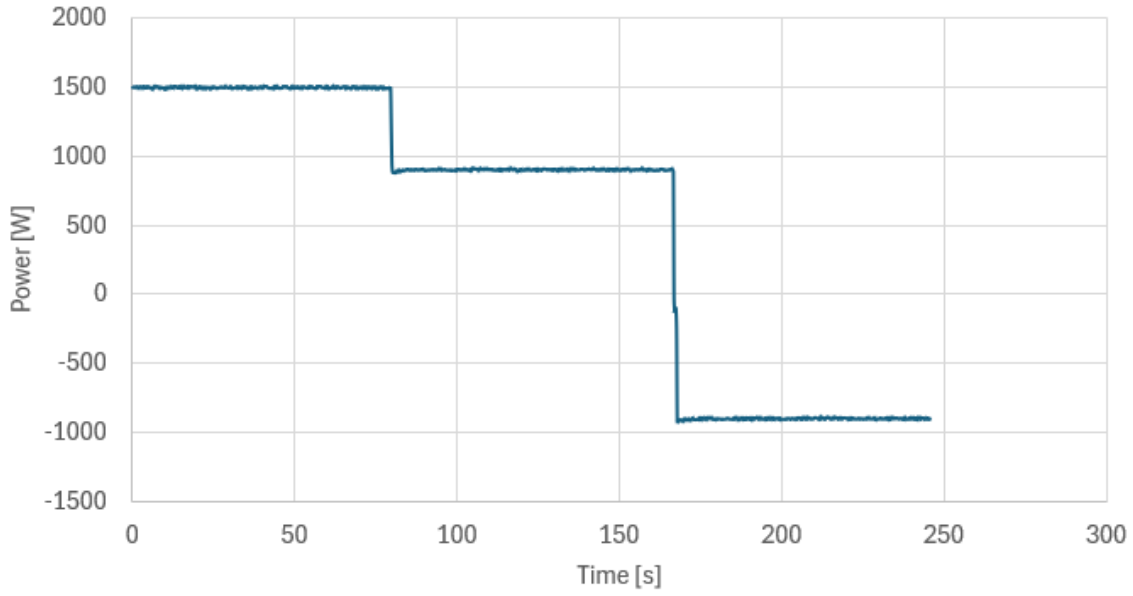
Bbis.7.4	**TABLE: Active power limitation in coincidence with external command coming from the Electricity Distributor**				**P**
Model	AF3K-MTH + ATOM HVS-7.68				
Set Point	P [W]	Actual power [W]	ΔP/Pn%	Limit [%]	Result
50% P_{SMAX}	1500	1506	0.20	--	--
30% P_{SMAX}	900	905	0.17	± 2.5 % P_{SMAX}	P
30% P_{CMAX}	-900	-903	-0.10	± 2.5 % P_{SMAX}	P

The test must be performed according to the following steps:

–Bring the storage system to 50% of the active power available for injection.
–Send to the generator an active power set-point equal to 30% of the P_{SMAX}.
–Maintain the set-point for a time of 60 s, compatibly with the energy capacity of the storage system.
–Measure the active power delivered by the inverter, at least 30 seconds after the command of the new active power regulation set-point is sent (this is to ensure that the system has reached the steady state).

The test is considered to have been successfully passed if the maximum deviation between the assigned level and the current measured value (average value with a window of 1 min.) For the active power is less than ± 2.5%P_{SMAX}.
In the case of storage systems connected to bidirectional converters, repeat the test at 30% of the P_{CMAX}.

Diagram:



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.7.4.1	**TABLE: Verification of the settling time at a power increase / decrease command**					P
Model	AF15K-MTH + ATOM HVS-20.48 (4P)					
Set Point	P [W]	Actual power [W]	Setting time (s)	ΔP/Pn%	Deviation Limit	Setting time
Bidirectional converters						
100% P_{SMAX} to 30% P_{CMAX}	-3072	-3120	20	-0.32	± 2.5 % Pn	≤ 50 s
100% P_{CMAX} to 50% P_{SMAX}	7500	7520	25	0.13	± 2.5 % Pn	≤ 50 s
Unidirectional converters						
100% P_{SMAX} to 30% P_{SMAX}	--	--	--	--	± 2.5 % Pn	≤ 50 s
0% P_{SMAX} to 50% P_{SMAX}	--	--	--	--	± 2.5 % Pn	≤ 50 s

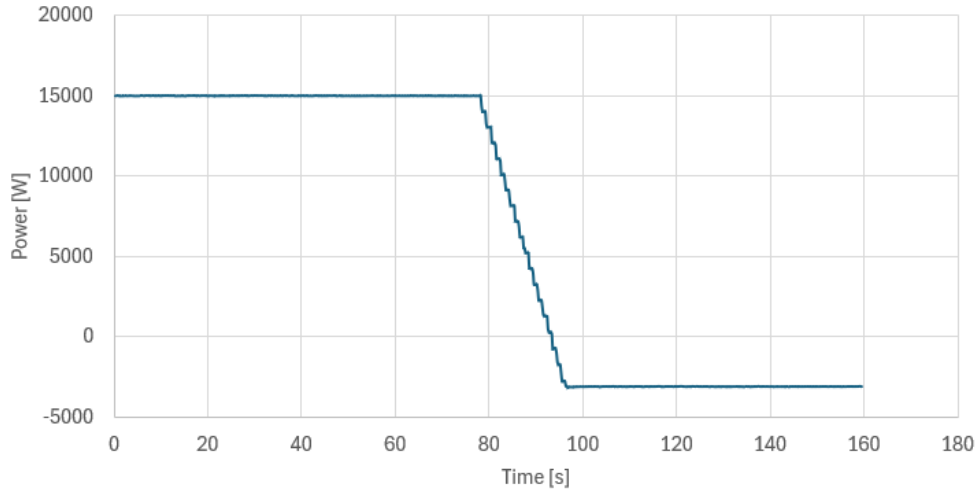
To check the settling time at a command to reduce the active power delivered, or increase the active power absorbed, the test is carried out:
–for storage systems connected to bidirectional converters, by adjusting the regulation parameter from 100%P_{SMAX} to 30% P_{CMAX} at time t_0;
–for storage systems connected to unidirectional converters, by adjusting the regulation parameter from 100% P_{SMAX} to 30% P_{SMAX} at time t_0.

To check the settling time at a command to increase the active power, or reduce the absorbed active power, the test is carried out:
–for storage systems connected to bidirectional converters, by adjusting the regulation parameter from 100%P_{CMAX} to 50% P_{SMAX} at time t_0;
–for storage systems connected to unidirectional converters, by adjusting the regulation parameter from 0%P_{SMAX} to 50%P_{SMAX} at time t_0.

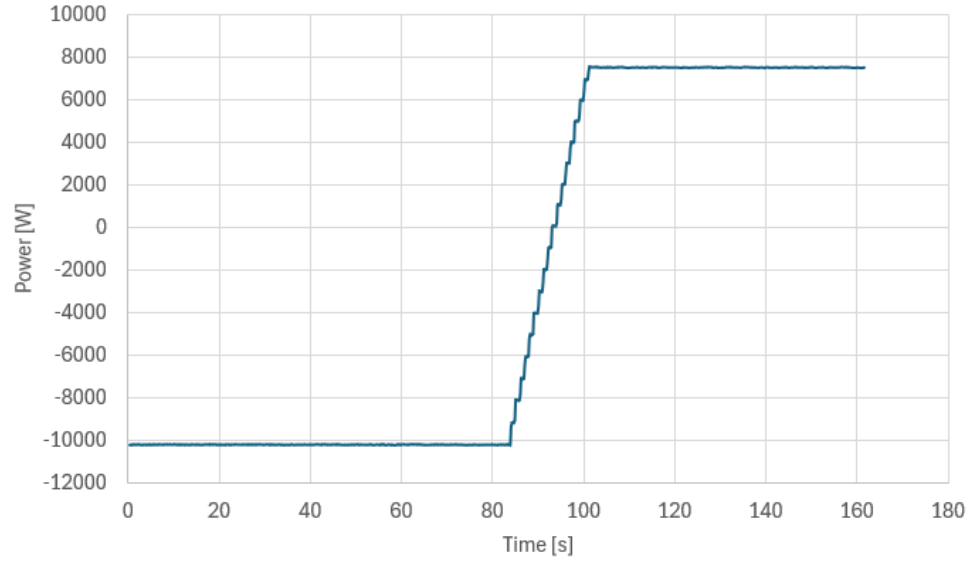
The settling time is the time interval from the instant t_0 of application of the step of increasing / limiting the active power (e.g. 100%P_{SMAX} ->30%P_{SMAX}) to the instant in which the power is stably within a tolerance band of ± 2.5%S_n with respect to the new set value.
The maximum measured settling time must be less than 50 s, and in any case not more than 60 s if the limitation command provides for the passage from 100%Sn to 15%S_n.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Graph: 100% P_{SMAX} to 30% P_{CMAX}:



Graph: 100% P_{CMAX} to 50% P_{SMAX}:



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.7.4.1	**TABLE: Verification of the settling time at a power increase / decrease command**					P
Model	AF15K-MTH + ATOM HVS-7.68					
Set Point	P [W]	Actual power [W]	Setting time (s)	ΔP/Pn (%)	Deviation Limit	Setting time
Bidirectional converters						
100% P_{SMAX} to 30% P_{CMAX}	-1152	-1150	23	0.03	± 2.5 % Pn	≤ 50 s
100% P_{CMAX} to 50% P_{SMAX}	3840	3832	25	-0.10	± 2.5 % Pn	≤ 50 s
Unidirectional converters						
100% P_{SMAX} to 30% P_{SMAX}	--	--	--	--	± 2.5 % Pn	≤ 50 s
0% P_{SMAX} to 50% P_{SMAX}	--	--	--	--	± 2.5 % Pn	≤ 50 s

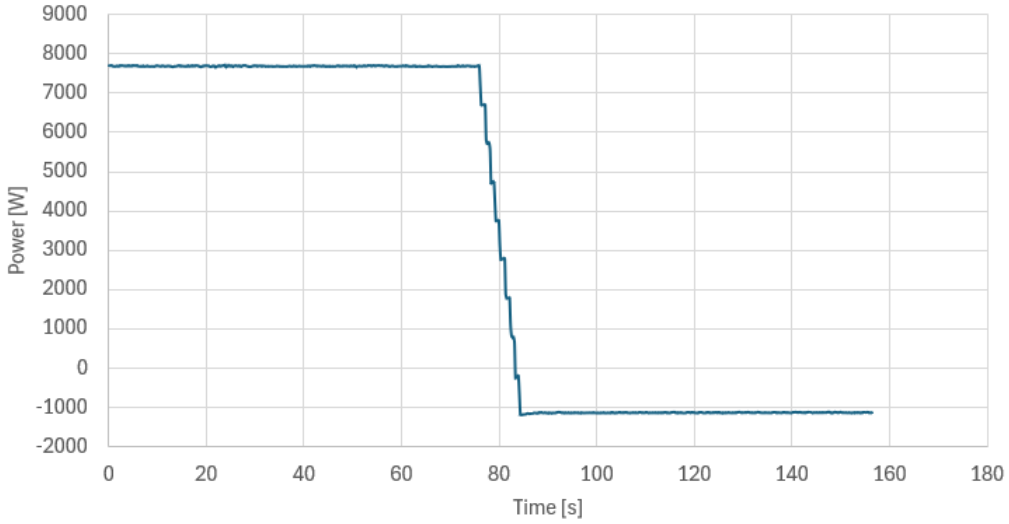
To check the settling time at a command to reduce the active power delivered, or increase the active power absorbed, the test is carried out:
–for storage systems connected to bidirectional converters, by adjusting the regulation parameter from 100%P_{SMAX} to 30% P_{CMAX} at time t_0;
–for storage systems connected to unidirectional converters, by adjusting the regulation parameter from 100% P_{SMAX} to 30% P_{SMAX} at time t_0.

To check the settling time at a command to increase the active power, or reduce the absorbed active power, the test is carried out:
–for storage systems connected to bidirectional converters, by adjusting the regulation parameter from 100%P_{CMAX} to 50% P_{SMAX} at time t_0;
–for storage systems connected to unidirectional converters, by adjusting the regulation parameter from 0%P_{SMAX} to 50%P_{SMAX} at time t_0.

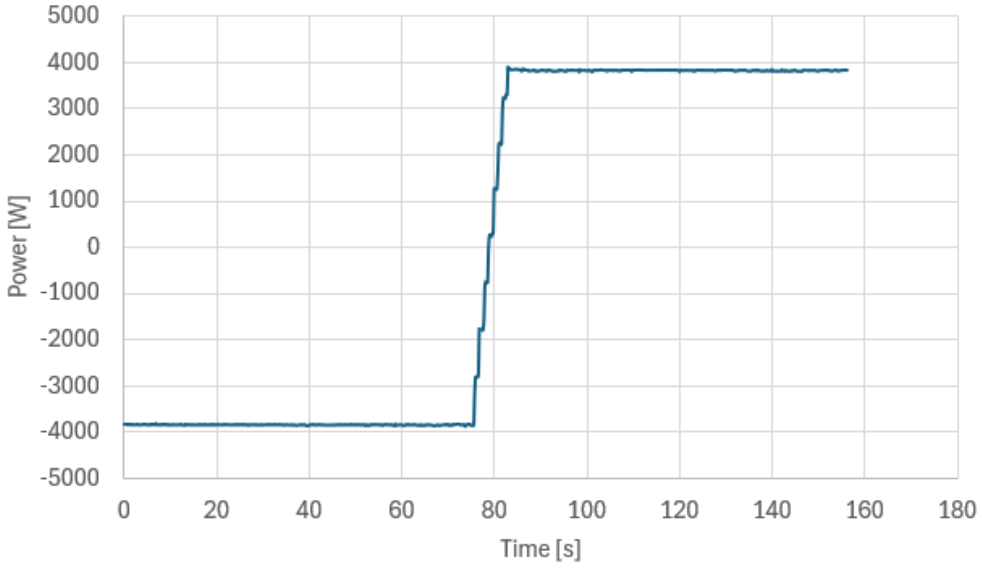
The settling time is the time interval from the instant t_0 of application of the step of increasing / limiting the active power (e.g. 100%P_{SMAX} ->30%P_{SMAX}) to the instant in which the power is stably within a tolerance band of ± 2.5%S_n with respect to the new set value.
The maximum measured settling time must be less than 50 s, and in any case not more than 60 s if the limitation command provides for the passage from 100%Sn to 15%S_n.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Graph: 100% P_{SMAX} to 30% P_{CMAX}:



Graph: 100% P_{CMAX} to 50% P_{SMAX}:



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.7.4.1	**TABLE: Verification of the settling time at a power increase / decrease command**					P
Model	AF3K-MTH + 3batery					
Set Point	P [W]	Actual power [W]	Setting time (s)	ΔP/Pn (%)	Deviation Limit	Setting time
Bidirectional converters						
100% P_{SMAX} to 30% P_{CMAX}	-900	-901	4.3	-0.03	± 2.5 % Pn	≤ 50 s
100% P_{CMAX} to 50% P_{SMAX}	1500	1519	3.8	0.50	± 2.5 % Pn	≤ 50 s
Unidirectional converters						
100% P_{SMAX} to 30% P_{SMAX}	--	--	--	--	± 2.5 % Pn	≤ 50 s
0% P_{SMAX} to 50% P_{SMAX}	--	--	--	--	± 2.5 % Pn	≤ 50 s

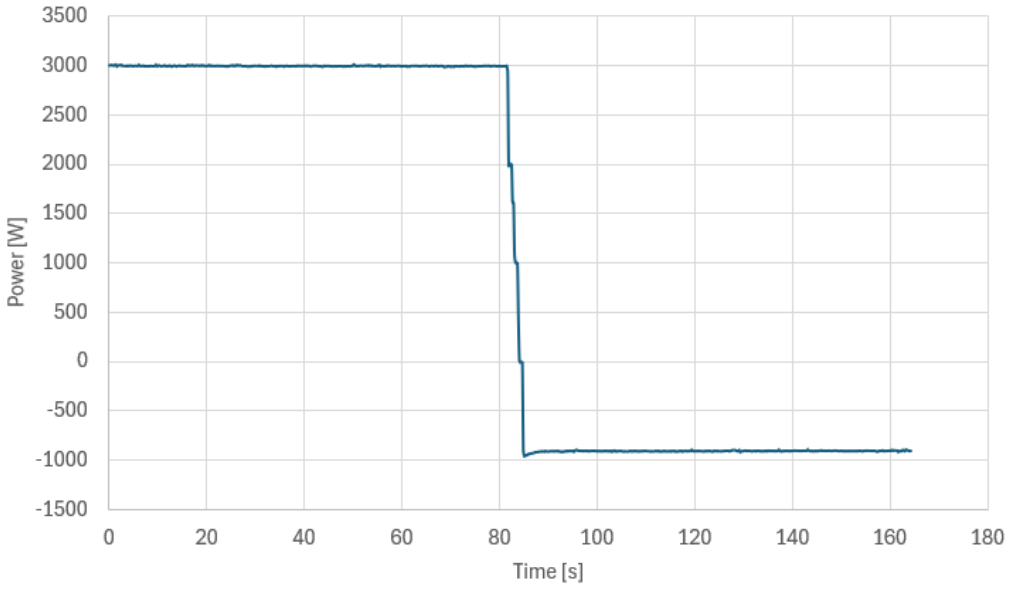
To check the settling time at a command to reduce the active power delivered, or increase the active power absorbed, the test is carried out:
–for storage systems connected to bidirectional converters, by adjusting the regulation parameter from 100%P_{SMAX} to 30% P_{CMAX} at time t_0;
–for storage systems connected to unidirectional converters, by adjusting the regulation parameter from 100% P_{SMAX} to 30% P_{SMAX} at time t_0.

To check the settling time at a command to increase the active power, or reduce the absorbed active power, the test is carried out:
–for storage systems connected to bidirectional converters, by adjusting the regulation parameter from 100%P_{CMAX} to 50% P_{SMAX} at time t_0;
–for storage systems connected to unidirectional converters, by adjusting the regulation parameter from 0%P_{SMAX} to 50%P_{SMAX} at time t_0.

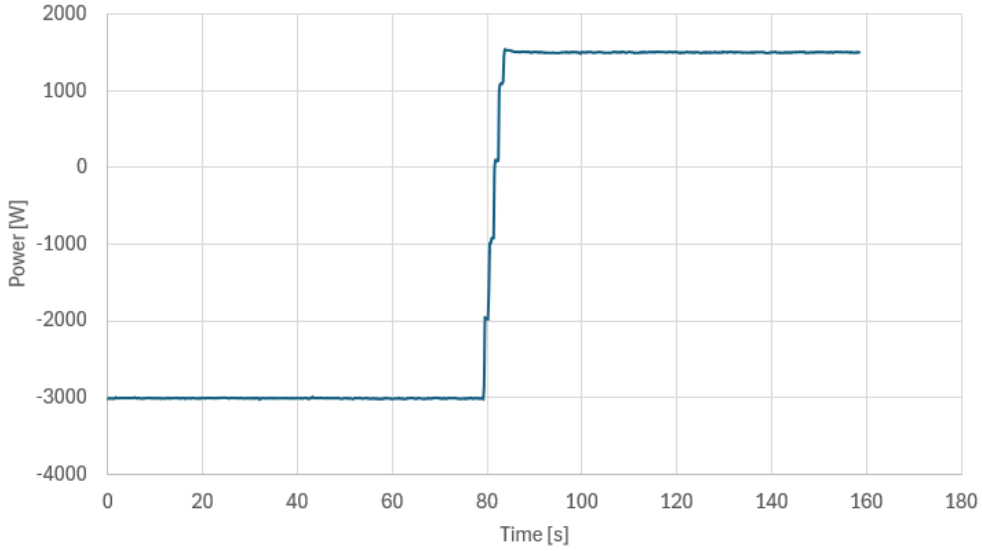
The settling time is the time interval from the instant t_0 of application of the step of increasing / limiting the active power (e.g. 100%P_{SMAX} ->30%P_{SMAX}) to the instant in which the power is stably within a tolerance band of ± 2.5%S_n with respect to the new set value.
The maximum measured settling time must be less than 50 s, and in any case not more than 60 s if the limitation command provides for the passage from 100%Sn to 15%S_n.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Graph: 100% P_{SMAX} to 30% P_{CMAX}:

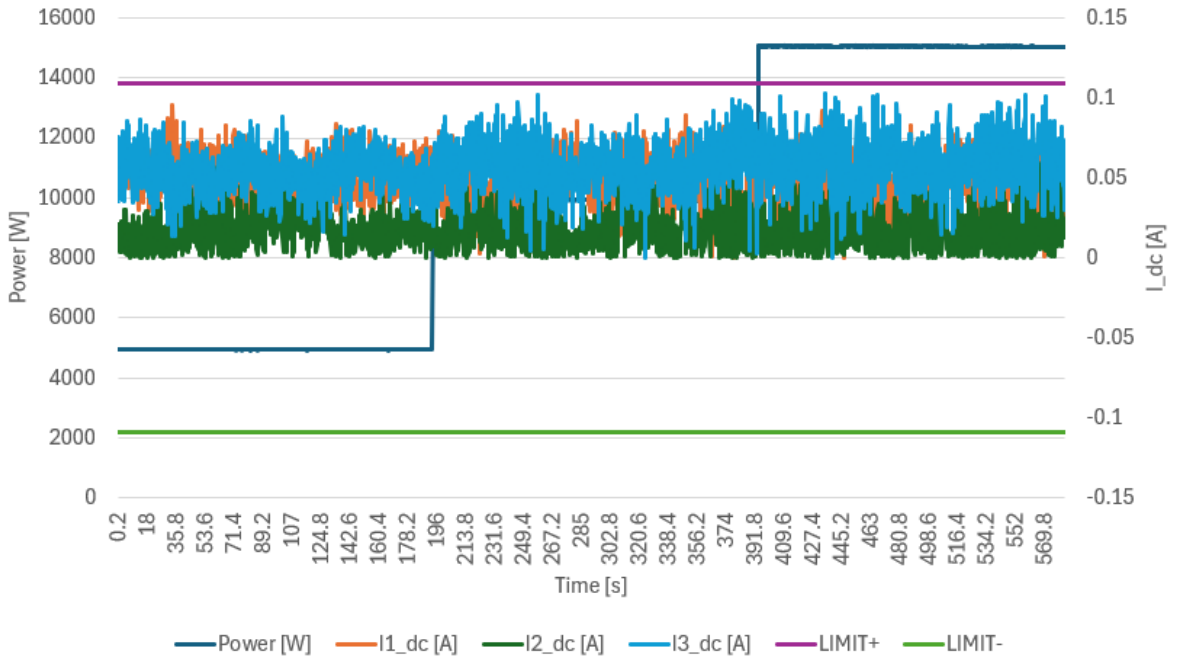


Graph: 100% P_{CMAX} to 50% P_{SMAX}:



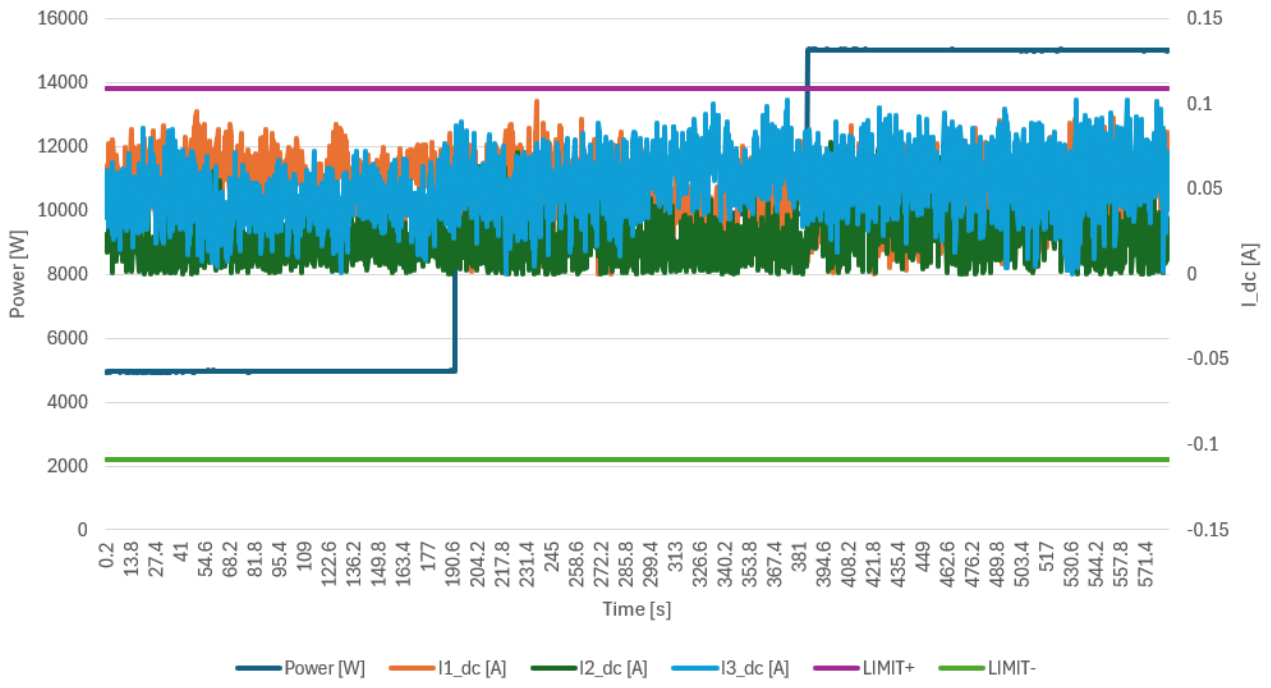
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.8.1	**TABLE: Verification of continuous component emission**		P
Model	AF15K-MTH + ATOM HVS-20.48 (4P)		
Completed test			
Power Level [%P_{SMAX}]	**(33 ± 5)%**	**(66 ± 5)%**	**(100 ± 5)%**
Ambient			
Total output Power (W)	4950	9900	15000
Output Vrms	230	230	230
Output Arms	7.2	14.4	21.7
Cos φ	0.993	0.998	0.999
L1 DC Component (A)	0.050	0.044	0.044
L2 DC Component (A)	0.018	0.017	0.019
L3 DC Component (A)	0.052	0.057	0.059
L1 DC Component (% I_r)	0.230	0.202	0.202
L2 DC Component (% I_r)	0.083	0.078	0.087
L3 DC Component (% I_r)	0.239	0.262	0.271



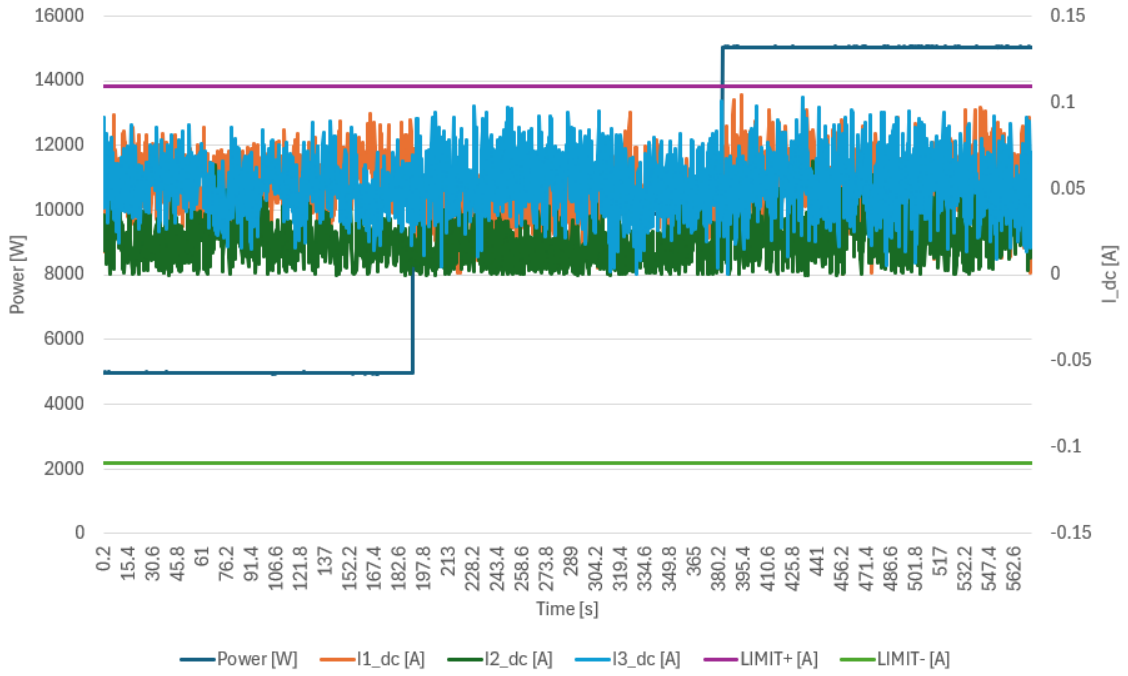
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Minimum ambient rating -25°C			
Total output Power (W)	4950	9900	15000
Output Vrms	230	230	230
Output Arms	7.2	14.4	21.7
Cos φ	0.993	0.998	0.999
L1 DC Component (A)	0.057	0.045	0.047
L2 DC Component (A)	0.018	0.019	0.028
L3 DC Component (A)	0.041	0.056	0.056
L1 DC Component (% I_r)	0.262	0.207	0.216
L2 DC Component (% I_r)	0.082	0.087	0.129
L3 DC Component (% I_r)	0.188	0.258	0.258



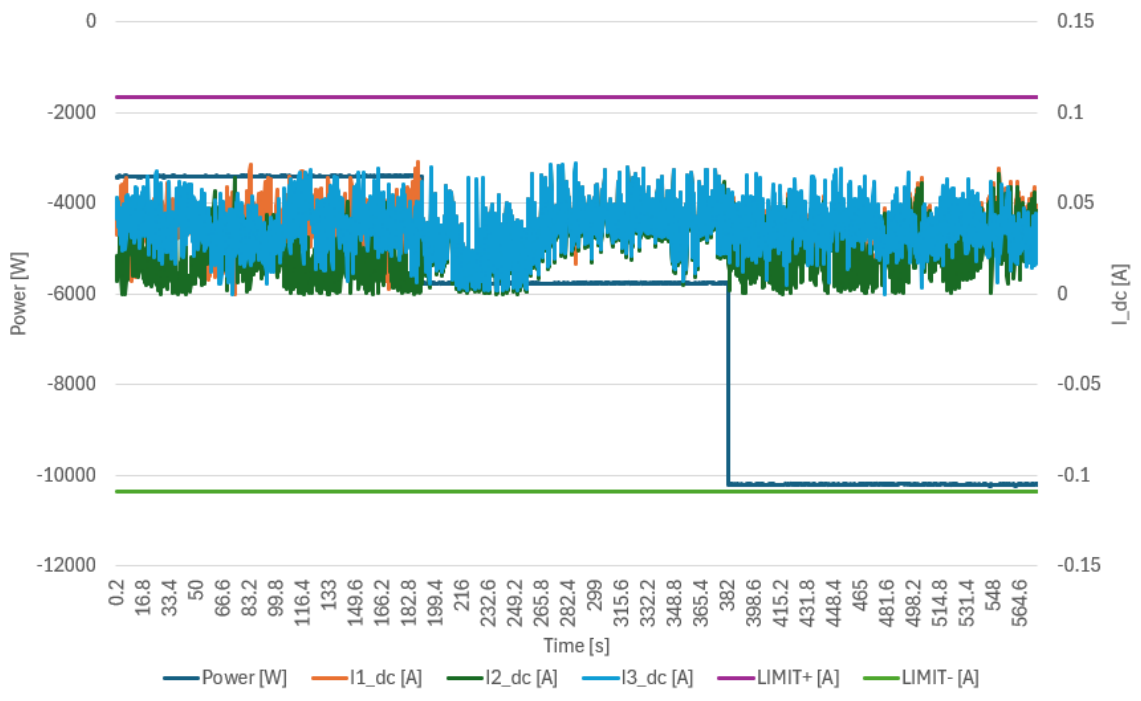
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Maximum ambient rating 60°C			
Total output Power (W)	4950	9900	15000
Output Vrms	230	230	230
Output Arms	7.2	14.4	21.7
Cos φ	0.993	0.998	0.999
L1 DC Component (A)	0.055	0.040	0.054
L2 DC Component (A)	0.020	0.015	0.027
L3 DC Component (A)	0.051	0.054	0.053
L1 DC Component (% I_r)	0.253	0.184	0.24
L2 DC Component (% I_r)	0.092	0.248	0.09
L3 DC Component (% I_r)	0.235	0.248	0.24



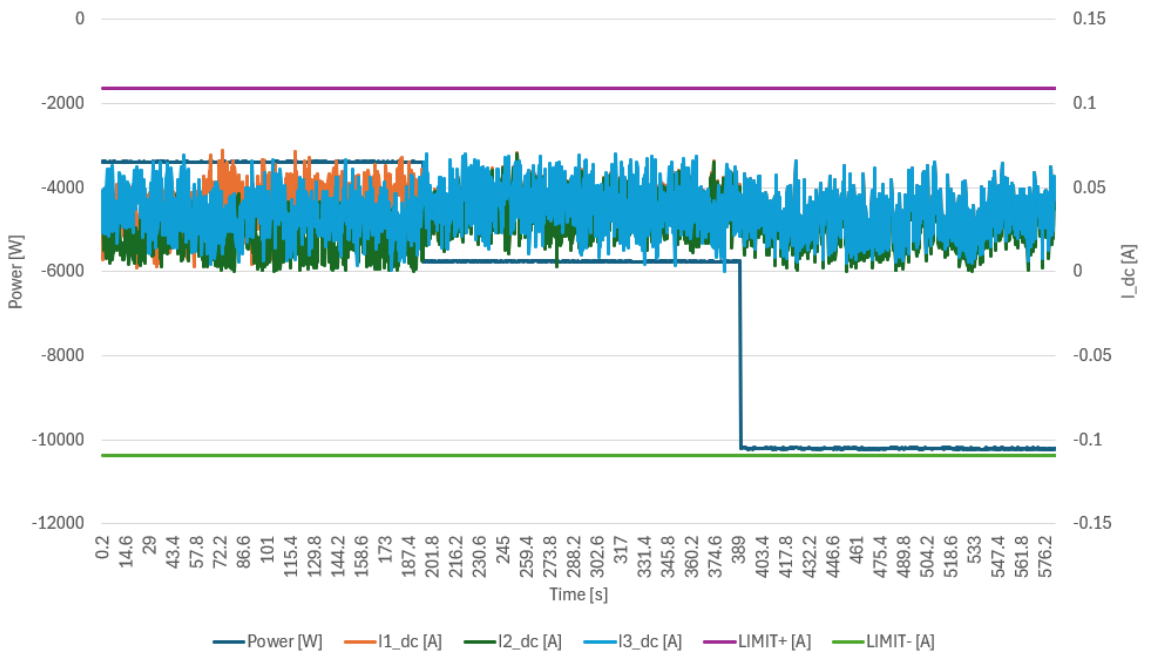
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Power Level [%P_{CMAX}]	**(33 ± 5)%**	**(66 ± 5)%**	**(100 ± 5)%**
Ambient			
Total output Power (W)	-3380	-6758	-10240
Output Vrms	230	230	230
Output Arms	5.0	8.4	14.8
Cos φ	-0.993	-0.993	-0.997
L1 DC Component (A)	0.037	0.035	0.028
L2 DC Component (A)	0.019	0.034	0.025
L3 DC Component (A)	0.038	0.036	0.036
L1 DC Component (% I_r)	0.250	0.236	0.189
L2 DC Component (% I_r)	0.128	0.229	0.168
L3 DC Component (% I_r)	0.256	0.243	0.243



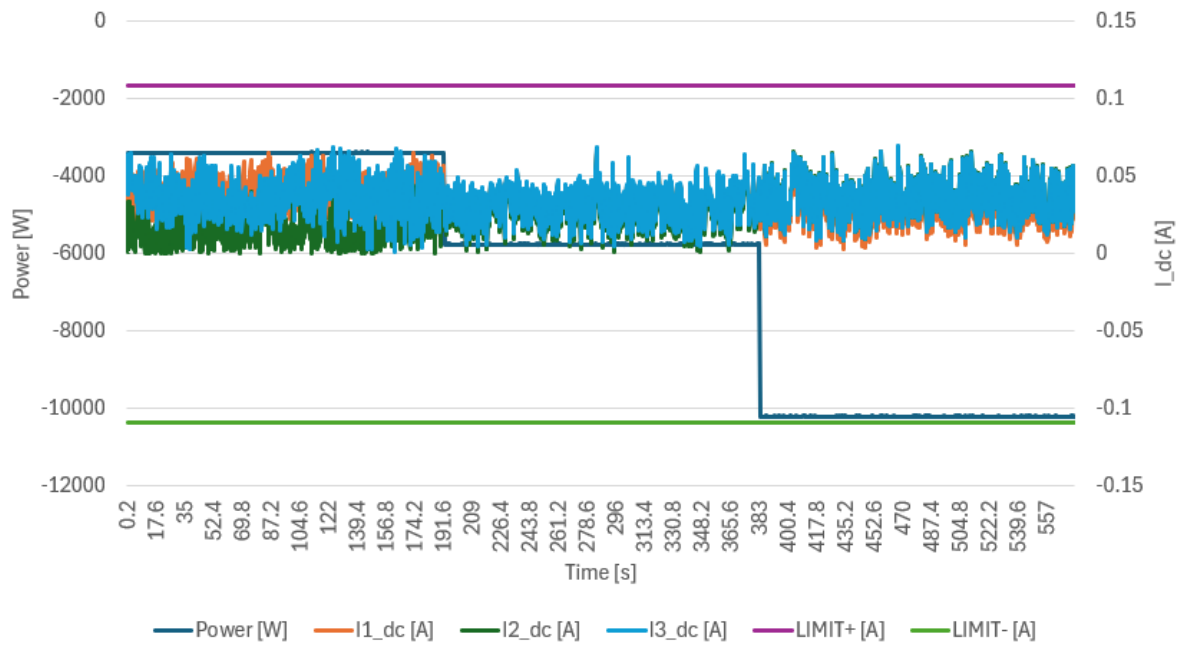
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Minimum ambient rating -25°C			
Total output Power (W)	-3380	-6758	-10240
Output Vrms	230	230	230
Output Arms	5.0	8.4	14.8
Cos φ	-0.993	-0.993	-0.997
L1 DC Component (A)	0.037	0.036	0.032
L2 DC Component (A)	0.020	0.035	0.027
L3 DC Component (A)	0.034	0.040	0.033
L1 DC Component (% I_r)	0.251	0.243	0.216
L2 DC Component (% I_r)	0.135	0.236	0.182
L3 DC Component (% I_r)	0.229	0.270	0.222



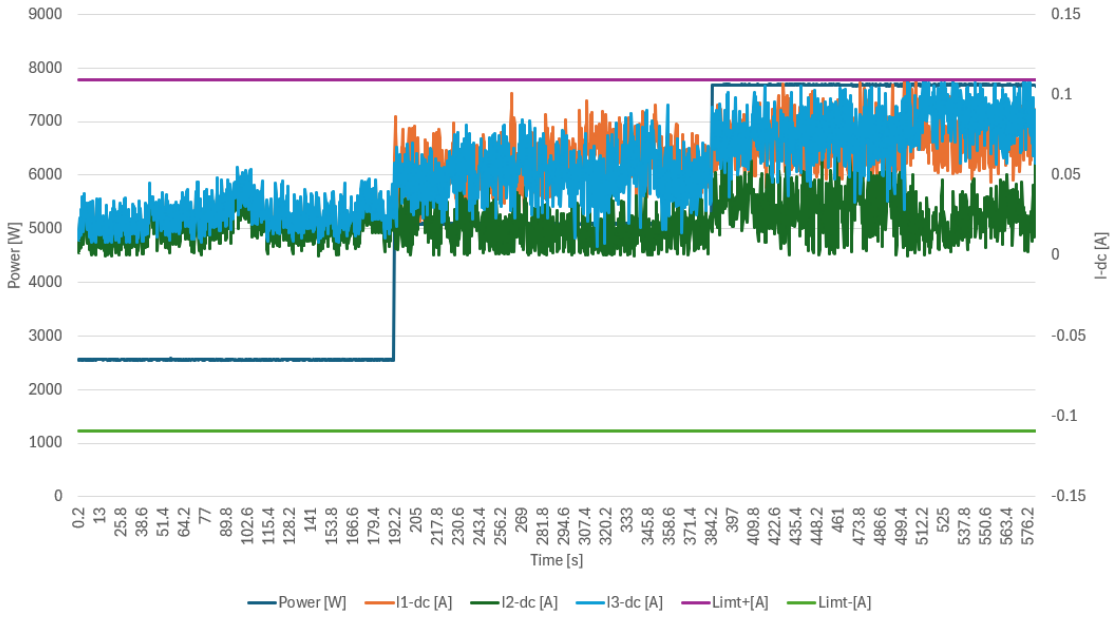
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Maximum ambient rating 60°C			
Total output Power (W)	-3380	-6758	-10240
Output Vrms	230	230	230
Output Arms	5.0	8.4	14.8
Cos φ	-0.993	-0.993	-0.997
L1 DC Component (A)	0.037	0.030	0.031
L2 DC Component (A)	0.016	0.028	0.036
L3 DC Component (A)	0.036	0.032	0.036
L1 DC Component (% I_r)	0.251	0.202	0.209
L2 DC Component (% I_r)	0.108	0.189	0.243
L3 DC Component (% I_r)	0.243	0.216	0.243



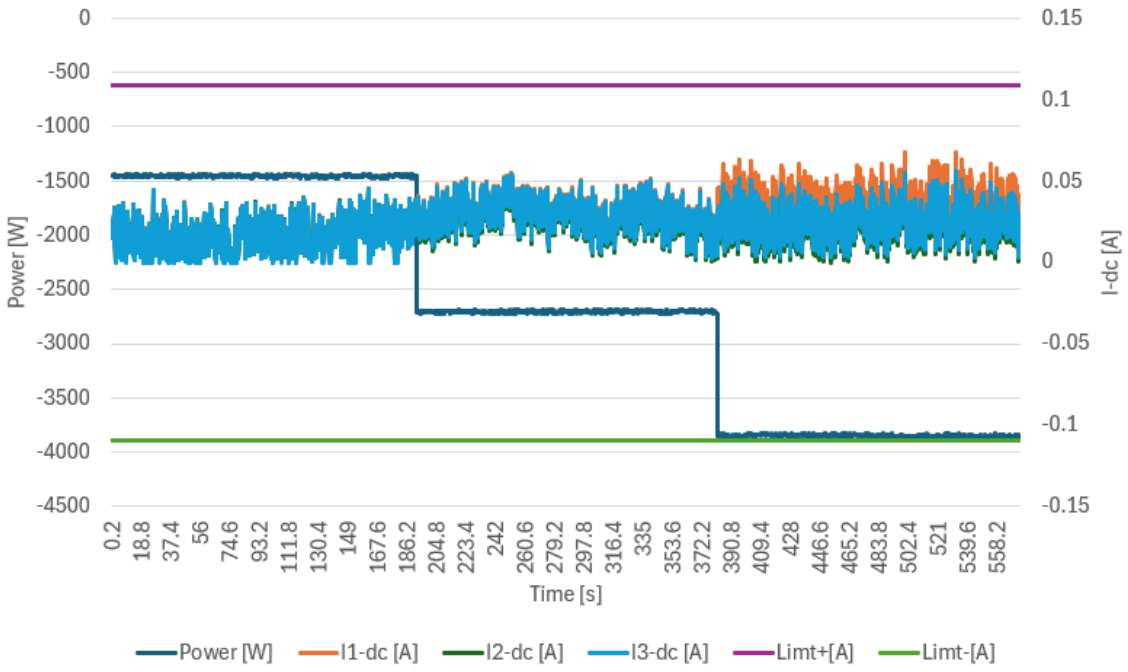
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.8.1	**TABLE: Verification of continuous component emission**		P
Model	AF15K-MTH + ATOM HVS-7.68		
Completed test-			
Power Level [%P_{SMAX}]	**(33 ± 5)%**	**(66 ± 5)%**	**(100 ± 5)%**
Maximum ambient rating 60°C			
Total output Power (W)	2556	5091	7683
Output Vrms	230	230	230
Output Arms	3.78	7.42	11.15
Cos φ	0.994	0.994	0.997
L1 DC Component (A)	0.022	0.055	0.054
L2 DC Component (A)	0.017	0.017	0.027
L3 DC Component (A)	0.025	0.050	0.053
L1 DC Component (% I_r)	0.18	0.49	0.48
L2 DC Component (% I_r)	0.15	0.15	0.24
L3 DC Component (% I_r)	0.22	0.44	0.47



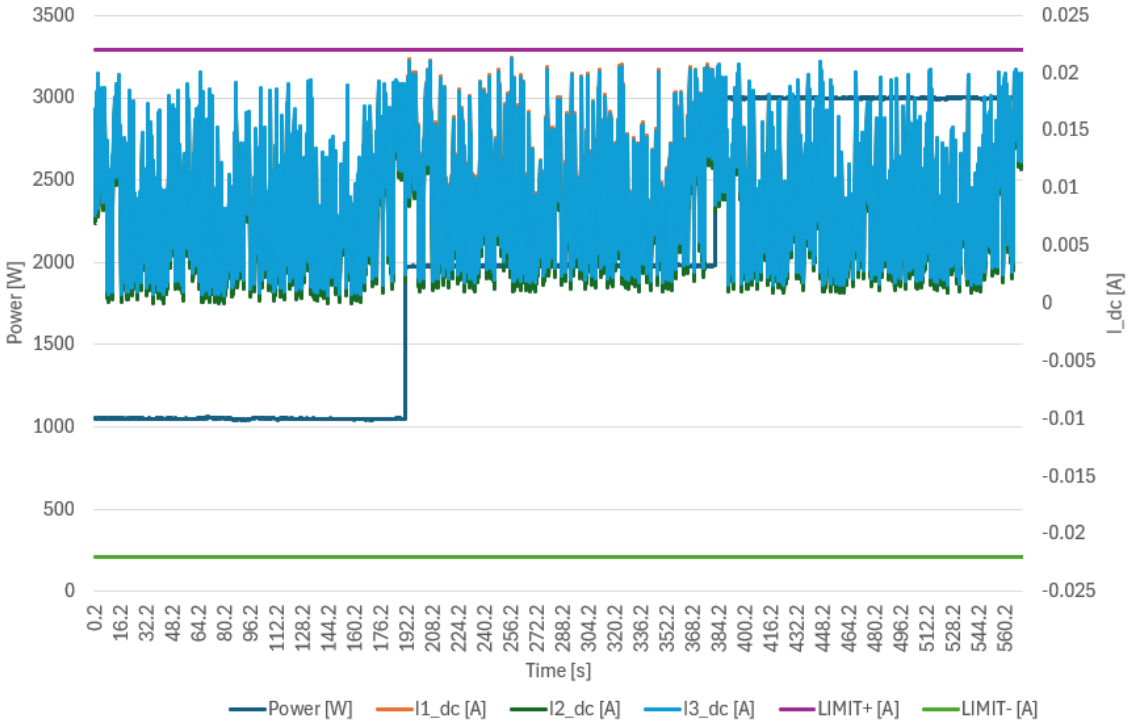
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Power Level [%P_{CMAX}]	**(33 ± 5)%**	**(66 ± 5)%**	**(100 ± 5)%**
Maximum ambient rating 60°C			
Total output Power (W)	-1455	-2704	-3844
Output Vrms	230	230	230
Output Arms	2.24	4.00	5.60
Cos φ	-0.991	-0.993	-0.993
L1 DC Component (A)	0.017	0.026	0.027
L2 DC Component (A)	0.016	0.025	0.022
L3 DC Component (A)	0.017	0.027	0.025
L1 DC Component (% I_r)	0.30	0.46	0.48
L2 DC Component (% I_r)	0.28	0.44	0.39
L3 DC Component (% I_r)	0.30	0.48	0.44



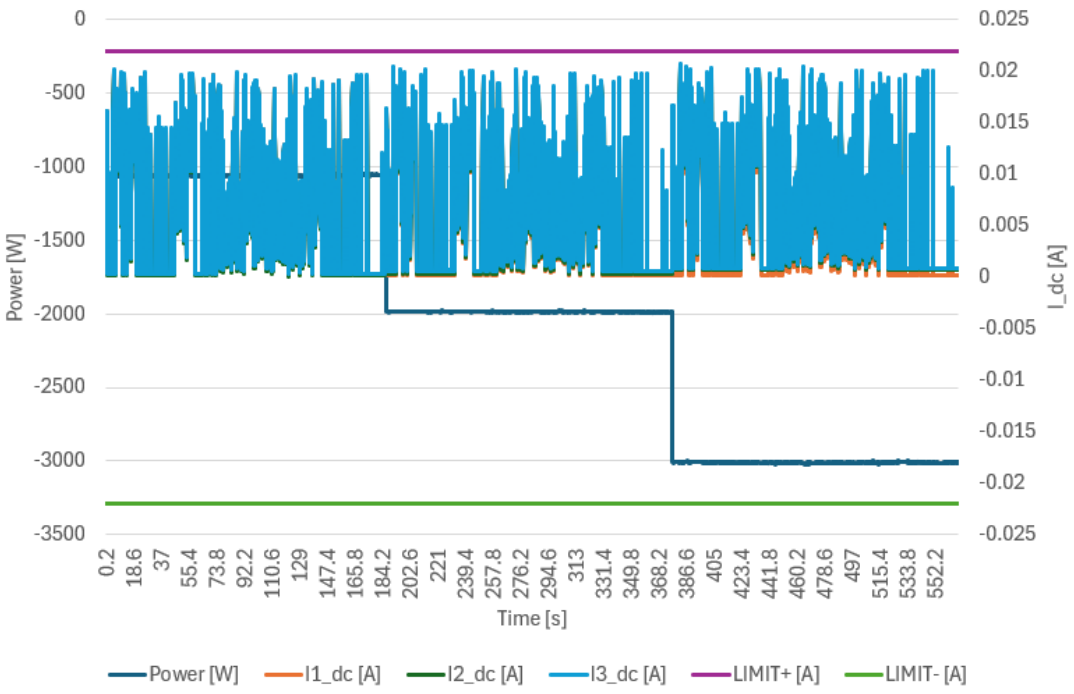
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.8.1	**TABLE: Verification of continuous component emission**		P
Model	AF3K-MTH + ATOM HVS-7.68		
Completed test			
Power Level [%P_{SMAX}]	**(33 ± 5)%**	**(66 ± 5)%**	**(100 ± 5)%**
Maximum ambient rating 60°C			
Total output Power (W)	1050	1978	2999
Output Vrms	230	230	230
Output Arms	1.55	2.88	4.35
Cos φ	0.992	0.993	0.996
L1 DC Component (A)	0.009	0.019	0.021
L2 DC Component (A)	0.008	0.014	0.018
L3 DC Component (A)	0.010	0.020	0.021
L1 DC Component (% I_r)	0.20	0.43	0.48
L2 DC Component (% I_r)	0.18	0.32	0.41
L3 DC Component (% I_r)	0.22	0.45	0.48



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Power Level [%P_{CMAX}]	**(33 ± 5)%**	**(66 ± 5)%**	**(100 ± 5)%**
Maximum ambient rating 60°C			
Total output Power (W)	-1059	-1985	-3009
Output Vrms	230	230	230
Output Arms	1.56	2.90	4.38
Cos φ	0.991	0.991	0.995
L1 DC Component (A)	0.012	0.015	0.016
L2 DC Component (A)	0.010	0.014	0.011
L3 DC Component (A)	0.011	0.019	0.019
L1 DC Component (% I_r)	0.27	0.34	0.36
L2 DC Component (% I_r)	0.22	0.32	0.25
L3 DC Component (% I_r)	0.25	0.43	0.43



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.8.2	**TABLE: Verification of protections against the continuous DC injection**			P
Model	AF15K-MTH + ATOM HVS-20.48 (4P)			
Actual Power **[%P_{SMAX}]**	Limits	Measurement [mA]	Limiting value[mA]	Disconnection time [ms]
Ambient 25°C, I_{dc} = 0.5% of I_{nom}				
33%	+0,5%I_{nom} /1s	111.1	110	707
66%	+0,5%I_{nom} /1s	110.5	110	823
100%	+0,5%I_{nom} /1s	112.3	110	826
Minimum ambient rating -25°C, I_{dc} = 0,5% of I_{nom}				
33%	+0,5%I_{nom} /1s	110.6	110	711
66%	+0,5%I_{nom} /1s	110.4	110	767
100%	+0,5%I_{nom} /1s	110.8	110	817
Maximum ambient rating +60°C, I_{dc} = 0,5% of I_{nom}				
33%	+0,5%I_{nom} /1s	111.4	110	740
66%	+0,5%I_{nom} /1s	112.2	110	798
100%	+0,5%I_{nom} /1s	111.3	110	825
Ambient 25°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1068	1000	77
66%	+1A Idc/200ms	1081	1000	200
100%	+1A Idc/200ms	1005	1000	48
Minimum ambient rating -25°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1039	1000	124
66%	+1A Idc/200ms	1028	1000	75
100%	+1A Idc/200ms	1011	1000	97
Maximum ambient rating +60°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1026	1000	152
66%	+1A Idc/200ms	1009	1000	124
100%	+1A Idc/200ms	1013	1000	178

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Actual Power **[%P_{CMAX}]**	Limits	Measurement [mA]	Limiting value [mA]	Disconnection time [ms]
Ambient 25°C, I_{dc} = 0.5% of I_{nom}				
33%	+0,5%I_{nom} /1s	75.4	75	623
66%	+0,5%I_{nom} /1s	75.3	75	642
100%	+0,5%I_{nom} /1s	75.2	75	838
Minimum ambient rating -25°C, I_{dc} = 0,5% of I_{nom}				
33%	+0,5%I_{nom} /1s	75.8	75	615
66%	+0,5%I_{nom} /1s	75.1	75	650
100%	+0,5%I_{nom} /1s	75.4	75	839
Maximum ambient rating +60°C, I_{dc} = 1A				
33%	+0,5%I_{nom} /1s	75.8	75	621
66%	+0,5%I_{nom} /1s	75.8	75	650
100%	+0,5%I_{nom} /1s	76.7	75	841
Ambient 25°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1017	1000	38
66%	+1A Idc/200ms	1016	1000	36
100%	+1A Idc/200ms	1025	1000	180
Minimum ambient rating -25°C, I_{dc} = 0,5% of I_{nom}				
33%	+1A Idc/200ms	1063	1000	196
66%	+1A Idc/200ms	1013	1000	73
100%	+1A Idc/200ms	1016	1000	179
Maximum ambient rating +60°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1006	1000	107
66%	+1A Idc/200ms	1010	1000	81
100%	+1A Idc/200ms	1018	1000	76

Note:
The internal temperature of the EUT must be stabilized.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.8.2	**TABLE: Verification of protections against the continuous DC injection**			P
Model	AF15K-MTH + ATOM HVS-7.68			
Actual Power **[%P_{SMAX}]**	Limits	Measurement [mA]	Limiting value[mA]	Disconnection time [ms]
Maximum ambient rating +60°C, I_{dc} = 0,5% of I_{nom}				
33%	+0.5%I_{nom} /1s	55.7	55	644
66%	+0.5%I_{nom} /1s	55.1	55	746
100%	+0.5%I_{nom} /1s	55.6	55	761
Maximum ambient rating +60°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1007	1000	196
66%	+1A Idc/200ms	1000	1000	158
100%	+1A Idc/200ms	1004	1000	164
Actual Power **[%P_{CMAX}]**	Limits	Measurement [mA]	Limiting value [mA]	Disconnection time [ms]
Maximum ambient rating +60°C, I_{dc} = 0,5% of I_{nom}				
33%	+0.5%I_{nom} /1s	28.8	28	725
66%	+0.5%I_{nom} /1s	28.6	28	705
100%	+0.5%I_{nom} /1s	28.0	28	800
Maximum ambient rating +60°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1005	1000	162
66%	+1A Idc/200ms	1005	1000	170
100%	+1A Idc/200ms	1005	1000	146
Note: The internal temperature of the EUT must be stabilized.				

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.8.2	**TABLE: Verification of protections against the continuous DC injection**			P
Model	AF3K-MTH + ATOM HVS-7.68			
Actual Power **[%P_{SMAX}]**	Limits	Measurement [mA]	Limiting value[mA]	Disconnection time [ms]
Maximum ambient rating +60°C, I_{dc} = 0,5% of I_{nom}				
33%	+0.5%I_{nom} /1s	22.9	22	696
66%	+0.5%I_{nom} /1s	22.8	22	680
100%	+0.5%I_{nom} /1s	22.9	22	710
Maximum ambient rating +60°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1005	1000	196
66%	+1A Idc/200ms	1005	1000	165
100%	+1A Idc/200ms	1000	1000	197
Actual Power **[%P_{CMAX}]**	Limits	Measurement [mA]	Limiting value [mA]	Disconnection time [ms]
Maximum ambient rating +60°C, I_{dc} = 0,5% of I_{nom}				
33%	+0.5%I_{nom} /1s	22.6	22	728
66%	+0.5%I_{nom} /1s	22.9	22	805
100%	+0.5%I_{nom} /1s	22.9	22	754
Maximum ambient rating +60°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1001	1000	164
66%	+1A Idc/200ms	1002	1000	195
100%	+1A Idc/200ms	1001	1000	193
Note: The internal temperature of the EUT must be stabilized.				

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.9	**TABLE: Verification of insensitivity to voltage dips (UVRT and OVRT(8.5. 1-figure 30) capability)**	**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)	

These tests have the purpose of verifying that the storage system, when used in plants with a total power greater than 11.08 kW, is insensitive to voltage drops according to the voltage-time profile indicated in Figure 71, based on what is reported in 8.5.1.

- in the hatched area of Figure 71 the storage system must not disconnect from the grid. In this area it is allowed to temporarily interrupt the supply / absorption of the active and reactive power exchanged with the grid before the onset of the fault;
- in the area below (grey) the generator can disconnect from the grid.
- within 400 ms from restoring network voltage to within the range of +10% and -15% of nominal voltage, the generator must return to supplying active and reactive power to the network as before the fault, with a maximum tolerance of ±10% of the nominal voltage of the generator. If voltage returns but remains in the range between 85% and 90%, power distribution may be reduced in relation to the generator limits of output power.

Verification of compliance with the requirements of immunity to voltage drop are carried out according to the test sequences shown in Table 38, to be carried out with the storage system running respectively:
a)between 10% and 30% of P_{SMAX};
b)and above 90% of P_{SMAX}.

In general, regardless of the test circuit used, the result of each sequence should be documented as follows:

- Time trend of active power P, reactive power Q, phase voltages at the output terminals (Vr, Vs and Vt) and related phase currents, as moving average rms values of a network cycle and updated every half cycle (10 ms), over a time window that runs from 100 ms before the start of the test and ends at least after 1 000 ms from the end of the voltage transient (in order to verify the restoration of active and reactive power). The voltage transient ends when the voltage returns to more than 85% of the rated voltage value. For phase currents, in addition to the rms value averaged over a period, the peak value for each phase must also be recorded and documented.
- In the same period of observation, the oscillograms of the voltages and phase currents will have to be reported (possibly with enlarged detail of the trend during the rising and falling voltage fronts).
- The calculation method used to determine the power, the power factor and the reactive current must also be described in the test report.

It will therefore be necessary to carry out at least 12 distinct test sequences, corresponding to 2 residual voltage levels to be replicated in order to simulate the cases of symmetrical three-phase and two-phase asymmetric MV and LV faults. Each sequence must then be repeated with the storage system operating at two levels of initial power delivered (a: 10% * P_{SMAX} - 30% * P_{SMAX}; b:> 90% * P_{SMAX}).

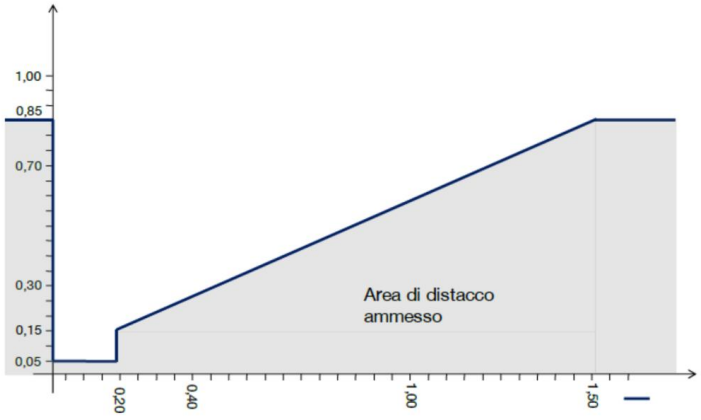


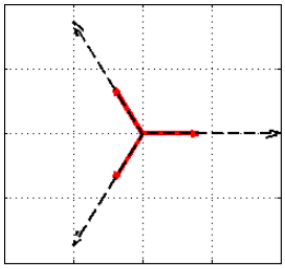
Figure 71 - Requirements for UVRT

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.9.2.2 Alternative test methods - network simulator:

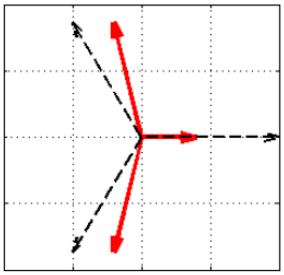
With reference to the list of tests shown in Table 39, the voltage drops that are the subject of these tests are caused by faults produced on the low, medium or high voltage distribution line. The types of faults considered are three:

1) three-phase symmetrical fault (Table 39, Tests No. 1 and 2)



2) two-phase asymmetric fault (Table 39, Tests No. 3 and 4)

A fault in MV, which causes a variation in LV not only of amplitude but also of the phase relationship of the voltages (the case considered involves the presence of a transformer Dy in the secondary substation).

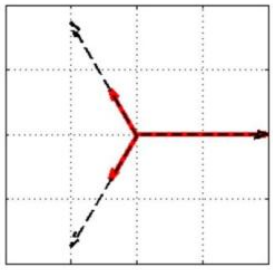


During the two-phase asymmetric fault, the residual amplitude of the 3 voltages and the phase shifts between the phases must comply with the values shown in the following table.

Table 40 - LV phase vectors in the presence of asymmetrical two-phase faults on the primary side of a transformer Dy in the secondary substation

Test No.	V/Vn	Phase-to-earth voltages			Phase angles		
		$u_1/u_{1,n}$	$u_2/u_{2,n}$	$u_3/u_{3,n}$	φ_{u1}	φ_{u2}	φ_{u3}
1a	0,10 ± 0,05	0,87 ± 0,05	0,87 ± 0,05	0,10 ± 0,05	27°	-147°	120°
2a	0,25 ± 0,05	0,88 ± 0,05	0,88 ± 0,05	0,25 ± 0,05	22°	-142°	120°
3a	0,50 ± 0,05	0,90 ± 0,05	0,90 ± 0,05	0,50 ± 0,05	14°	-134°	120°
4a	0,75 ± 0,05	0,94 ± 0,05	0,94 ± 0,05	0,75 ± 0,05	7°	- 127°	120°
normal conditions	1	1	1	1	0°	-120°	120°

3) LV two-phase asymmetric fault (Table 39, Tests No. 5 and 6)



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Requirement of LVRT test:

Table 39 - Test sequences to verify immunity to temporary voltage dips. The amplitude, duration and shape relate to no-load test conditions

List of tests	Residual amplitude of phase-to-phase voltage V/V_{nom}	Drop duration limit [ms]	Power re-supply time after restoring network [ms]	Shape (*)
1s – three-phase symmetrical fault	0.10 ± 0.05 (V_1/Vn)	200 ± 20	400	
1a – two-phase asymmetric failure	0.10 ± 0.05 (V_1/Vn)	200 ± 20	400	
2s – three-phase symmetrical fault	0.25 ± 0.05 (V_2/Vn)	400 ± 20	400	
2a – two-phase asymmetric failure	0.25 ± 0.05 (V_2/Vn)	400 ± 20	400	
3s – three-phase asymmetrical fault	0.50 ± 0.05 (V_3/Vn)	850 ± 20	400	
3a – two-phase asymmetric failure	0.50 ± 0.05 (V_3/Vn)	850 ± 20	400	
4s – three-phase asymmetrical fault	0.75 ± 0.05 (V_4/Vn)	1300 ± 20	400	
4a – two-phase asymmetric failure	0.75 ± 0.05 (V_4/Vn)	1300 ± 20	400	
5 – LV two-phase asymmetrical fault	0.10 ± 0.05 (V_5/Vn)	200 ± 20	400	
6 – LV two-phase asymmetrical fault	0.50 ± 0.05 (V_6/Vn)	850 ± 20	400	
7 – three-phase symmetrical fault	1.20 ± 0.05(V_7/Vn)	500 ± 20	400	
8 – three-phase symmetrical fault	1.25 ± 0.05(V_8/Vn)	100 ± 20	400	

Test No.	V/V_{nom}	Phase-to-earth voltages			Phase angles		
		$U_1/U_{1,nom}$	$U_2/U_{2,nom}$	$U_3/U_{3,nom}$	φ_{U1}	φ_{U2}	φ_{U3}
1s	0.10 ± 0.05	0.10 ± 0.05	0.10 ± 0.05	0.10 ± 0.05	0°	-120°	120°
1a	0.10 ± 0.05	0.87 ± 0.05	0.87 ± 0.05	0.10 ± 0.05	27°	-147°	120°
2s	0.25 ± 0.05	0.25 ± 0.05	0.25 ± 0.05	0.25 ± 0.05	0°	-120°	120°
2a	0.25 ± 0.05	0.88 ± 0.05	0.88 ± 0.05	0.25 ± 0.05	22°	-142°	120°
3s	0.50 ± 0.05	0.50 ± 0.05	0.50 ± 0.05	0.50 ± 0.05	0°	-120°	120°
3a	0.50 ± 0.05	0.90 ± 0.05	0.90 ± 0.05	0.50 ± 0.05	14°	-134°	120°
4s	0.75 ± 0.05	0.75 ± 0.05	0.75 ± 0.05	0.75 ± 0.05	0°	-120°	120°
4a	0.75 ± 0.05	0.94 ± 0.05	0.94 ± 0.05	0.75 ± 0.05	7°	-127°	120°
5	0.10 ± 0.05	1	0.10 ± 0.05	0.10 ± 0.05	0°	-120°	120°
6	0.50 ± 0.05	1	0.50 ± 0.05	0.50 ± 0.05	0°	-120°	120°
7	1.20 ± 0.05	1.20 ± 0.05	1.20 ± 0.05	1.20 ± 0.05	0°	-120°	120°
8	1.25 ± 0.05	1.25 ± 0.05	1.25 ± 0.05	1.25 ± 0.05	0°	-120°	120°
normal condition	1	1	1	1	0°	-120°	120°

(*) Regardless of the method used to simulate the transients (simulator or impedance network), the falling and rising edges of the voltage must have a duration of less than 10 ms.

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Clause	Requirement - Test	Result - Remark	Verdict

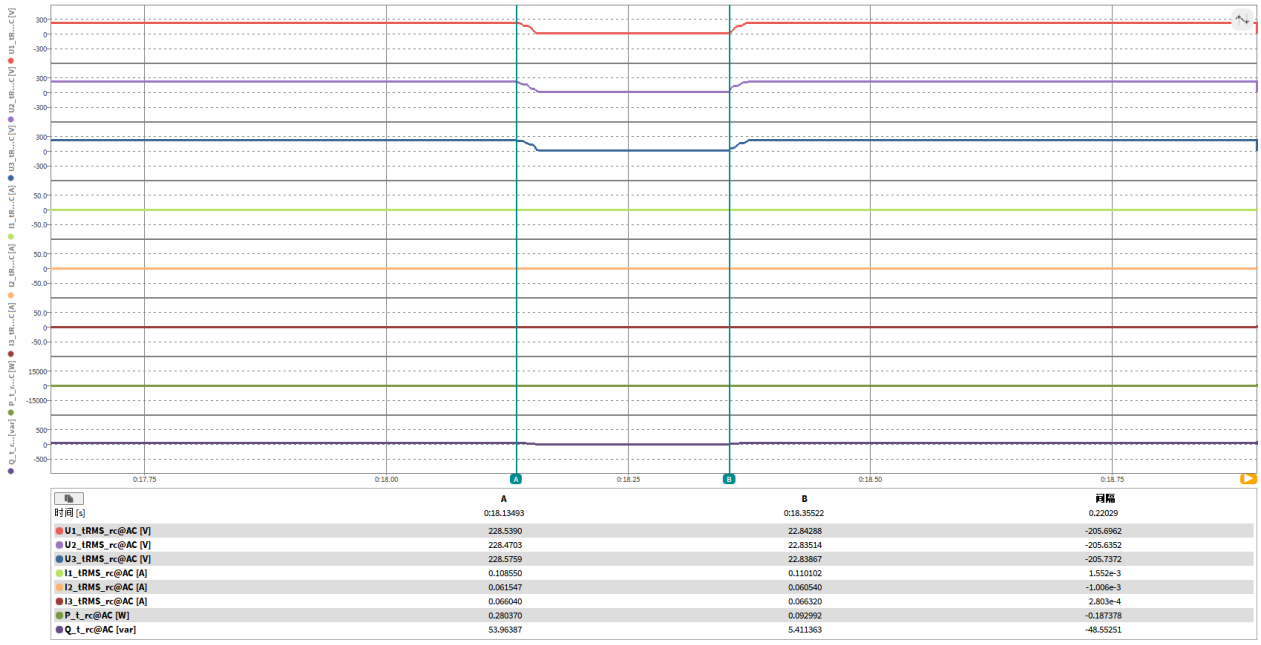
Graph of LVRT and OVRT test:				
Model	AF15K-MTH + ATOM HVS-20.48 (4P)			
List of tests	**Residual amplitude of phase-to-phase voltage V/V_{nom}**	**Drop duration limit [ms]**	**Measured drop duration [ms]**	**Duration of restoring network [ms]**
1s – three-phase symmetrical fault (P = 0.1 - 0.3)	0.10 ± 0.05 (V_1/Vn)	200 +20	215	130
1s – three-phase symmetrical fault (P > 0.9)	0.10 ± 0.05 (V_1/Vn)	200 +20	218	260
1a – two-phase asymmetrical fault (P = 0.1 - 0.3)	0.10 ± 0.05 (V_1/Vn)	200 +20	218	175
1a – two-phase asymmetrical fault (P > 0.9)	0.10 ± 0.05 (V_1/Vn)	200 +20	217	253
2s – three-phase symmetrical fault (P = 0.1 - 0.3)	0.25 ± 0.05 (V_2/Vn)	400 +20	418	149
2s – three-phase symmetrical fault (P > 0.9)	0.25 ± 0.05 (V_2/Vn)	400 +20	418	237
2a – three-phase symmetrical fault (P = 0.1 - 0.3)	0.25 ± 0.05 (V_2/Vn)	400 +20	416	158
2a – three-phase symmetrical fault (P > 0.9)	0.25 ± 0.05 (V_2/Vn)	400 +20	416	168
3s – three-phase symmetrical fault (P = 0.1 - 0.3)	0.50 ± 0.05 (V_3/Vn)	850 ± 20	868	95
3s – three-phase symmetrical fault (P > 0.9)	0.50 ± 0.05 (V_3/Vn)	850 ± 20	865	252
3a – two-phase asymmetrical fault (P = 0.1 - 0.3)	0.50 ± 0.05 (V_3/Vn)	850 ± 20	865	117
3a – two-phase asymmetrical fault (P > 0.9)	0.50 ± 0.05 (V_3/Vn)	850 ± 20	868	217
4s – three-phase symmetrical fault (P = 0.1 - 0.3)	0.75 ± 0.05 (V_4/Vn)	1300 ± 20	1319	199
4s – three-phase symmetrical fault (P > 0.9)	0.75 ± 0.05 (V_4/Vn)	1300 ± 20	1314	199
4a – two-phase asymmetrical fault (P = 0.1 - 0.3)	0.75 ± 0.05 (V_4/Vn)	1300 ± 20	1315	197
4a – two-phase asymmetrical fault (P > 0.9)	0.75 ± 0.05 (V_4/Vn)	1300 ± 20	1315	251
5 – LV two-phase asymmetrical fault (P = 0.1 - 0.3)	0.10 ± 0.05 (V_5/Vn)	200 +20	218	134
5 – LV two-phase asymmetrical fault (P > 0.9)	0.10 ± 0.05 (V_5/Vn)	200 +20	215	190
6 – LV two-phase asymmetrical fault (P = 0.1 - 0.3)	0.50 ± 0.05 (V_6/Vn)	850 +20	865	209
6 – LV two-phase asymmetrical fault (P > 0.9)	0.50 ± 0.05 (V_6/Vn)	850 +20	869	208

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Clause	Requirement - Test	Result - Remark	Verdict

7– HV three-phase symmetrical fault (P = 0.1 - 0.3)	1.20 ± 0.05 (V_7/Vn)	500 +20	518	135
7– HV three-phase symmetrical (P > 0.9)	1.20 ± 0.05 (V_7/Vn)	500 +20	518	235
8–HV three-phase symmetrical fault (P = 0.1 - 0.3)	1.25 ± 0.05 (V_8/Vn)	100 +20	118	170
8– HV three-phase symmetrical (P > 0.9)	1.25 ± 0.05 (V_8/Vn)	100 +20	119	236
Note: The interface protection shall be disabled or adjusted to avoid spurious tripping during testing. The test conditions are performed as worst case conditions. The inverter feeds maximal active and reactive power during the complete test.				

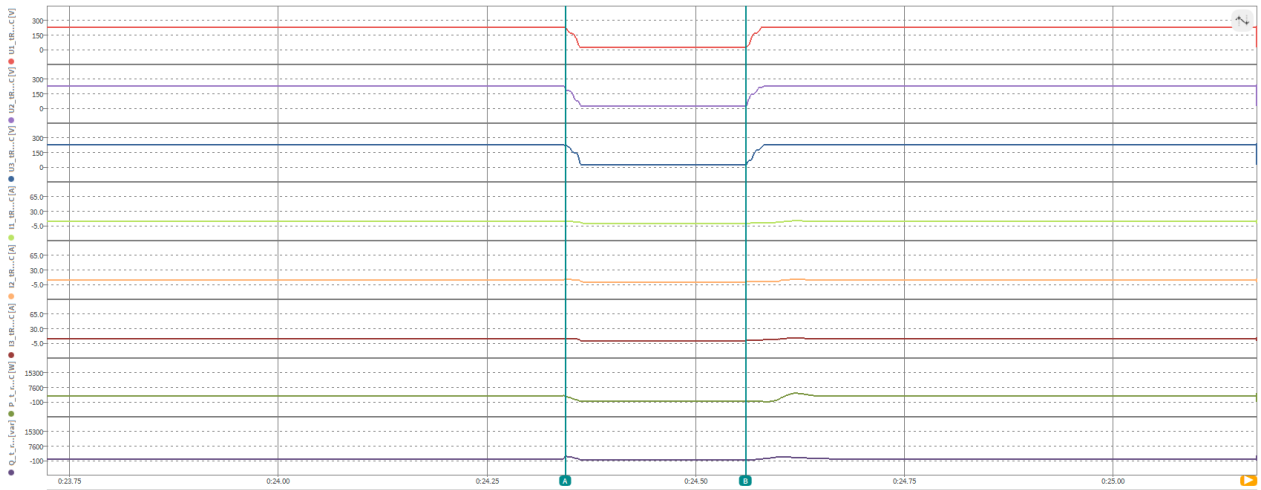
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1s-Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A), 0% load
Test overview(voltage,current,active and reactive power)



时间 [s]	A 0:18.13493	B 0:18.35522	间隔 0.22029
U1_tRMS_rc@AC [V]	228.5390	22.84288	-205.6962
U2_tRMS_rc@AC [V]	228.4703	22.83514	-205.6352
U3_tRMS_rc@AC [V]	228.5759	22.83867	-205.7372
I1_tRMS_rc@AC [A]	0.108550	0.110102	1.552e-3
I2_tRMS_rc@AC [A]	0.061547	0.060540	-1.006e-3
I3_tRMS_rc@AC [A]	0.066040	0.066320	2.803e-4
P_t_rc@AC [W]	0.280370	0.092992	-0.187378
Q_t_rc@AC [var]	53.96387	5.411363	-48.55251

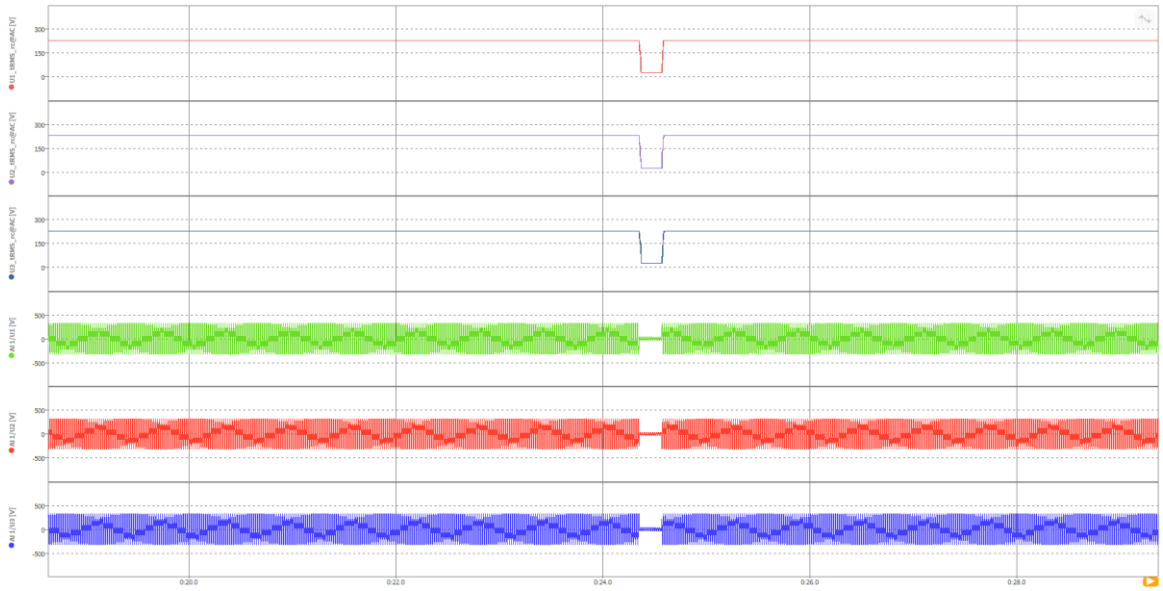
Test 1s-1.1 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)



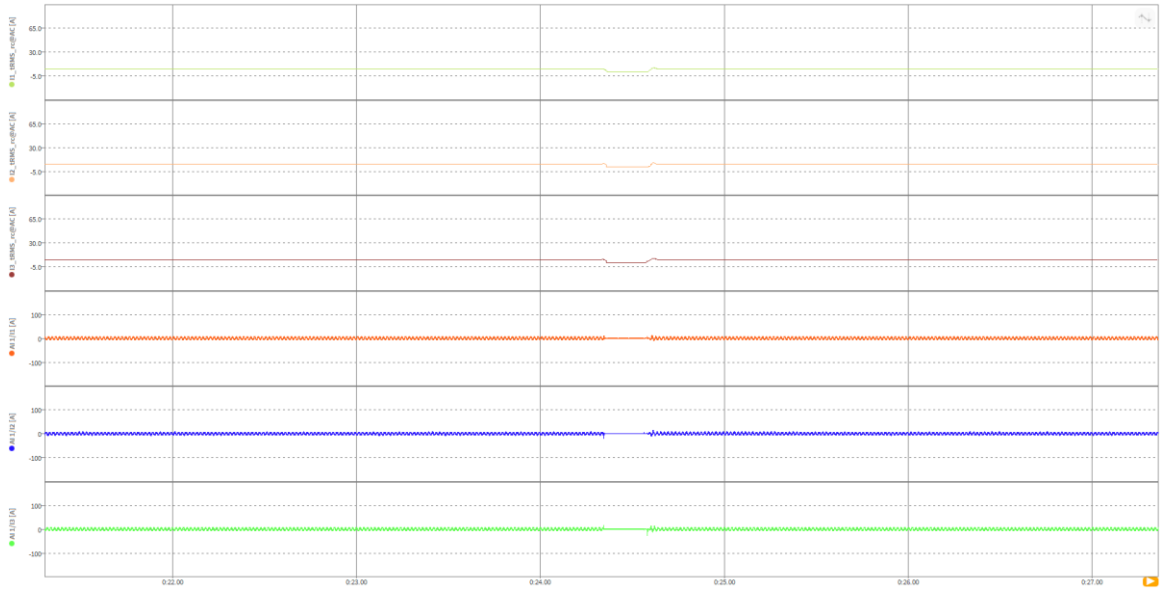
时间 [s]	A 0:24.34454	B 0:24.56019	间隔 0.21565
U1_tRMS_rc@AC [V]	227.4013	22.85926	-204.5420
U2_tRMS_rc@AC [V]	212.1154	22.85771	-189.2577
U3_tRMS_rc@AC [V]	219.3785	22.86284	-196.5157
I1_tRMS_rc@AC [A]	4.589365	0.145736	-4.443629
I2_tRMS_rc@AC [A]	6.041758	0.093574	-5.948183
I3_tRMS_rc@AC [A]	5.303970	0.102843	-5.201127
P_t_rc@AC [W]	2956.550	-0.030515	-2956.580
Q_t_rc@AC [var]	1852.086	7.821521	-1844.265

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1s-1.2 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

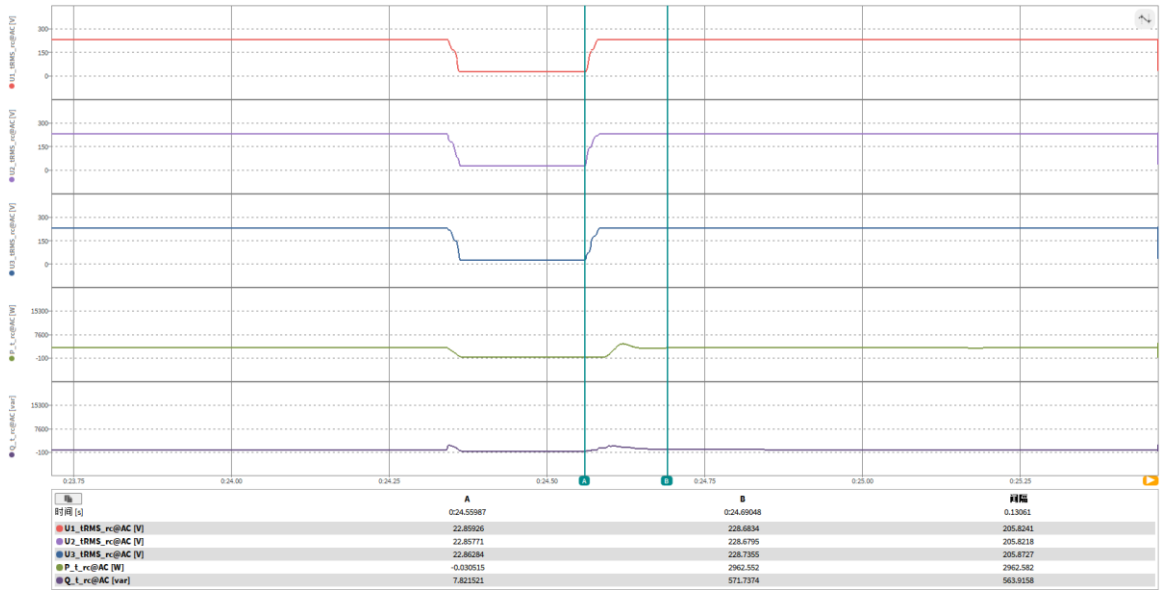


Test 1s-1.3 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents



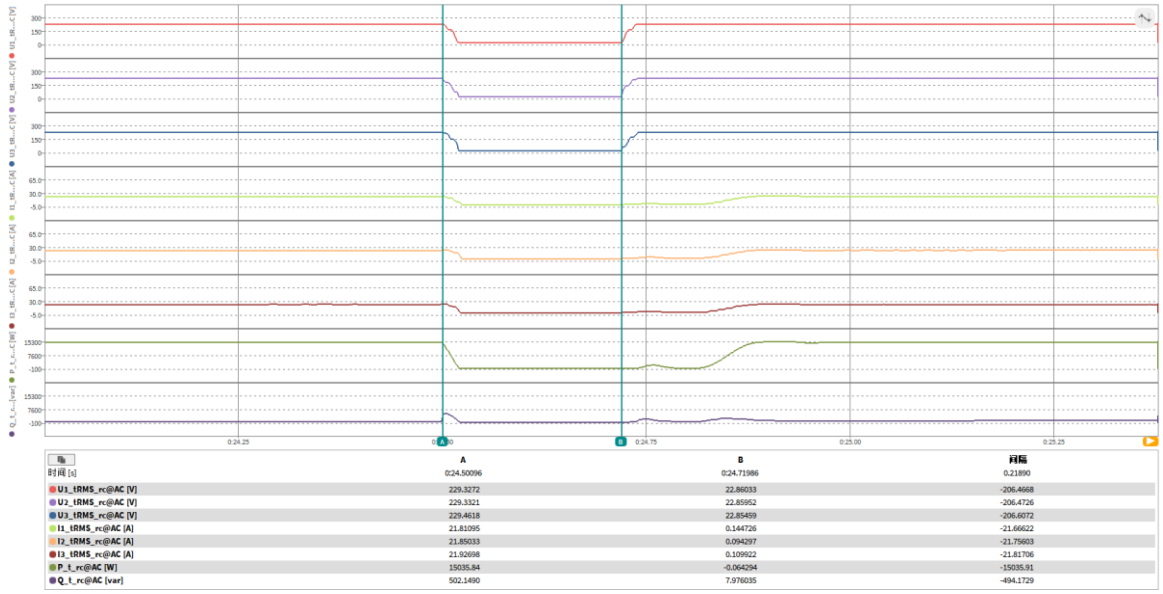
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1s-1.4 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),20% load restoring time



时间 [s]	A 0:24.55987	B 0:24.69048	间隔 0.13061
U1_tRMS_rc@AC [V]	22.85926	228.6834	205.8241
U2_tRMS_rc@AC [V]	22.85771	228.6795	205.8218
U3_tRMS_rc@AC [V]	22.86284	228.7355	205.8727
P_t_rc@AC [W]	-0.030515	2962.552	2962.582
Q_t_rc@AC [var]	7.821521	571.7374	563.9158

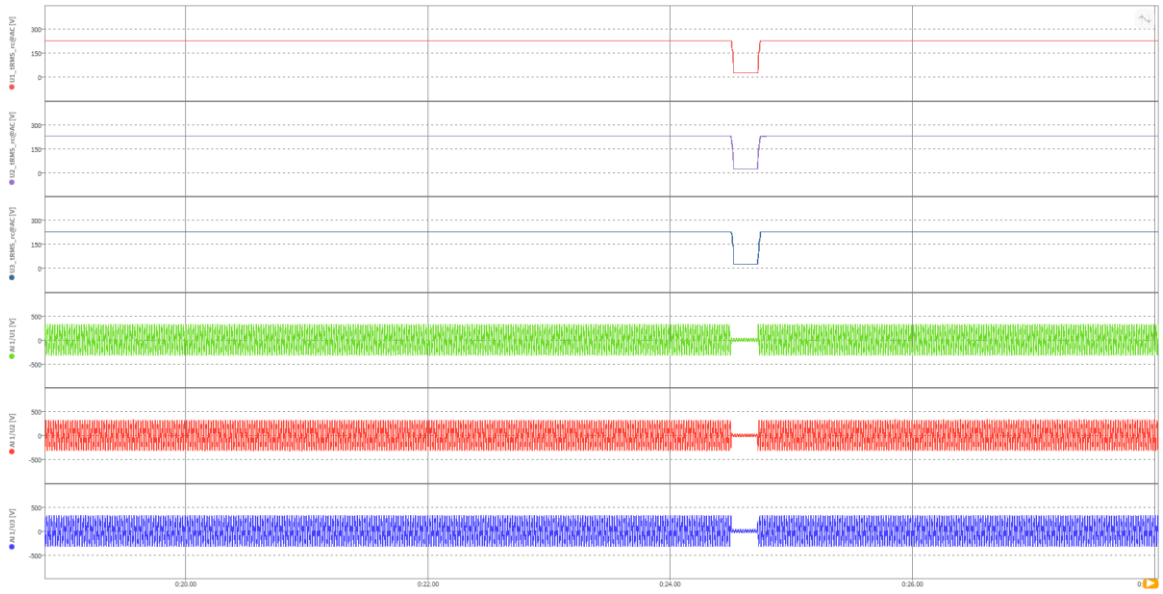
Test 1s-2.1 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),95% load
Test overview(voltage,current,active and reactive power)



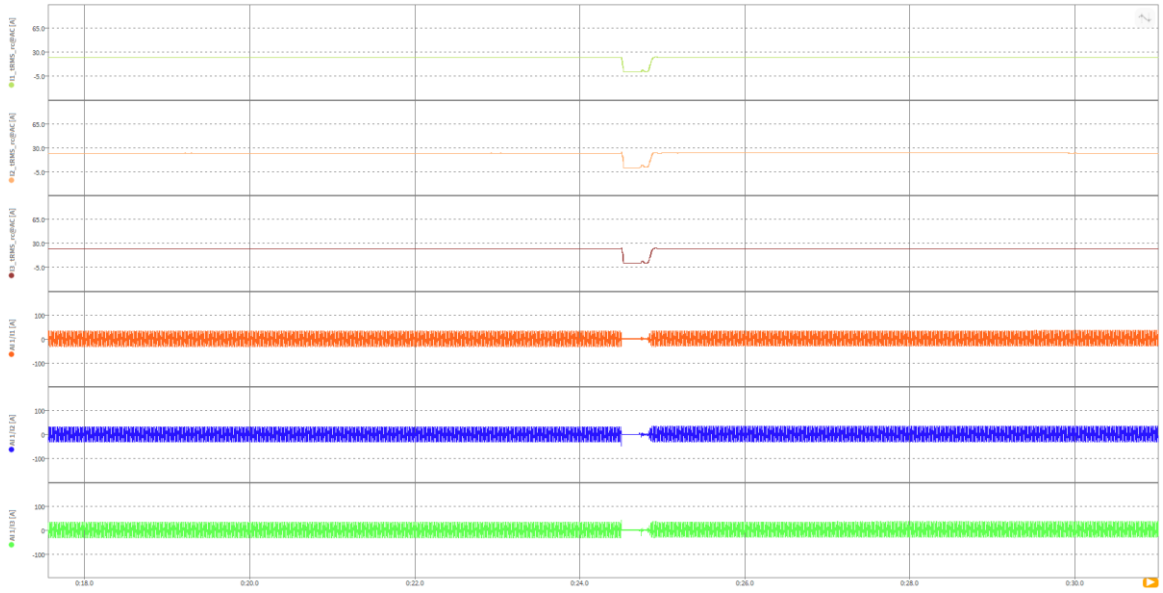
时间 [s]	A 0:24.50096	B 0:24.71986	间隔 0.21890
U1_tRMS_rc@AC [V]	229.3272	22.86033	-206.4668
U2_tRMS_rc@AC [V]	229.3321	22.85952	-206.4726
U3_tRMS_rc@AC [V]	229.4618	22.85459	-206.6072
I1_tRMS_rc@AC [A]	21.81095	0.144726	-21.66622
I2_tRMS_rc@AC [A]	21.85033	0.094297	-21.75603
I3_tRMS_rc@AC [A]	21.92698	0.109922	-21.81706
P_t_rc@AC [W]	15035.84	-0.064294	-15035.91
Q_t_rc@AC [var]	502.1490	7.976035	-494.1729

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1s-2.2 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

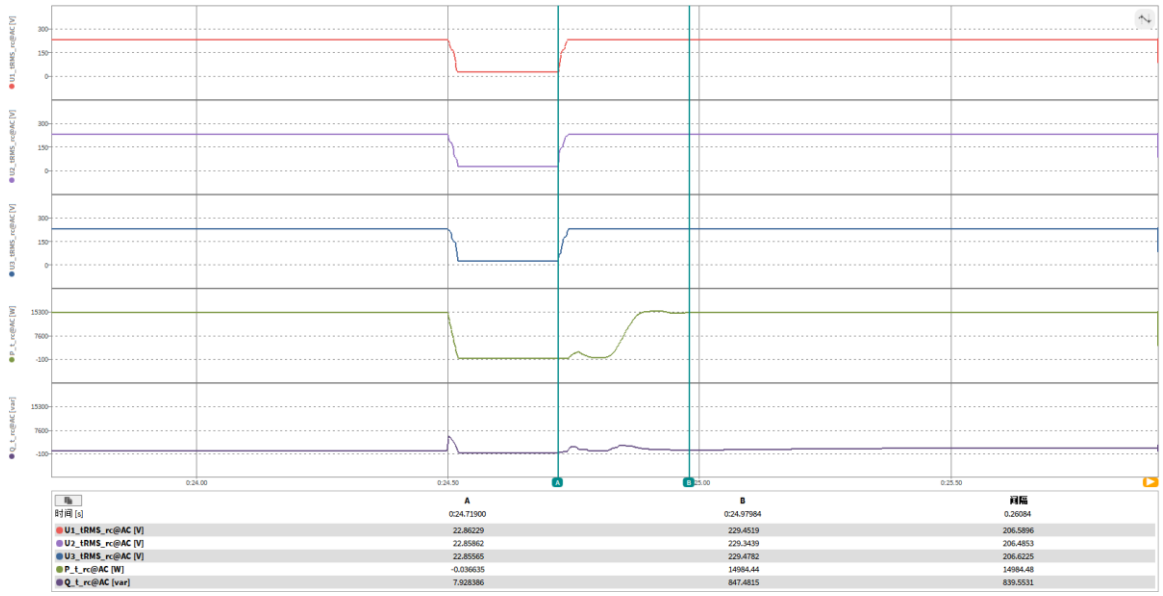


Test 1s-2.3 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents



CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1s-2.4 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A), 95% load restoring time



时间 [s]	A	B	Δ
	0:24.71900	0:24.97984	0.26084
U1_tRMS_rc@AC [V]	22.86229	229.4519	206.5896
U2_tRMS_rc@AC [V]	22.85862	229.3439	206.4853
U3_tRMS_rc@AC [V]	22.85565	229.4782	206.6225
P_t_rc@AC [W]	-0.036635	14984.44	14984.48
Q_t_rc@AC [var]	7.928386	847.4815	839.5531

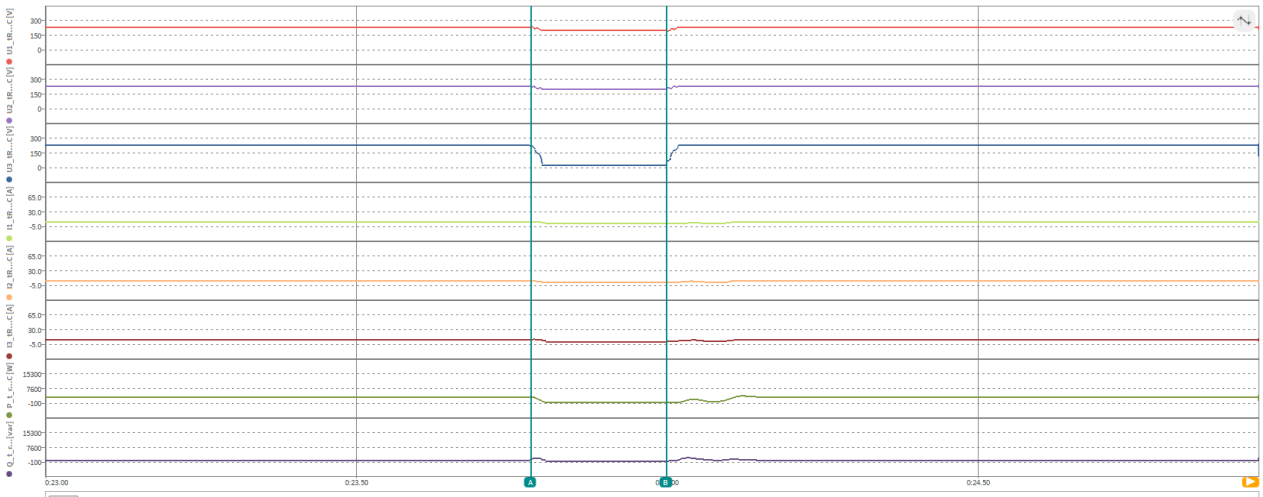
Test 1a-Depth of fault phase: 0.1p.u.,two-phase-asymmetrical (type D), 0% load
Test overview(voltage,current,active and reactive power)



时间 [s]	A	B	Δ
	0:17.88877	0:18.10925	0.22048
U1_tRMS_rc@AC [V]	228.5516	198.0819	-30.46970
U2_tRMS_rc@AC [V]	228.4765	200.3253	-28.15120
U3_tRMS_rc@AC [V]	228.5552	33.28783	-195.2674
I1_tRMS_rc@AC [A]	0.115116	0.118606	3.489e-3
I2_tRMS_rc@AC [A]	0.060526	0.057868	-2.658e-3
I3_tRMS_rc@AC [A]	0.064206	0.065972	1.765e-3
P_t_rc@AC [W]	-0.037092	0.082347	0.119439
Q_t_rc@AC [var]	54.81346	37.28201	-17.53144

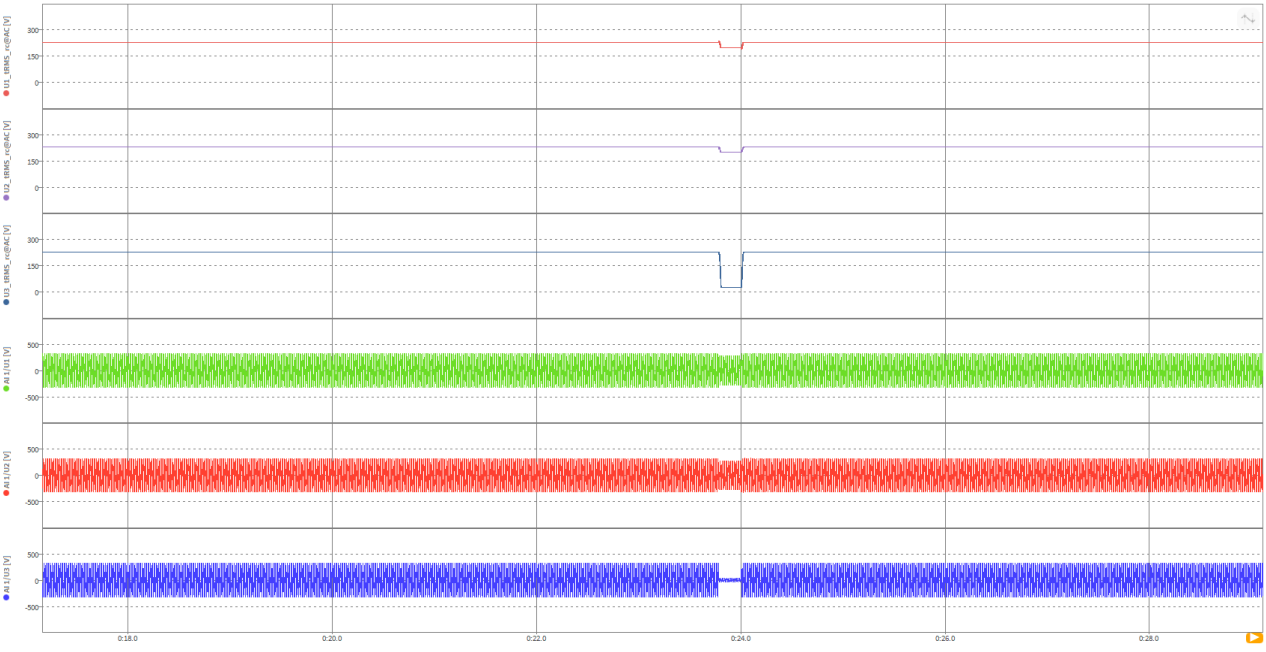
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1a-1.1 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),20% load
Test overview(voltage,current,active and reactive power)



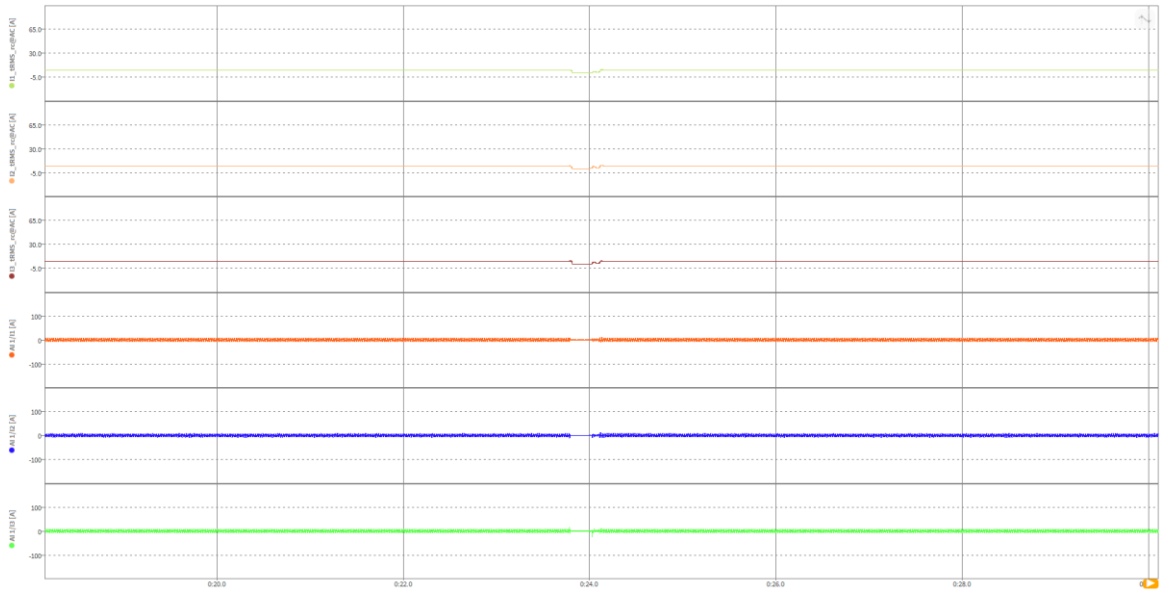
时间 [s]	A 0:23.780452	B 0:23.999002	间隔 0.218549
U1_tRMS_rc@AC [V]	228.7316	199.0795	-29.65211
U2_tRMS_rc@AC [V]	228.4763	199.0393	-29.43697
U3_tRMS_rc@AC [V]	228.3438	22.85424	-205.4895
I1_tRMS_rc@AC [A]	4.417670	0.579697	-3.837973
I2_tRMS_rc@AC [A]	4.477049	0.567677	-3.909372
I3_tRMS_rc@AC [A]	4.484837	0.095753	-4.389083
P_t_rc@AC [W]	3019.640	-0.528121	-3020.168
Q_t_rc@AC [var]	479.3172	230.5836	-248.7336

Test 1a-1.2 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

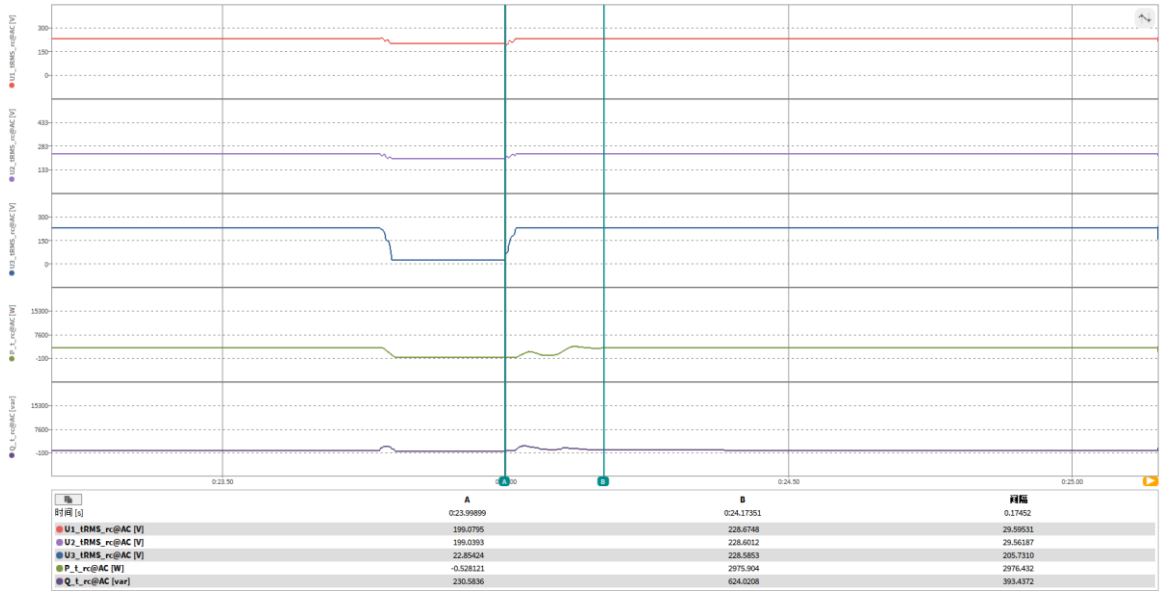


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1a-1.3 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase currents

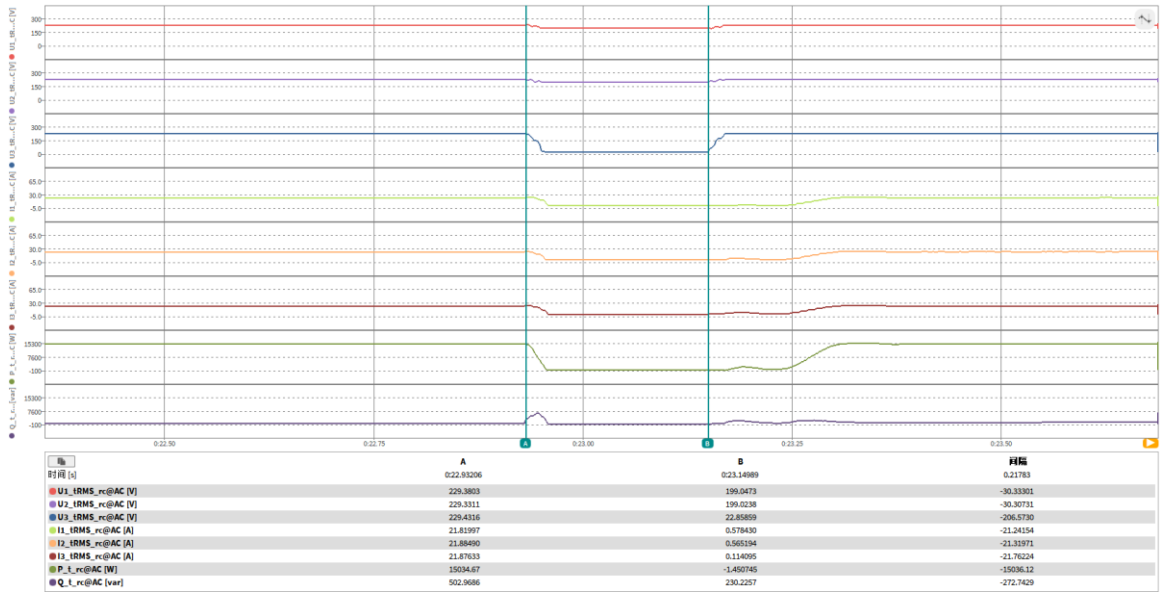


Test 1a-1.4 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),20% load
restoring time



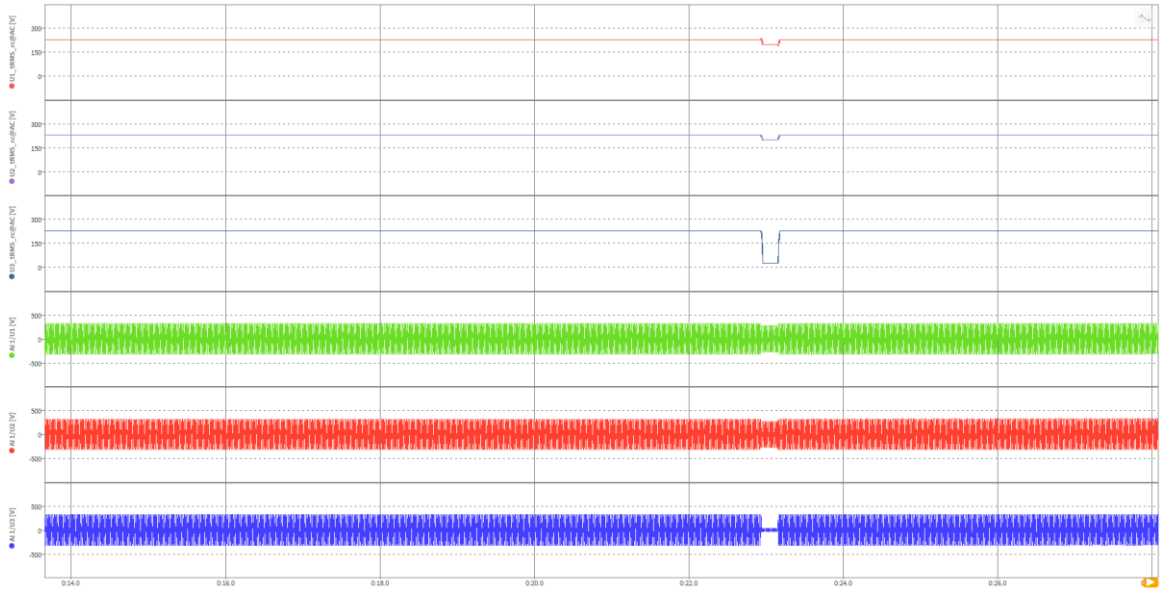
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1a-2.1 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),95% load
Test overview(voltage,current,active and reactive power)



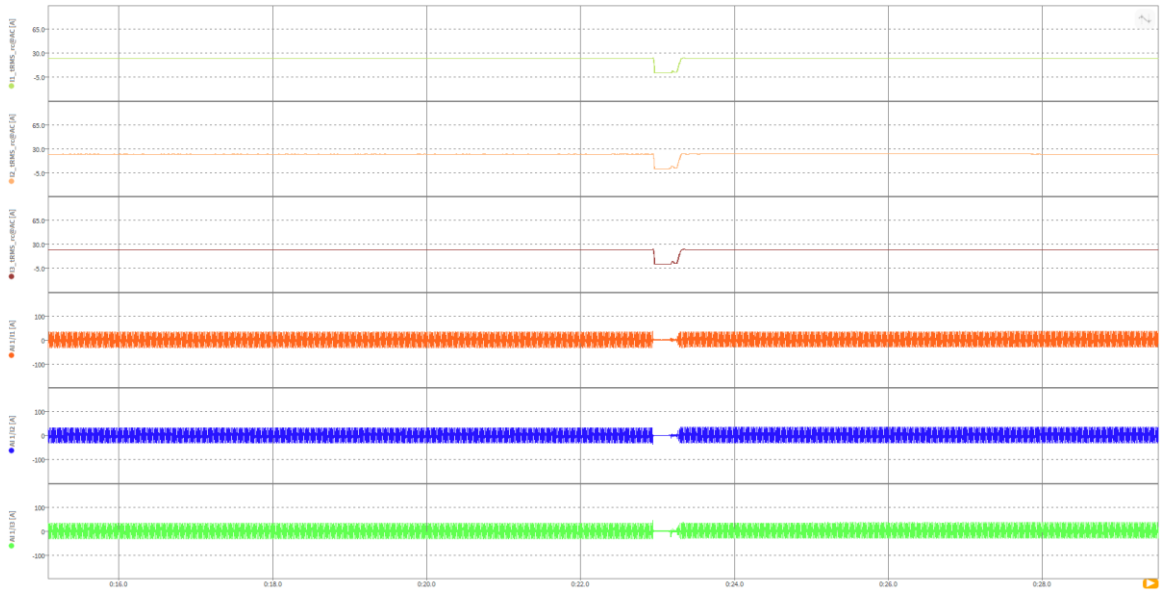
时间 [s]	A 0:22.93206	B 0:23.14989	间隔 0.21783
U1_tRMS_rc@AC [V]	229.3803	199.0473	-30.33301
U2_tRMS_rc@AC [V]	229.3311	199.0238	-30.30731
U3_tRMS_rc@AC [V]	229.4316	22.85859	-206.5730
I1_tRMS_rc@AC [A]	21.81997	0.578430	-21.24154
I2_tRMS_rc@AC [A]	21.88490	0.565194	-21.31971
I3_tRMS_rc@AC [A]	21.87633	0.114095	-21.76224
P_t_rc@AC [W]	15034.67	-1.450745	-15036.12
Q_t_rc@AC [var]	502.9686	230.2257	-272.7429

Test 1a-2.2 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

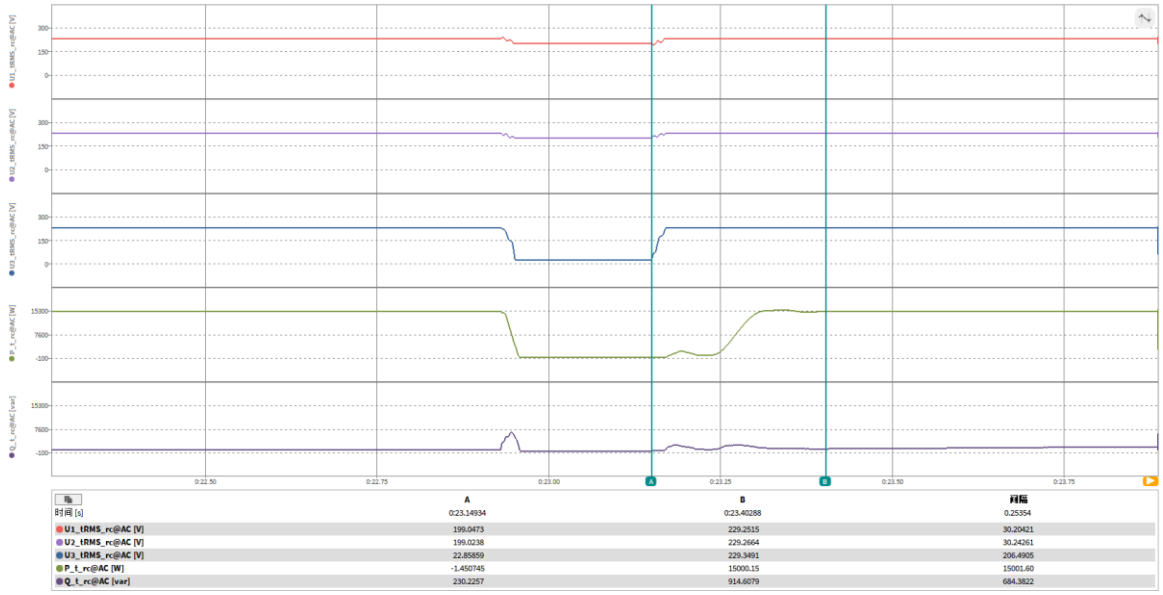


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1a-2.3 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase currents

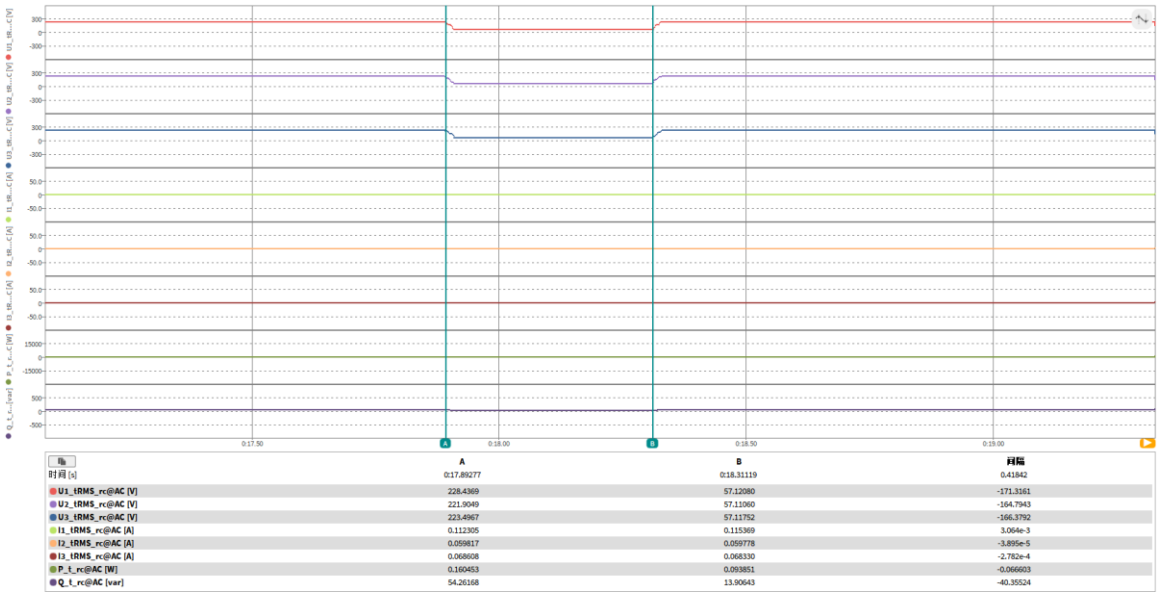


Test 1a-2.4 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D), 95% load
restoring time



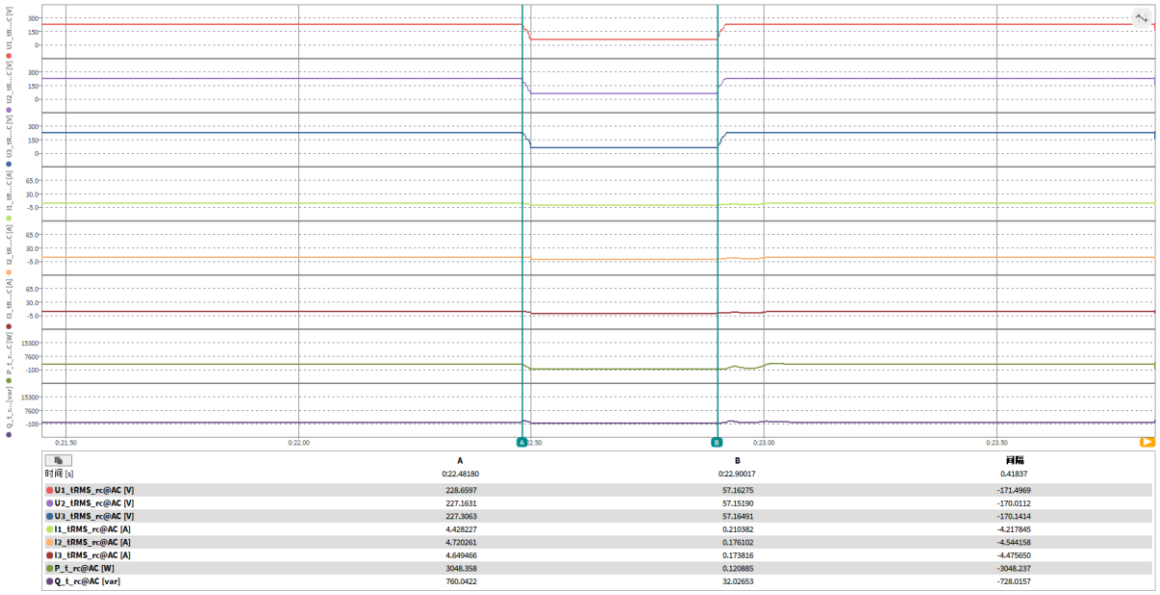
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2s-Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A), 0% load
Test overview(voltage,current,active and reactive power)



时间 [s]	A	B	间隔
	0:17.89277	0:18.31119	0.41842
U1_tRMS_rc@AC [V]	228.4369	57.12080	-171.3161
U2_tRMS_rc@AC [V]	221.9049	57.11060	-164.7943
U3_tRMS_rc@AC [V]	223.4967	57.11752	-166.3792
I1_tRMS_rc@AC [A]	0.112305	0.115369	3.064e-3
I2_tRMS_rc@AC [A]	0.059817	0.059778	-3.895e-5
I3_tRMS_rc@AC [A]	0.068608	0.068330	-2.782e-4
P_t_rc@AC [W]	0.160453	0.093851	-0.066603
Q_t_rc@AC [var]	54.26168	13.90643	-40.35524

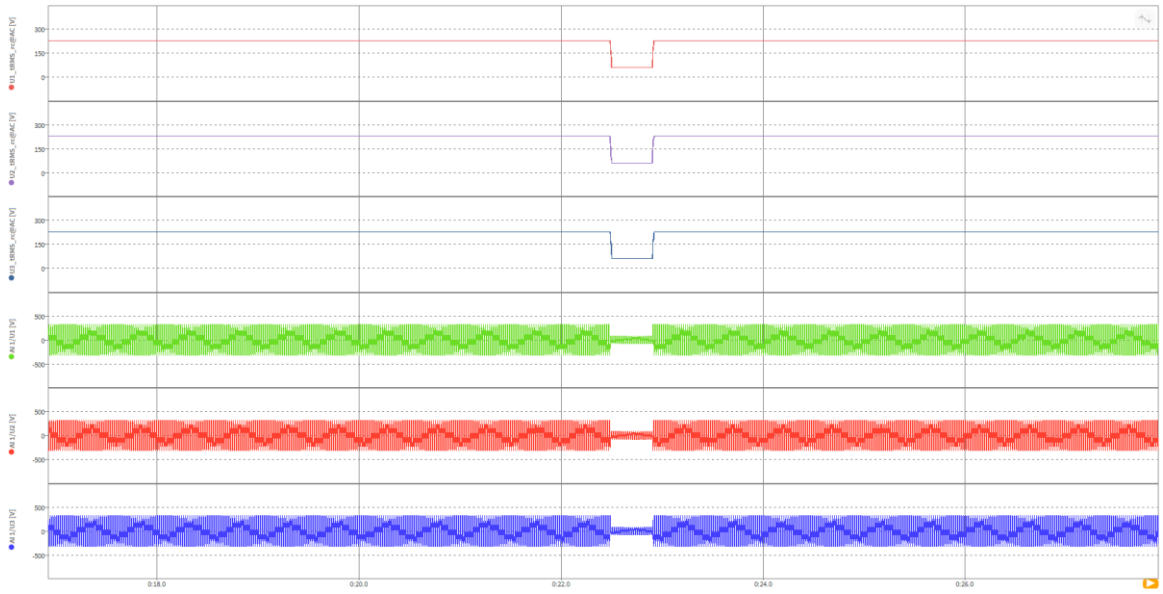
Test 2s-1.1 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)



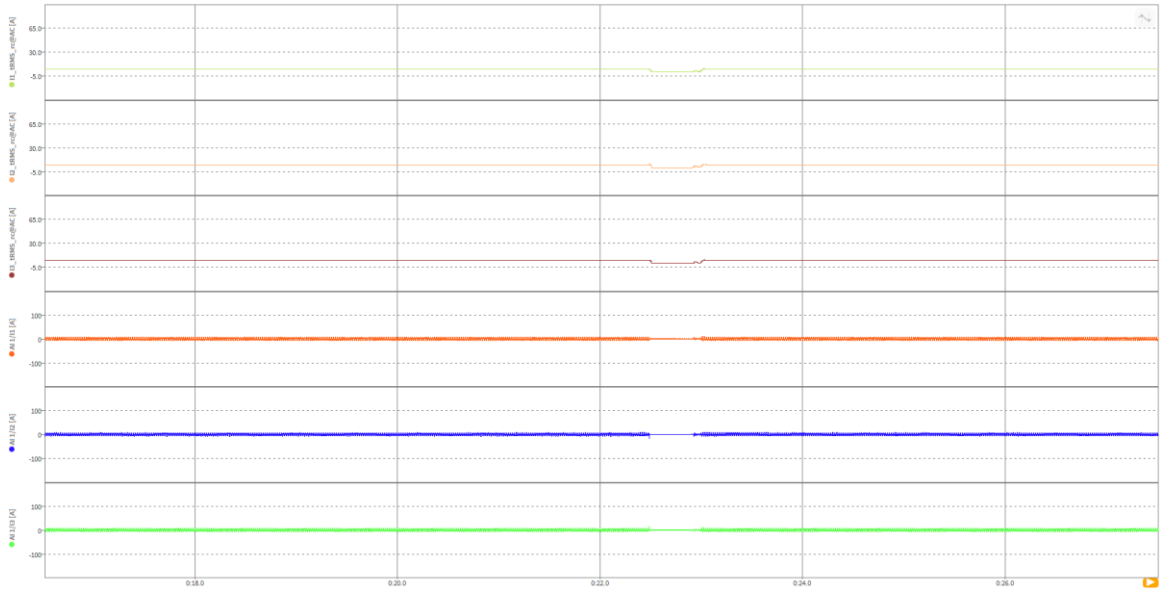
时间 [s]	A	B	间隔
	0:22.48180	0:22.90017	0.41837
U1_tRMS_rc@AC [V]	228.6597	57.16275	-171.4969
U2_tRMS_rc@AC [V]	227.1631	57.15190	-170.0112
U3_tRMS_rc@AC [V]	227.3063	57.16491	-170.1414
I1_tRMS_rc@AC [A]	4.428227	0.210382	-4.217845
I2_tRMS_rc@AC [A]	4.720261	0.176102	-4.544158
I3_tRMS_rc@AC [A]	4.649466	0.173816	-4.475650
P_t_rc@AC [W]	3048.358	0.120885	-3048.237
Q_t_rc@AC [var]	760.0422	32.02653	-728.0157

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2s-1.2 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

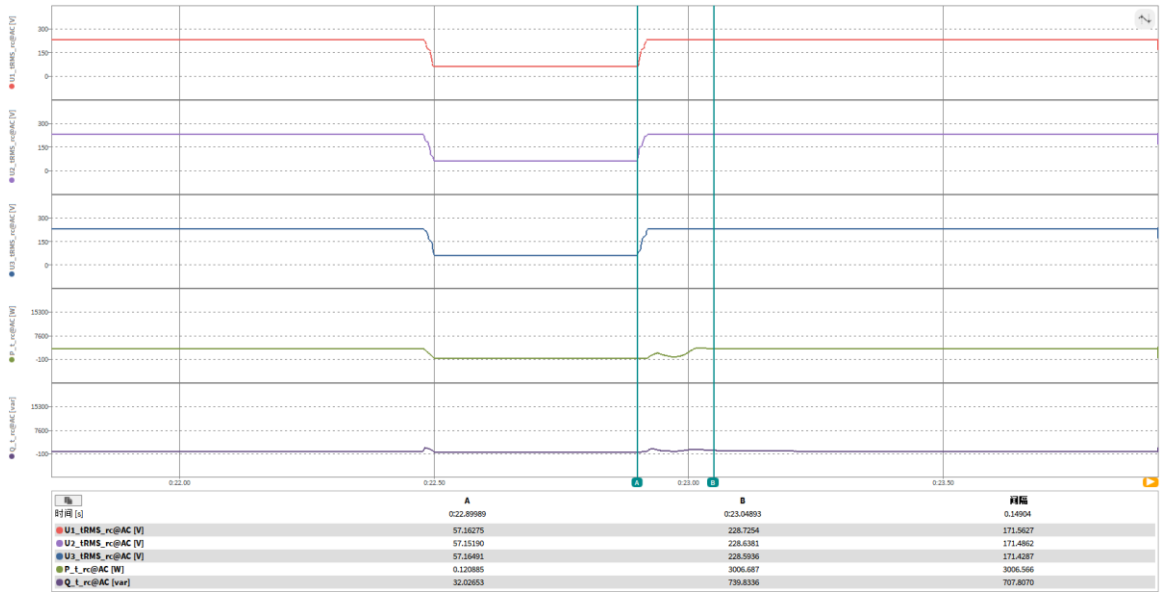


Test 2s-1.3 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents



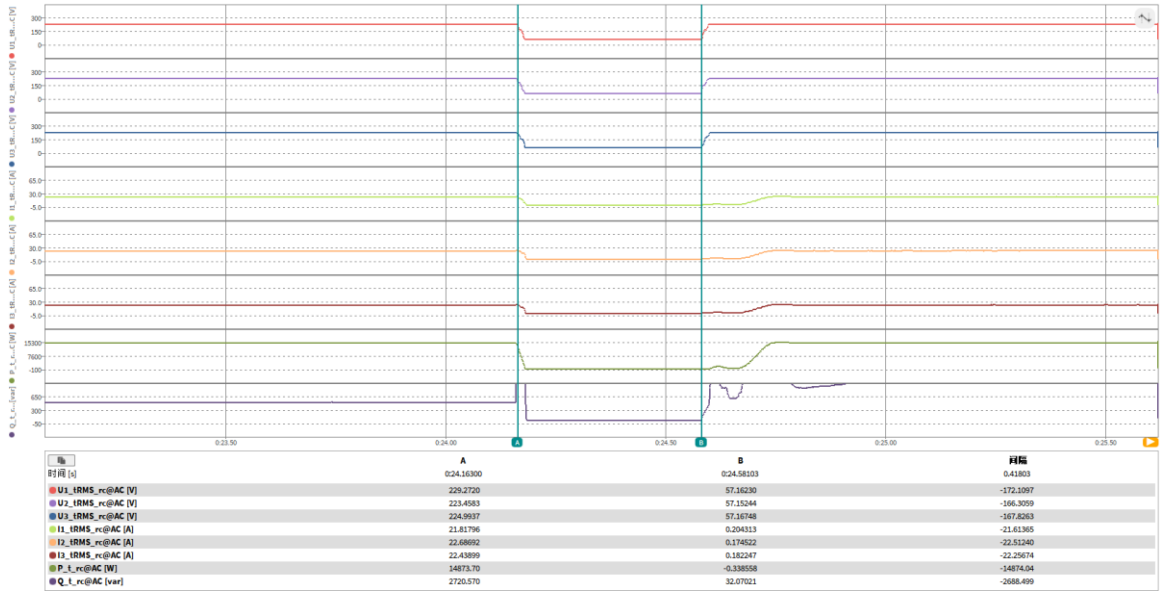
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2s-1.4 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),20% load restoring time



时间 [s]	A	B	间隔
	0:22.89989	0:23.04893	0.14904
U1_tRMS_rc@AC [V]	57.16275	228.7254	171.5627
U2_tRMS_rc@AC [V]	57.15190	228.6381	171.4862
U3_tRMS_rc@AC [V]	57.16491	228.5936	171.4287
P_t_rc@AC [W]	0.120885	3006.687	3006.566
Q_t_rc@AC [var]	32.02653	739.8336	707.8070

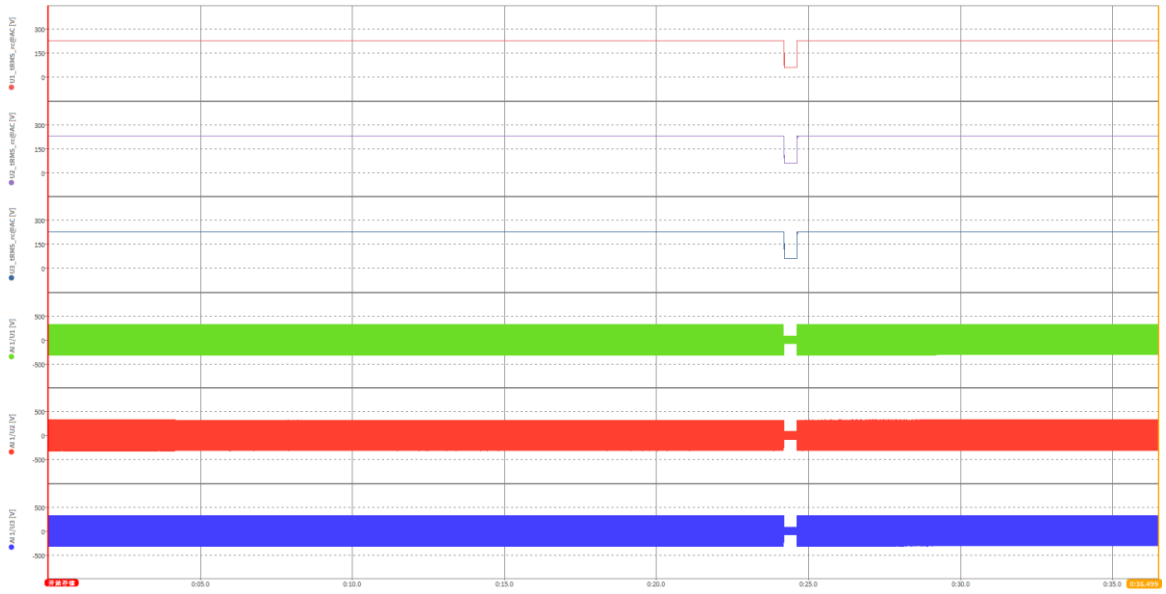
Test 2s-2.1 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),95% load
Test overview(voltage,current,active and reactive power)



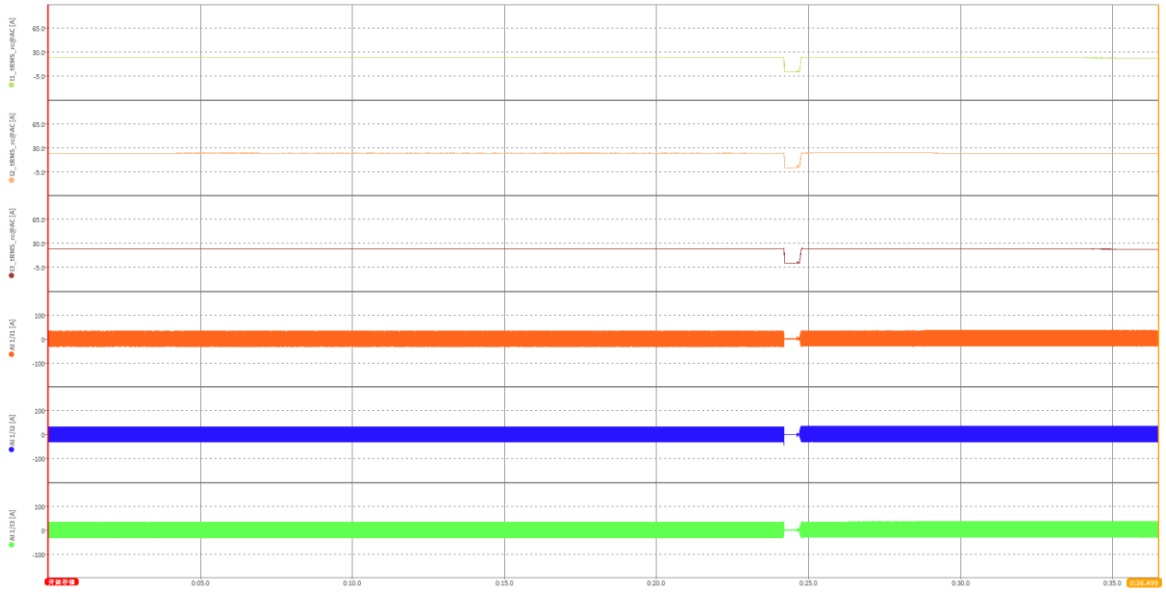
时间 [s]	A	B	间隔
	0:24.16300	0:24.58103	0.41803
U1_tRMS_rc@AC [V]	229.2720	57.16230	-172.1097
U2_tRMS_rc@AC [V]	223.4583	57.15244	-166.3059
U3_tRMS_rc@AC [V]	224.9937	57.16748	-167.8263
I1_tRMS_rc@AC [A]	21.81796	0.204313	-21.61365
I2_tRMS_rc@AC [A]	22.68692	0.174522	-22.51240
I3_tRMS_rc@AC [A]	22.43899	0.182247	-22.25674
P_t_rc@AC [W]	14873.70	-0.338558	-14874.04
Q_t_rc@AC [var]	2720.570	32.07021	-2688.499

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2s-2.2 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

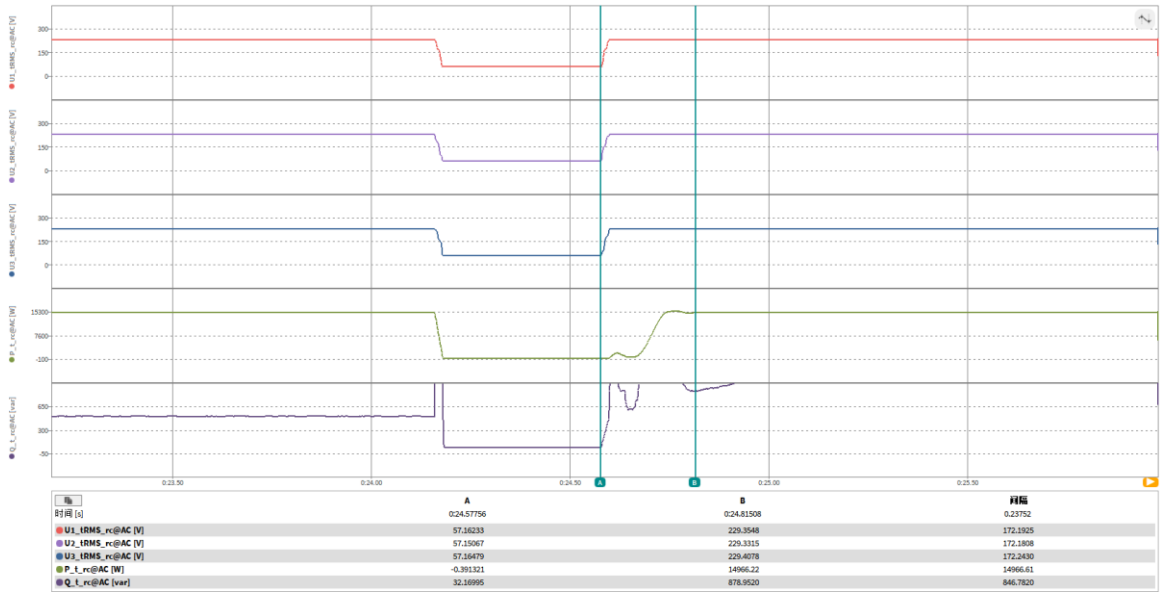


Test 2s-2.3 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents



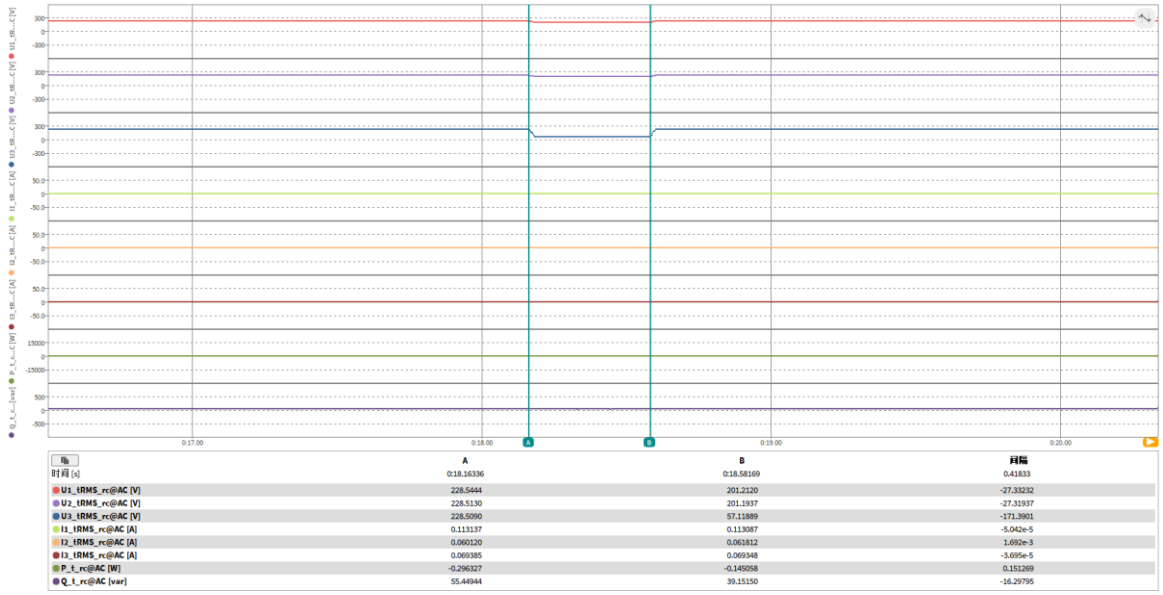
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2s-2.4 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A), 95% load restoring time



时间 [s]	A	B	间隔
	0:24.57756	0:24.81508	0.23752
U1_tRMS_rc@AC [V]	57.16233	229.3548	172.1925
U2_tRMS_rc@AC [V]	57.15067	229.3315	172.1808
U3_tRMS_rc@AC [V]	57.16479	229.4078	172.2430
P_t_rc@AC [W]	-0.391321	14966.22	14966.61
Q_t_rc@AC [var]	32.16995	878.9520	846.7820

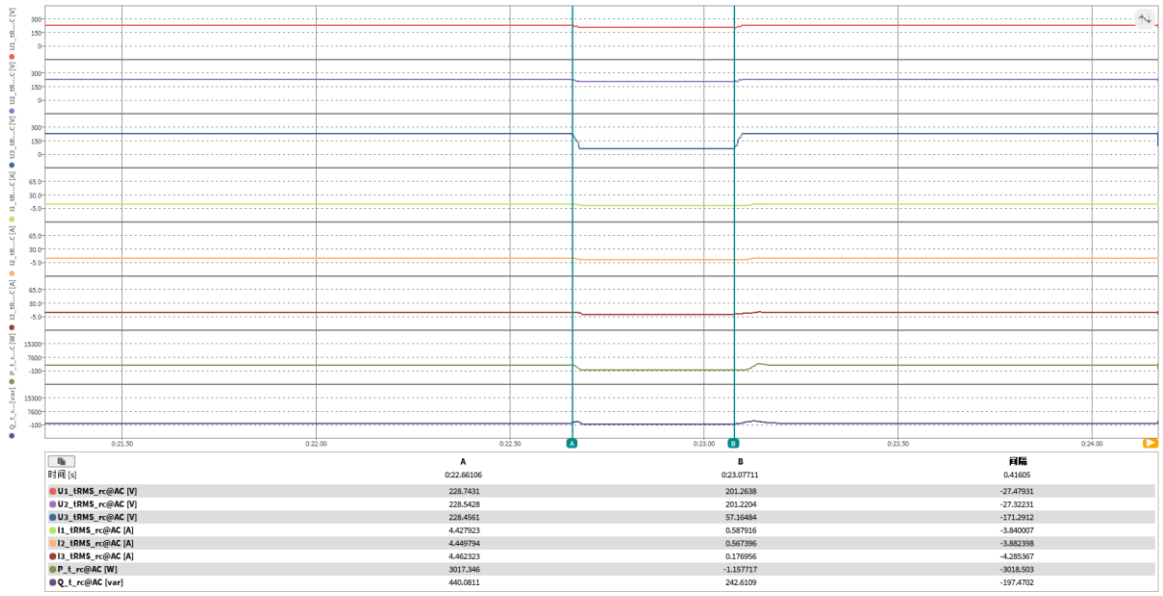
Test 2a-Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D), 0% load
Test overview(voltage,current,active and reactive power)



时间 [s]	A	B	间隔
	0:18.16336	0:18.58169	0.41833
U1_tRMS_rc@AC [V]	228.5444	201.2120	-27.33232
U2_tRMS_rc@AC [V]	228.5130	201.1937	-27.31937
U3_tRMS_rc@AC [V]	228.5090	57.11889	-171.3901
I1_tRMS_rc@AC [A]	0.113137	0.113087	-5.042e-5
I2_tRMS_rc@AC [A]	0.060120	0.061812	1.692e-3
I3_tRMS_rc@AC [A]	0.069385	0.069348	-3.695e-5
P_t_rc@AC [W]	-0.296327	-0.145058	0.151269
Q_t_rc@AC [var]	55.44944	39.15150	-16.29795

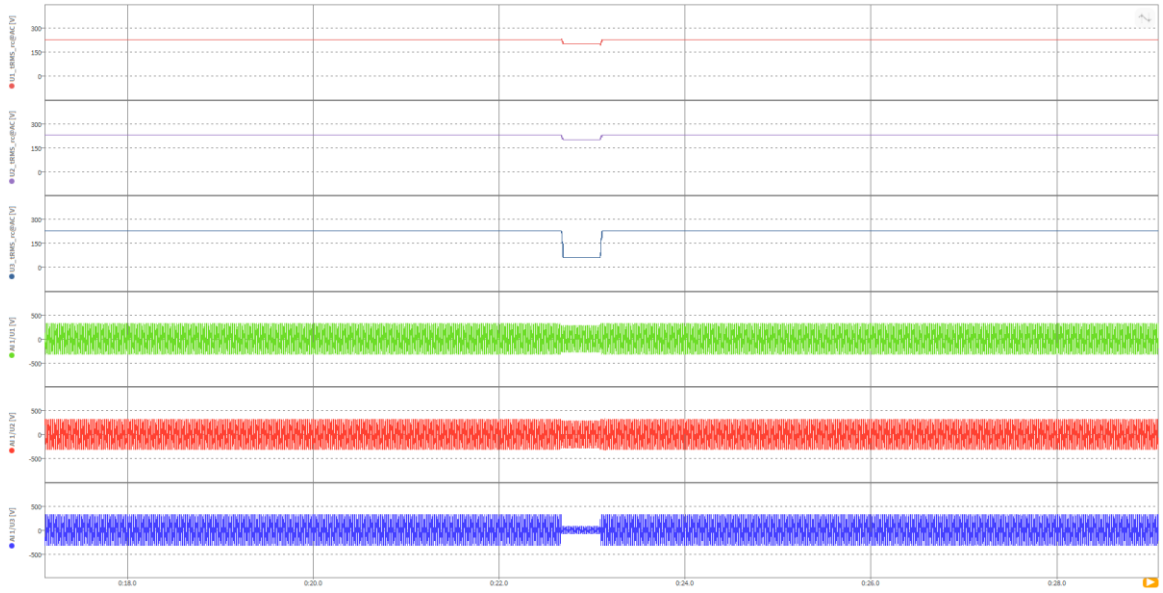
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2a-1.1 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),20% load
Test overview(voltage,current,active and reactive power)



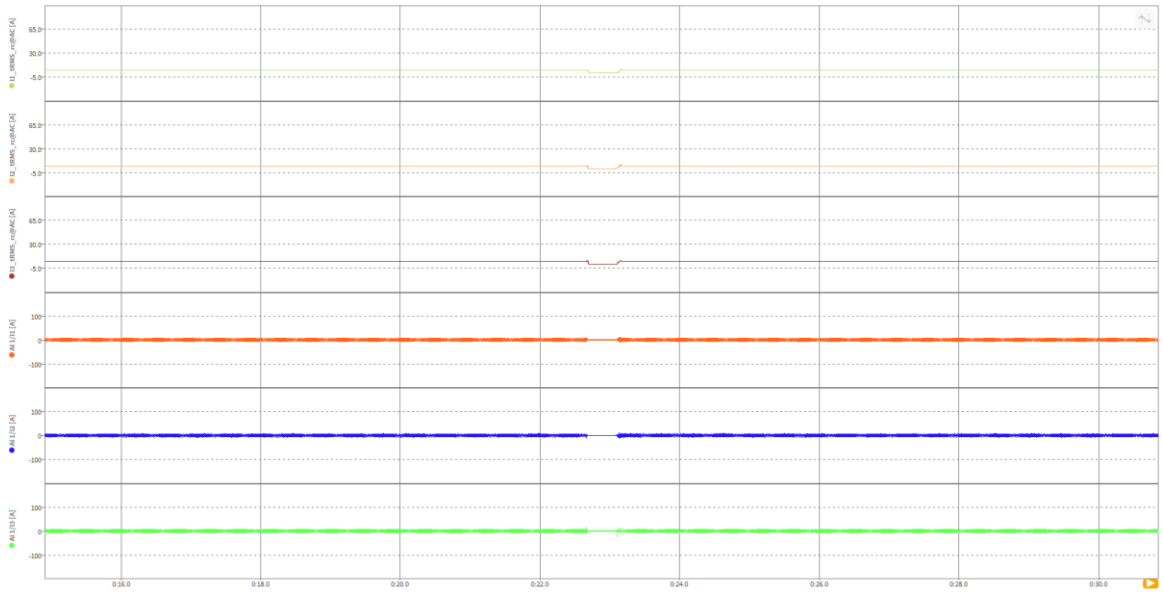
时间 [s]	A	B	间隔
	0:22.66106	0:23.07711	0.41605
U1_tRMS_rc@AC [V]	228.7431	201.2638	-27.47931
U2_tRMS_rc@AC [V]	228.5428	201.2204	-27.32231
U3_tRMS_rc@AC [V]	228.4561	57.16484	-171.2912
I1_tRMS_rc@AC [A]	4.427923	0.587916	-3.840007
I2_tRMS_rc@AC [A]	4.449794	0.567396	-3.882398
I3_tRMS_rc@AC [A]	4.462323	0.176956	-4.285367
P_t_rc@AC [W]	3017.346	-1.157717	-3018.503
Q_t_rc@AC [var]	440.0811	242.6109	-197.4702

Test 2a-1.2 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

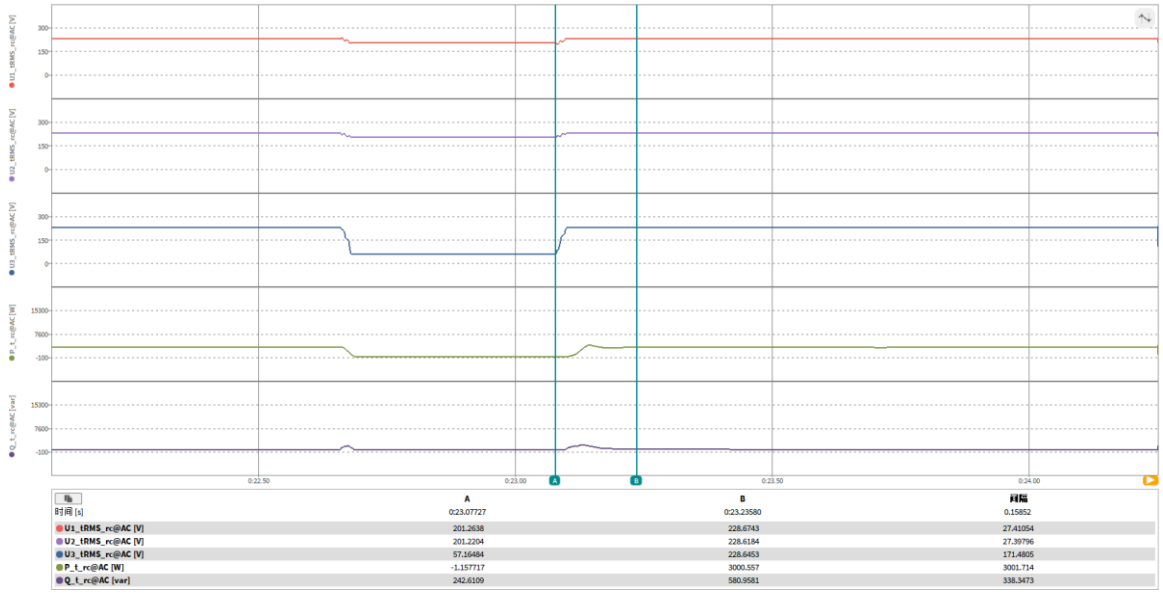


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2a-1.3 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase currents

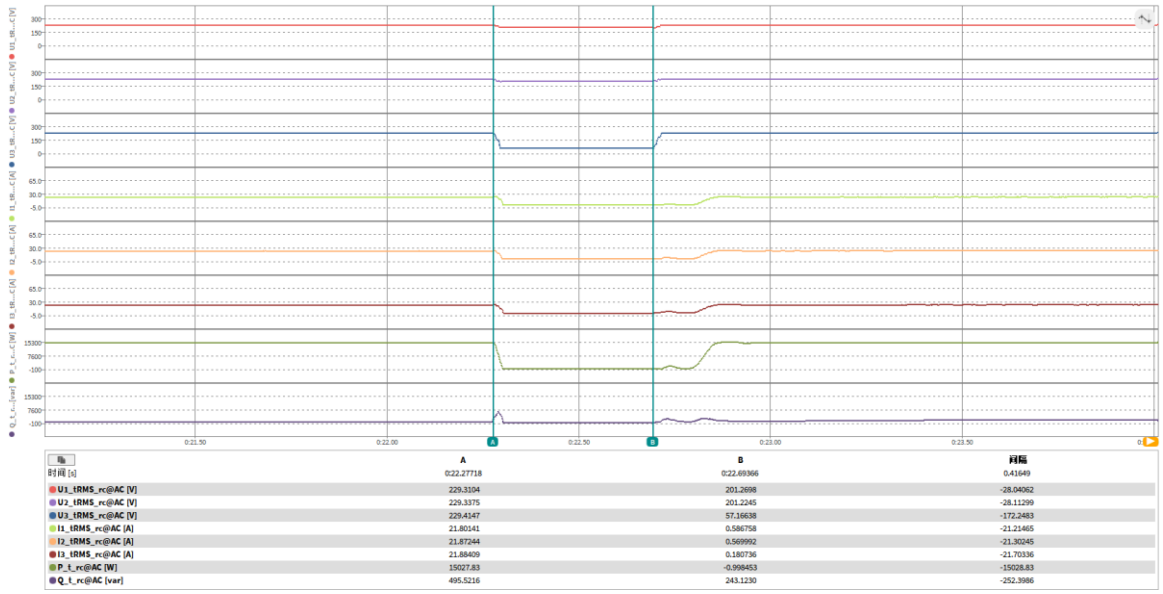


Test 2a-1.4 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),20% load
restoring time



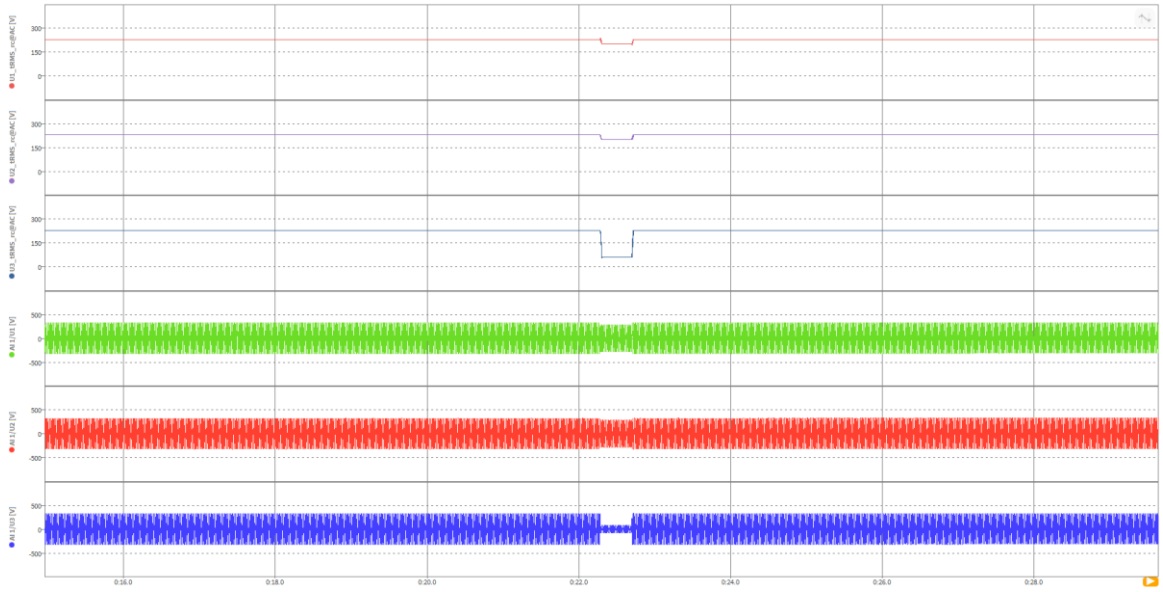
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2a-2.1 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),95% load
Test overview(voltage,current,active and reactive power)



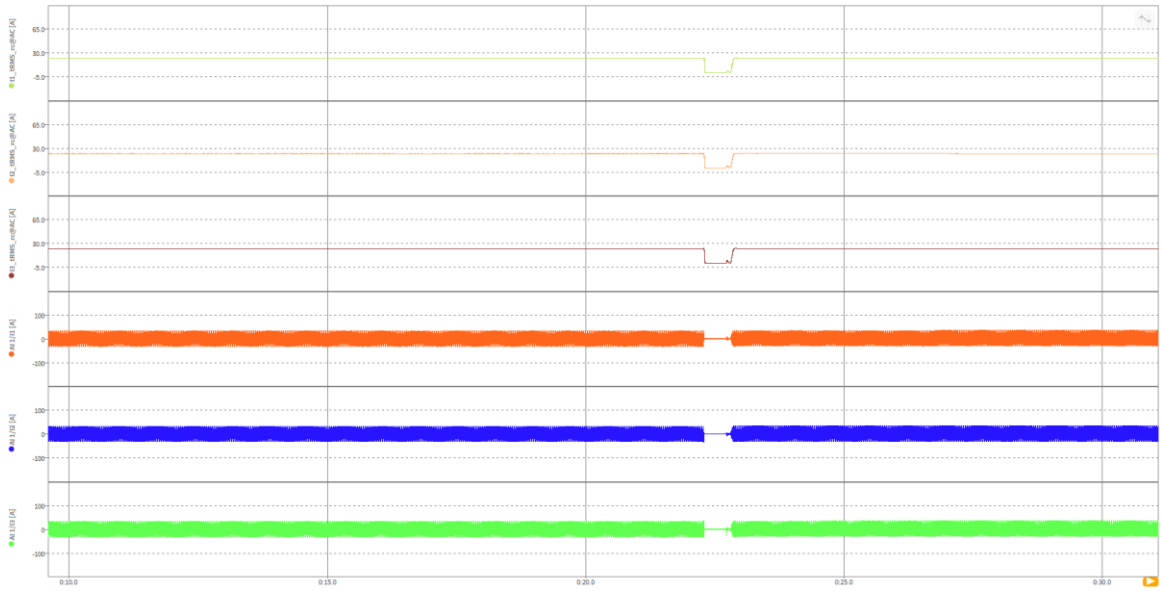
时间 [s]	A 0:22.27718	B 0:22.69366	间隔 0.41649
U1_tRMS_rc@AC [V]	229.3104	201.2698	-28.04062
U2_tRMS_rc@AC [V]	229.3375	201.2245	-28.11299
U3_tRMS_rc@AC [V]	229.4147	57.16638	-172.2483
I1_tRMS_rc@AC [A]	21.80141	0.586758	-21.21465
I2_tRMS_rc@AC [A]	21.87244	0.569992	-21.30245
I3_tRMS_rc@AC [A]	21.68409	0.180736	-21.70336
P_t_rc@AC [W]	15027.83	-0.998453	-15028.83
Q_t_rc@AC [var]	495.5216	243.1230	-252.3986

Test 2a-2.2 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

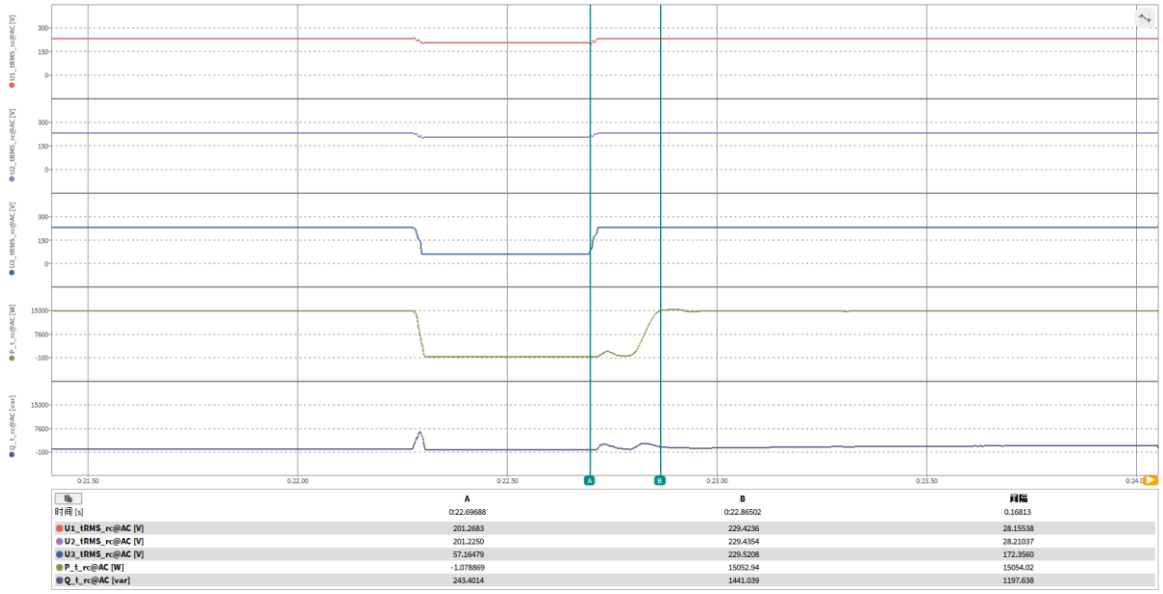


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 2a-2.3 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase currents

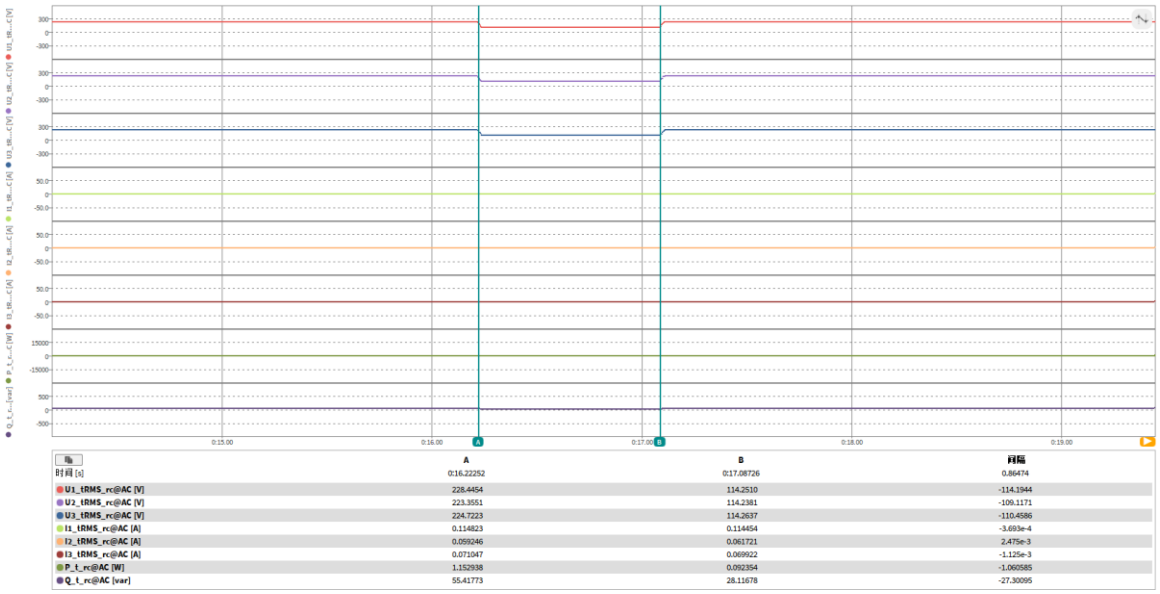


Test 2a-2.4 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D), 95% load
restoring time



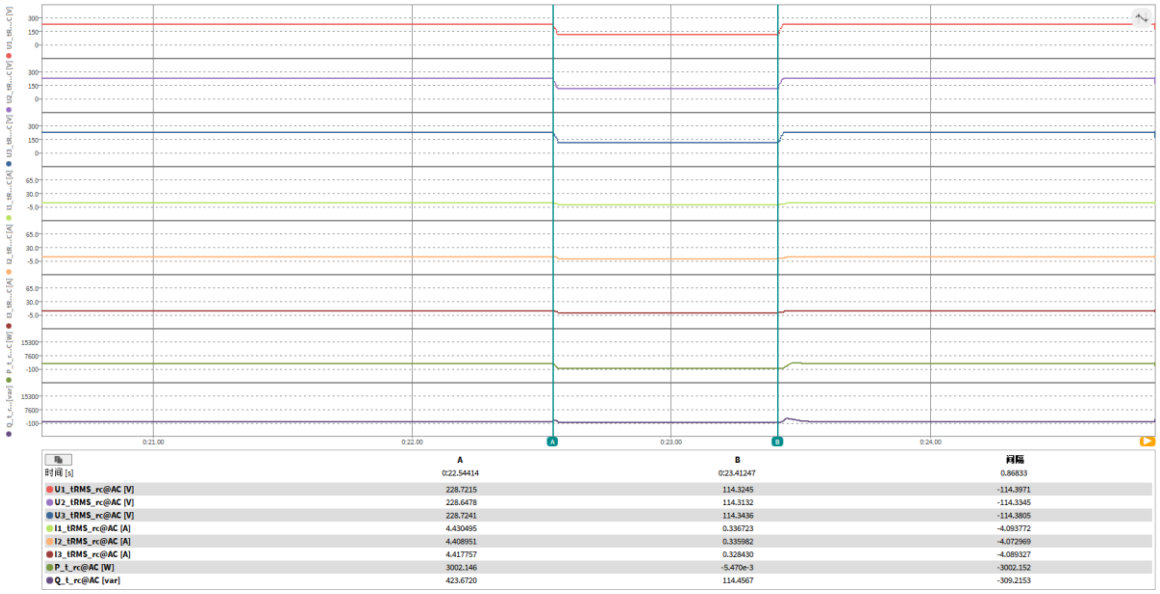
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3s-Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A), 0% load
Test overview(voltage,current,active and reactive power)



时间 [s]	A 0:16.22252	B 0:17.08726	间隔 0.86474
U1_tRMS_rc@AC [V]	228.4454	114.2510	-114.1944
U2_tRMS_rc@AC [V]	223.3551	114.2381	-109.1171
U3_tRMS_rc@AC [V]	224.7223	114.2637	-110.4586
I1_tRMS_rc@AC [A]	0.114823	0.114454	-3.693e-4
I2_tRMS_rc@AC [A]	0.059246	0.061721	2.475e-3
I3_tRMS_rc@AC [A]	0.071047	0.069922	-1.125e-3
P_t_rc@AC [W]	1.152938	0.092354	-1.060585
Q_t_rc@AC [var]	55.41773	28.11678	-27.30095

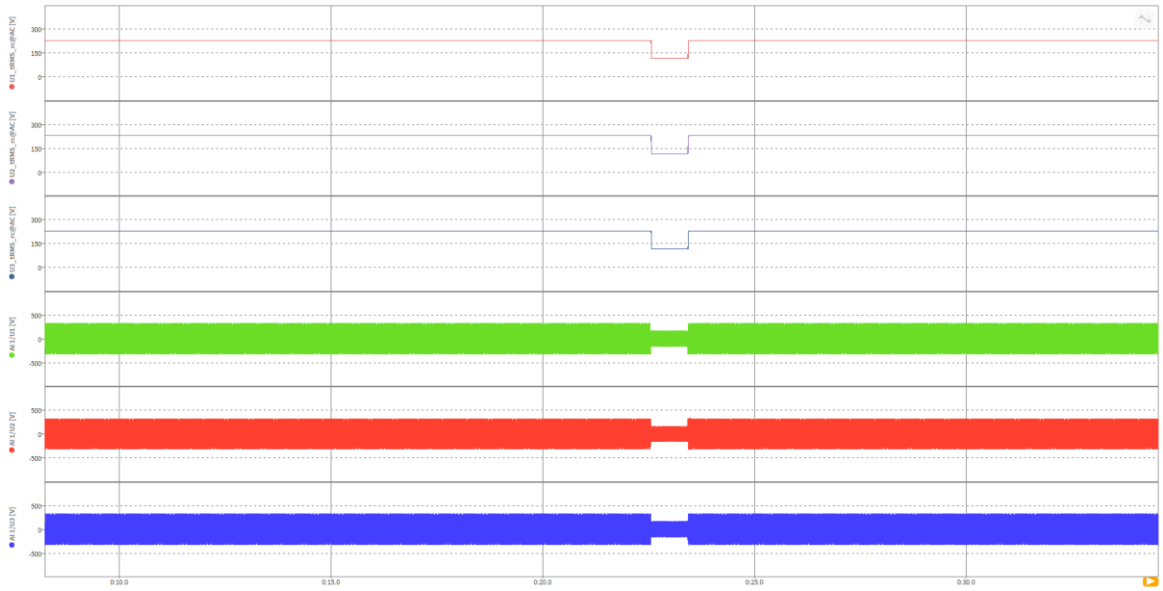
Test 3s-1.1 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)



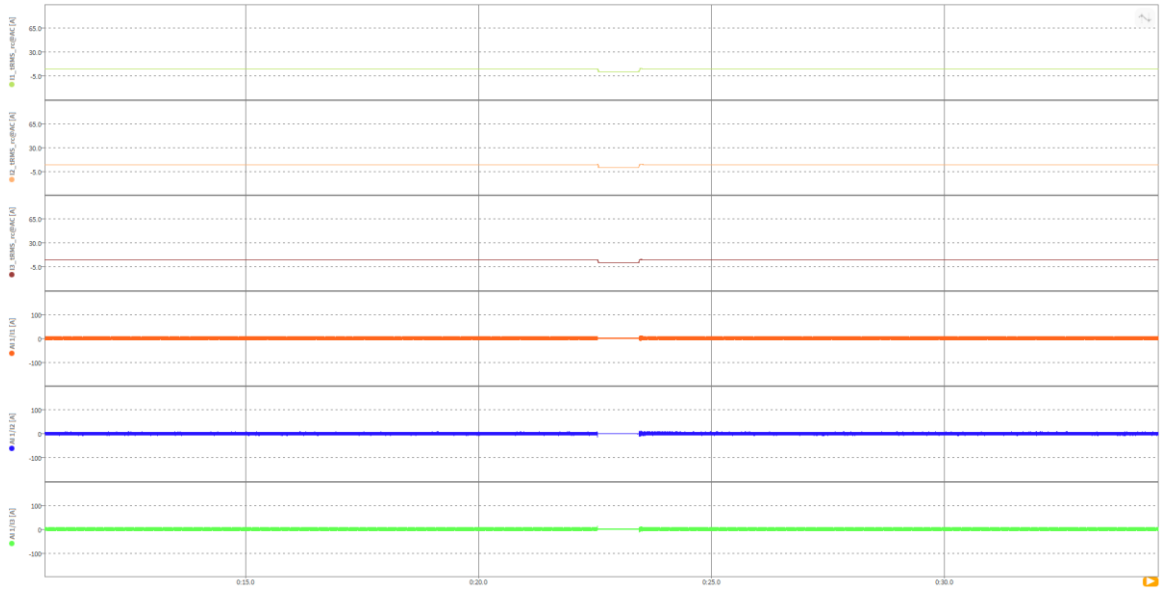
时间 [s]	A 0:22.54414	B 0:23.41247	间隔 0.86833
U1_tRMS_rc@AC [V]	228.7215	114.3245	-114.3971
U2_tRMS_rc@AC [V]	228.6478	114.3132	-114.3345
U3_tRMS_rc@AC [V]	228.7241	114.3436	-114.3805
I1_tRMS_rc@AC [A]	4.430495	0.336723	-4.093772
I2_tRMS_rc@AC [A]	4.408951	0.335982	-4.072969
I3_tRMS_rc@AC [A]	4.417757	0.328430	-4.089327
P_t_rc@AC [W]	3002.146	-5.470e-3	-3002.152
Q_t_rc@AC [var]	423.6720	114.4567	-309.2153

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3s-1.2 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

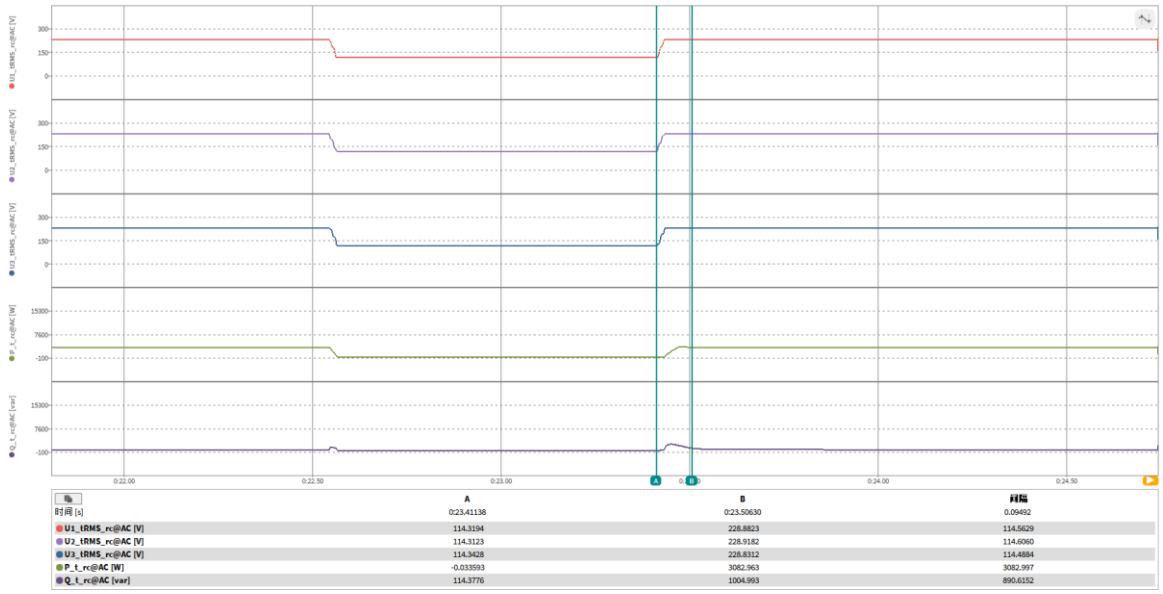


Test 3s-1.3 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents



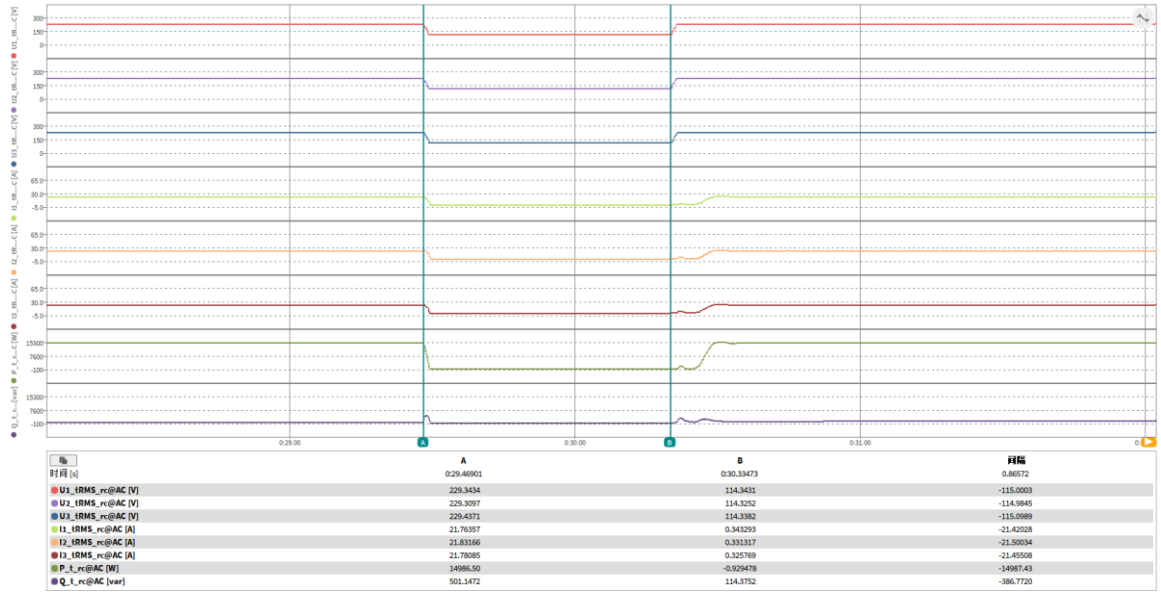
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3s-1.4 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),20% load restoring time



时间 [s]	A	B	间隔
	0:23.41138	0:23.50630	0.09492
U1_tRMS_rc@AC [V]	114.3194	228.8823	114.5629
U2_tRMS_rc@AC [V]	114.3123	228.9182	114.6060
U3_tRMS_rc@AC [V]	114.3428	228.8312	114.4884
P_t_rc@AC [W]	-0.033593	3082.963	3082.997
Q_t_rc@AC [var]	114.3776	1004.993	890.6152

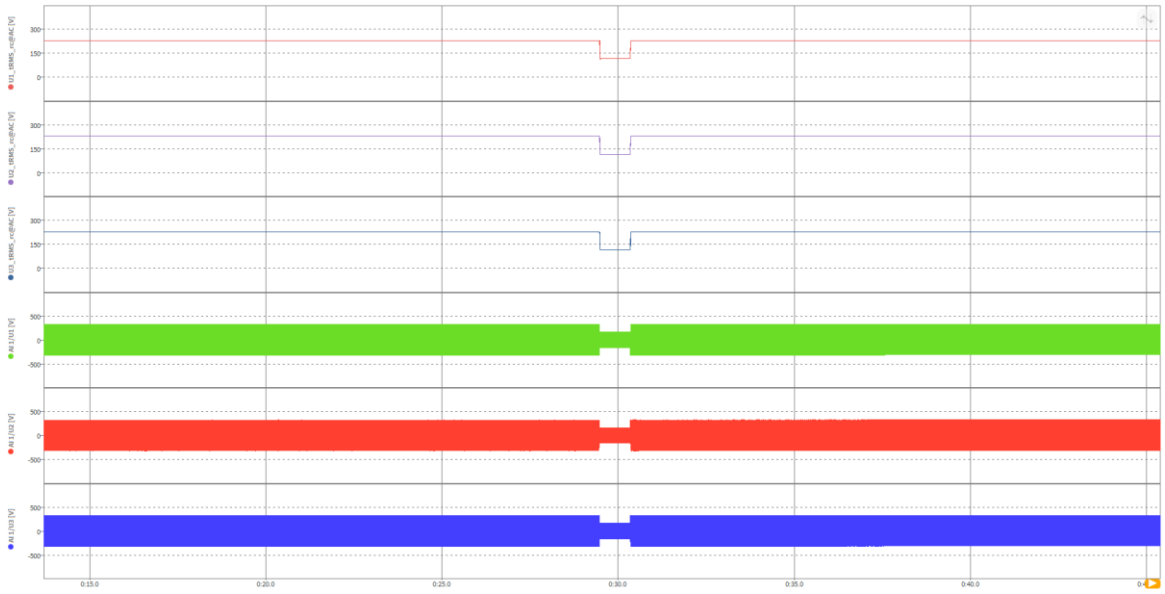
Test 3s-2.1 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),95% load
Test overview(voltage,current,active and reactive power)



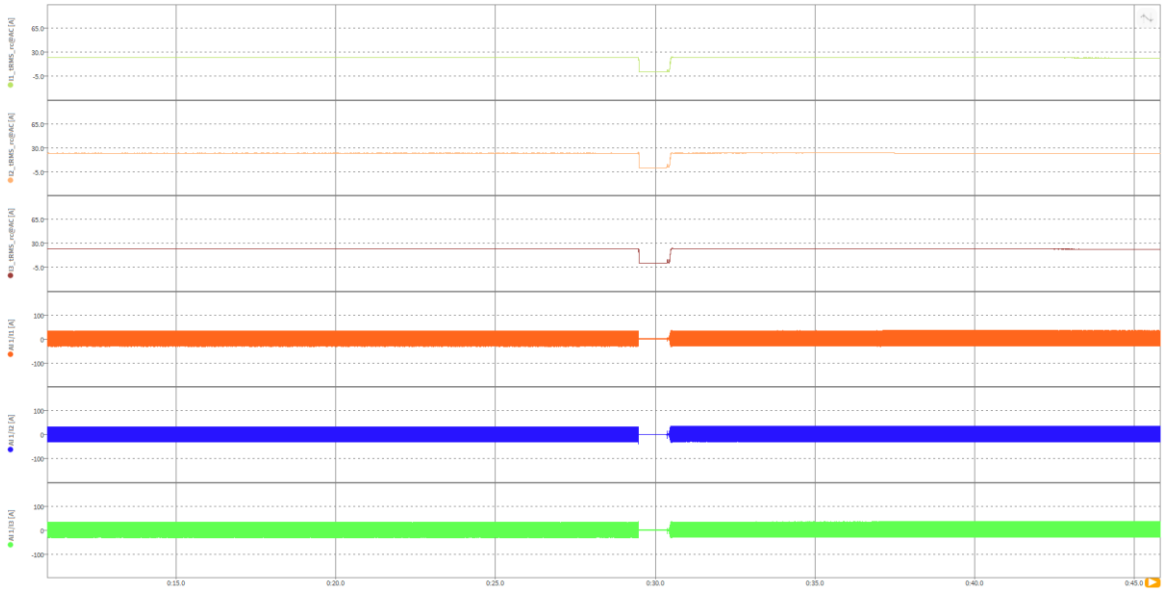
时间 [s]	A	B	间隔
	0:29.46901	0:30.33473	0.86572
U1_tRMS_rc@AC [V]	229.3434	114.3431	-115.0003
U2_tRMS_rc@AC [V]	229.3097	114.3252	-114.9845
U3_tRMS_rc@AC [V]	229.4371	114.3382	-115.0989
I1_tRMS_rc@AC [A]	21.76357	0.343293	-21.42028
I2_tRMS_rc@AC [A]	21.83166	0.331317	-21.50034
I3_tRMS_rc@AC [A]	21.78085	0.325769	-21.45508
P_t_rc@AC [W]	14986.50	-0.929478	-14987.43
Q_t_rc@AC [var]	501.1472	114.3752	-386.7720

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3s-2.2 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

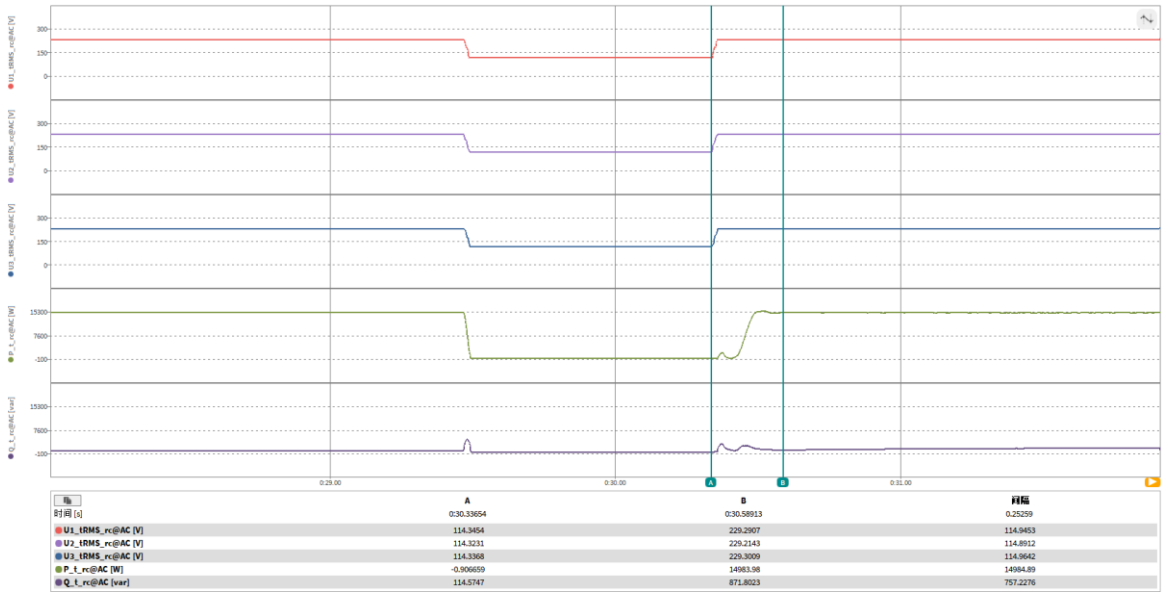


Test 3s-2.3 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents



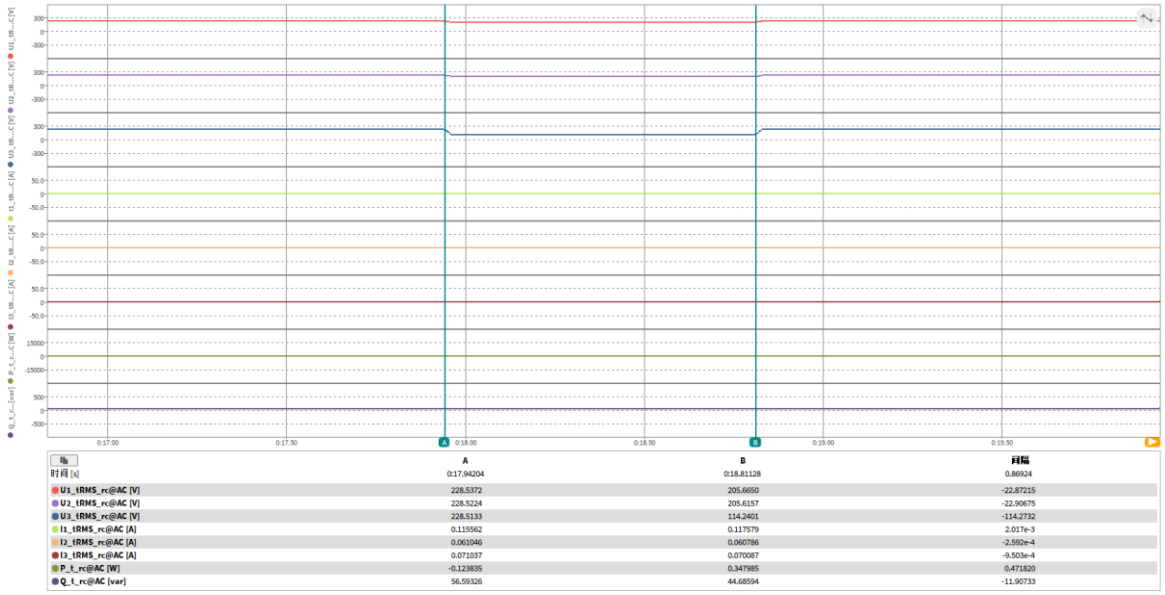
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3s-2.4 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A), 95% load restoring time



时间 [s]	A	B	Δ
	0:30.33654	0:30.58913	0.25259
U1_tRMS_rc@AC [V]	114.3454	229.2907	114.9453
U2_tRMS_rc@AC [V]	114.3231	229.2143	114.8912
U3_tRMS_rc@AC [V]	114.3368	229.3009	114.9642
P_t_rc@AC [W]	-0.906659	14983.98	14984.89
Q_t_rc@AC [var]	114.5747	871.8023	757.2276

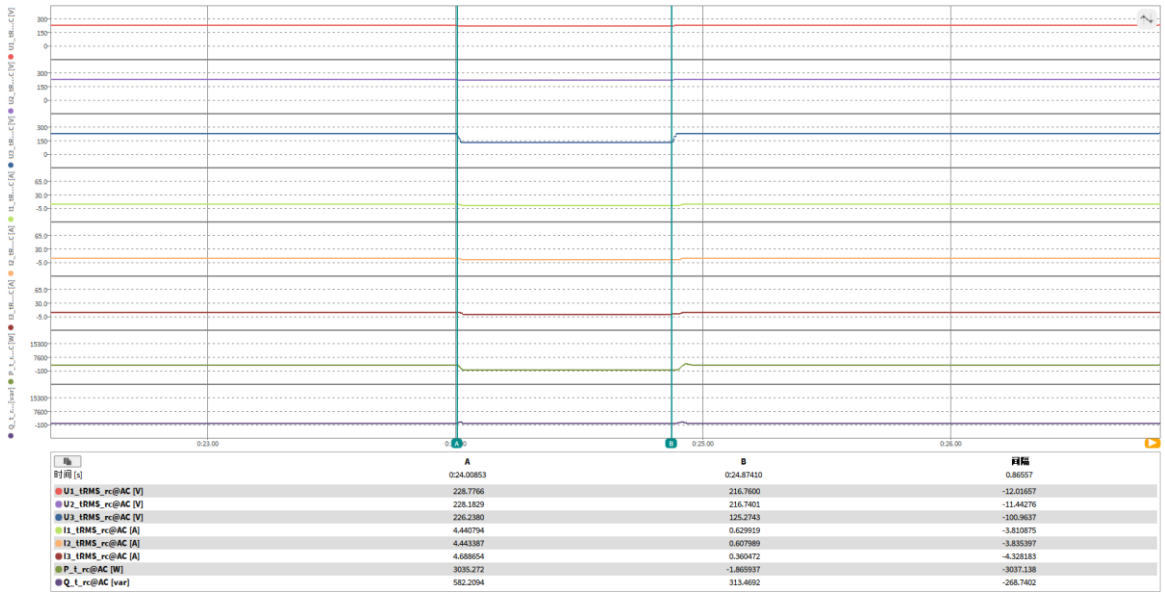
Test 3a-Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D), 0% load
Test overview(voltage,current,active and reactive power)



时间 [s]	A	B	Δ
	0:17.94204	0:18.81128	0.86924
U1_tRMS_rc@AC [V]	228.5372	205.6650	-22.87215
U2_tRMS_rc@AC [V]	228.5224	205.6157	-22.90675
U3_tRMS_rc@AC [V]	228.5133	114.2401	-114.2732
I1_tRMS_rc@AC [A]	0.115562	0.117579	2.017e-3
I2_tRMS_rc@AC [A]	0.061046	0.060786	-2.592e-4
I3_tRMS_rc@AC [A]	0.071037	0.070087	-9.503e-4
P_t_rc@AC [W]	-0.123835	0.347985	0.471820
Q_t_rc@AC [var]	56.59326	44.68594	-11.90733

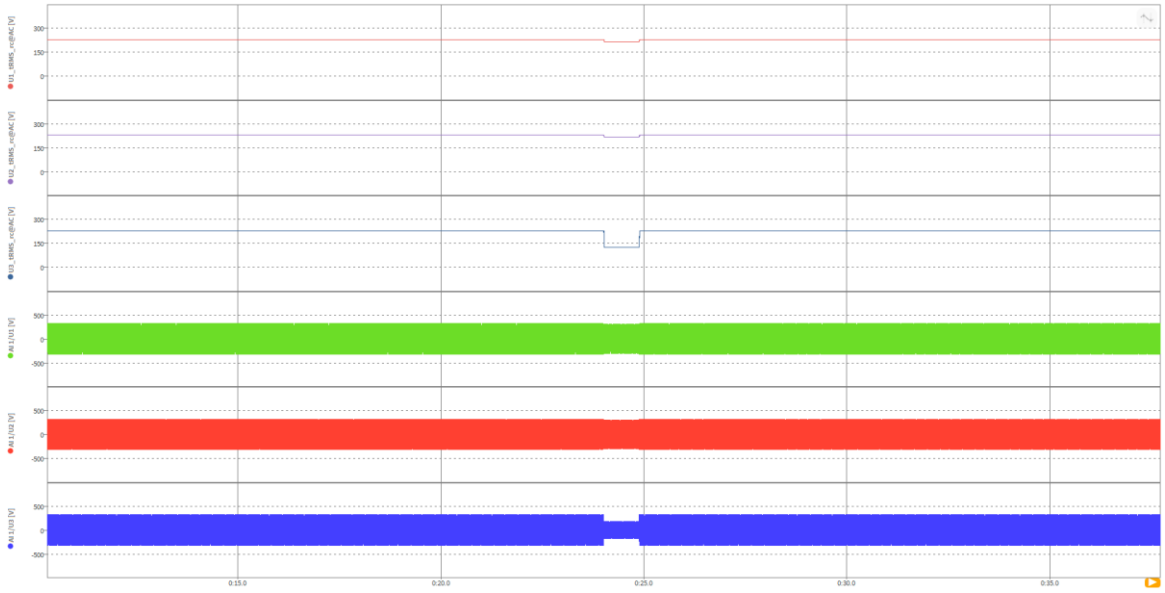
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3a-1.1 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),20% load
Test overview(voltage,current,active and reactive power)



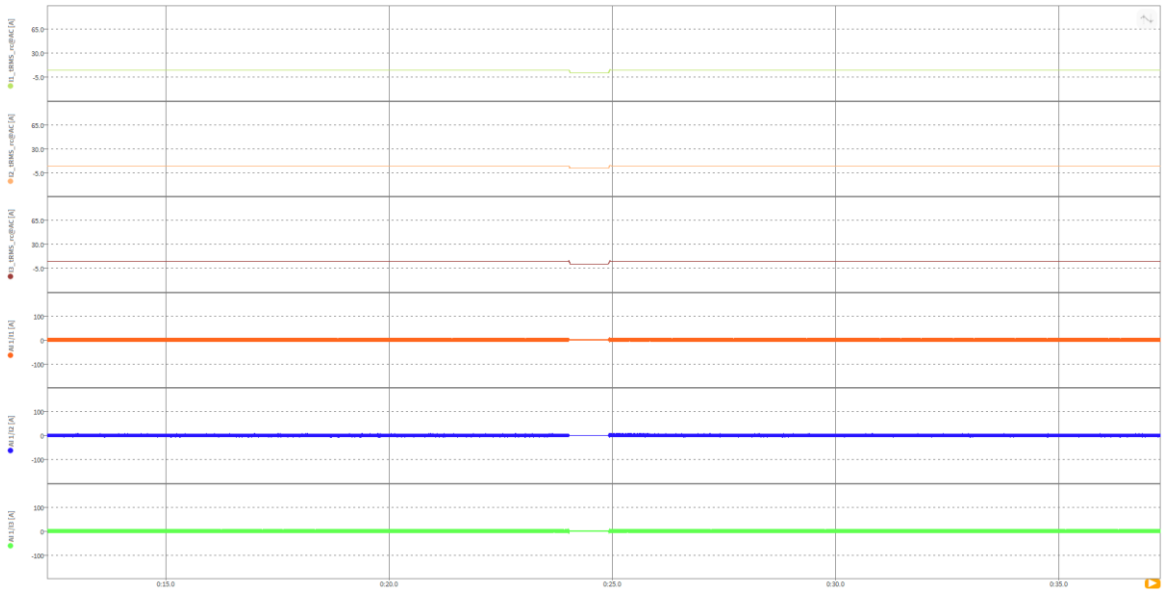
时间 [s]	A	B	RMS
U1_tRMS_rc@AC [V]	228.7766	216.7600	-12.01657
U2_tRMS_rc@AC [V]	228.1829	216.7401	-11.44276
U3_tRMS_rc@AC [V]	226.2380	125.2743	-100.9637
I1_tRMS_rc@AC [A]	4.440794	0.629919	-3.810875
I2_tRMS_rc@AC [A]	4.443387	0.607989	-3.835397
I3_tRMS_rc@AC [A]	4.688654	0.360472	-4.328183
P_t_rc@AC [W]	3035.272	-1.865937	-3037.138
Q_t_rc@AC [var]	582.2094	313.4692	-268.7402

Test 3a-1.2 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

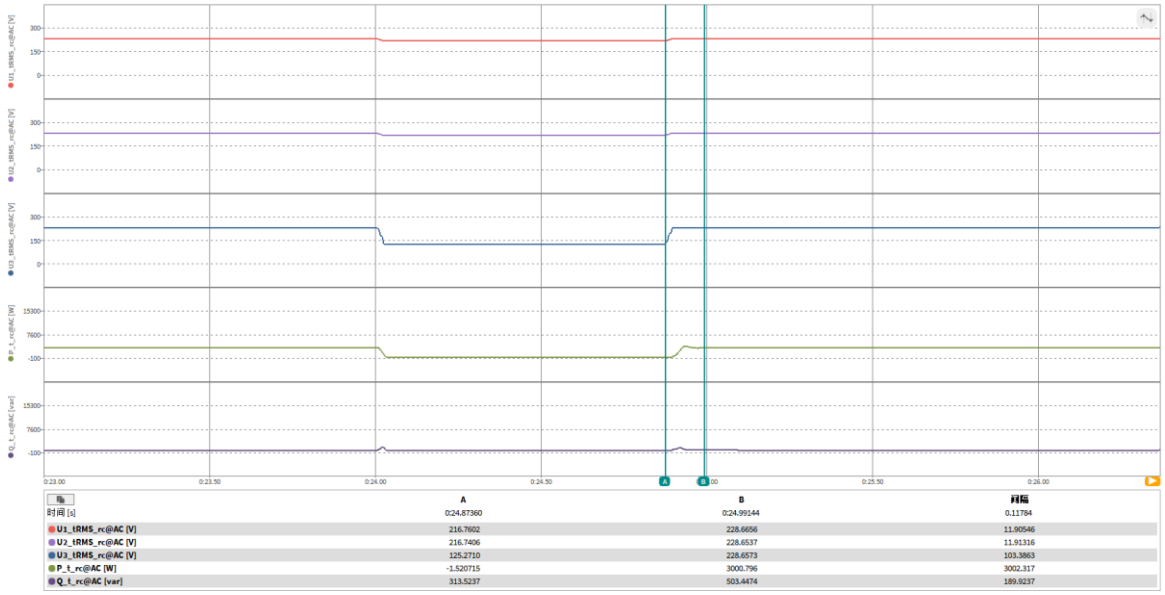


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3a-1.3 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase currents

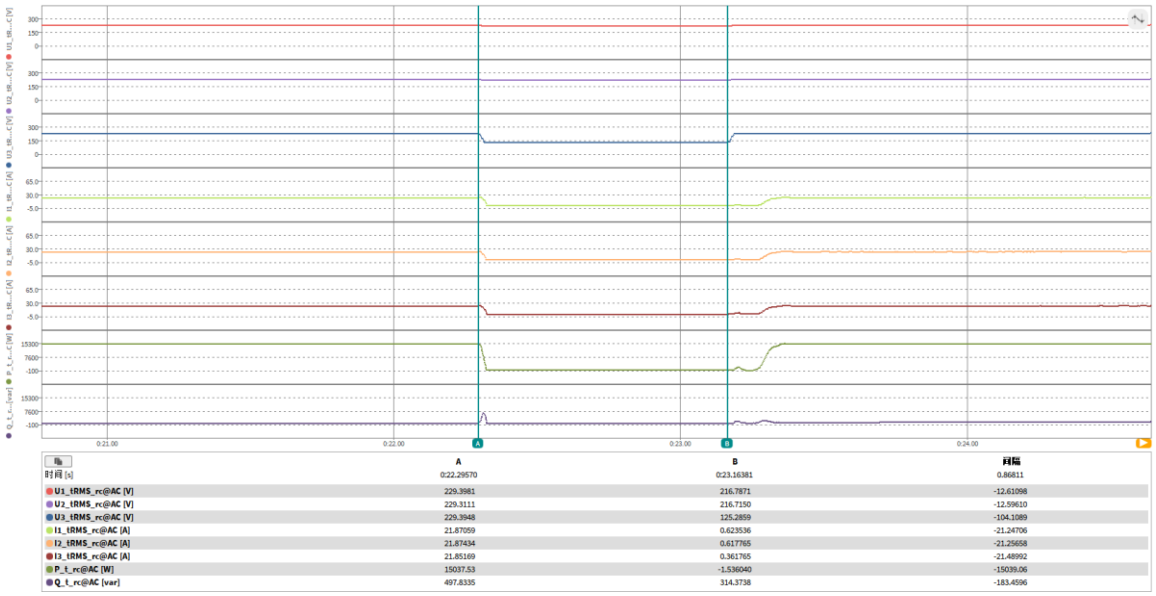


Test 3a-1.4 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),20% load
restoring time



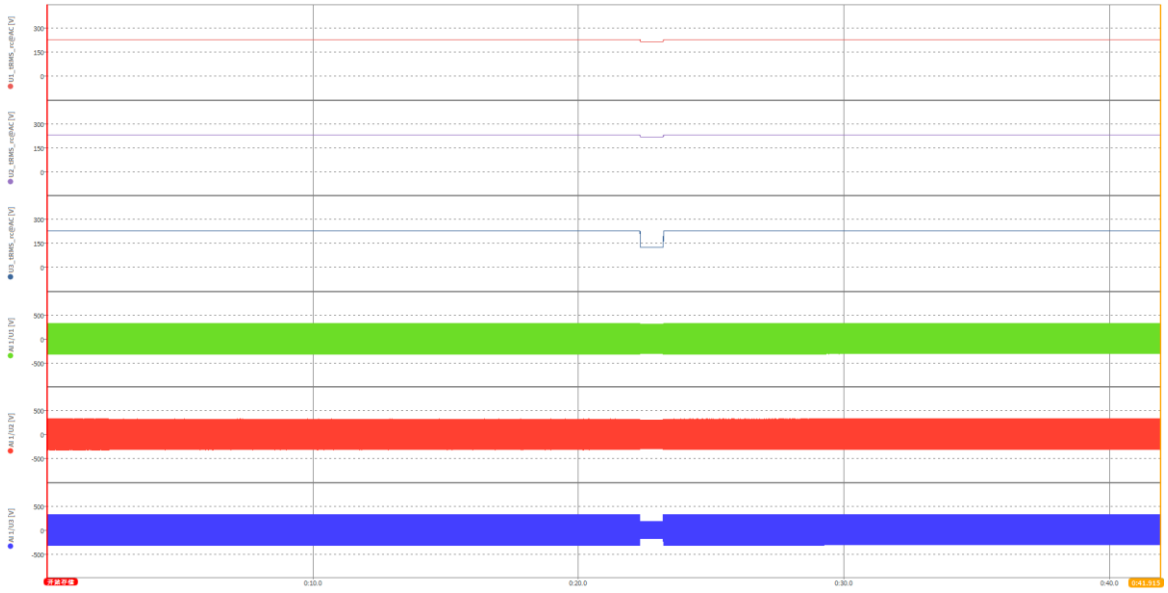
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3a-2.1 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),95% load
Test overview(voltage,current,active and reactive power)



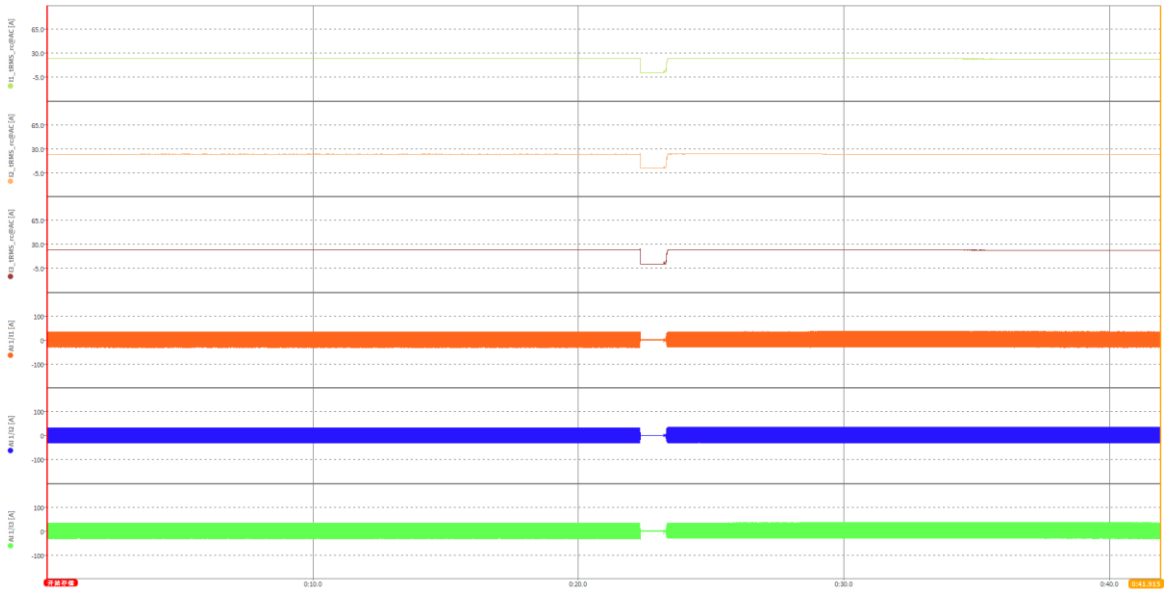
时间 [s]	A	B	间隔
	0:22.29570	0:23.16381	0.86811
U1_tRMS_rc@AC [V]	229.3981	216.7871	-12.61098
U2_tRMS_rc@AC [V]	229.3111	216.7150	-12.59610
U3_tRMS_rc@AC [V]	229.3948	125.2859	-104.1089
I1_tRMS_rc@AC [A]	21.87059	0.623536	-21.24706
I2_tRMS_rc@AC [A]	21.87434	0.617765	-21.25658
I3_tRMS_rc@AC [A]	21.85169	0.361765	-21.48992
P_t_rc@AC [W]	15037.53	-1.536040	-15039.06
Q_t_rc@AC [var]	497.8335	314.3738	-183.4596

Test 3a-2.2 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

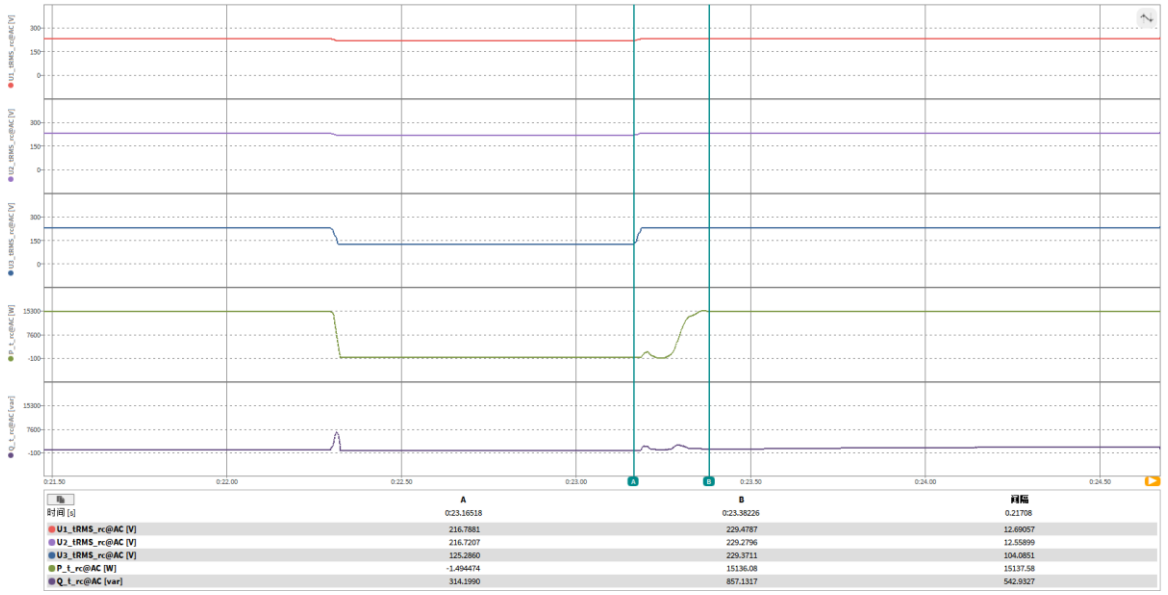


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 3a-2.3 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase currents

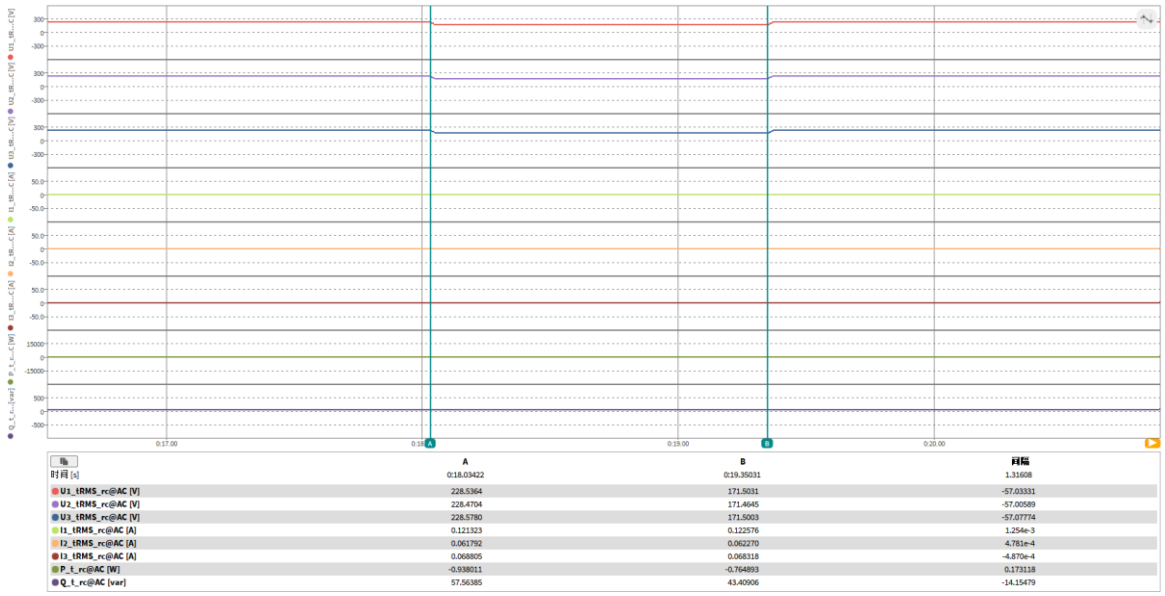


Test 3a-2.4 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D), 95% load
restoring time



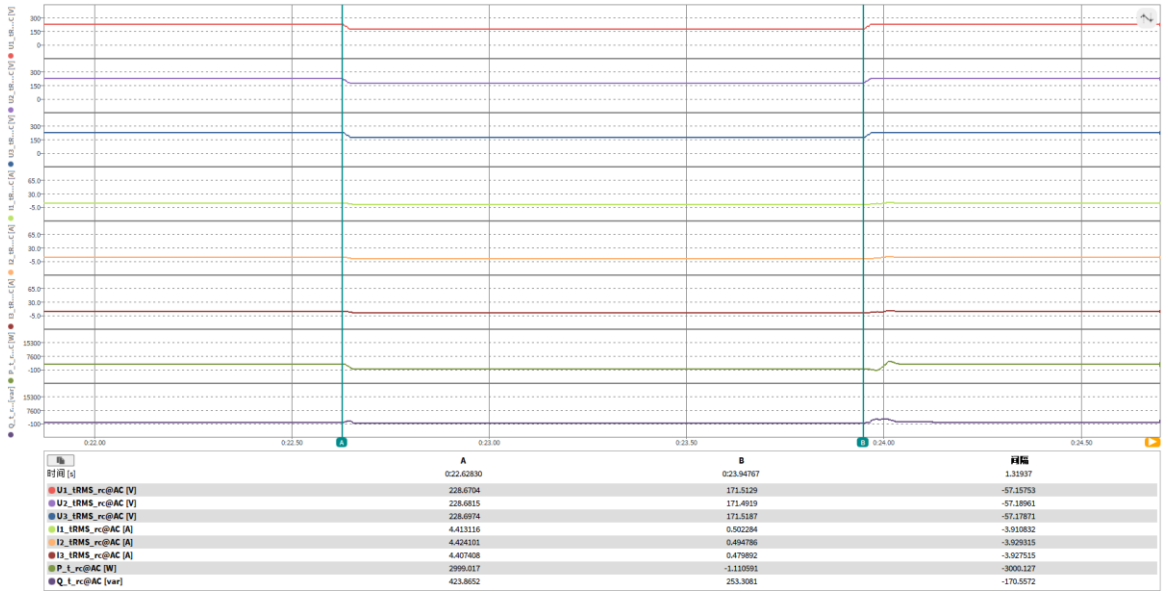
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4s-Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A), 0% load
Test overview(voltage,current,active and reactive power)



时间 [s]	A	B	间隔
U1_tRMS_rc@AC [V]	228.5364	171.5031	-57.03331
U2_tRMS_rc@AC [V]	228.4704	171.4645	-57.00589
U3_tRMS_rc@AC [V]	228.5780	171.5003	-57.07774
I1_tRMS_rc@AC [A]	0.121323	0.122576	1.254e-3
I2_tRMS_rc@AC [A]	0.061792	0.062270	4.781e-4
I3_tRMS_rc@AC [A]	0.068805	0.068318	-4.870e-4
P_t_rc@AC [W]	-0.938011	-0.764893	0.173118
Q_t_rc@AC [var]	57.56385	43.40906	-14.15479

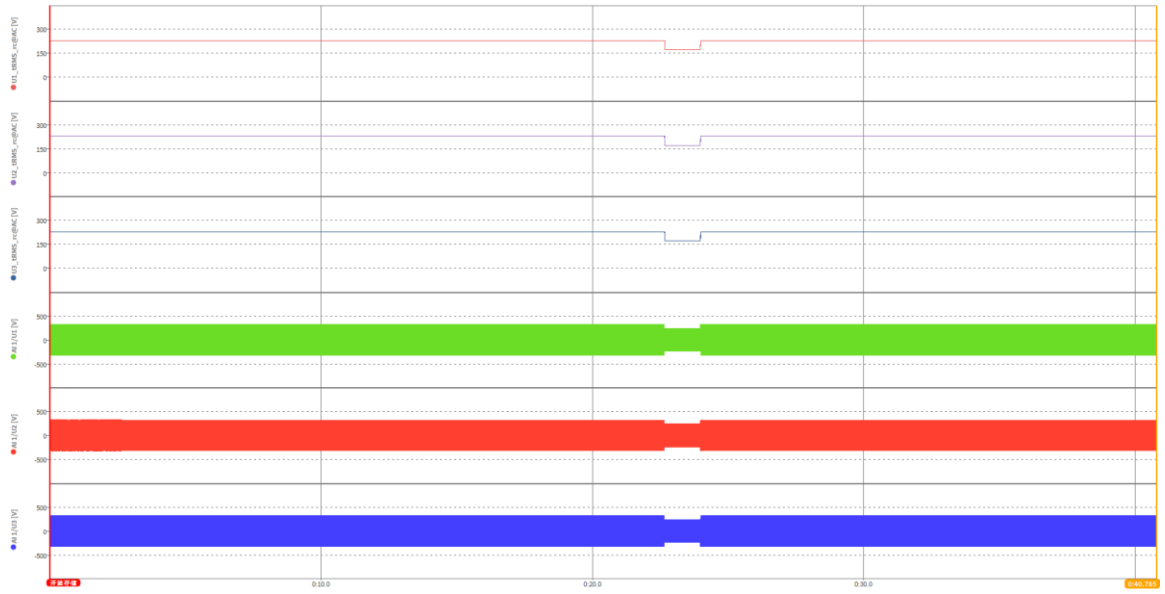
Test 4s-1.1 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)



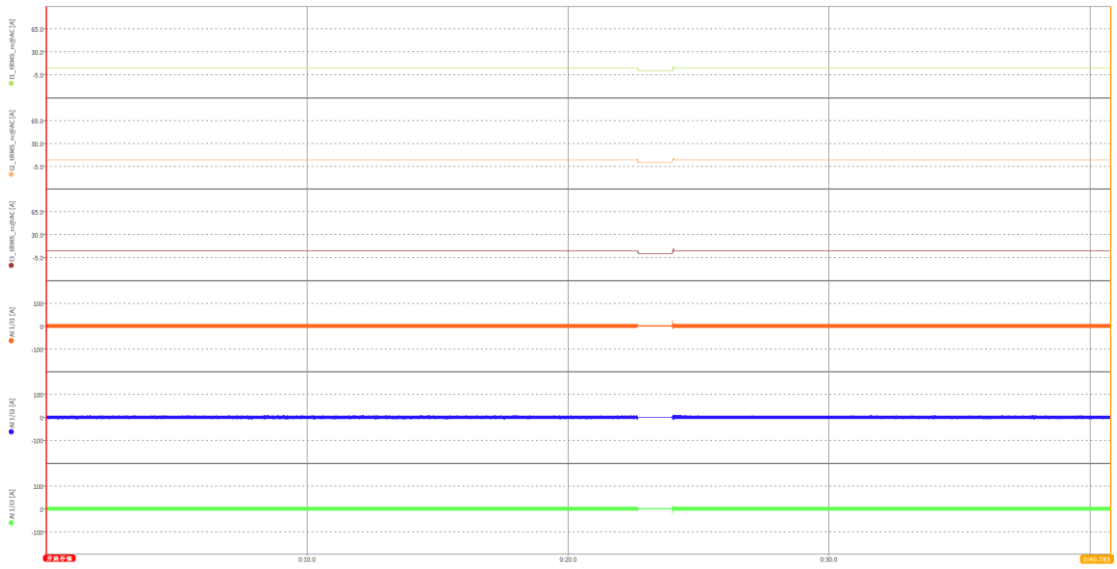
时间 [s]	A	B	间隔
U1_tRMS_rc@AC [V]	228.6704	171.5129	-57.15753
U2_tRMS_rc@AC [V]	228.6815	171.4919	-57.18961
U3_tRMS_rc@AC [V]	228.6974	171.5187	-57.17871
I1_tRMS_rc@AC [A]	4.413116	0.502284	-3.910832
I2_tRMS_rc@AC [A]	4.424101	0.494786	-3.929315
I3_tRMS_rc@AC [A]	4.407408	0.479892	-3.927515
P_t_rc@AC [W]	2999.017	-1.110591	-3000.127
Q_t_rc@AC [var]	423.8652	253.3081	-170.5572

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4s-1.2 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

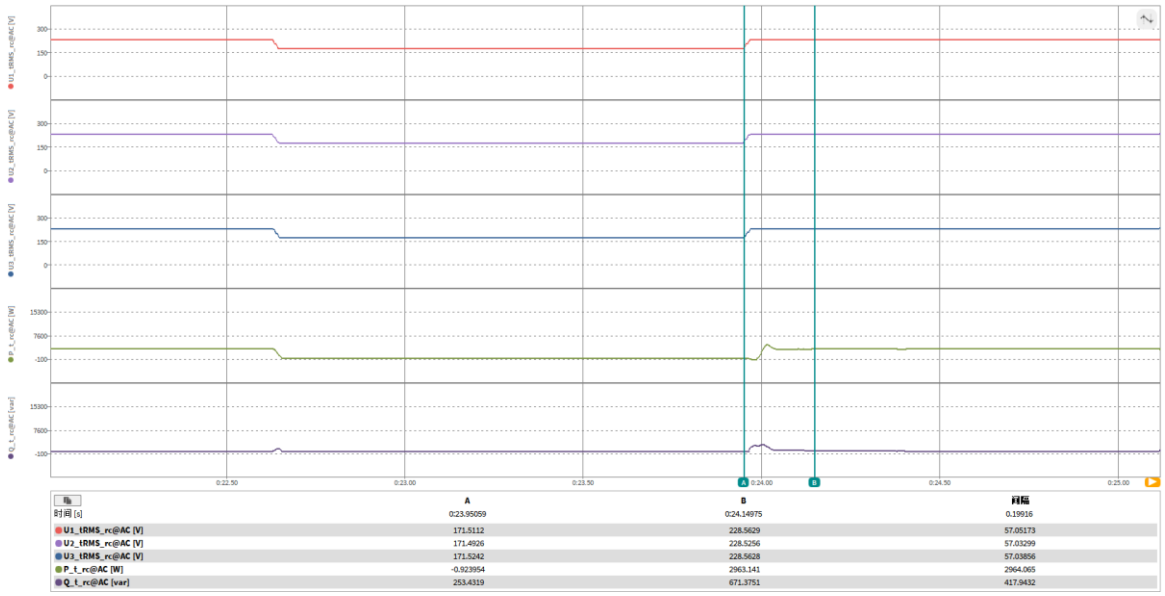


Test 4s-1.3 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents



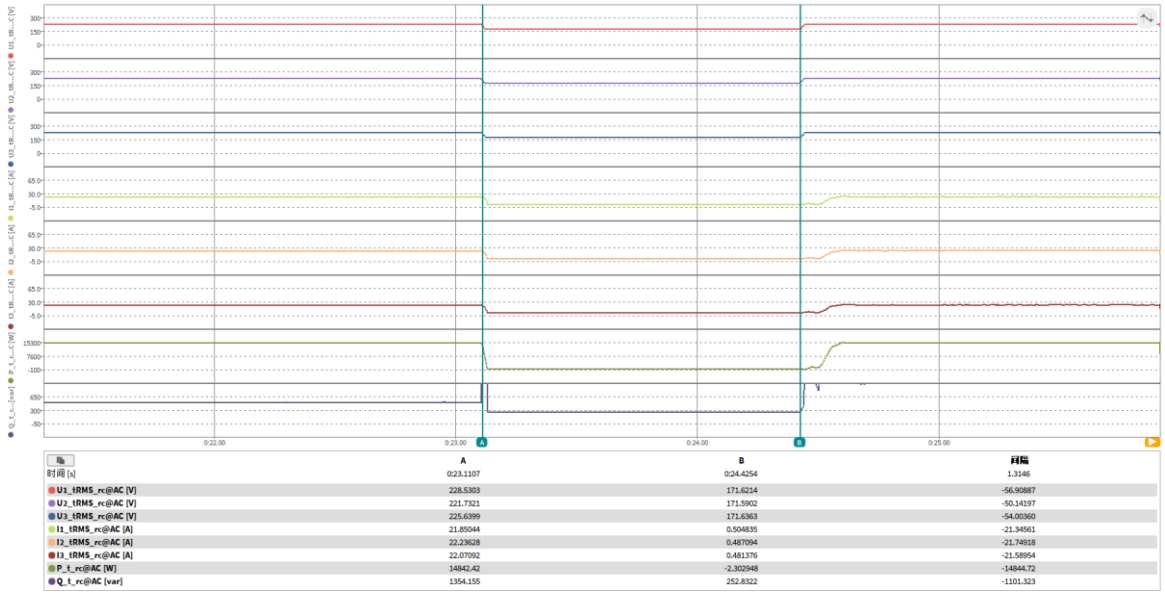
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4s-1.4 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),20% load restoring time



时间 [s]	A	B	间隔
	0:23.95059	0:24.14975	0.19916
U1_tRMS_rc@AC [V]	171.5112	228.5629	57.05173
U2_tRMS_rc@AC [V]	171.4926	228.5256	57.03299
U3_tRMS_rc@AC [V]	171.5242	228.5628	57.03856
P_t_rc@AC [W]	-0.923954	2963.141	2964.065
Q_t_rc@AC [var]	253.4319	671.3751	417.9432

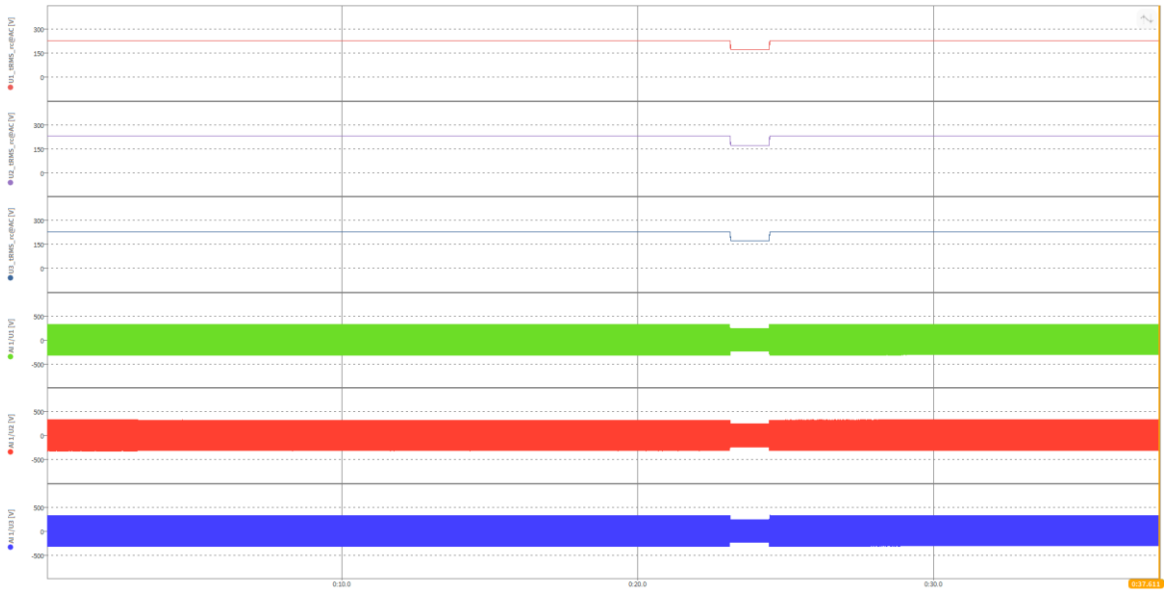
Test 4s-2.1 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),95% load
Test overview(voltage,current,active and reactive power)



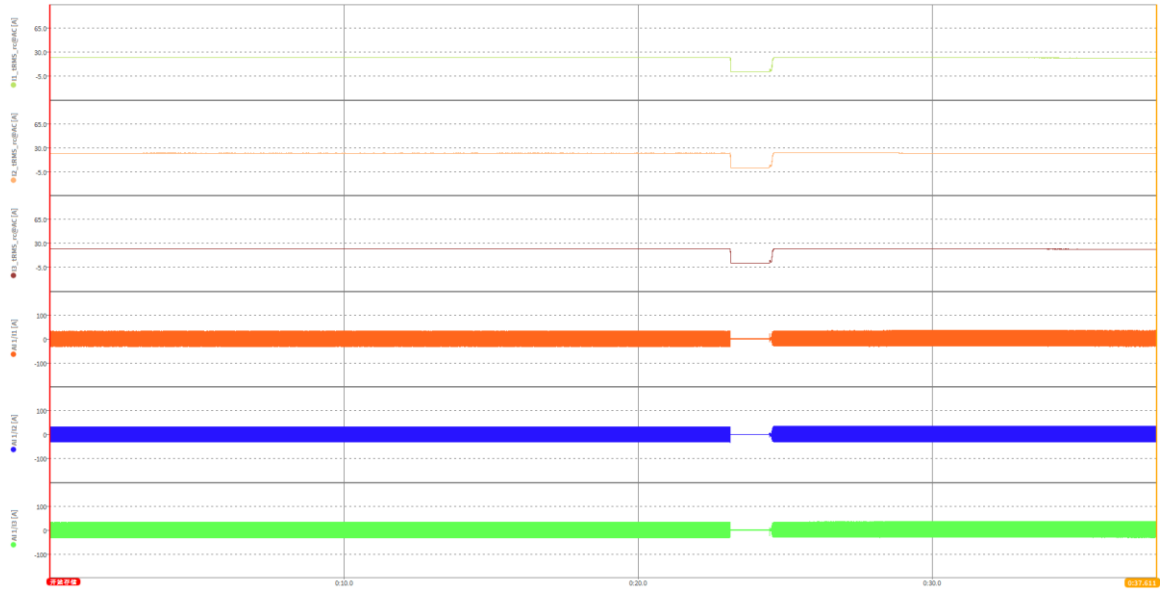
时间 [s]	A	B	间隔
	0:23.1107	0:24.4254	1.3146
U1_tRMS_rc@AC [V]	228.5303	171.6214	-56.90887
U2_tRMS_rc@AC [V]	221.7321	171.5902	-50.14197
U3_tRMS_rc@AC [V]	225.6399	171.6363	-54.00360
I1_tRMS_rc@AC [A]	21.85044	0.504835	-21.34561
I2_tRMS_rc@AC [A]	22.23628	0.487094	-21.74918
I3_tRMS_rc@AC [A]	22.07092	0.481376	-21.58954
P_t_rc@AC [W]	14842.42	-2.302948	-14844.72
Q_t_rc@AC [var]	1354.155	252.8322	-1101.323

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4s-2.2 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

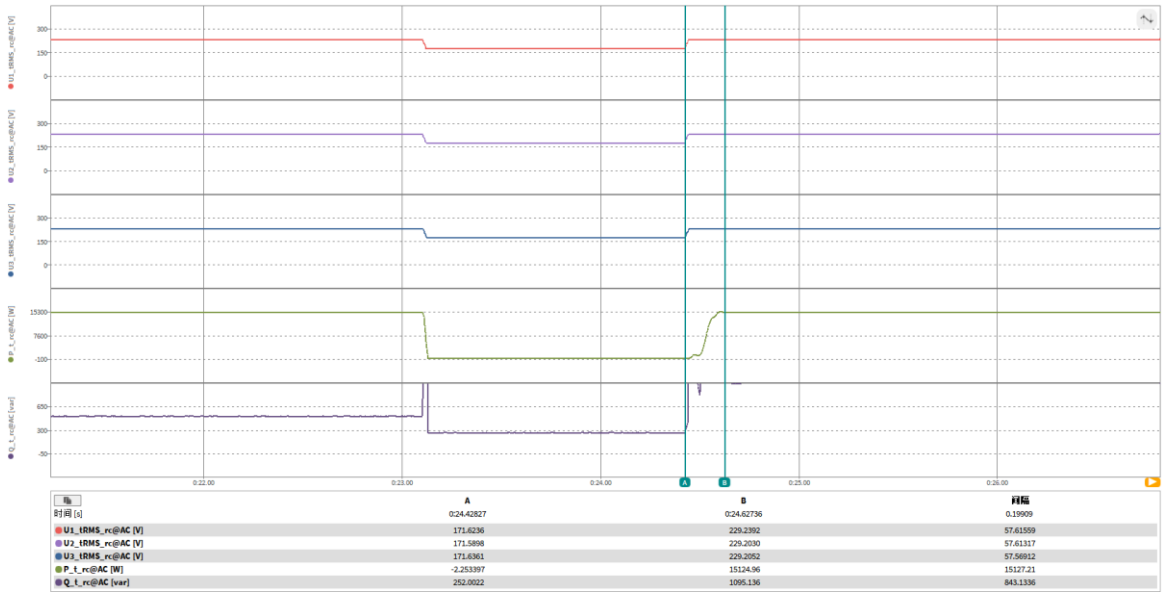


Test 4s-2.3 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents



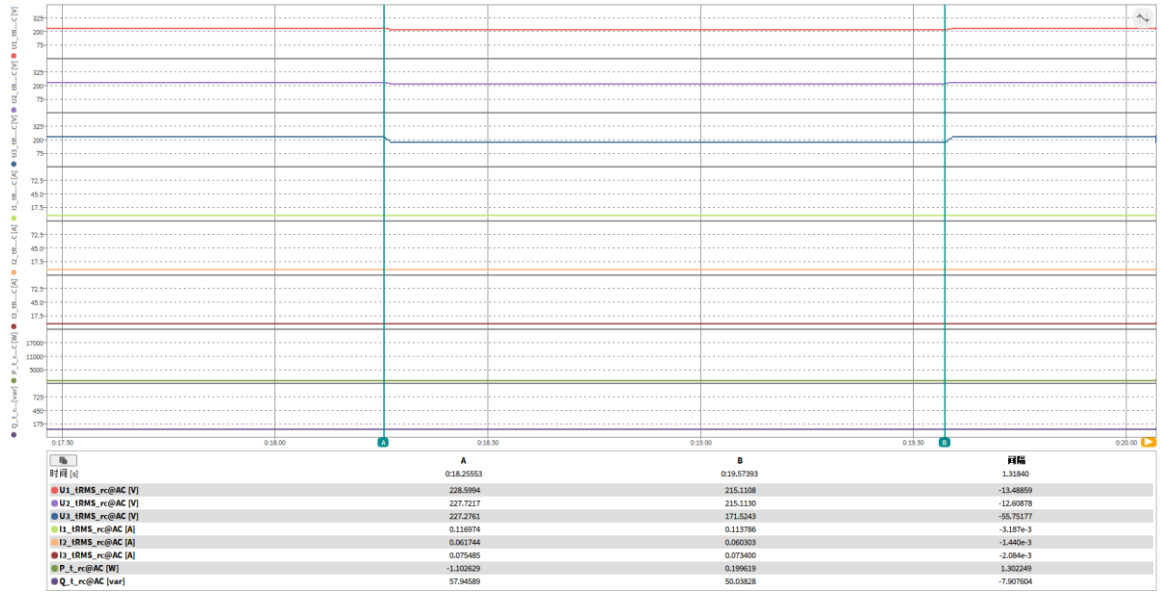
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4s-2.4 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A), 95% load restoring time



时间 [s]	A	B	间隔
	0:24.42827	0:24.62736	0.19909
U1_tRMS_rc@AC [V]	171.6236	229.2392	57.61559
U2_tRMS_rc@AC [V]	171.5898	229.2030	57.61317
U3_tRMS_rc@AC [V]	171.6361	229.2052	57.56912
P_t_rc@AC [W]	-2.253397	15124.96	15127.21
Q_t_rc@AC [var]	252.0022	1095.136	843.1336

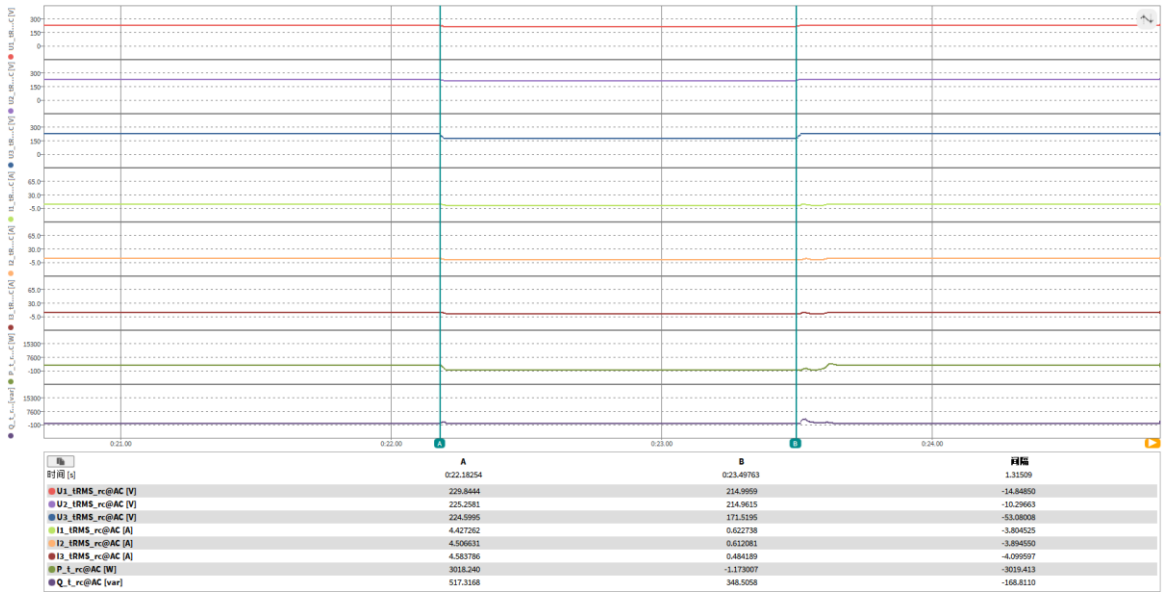
Test 4a-Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D), 0% load
Test overview(voltage,current,active and reactive power)



时间 [s]	A	B	间隔
	0:18.25553	0:19.57393	1.31840
U1_tRMS_rc@AC [V]	228.5994	215.1108	-13.48859
U2_tRMS_rc@AC [V]	227.7217	215.1130	-12.60878
U3_tRMS_rc@AC [V]	227.2761	171.5243	-55.75177
I1_tRMS_rc@AC [A]	0.116974	0.113786	-3.187e-3
I2_tRMS_rc@AC [A]	0.061744	0.060303	-1.440e-3
I3_tRMS_rc@AC [A]	0.075485	0.073400	-2.084e-3
P_t_rc@AC [W]	-1.102629	0.199619	1.302249
Q_t_rc@AC [var]	57.94589	50.03828	-7.907604

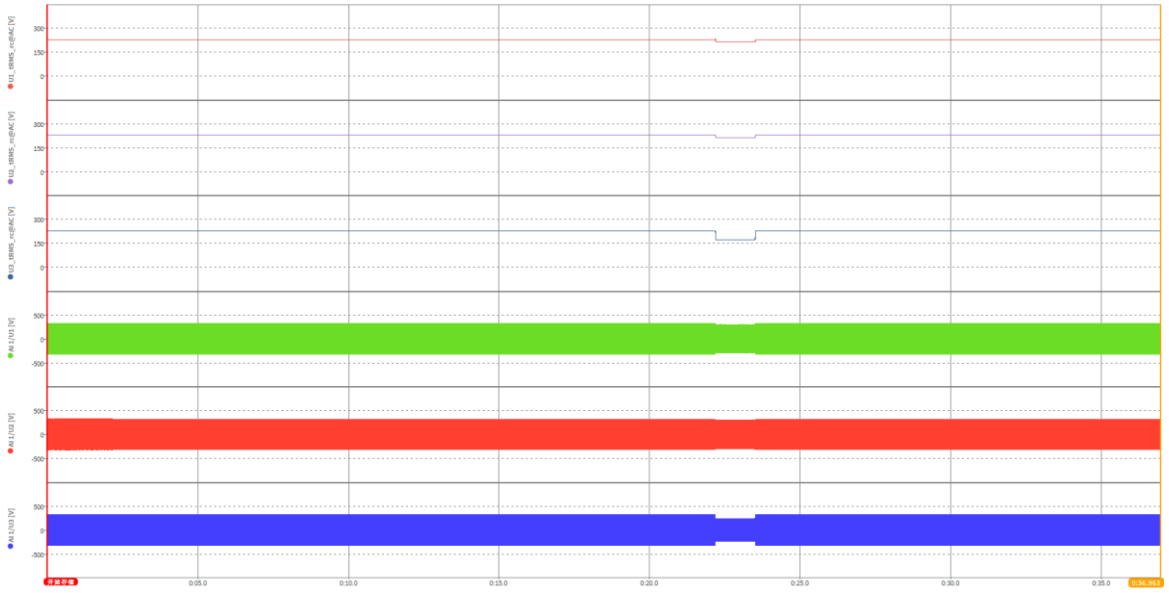
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4a-1.1 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),20% load
Test overview(voltage,current,active and reactive power)



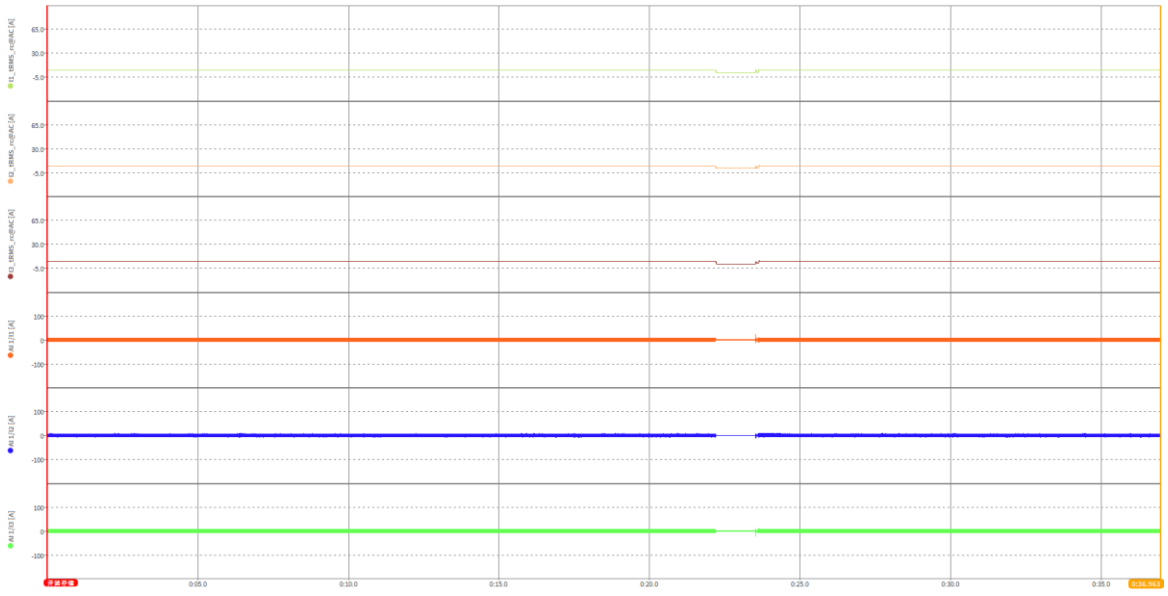
时间 [s]	A 0:22.18254	B 0:23.49763	间隔 1.31509
U1_tRMS_rc@AC [V]	229.8444	214.9959	-14.84850
U2_tRMS_rc@AC [V]	225.2581	214.9615	-10.29663
U3_tRMS_rc@AC [V]	224.5995	171.5195	-53.08008
I1_tRMS_rc@AC [A]	4.427262	0.622738	-3.804525
I2_tRMS_rc@AC [A]	4.506631	0.612081	-3.894550
I3_tRMS_rc@AC [A]	4.583786	0.484189	-4.099597
P_t_rc@AC [W]	3018.240	-1.173007	-3019.413
Q_t_rc@AC [var]	517.3168	348.5058	-168.8110

Test 4a-1.2 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

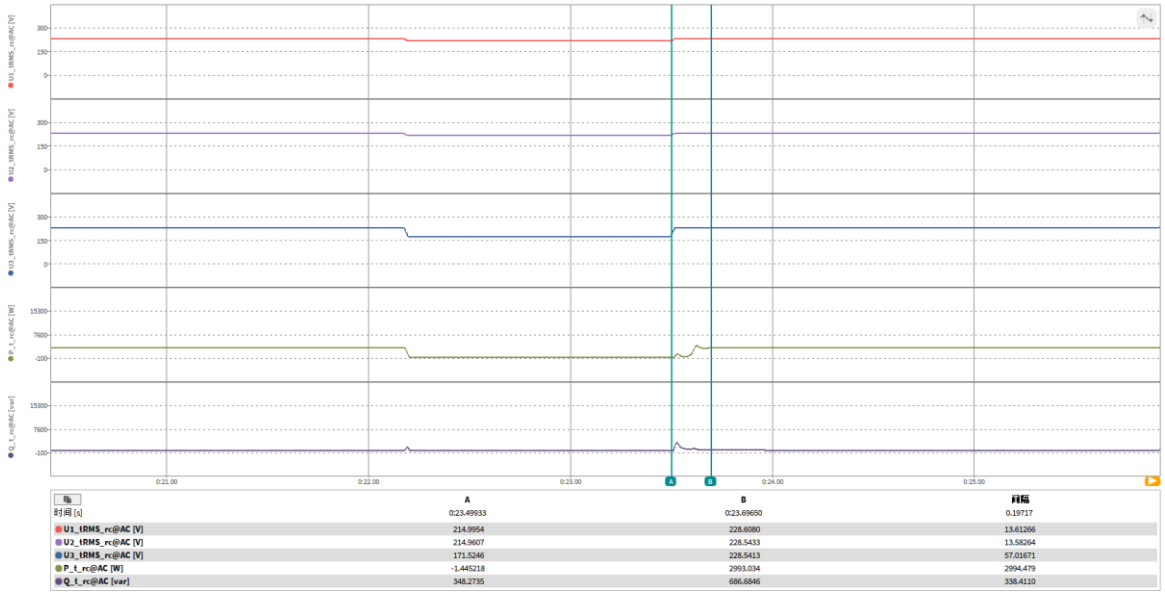


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4a-1.3 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase currents

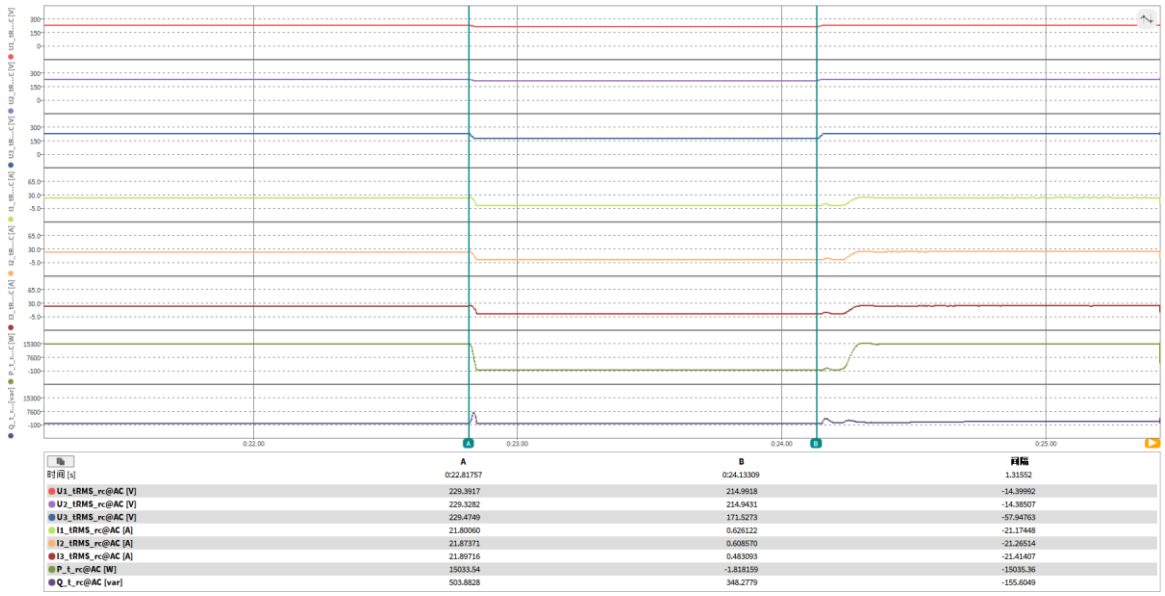


Test 4a-1.4 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),20% load
restoring time



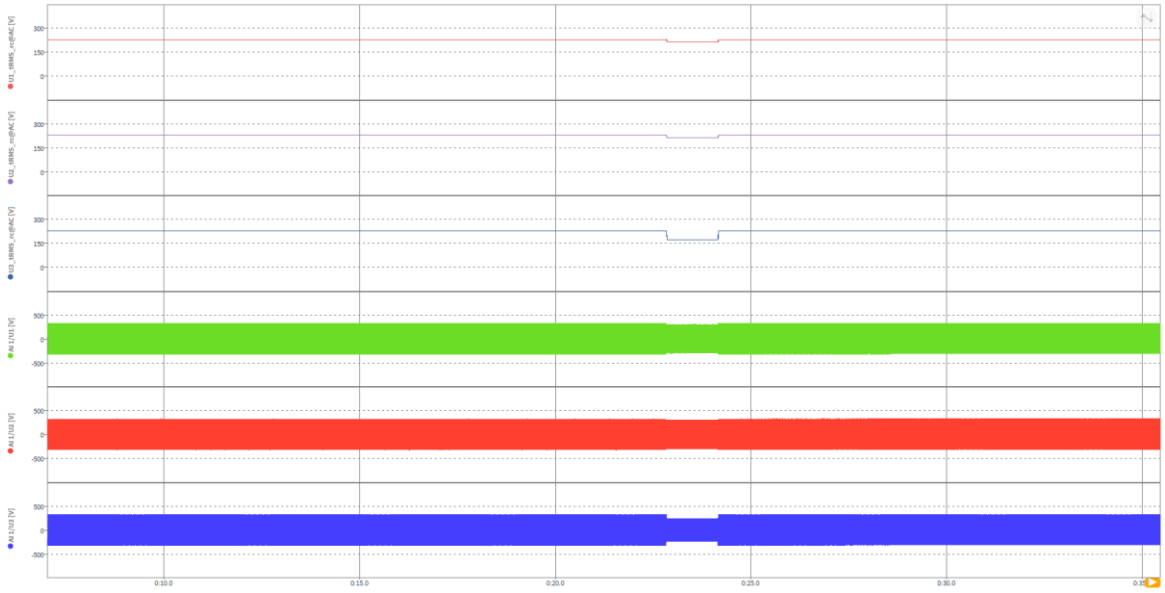
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4a-2.1 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),95% load
Test overview(voltage,current,active and reactive power)



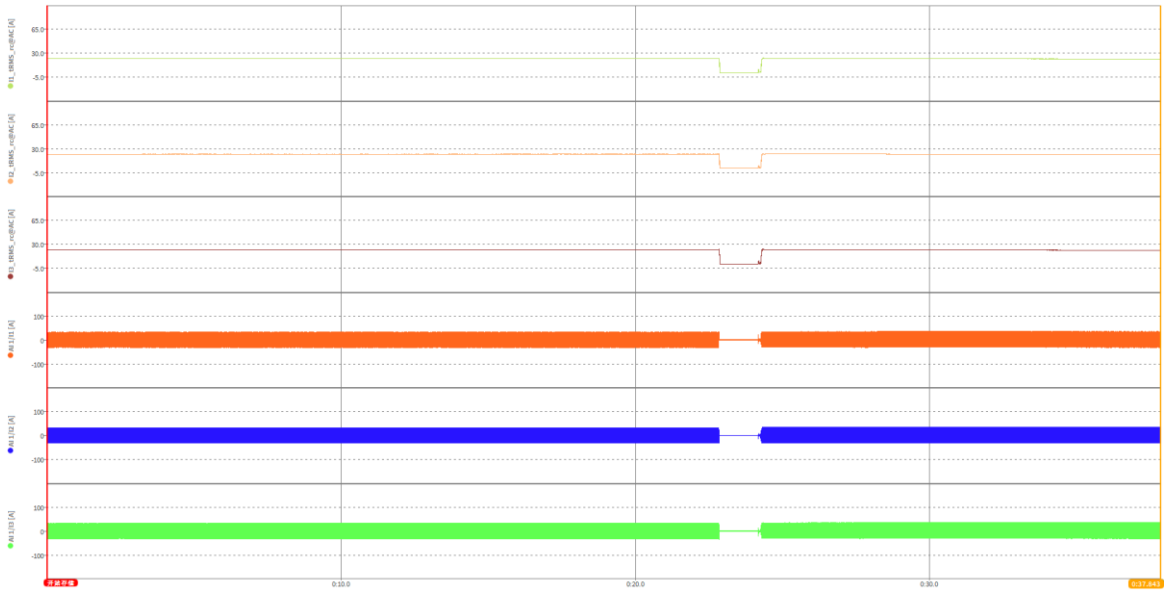
时间 [s]	A	B	Δ
	0:22.81757	0:24.13309	1.31552
U1_tRMS_rc@AC [V]	229.3917	214.9918	-14.39992
U2_tRMS_rc@AC [V]	229.3282	214.9431	-14.38507
U3_tRMS_rc@AC [V]	229.4749	171.5273	-57.94763
I1_tRMS_rc@AC [A]	21.80060	0.626122	-21.17448
I2_tRMS_rc@AC [A]	21.87371	0.608570	-21.26514
I3_tRMS_rc@AC [A]	21.89716	0.483093	-21.41407
P_t_rc@AC [W]	15033.54	-1.818159	-15035.36
Q_t_rc@AC [var]	503.8828	348.2779	-155.6049

Test 4a-2.2 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

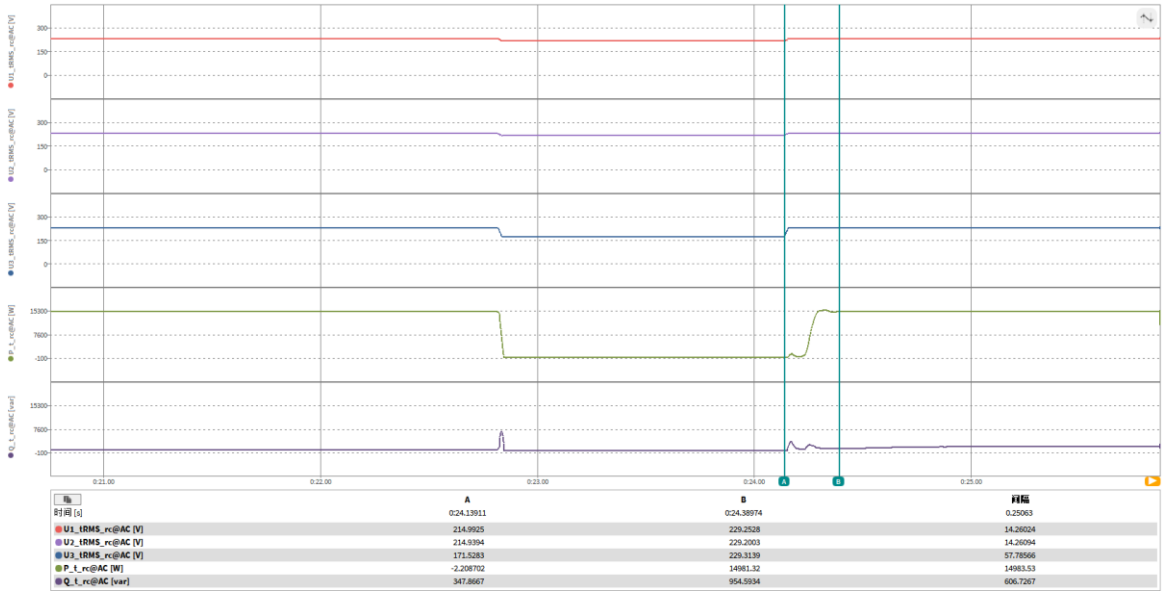


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 4a-2.3 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase currents

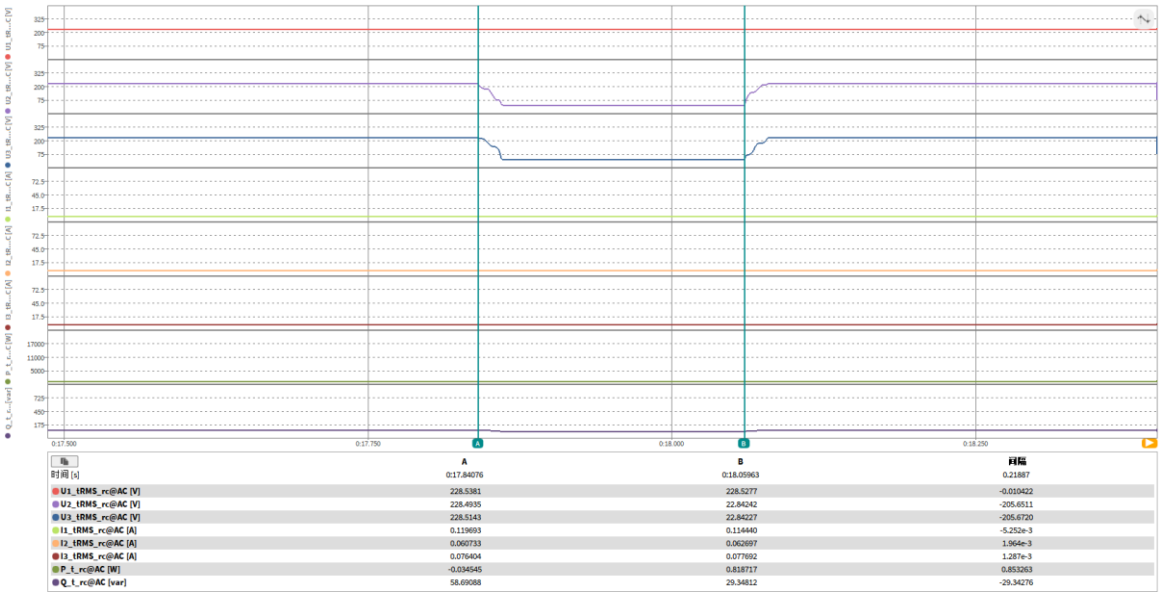


Test 4a-2.4 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D), 95% load
restoring time



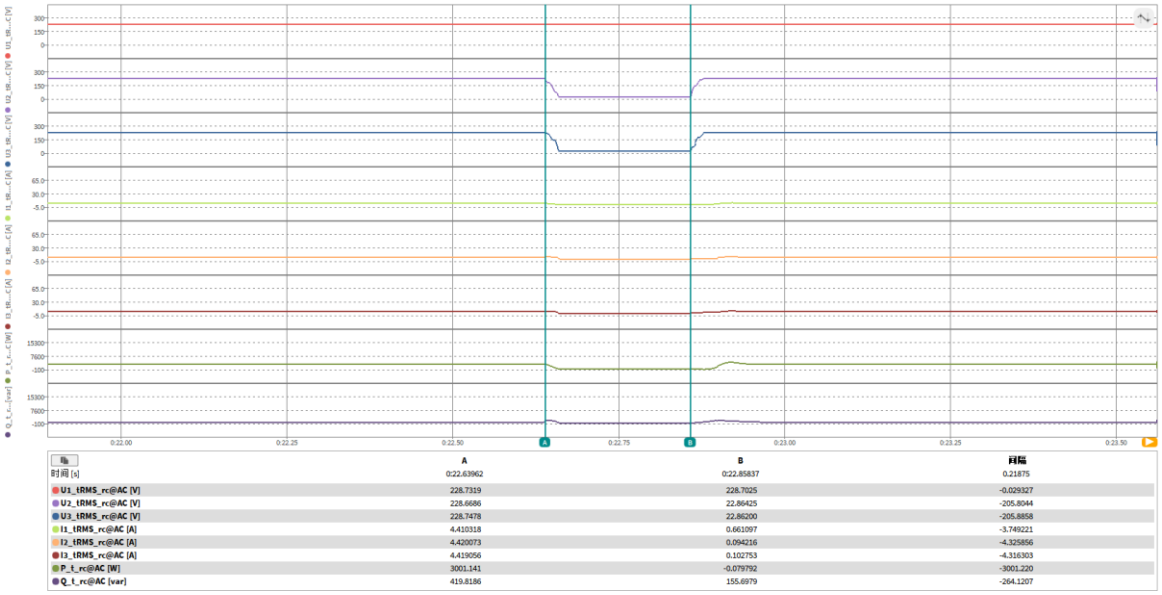
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 5-Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D), 0% load
Test overview(voltage,current,active and reactive power)



时间 [s]	A 0:17.84076	B 0:18.05963	Δ 0.21887
U1_tRMS_rc@AC [V]	228.5381	228.5277	-0.010422
U2_tRMS_rc@AC [V]	228.4935	22.84242	-205.6511
U3_tRMS_rc@AC [V]	228.5143	22.84227	-205.6720
I1_tRMS_rc@AC [A]	0.119693	0.114440	-5.252e-3
I2_tRMS_rc@AC [A]	0.060733	0.062697	1.964e-3
I3_tRMS_rc@AC [A]	0.076404	0.077692	1.287e-3
P_t_rc@AC [W]	-0.034545	0.818717	0.853263
Q_t_rc@AC [var]	58.69088	29.34812	-29.34276

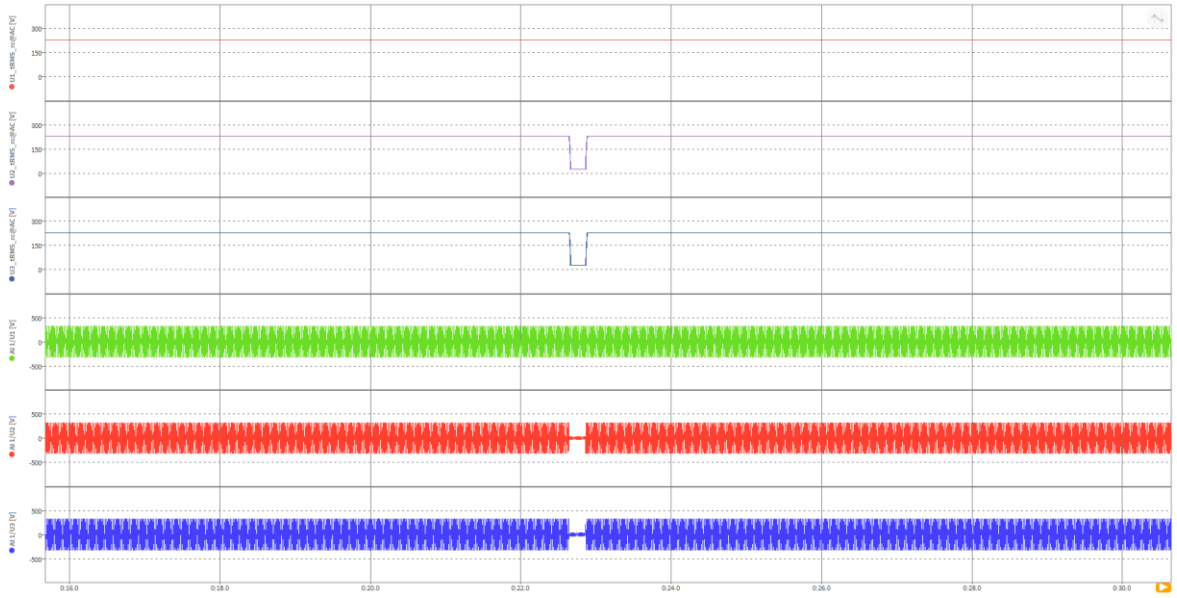
Test 5-1.1 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),20% load
Test overview(voltage,current,active and reactive power)



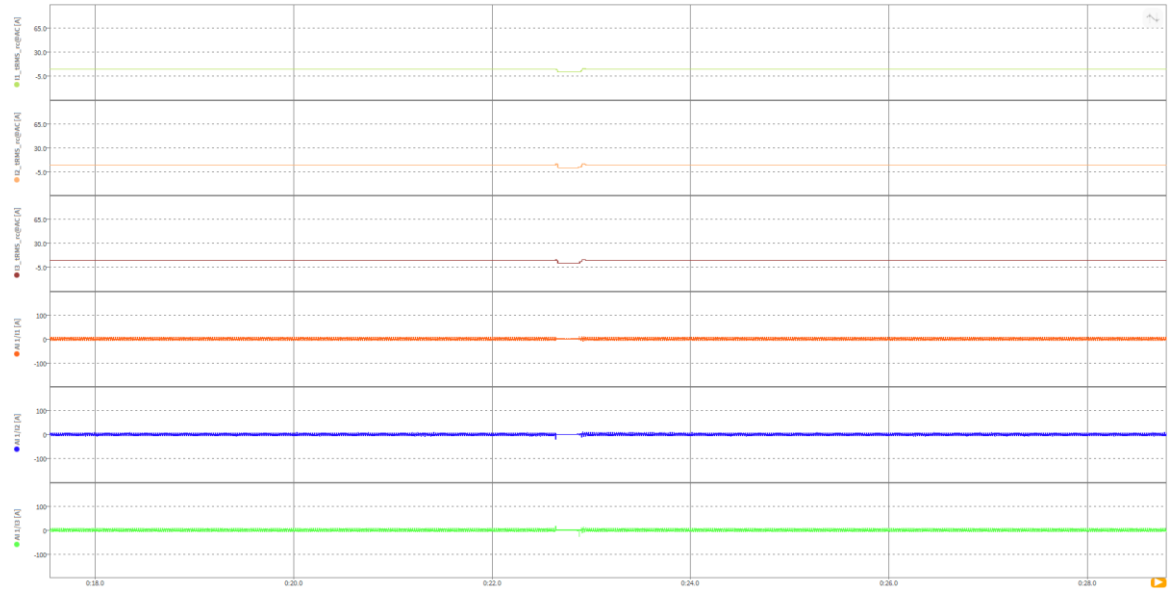
时间 [s]	A 0:22.63962	B 0:22.85837	Δ 0.21875
U1_tRMS_rc@AC [V]	228.7319	228.7025	-0.029327
U2_tRMS_rc@AC [V]	228.6686	22.86425	-205.8044
U3_tRMS_rc@AC [V]	228.7478	22.86200	-205.8858
I1_tRMS_rc@AC [A]	4.410318	0.661097	-3.749221
I2_tRMS_rc@AC [A]	4.420073	0.094216	-4.325856
I3_tRMS_rc@AC [A]	4.419056	0.102753	-4.316303
P_t_rc@AC [W]	3001.141	-0.079792	-3001.220
Q_t_rc@AC [var]	419.8186	155.6979	-264.1207

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 5-1.2 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

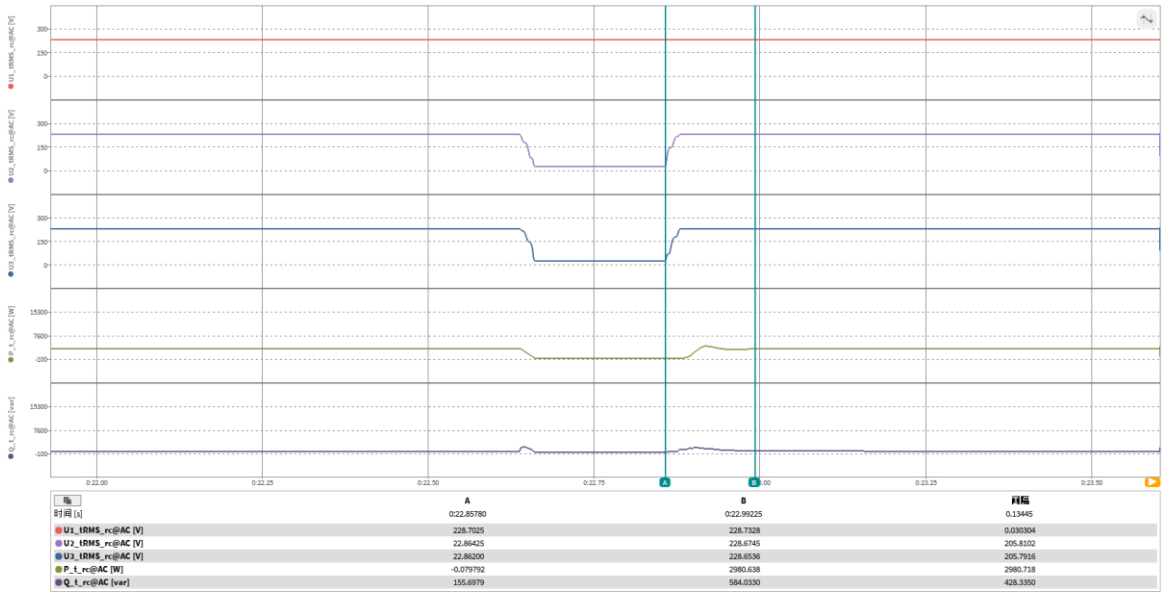


Test 5-1.3 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase currents



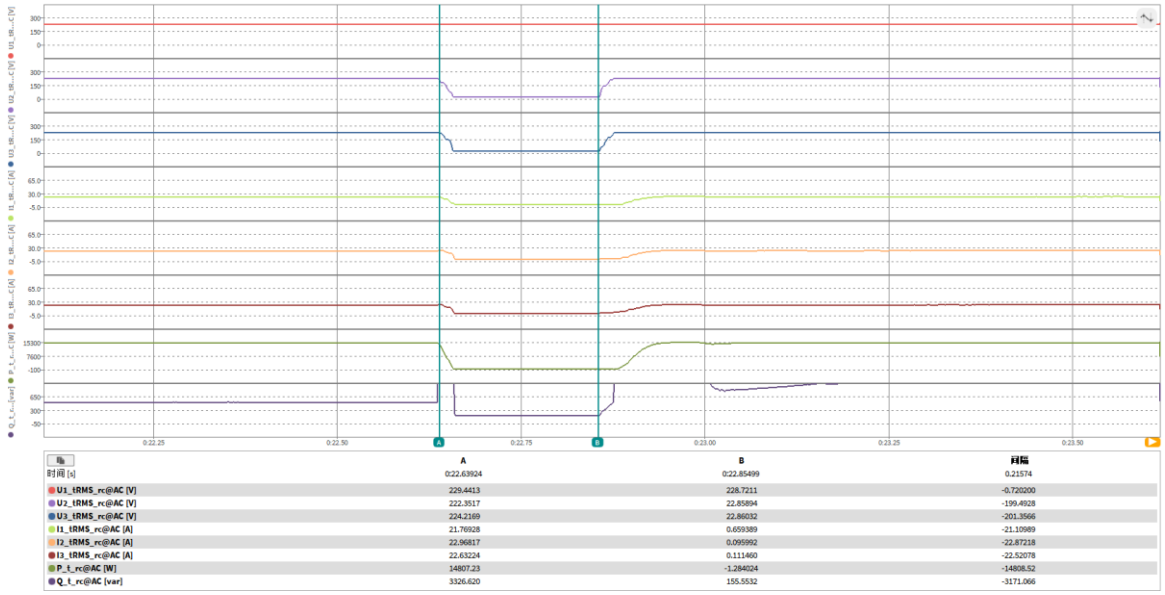
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 5-1.4 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),20% load restoring time



时间 [s]	A	B	间隔
U1_tRMS_rc@AC [V]	0:22.85780	0:22.99225	0.13445
U2_tRMS_rc@AC [V]	228.7025	228.7328	0.030304
U3_tRMS_rc@AC [V]	22.86425	228.6745	205.8102
P_t_rc@AC [W]	22.86200	228.6536	205.7916
Q_t_rc@AC [var]	-0.079792	2980.638	2980.718
	155.6979	584.0330	428.3350

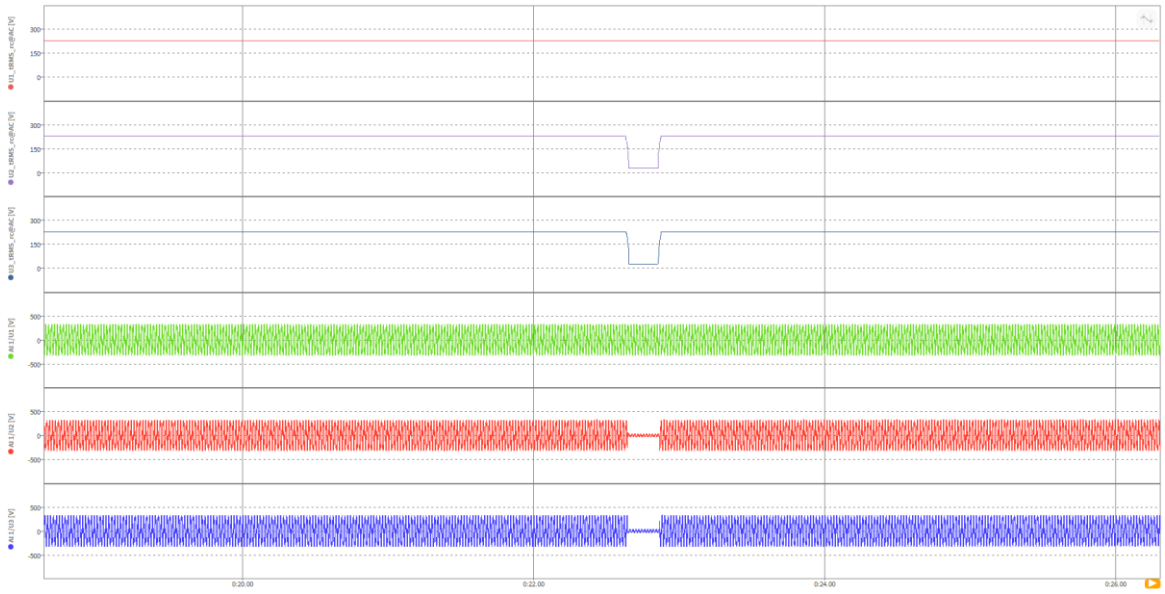
Test 5-2.1 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),95% load
Test overview(voltage,current,active and reactive power)



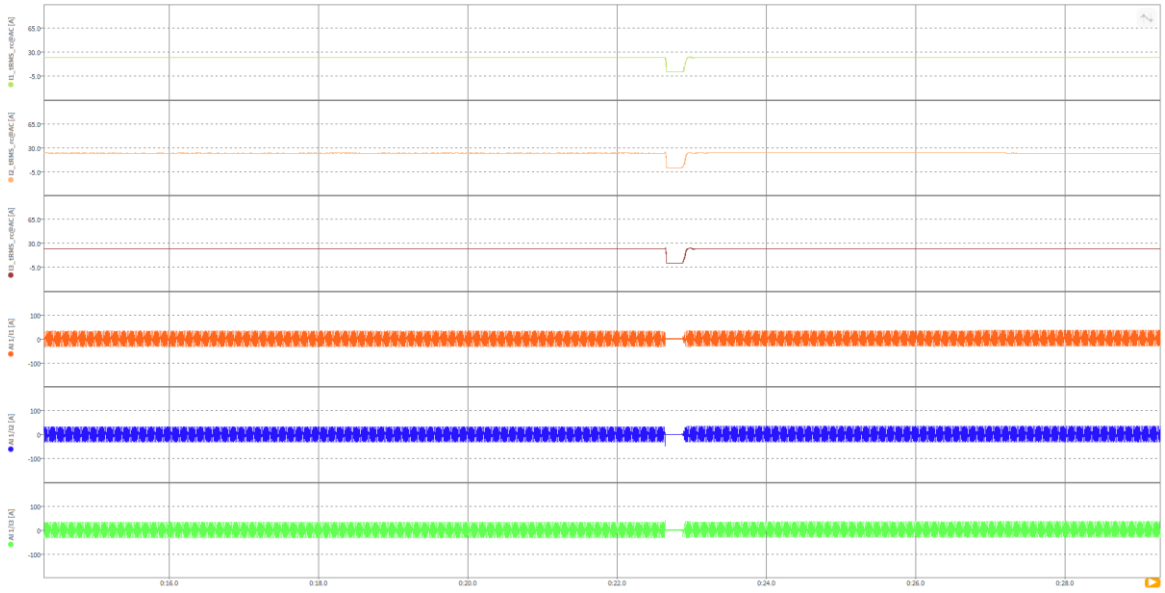
时间 [s]	A	B	间隔
U1_tRMS_rc@AC [V]	0:22.63924	0:22.85499	0.21574
U2_tRMS_rc@AC [V]	229.4413	228.7211	-0.720200
U3_tRMS_rc@AC [V]	222.3517	22.85894	-199.4928
I1_tRMS_rc@AC [A]	224.2169	22.86032	-201.3566
I2_tRMS_rc@AC [A]	21.76928	0.659389	-21.10989
I3_tRMS_rc@AC [A]	22.96817	0.095992	-22.87218
P_t_rc@AC [W]	22.63224	0.111460	-22.52078
Q_t_rc@AC [var]	14807.23	-1.284024	-14808.52
	3326.620	155.5532	-3171.066

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 5-2.2 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

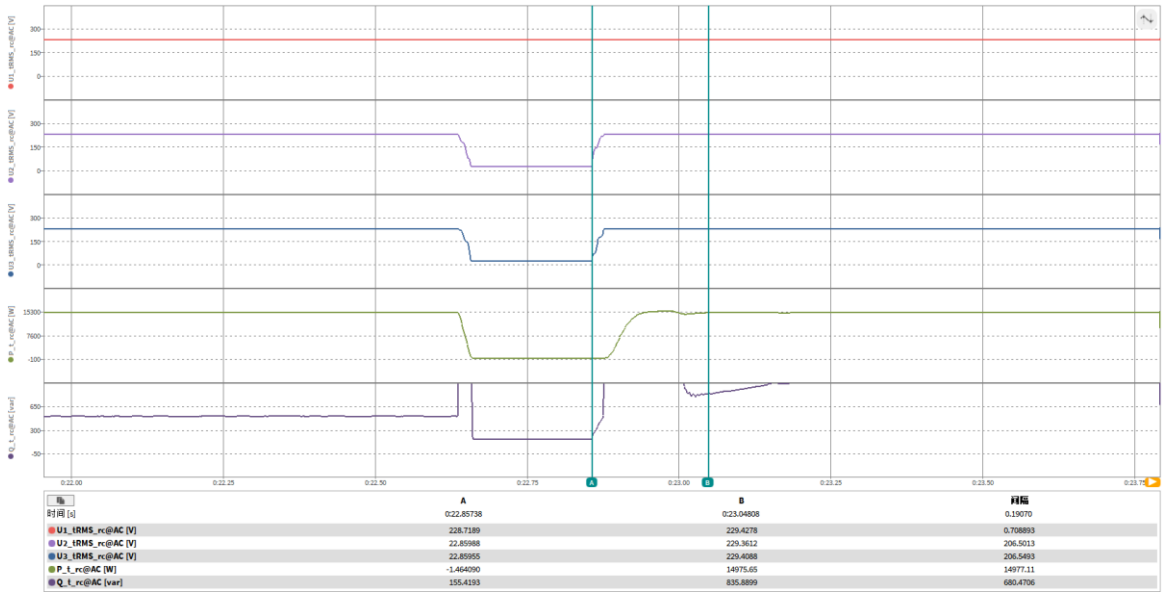


Test 5-2.3 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase currents

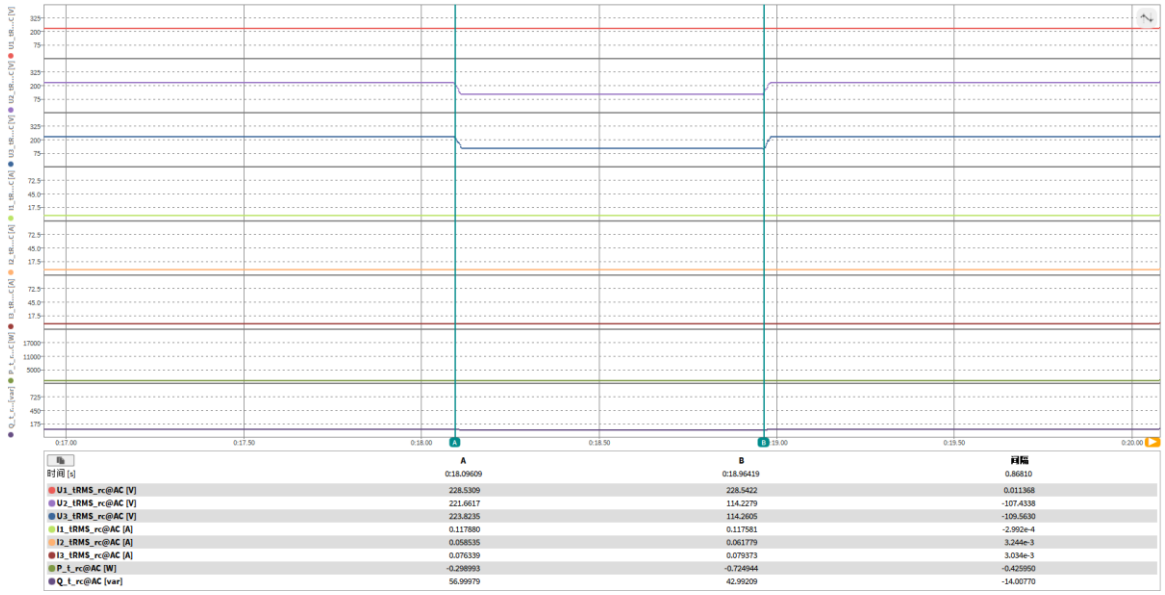


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 5-2.4 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D), 95% load restoring time

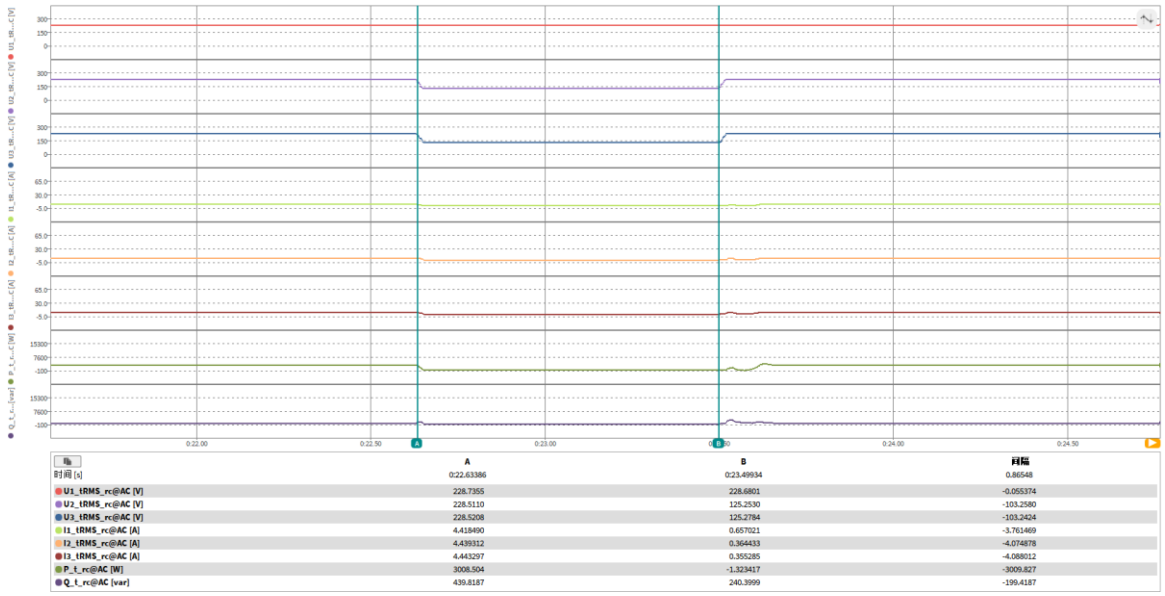


Test 6-Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D), 0% load
Test overview(voltage,current,active and reactive power)



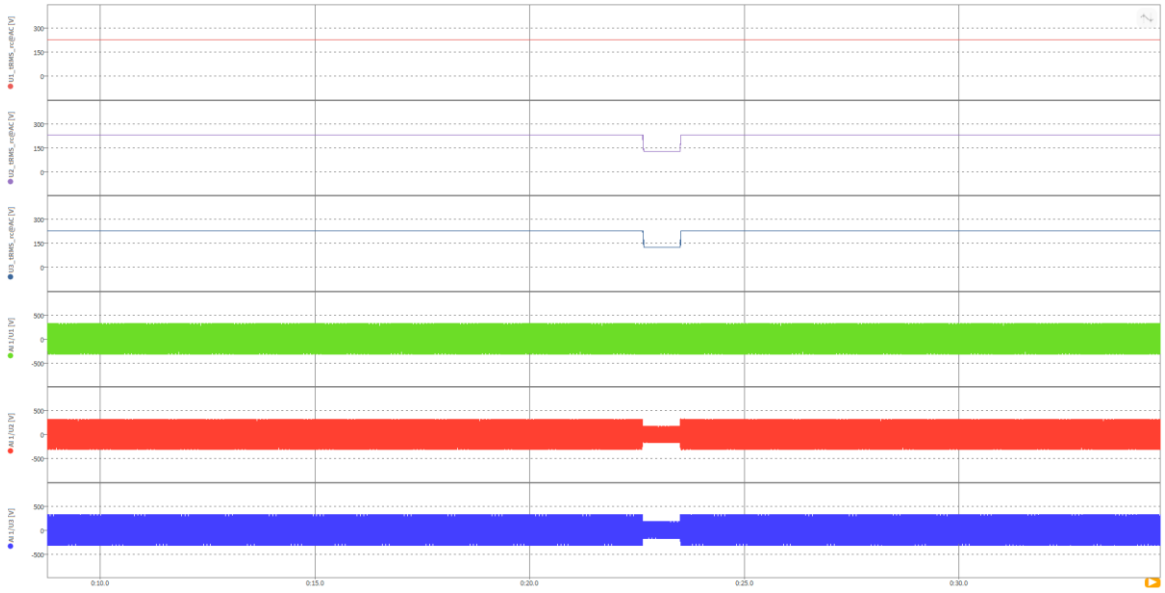
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 6-1.1 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),20% load
Test overview(voltage,current,active and reactive power)



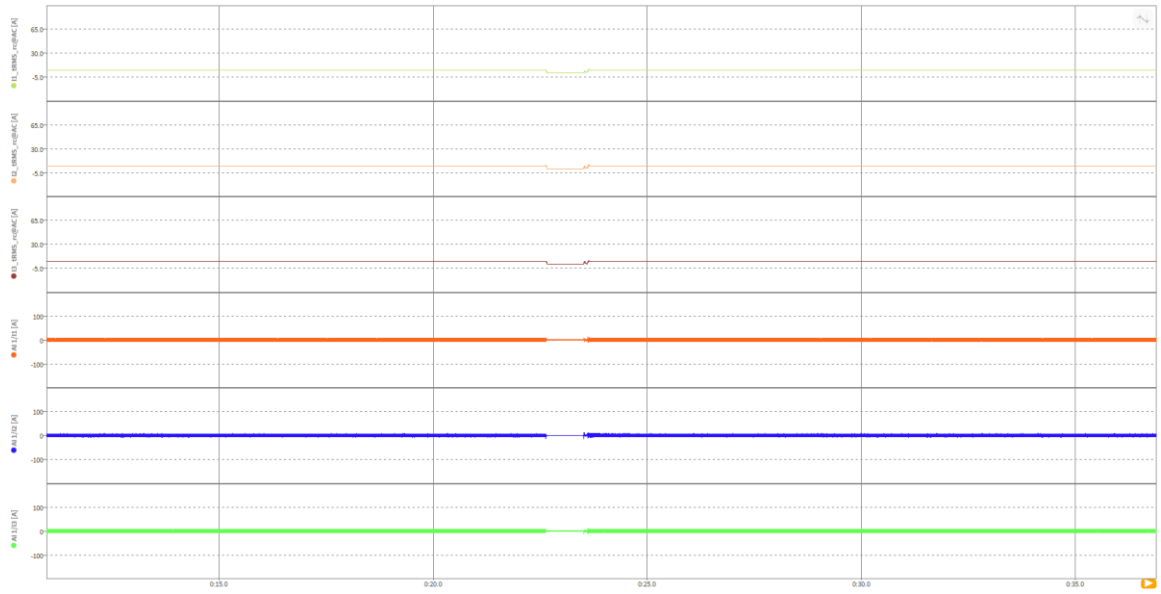
时间 [s]	A 0:22.63386	B 0:23.49934	Δ 0.86548
U1_tRMS_rc@AC [V]	228.7355	228.6801	-0.055374
U2_tRMS_rc@AC [V]	228.5110	125.2530	-103.2580
U3_tRMS_rc@AC [V]	228.5208	125.2784	-103.2424
I1_tRMS_rc@AC [A]	4.418490	0.657021	-3.761469
I2_tRMS_rc@AC [A]	4.439312	0.364433	-4.074878
I3_tRMS_rc@AC [A]	4.443297	0.355285	-4.088012
P_t_rc@AC [W]	3008.504	-1.323417	-3009.827
Q_t_rc@AC [var]	439.8187	240.3999	-199.4187

Test 6-1.2 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

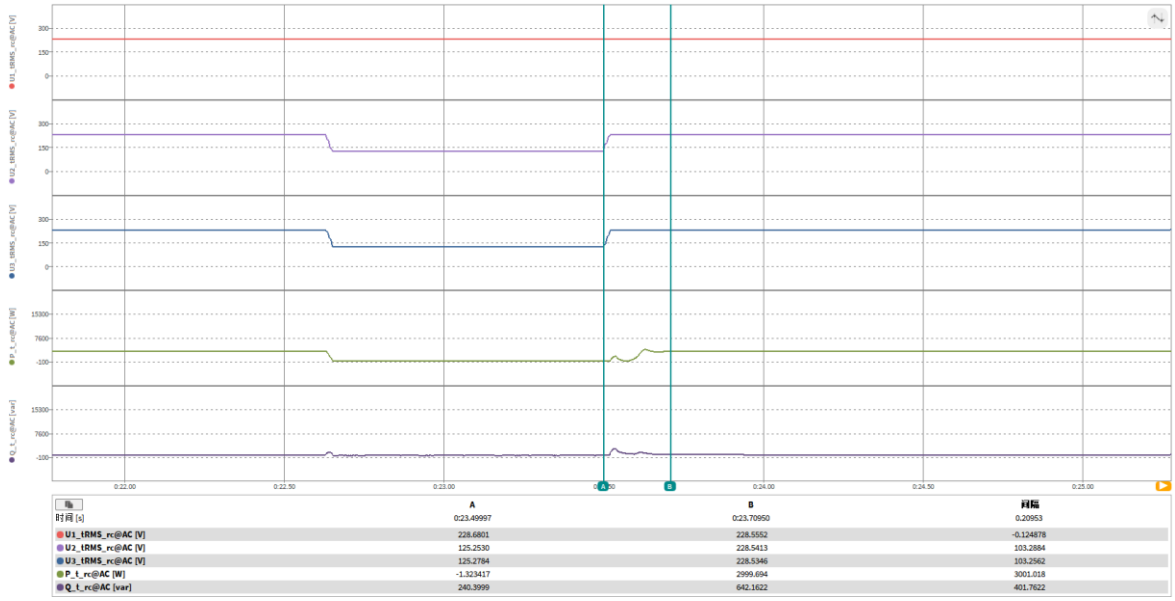


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 6-1.3 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase currents

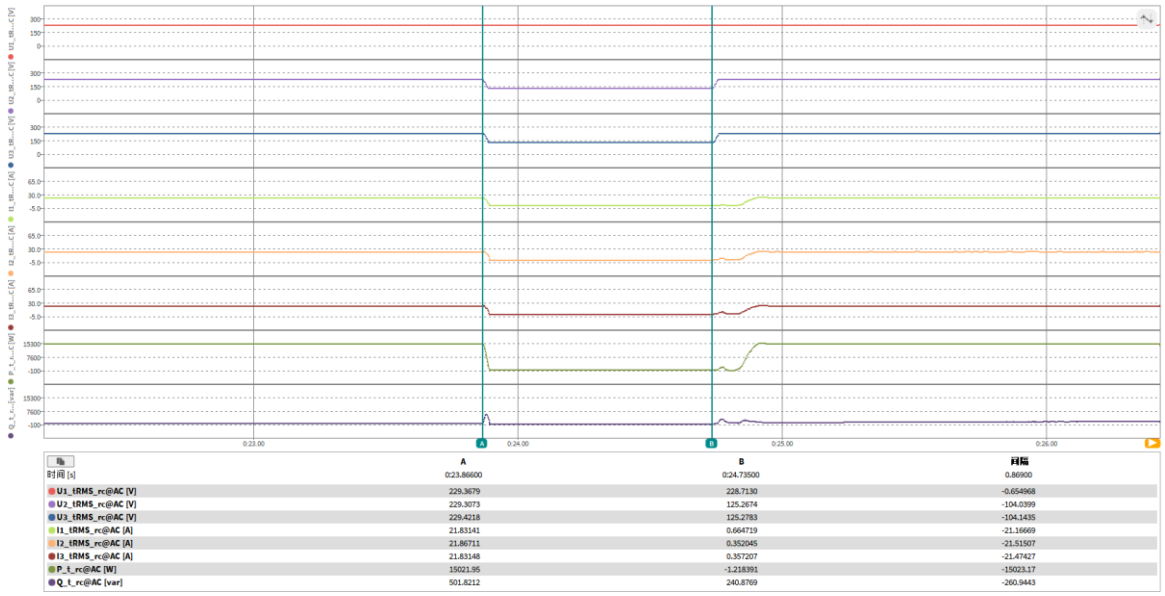


Test 6-1.4 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),20% load
restoring time



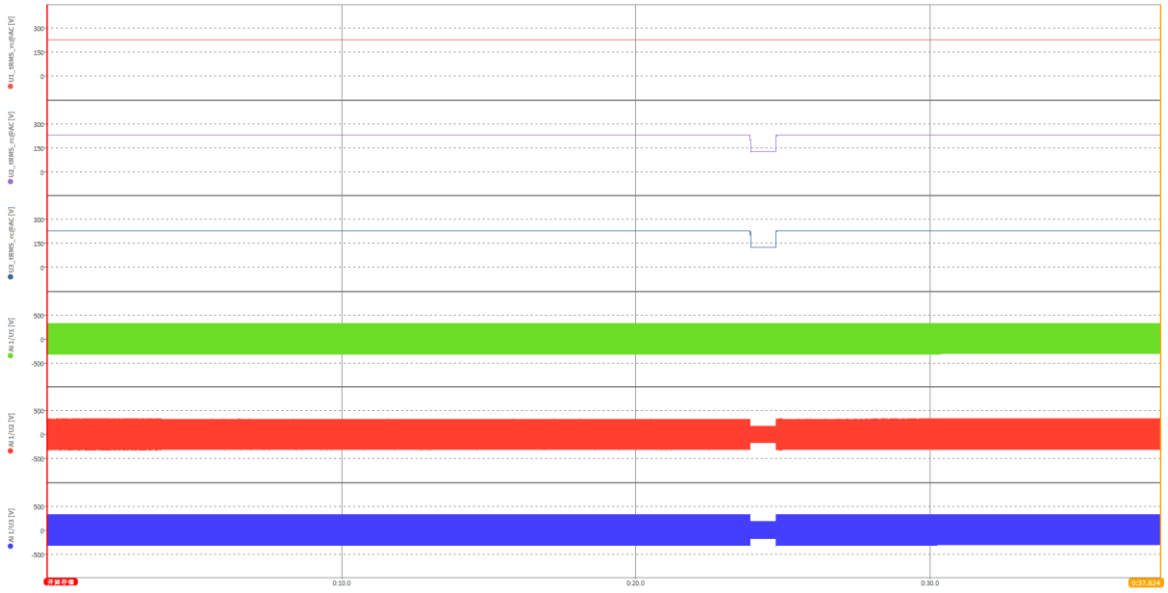
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 6-2.1 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),95% load
Test overview(voltage,current,active and reactive power)



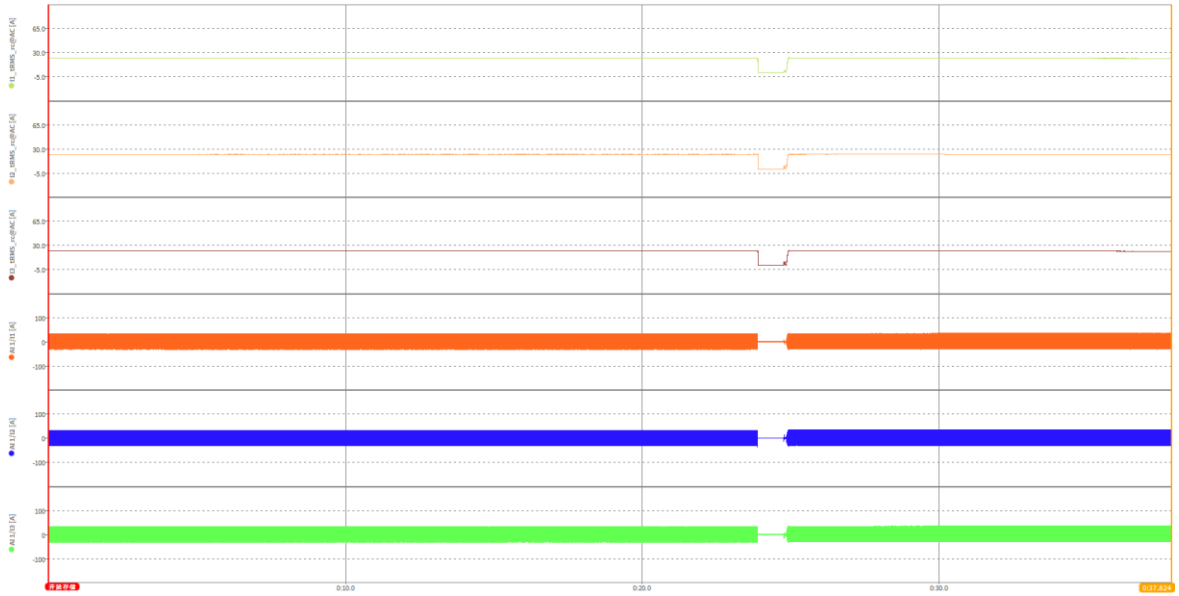
时间 [s]	A 0:23.86600	B 0:24.73500	间隔 0.86900
U1_tRMS_rc@AC [V]	229.3679	228.7130	-0.654968
U2_tRMS_rc@AC [V]	229.3073	125.2674	-104.0399
U3_tRMS_rc@AC [V]	229.4218	125.2783	-104.1435
I1_tRMS_rc@AC [A]	21.83141	0.664719	-21.16669
I2_tRMS_rc@AC [A]	21.86711	0.352045	-21.51507
I3_tRMS_rc@AC [A]	21.83148	0.357207	-21.47427
P_t_rc@AC [W]	15021.95	-1.218391	-15023.17
Q_t_rc@AC [var]	501.8212	240.8769	-260.9443

Test 6-2.2 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

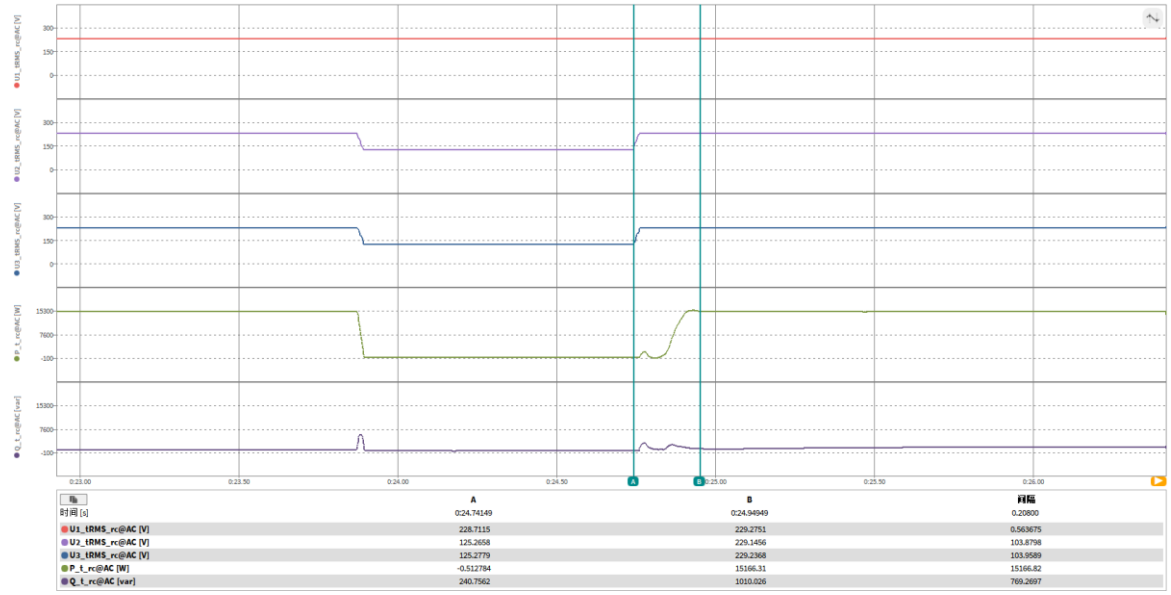


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 6-2.3 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase currents

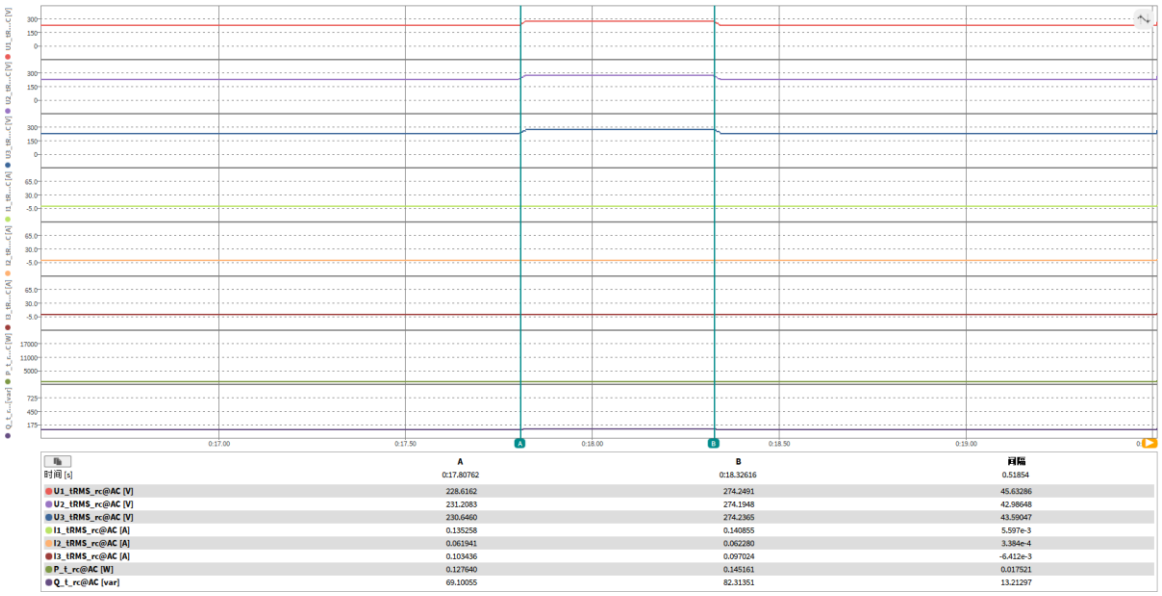


Test 6-2.4 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D), 95% load
restoring time



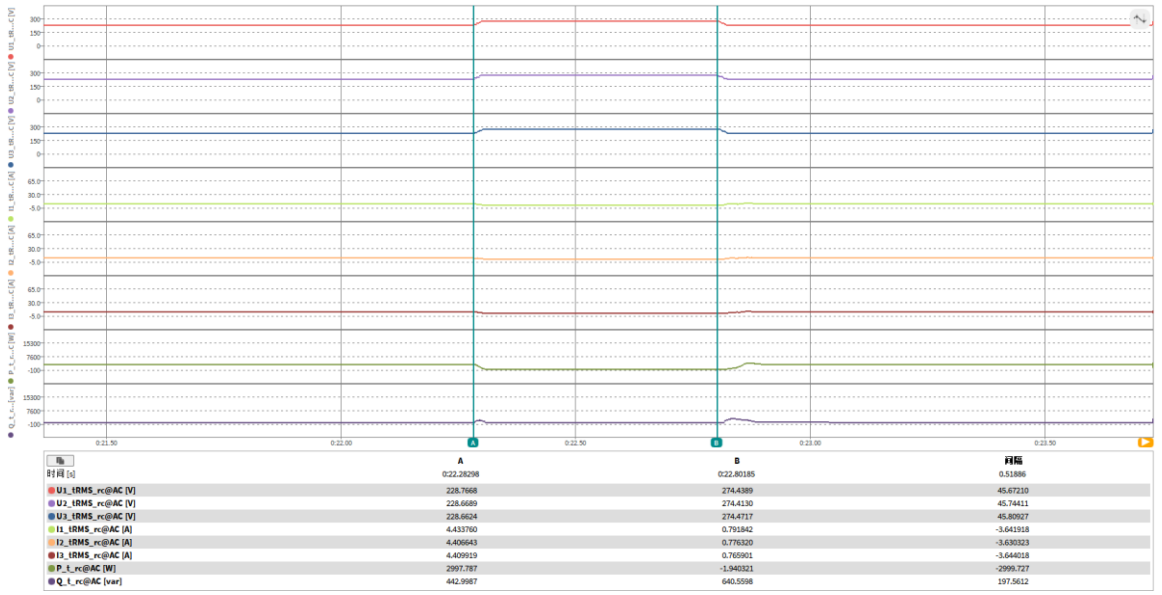
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 7-Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A), 0% load
Test overview(voltage,current,active and reactive power)



时间 [s]	A 0:17.80762	B 0:18.32616	间隔 0.51854
U1_tRMS_rc@AC [V]	228.6162	274.2491	45.63286
U2_tRMS_rc@AC [V]	231.2083	274.1948	42.98648
U3_tRMS_rc@AC [V]	230.6460	274.2365	43.59047
I1_tRMS_rc@AC [A]	0.135258	0.140855	5.597e-3
I2_tRMS_rc@AC [A]	0.061941	0.062280	3.384e-4
I3_tRMS_rc@AC [A]	0.103436	0.097024	-6.412e-3
P_t_rc@AC [W]	0.127640	0.145161	0.017521
Q_t_rc@AC [var]	69.10055	82.31351	13.21297

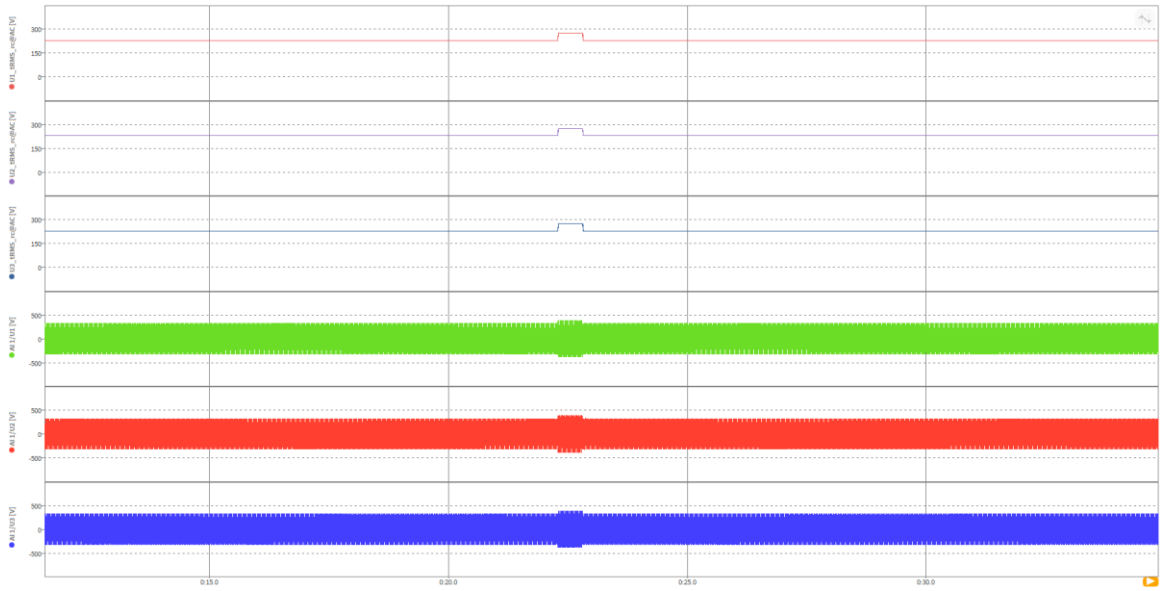
Test 7-1.1 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)



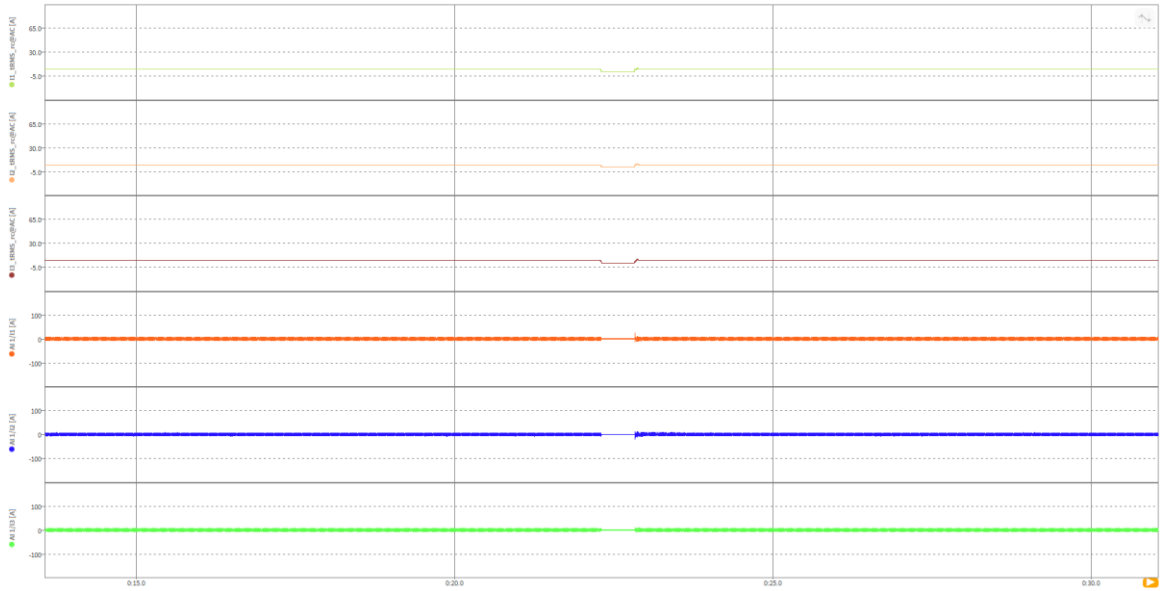
时间 [s]	A 0:22.28298	B 0:22.80185	间隔 0.51886
U1_tRMS_rc@AC [V]	228.7668	274.4389	45.67210
U2_tRMS_rc@AC [V]	228.6689	274.4130	45.74411
U3_tRMS_rc@AC [V]	228.6624	274.4717	45.80927
I1_tRMS_rc@AC [A]	4.433760	0.791842	-3.641918
I2_tRMS_rc@AC [A]	4.406643	0.776320	-3.630323
I3_tRMS_rc@AC [A]	4.409919	0.765901	-3.644018
P_t_rc@AC [W]	2997.787	-1.940321	-2999.727
Q_t_rc@AC [var]	442.9987	640.5598	197.5612

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 7-1.2 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

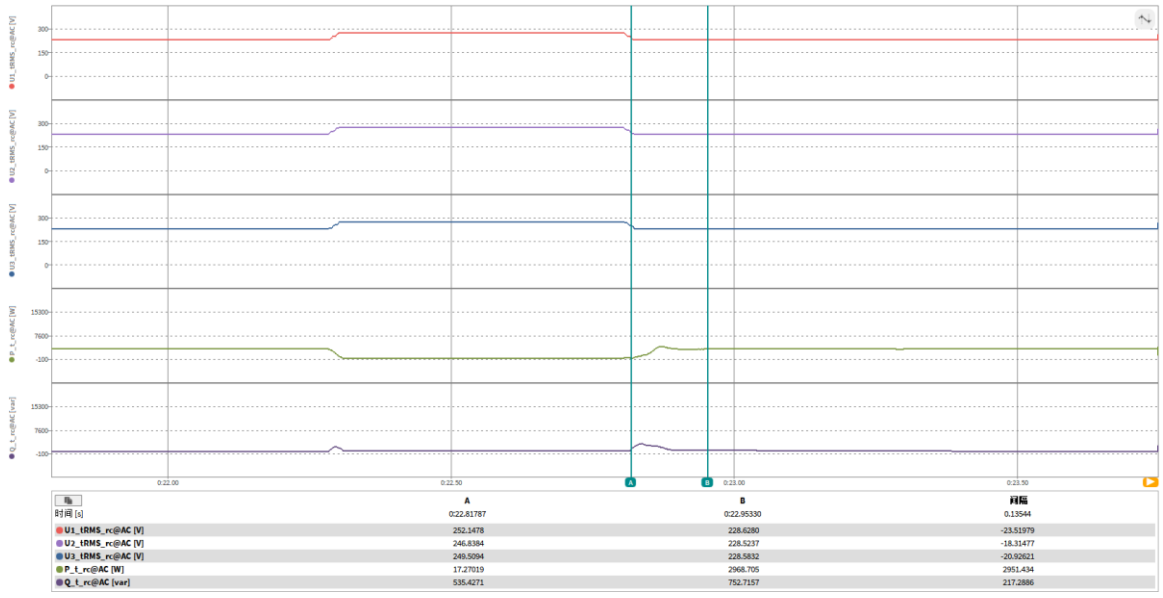


Test 7-1.3 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents



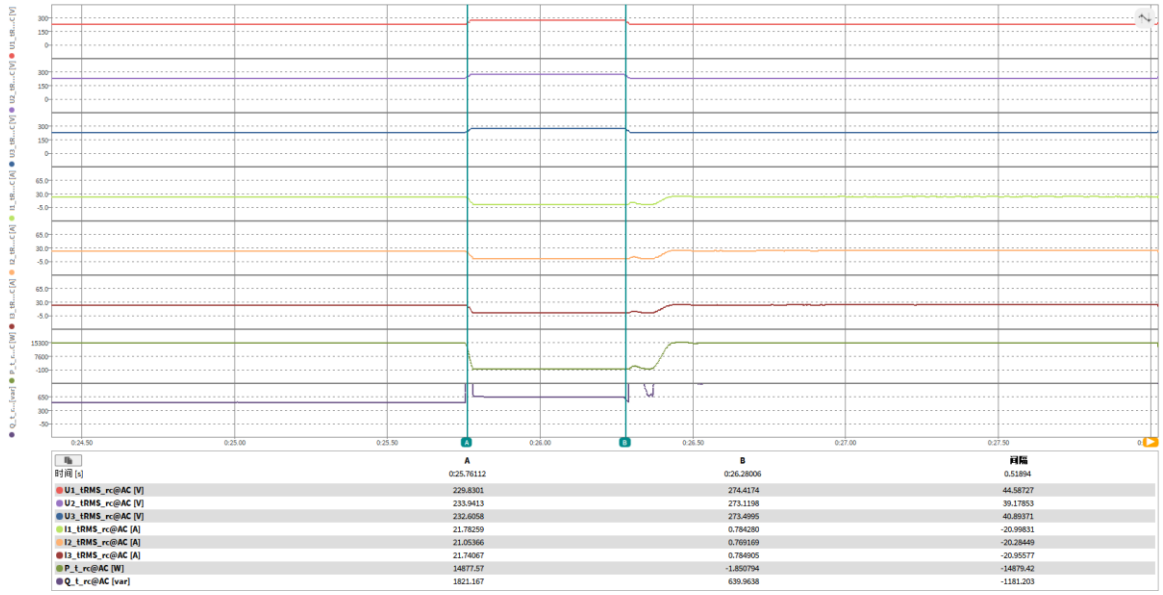
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 7-1.4 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),20% load restoring time



时间 [s]	A	B	间隔
	0:22.81787	0:22.95330	0.13544
U1_tRMS_rc@AC [V]	252.1478	228.6280	-23.51979
U2_tRMS_rc@AC [V]	246.8384	228.5237	-18.31477
U3_tRMS_rc@AC [V]	249.5094	228.5832	-20.92621
P_t_rc@AC [W]	17.27019	2968.705	2951.434
Q_t_rc@AC [var]	535.4271	752.7157	217.2886

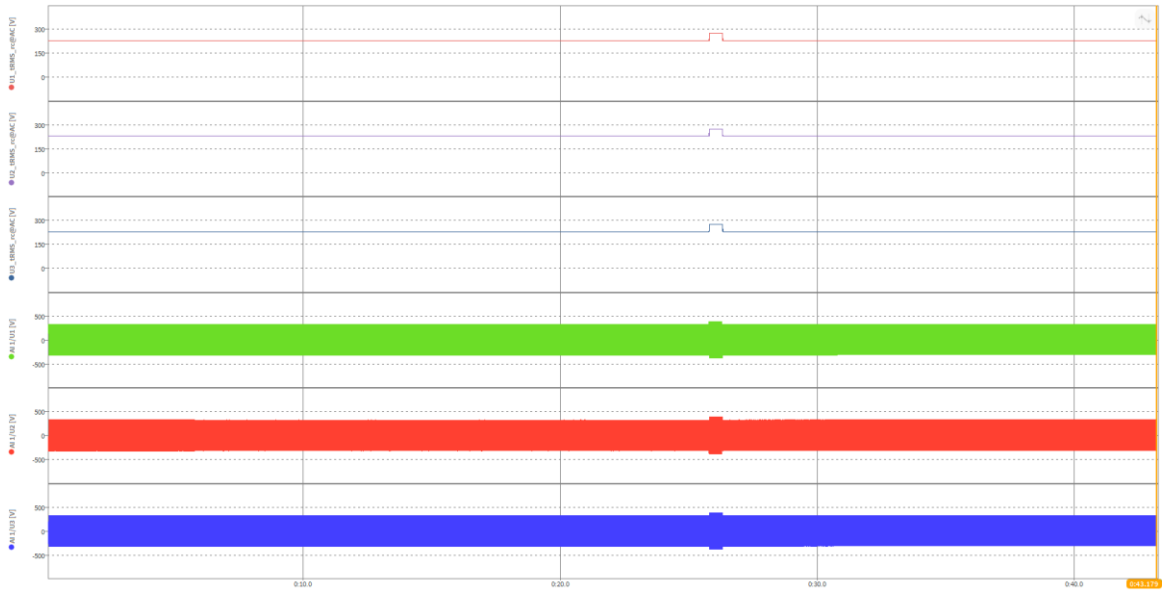
Test 7-2.1 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),95% load
Test overview(voltage,current,active and reactive power)



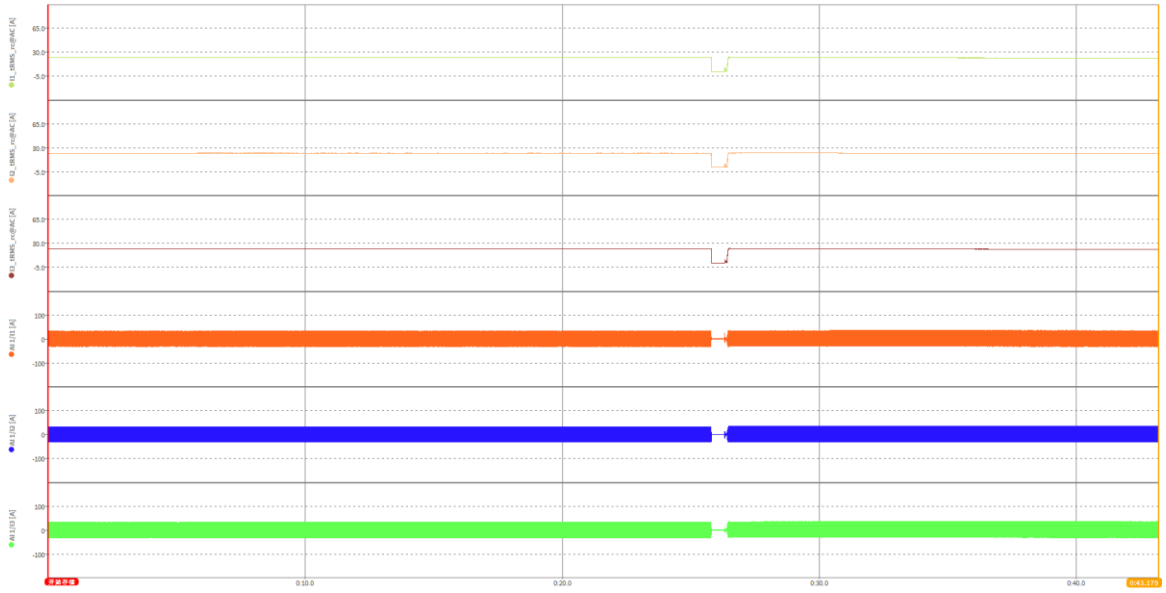
时间 [s]	A	B	间隔
	0:25.76112	0:26.28006	0.51894
U1_tRMS_rc@AC [V]	229.8301	274.4174	44.58727
U2_tRMS_rc@AC [V]	233.9413	273.1198	39.17853
U3_tRMS_rc@AC [V]	232.6058	273.4995	40.89371
I1_tRMS_rc@AC [A]	21.78259	0.784280	-20.99831
I2_tRMS_rc@AC [A]	21.05366	0.769169	-20.28449
I3_tRMS_rc@AC [A]	21.74067	0.784905	-20.95577
P_t_rc@AC [W]	14877.57	-1.850794	-14879.42
Q_t_rc@AC [var]	1821.167	639.9638	-1181.203

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 7-2.2 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

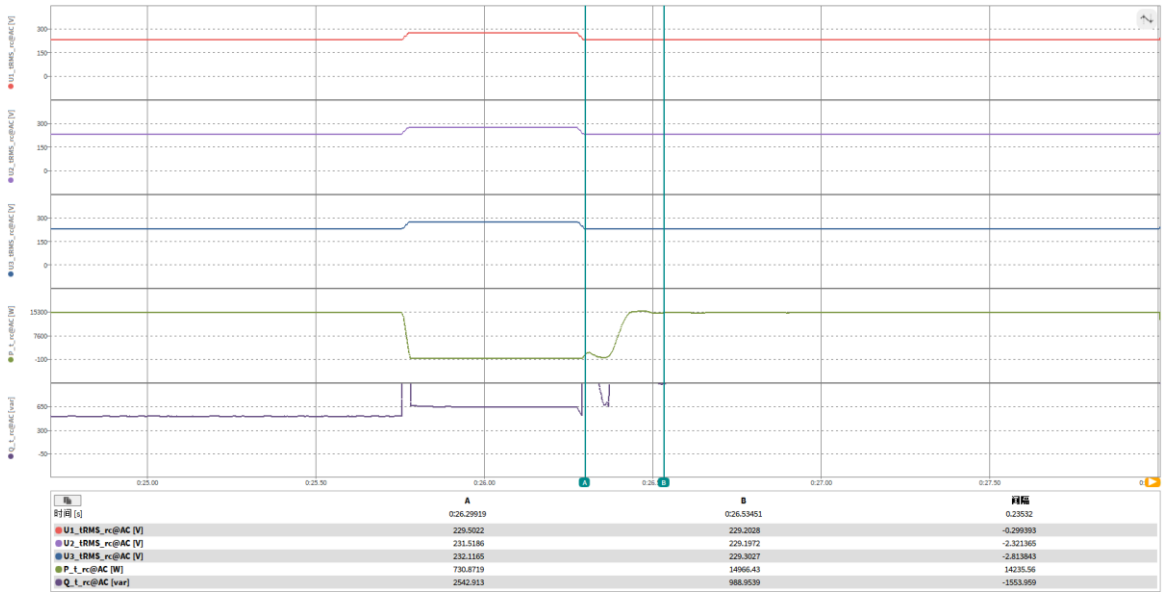


Test 7-2.3 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents



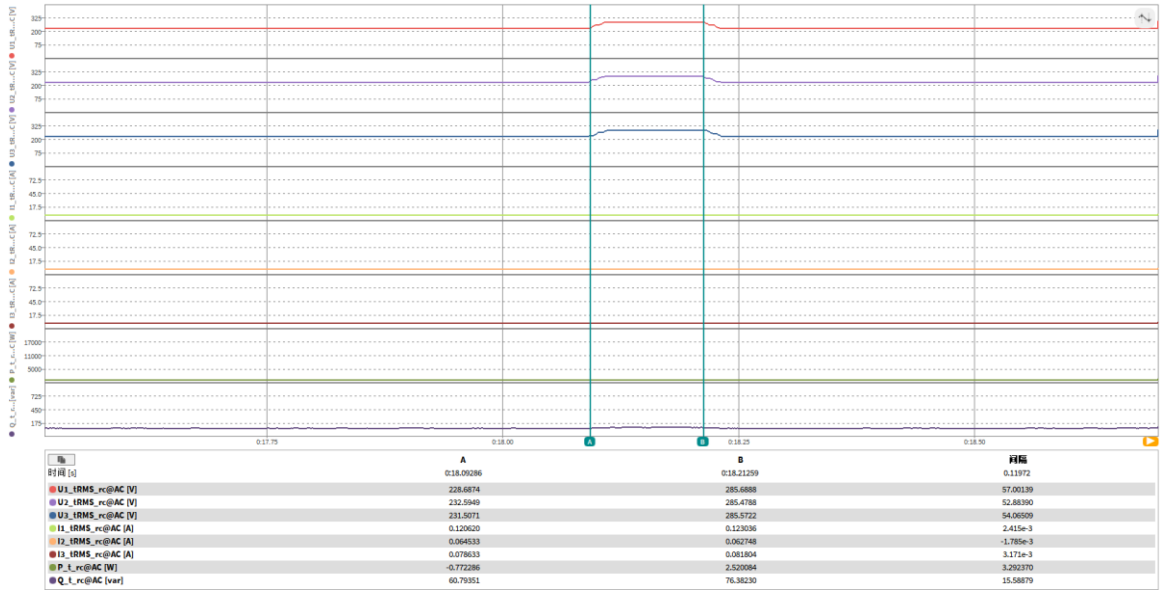
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 7-2.4 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A), 95% load restoring time



时间 [s]	A 0:26.29919	B 0:26.53451	间隔 0.23532
U1_tRMS_rc@AC [V]	229.5022	229.2028	-0.299393
U2_tRMS_rc@AC [V]	231.5186	229.1972	-2.321365
U3_tRMS_rc@AC [V]	232.1165	229.3027	-2.813843
P_t_rc@AC [W]	730.8719	14966.43	14235.56
Q_t_rc@AC [var]	2542.913	988.9539	-1553.959

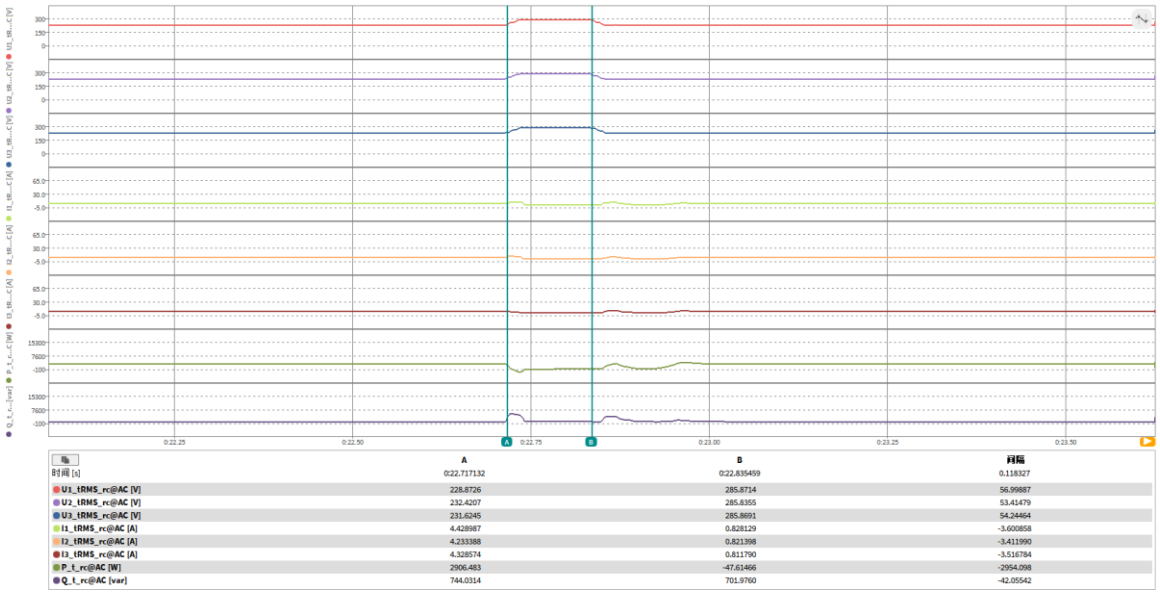
Test 8-Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A), 0% load
Test overview(voltage,current,active and reactive power)



时间 [s]	A 0:18.09286	B 0:18.21259	间隔 0.11972
U1_tRMS_rc@AC [V]	228.6874	285.6888	57.00139
U2_tRMS_rc@AC [V]	232.5949	285.4788	52.88390
U3_tRMS_rc@AC [V]	231.5071	285.5722	54.06509
I1_tRMS_rc@AC [A]	0.120620	0.123036	2.415e-3
I2_tRMS_rc@AC [A]	0.064533	0.062748	-1.785e-3
I3_tRMS_rc@AC [A]	0.078633	0.081804	3.171e-3
P_t_rc@AC [W]	-0.772286	2.520084	3.292370
Q_t_rc@AC [var]	60.79351	76.38230	15.58879

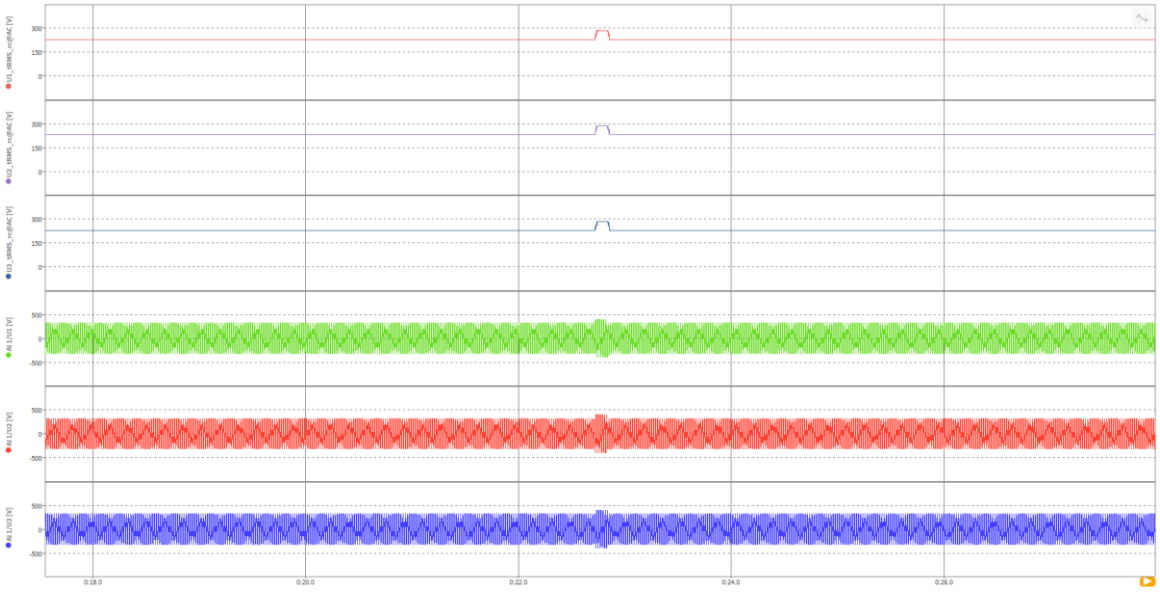
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 8-1.1 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)



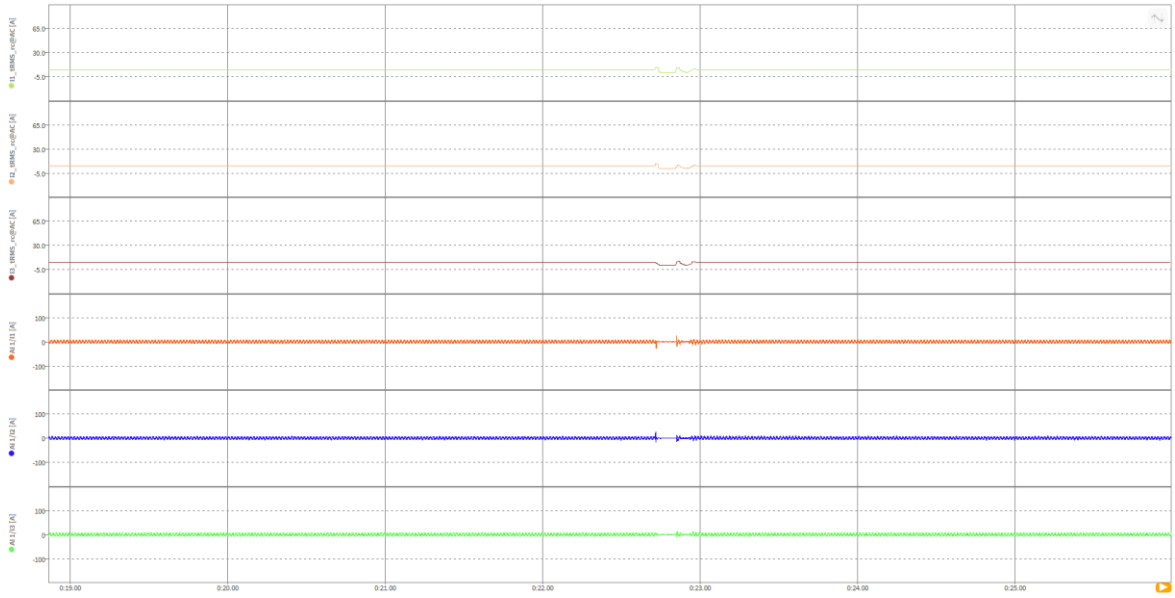
时间 [s]	A 0:22.717132	B 0:22.835459	间隔 0.118327
U1_tRMS_rc@AC [V]	228.8726	285.8714	56.99887
U2_tRMS_rc@AC [V]	232.4207	285.8355	53.41479
U3_tRMS_rc@AC [V]	231.6245	285.8691	54.24464
I1_tRMS_rc@AC [A]	4.428987	0.828129	-3.600858
I2_tRMS_rc@AC [A]	4.233388	0.821398	-3.411990
I3_tRMS_rc@AC [A]	4.328574	0.811790	-3.516784
P_t_rc@AC [W]	2906.483	-47.61466	-2954.098
Q_t_rc@AC [var]	744.0314	701.9760	-42.05542

Test 8-1.2 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

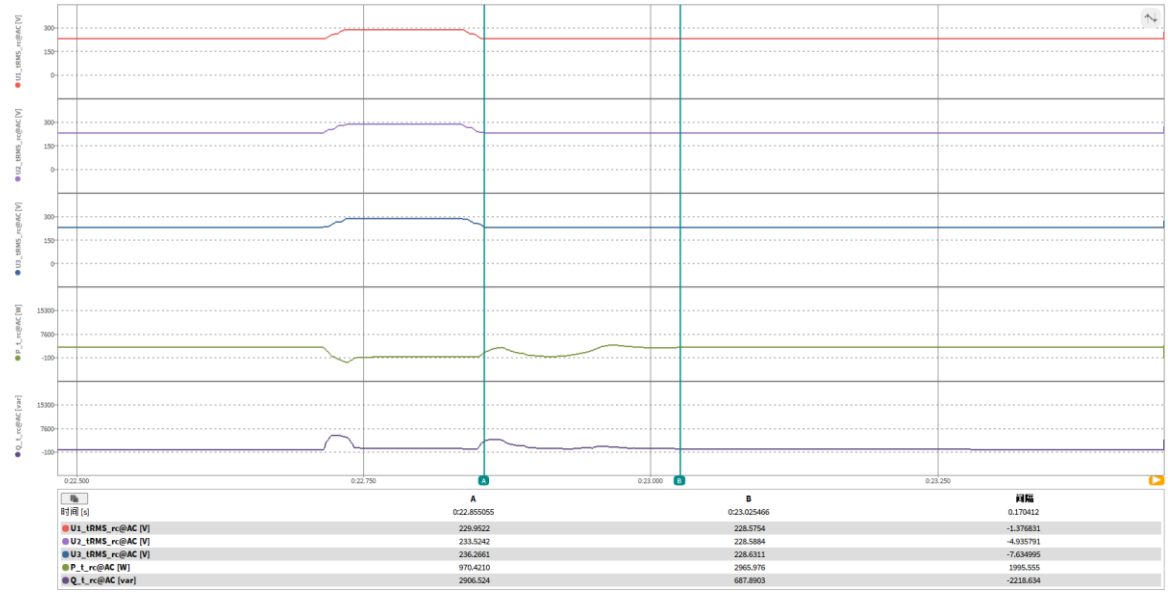


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 8-1.3 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents

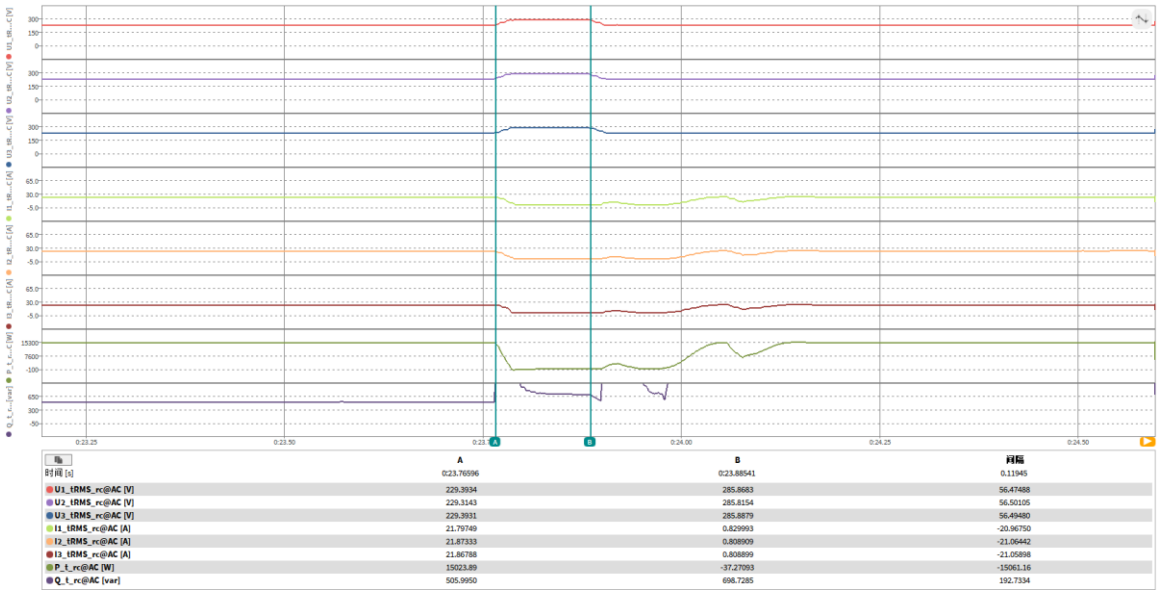


Test 8-1.4 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),20% load
restoring time



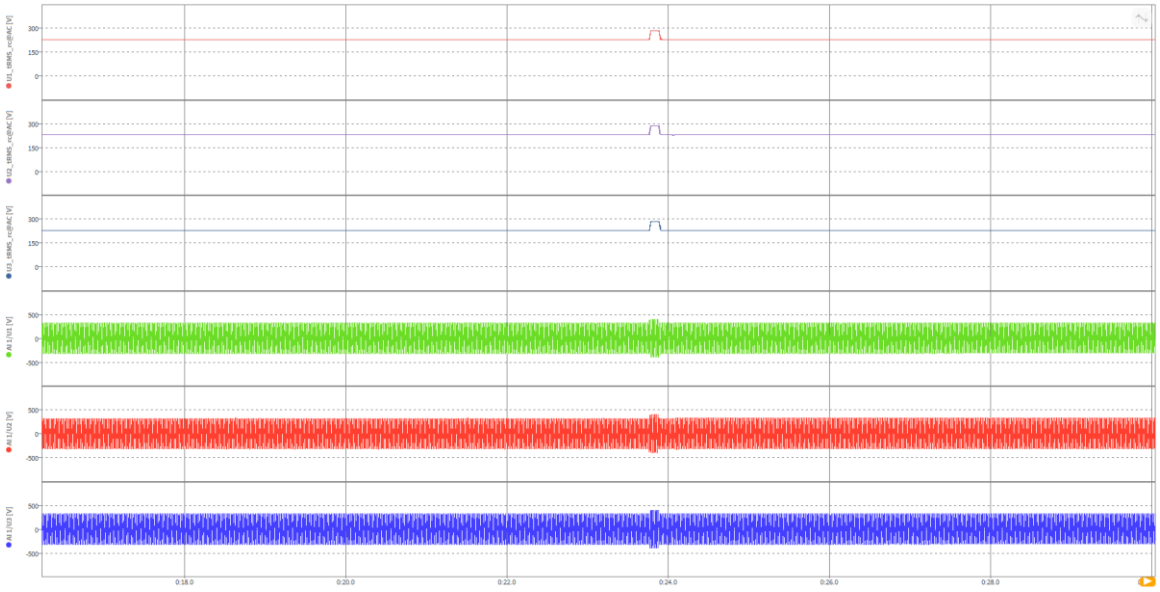
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 8-2.1 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),95% load
Test overview(voltage,current,active and reactive power)



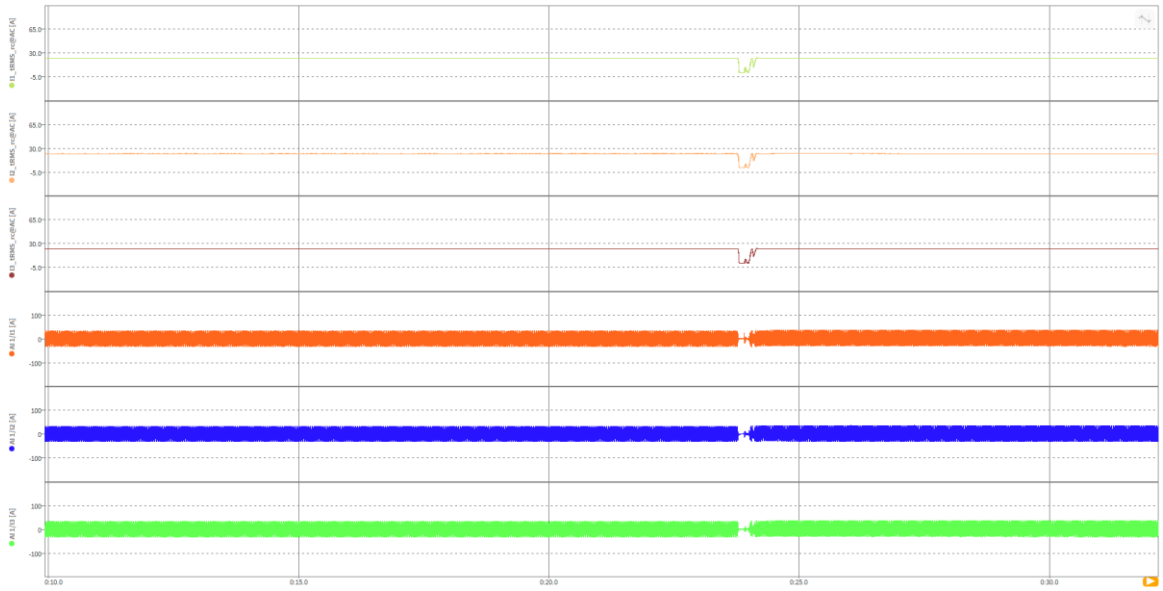
时间 [s]	A 0:23.76596	B 0:23.88541	间隔 0.11945
U1_tRMS_rc@AC [V]	229.3934	285.8683	56.47488
U2_tRMS_rc@AC [V]	229.3143	285.8154	56.50105
U3_tRMS_rc@AC [V]	229.3931	285.8879	56.49480
I1_tRMS_rc@AC [A]	21.79749	0.829993	-20.96750
I2_tRMS_rc@AC [A]	21.87333	0.808909	-21.06442
I3_tRMS_rc@AC [A]	21.86788	0.808899	-21.05898
P_t_rc@AC [W]	15023.89	-37.27093	-15061.16
Q_t_rc@AC [var]	505.9950	698.7285	192.7334

Test 8-2.2 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

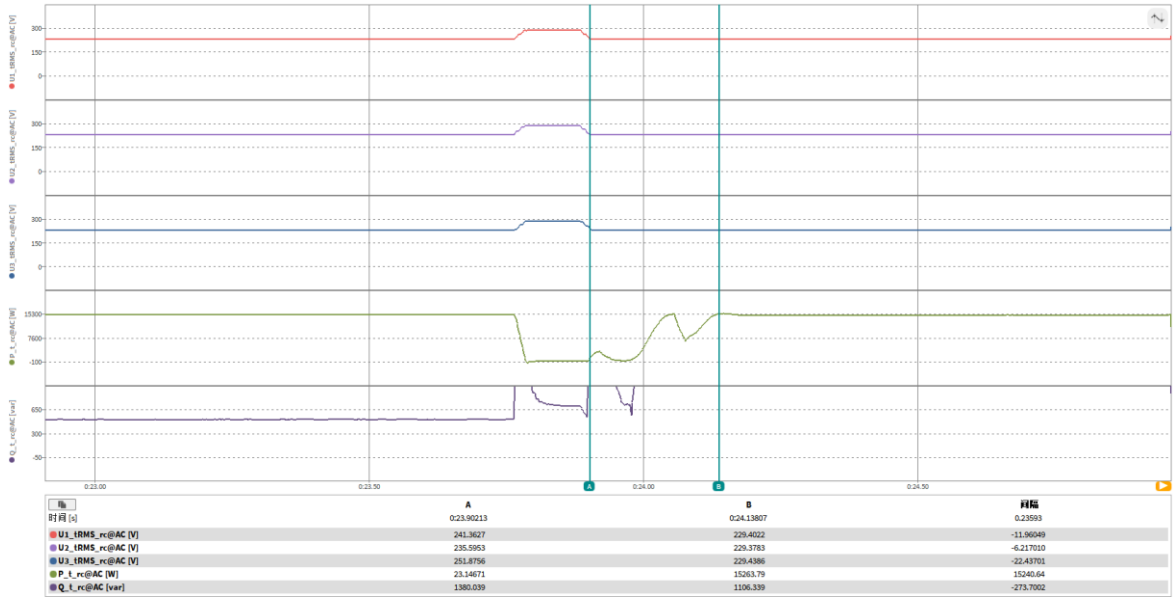


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 8-2.3 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents



Test 8-2.4 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A), 95% load
restoring time



时间 [s]	A	B	Δ
U1_tRMS_rc@AC [V]	241.3627	229.4022	-11.96049
U2_tRMS_rc@AC [V]	235.5953	229.3783	-6.217010
U3_tRMS_rc@AC [V]	251.8756	229.4386	-22.43701
P_t_rc@AC [W]	23.14671	15263.79	15240.64
Q_t_rc@AC [var]	1380.039	1106.339	-273.7002

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.10	**TABLE: Verification of insensitivity to automatic reclosing in phase discrepancy**				**P**
Model	AF15K-MTH + ATOM HVS-20.48 (4P)				
Test 1: Phase angle shift of 90°					
Power level	Cos φ	Phase shift angle(°)	Current 20 ms before phase shift(A)	Current 200ms after phase shift(A)	Result
100%	0.996	90	16.82	0	The inverter is protected off the grid after performing the phase angle conversion and then reconnected to the grid to continue supplying power to the grid. No damage, no danger.
Test 2: Phase angle shift of 180°					
Power level	Cos φ	Phase shift angle(°)	Current 20 ms before phase shift(A)	Current 200ms after phase shift(A)	Result
100%	0.997	180	16.86	0	The inverter is protected off the grid after performing the phase angle conversion and then reconnected to the grid to continue supplying power to the grid. No damage, no danger.

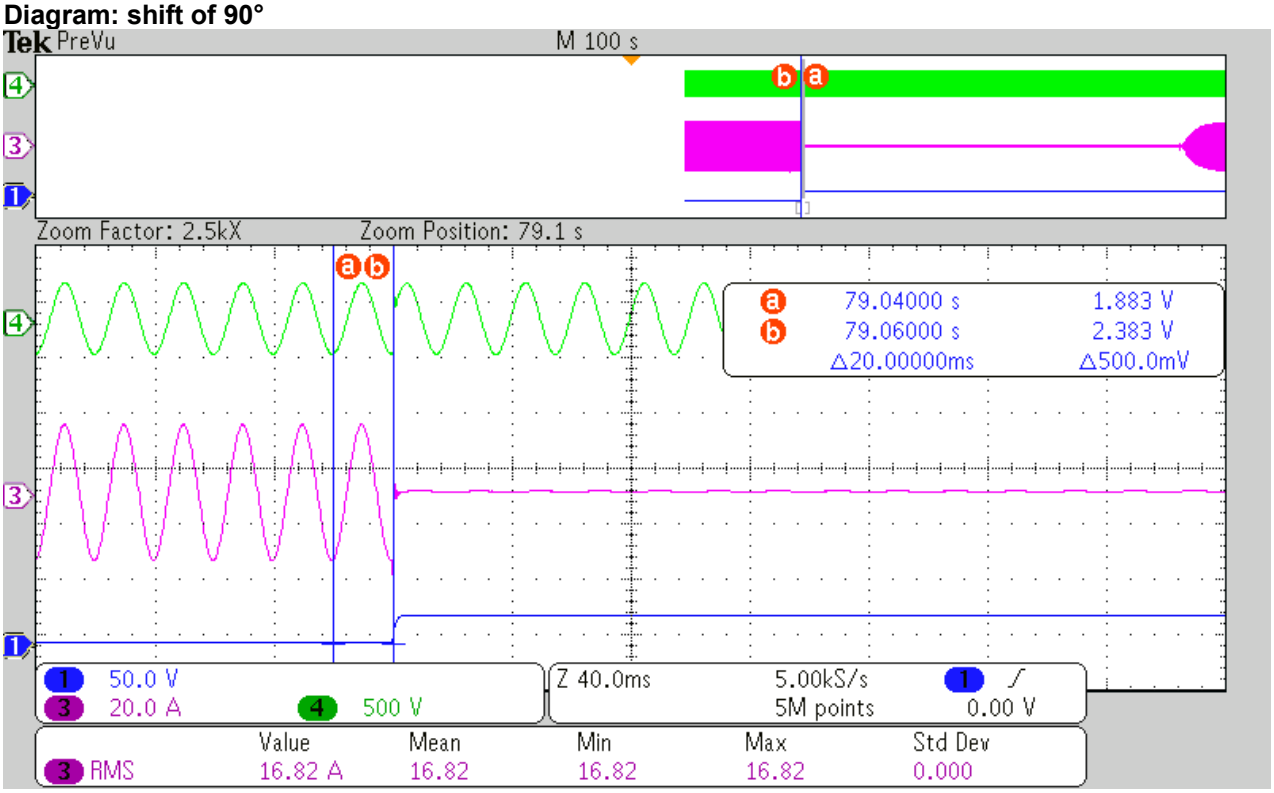
Note:
With reference to the diagram shown in Figure 75 - use of simulated network:
- the network simulator must be able to produce phase jumps in the voltage at the inverter output terminals of 90° and 180° respectively;
- the storage system must operate at a power level compatible with the characteristics of the test circuit and with a unitary power factor (cos φ = 1);
- VR: simulated mains voltage.
- The storage system must be brought into operation at the full power available for discharge. Let the system operate in the set conditions for at least 5 minutes, compatibly with the energy capacity of the EESS, or the time required for the internal temperature of the converter to stabilize.

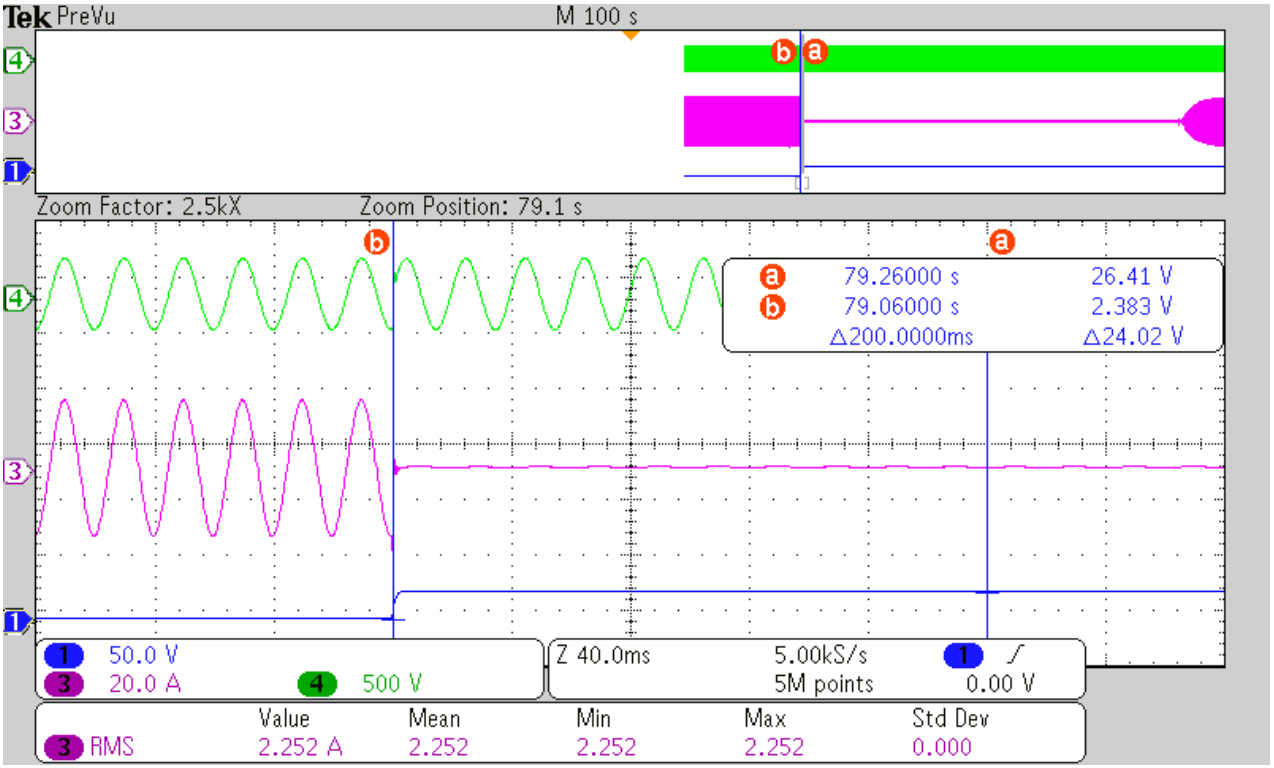
At the end of the stabilization period, 2 tests must be carried out in sequence, inducing a transient that suddenly produces a phase shift angle on the simulated mains voltage VR equal to 90 ° and 180 °.

In the test report, the following must be indicated for each of the two test sequences:
- the angle between the voltage before and after the phase jump, with an instrument having an error of 1°;
- the current of the storage system over a time window that runs from 20 ms before to at least 200 ms after the phase jump of the simulated mains voltage.

CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

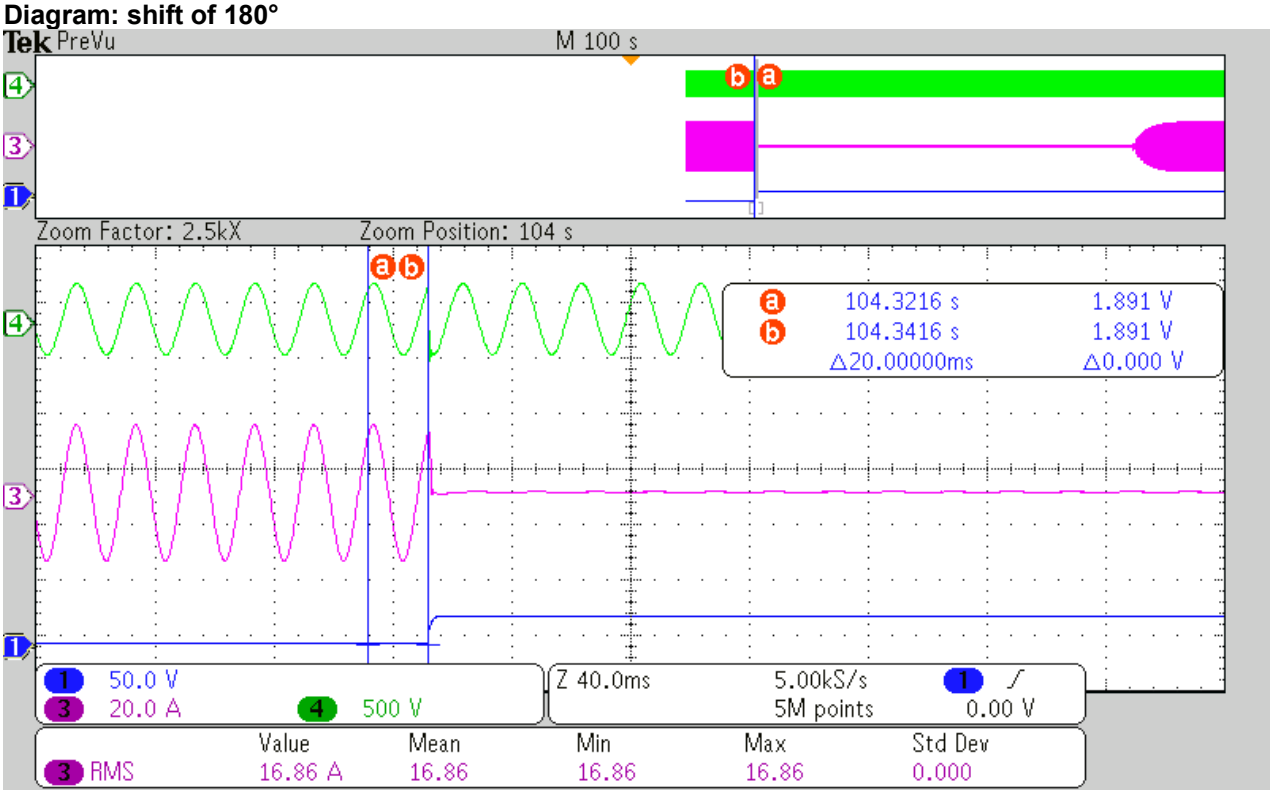
Diagram: shift of 90°

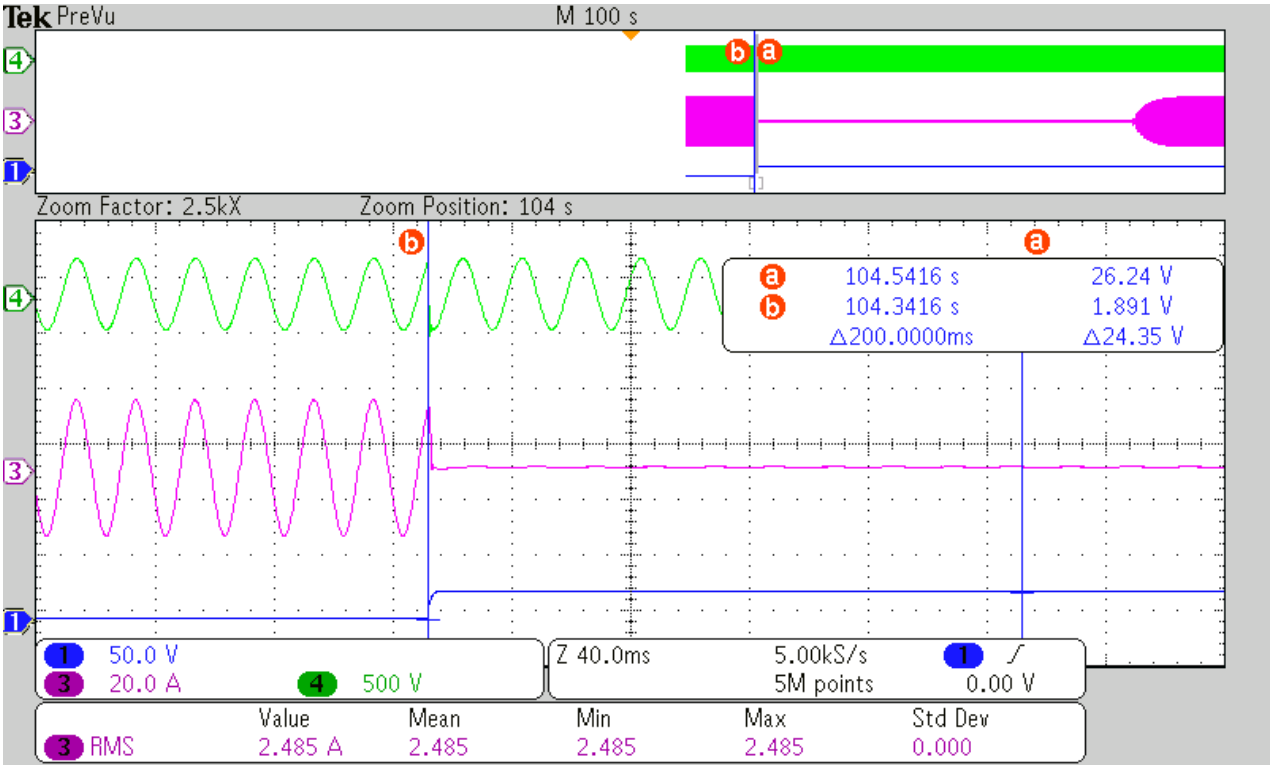




CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Diagram: shift of 180°





Annex 1
ISO 9001 certificate

CERTIFICATE

Quality Management System
ISO 9001:2015

AFORE NEW ENERGY TECHNOLOGY (SHANGHAI) CO.,LTD.

Certificate No.:	24CN34507669Q
Unified social credit code:	91310000561932991K
Registered Address:	Building 7, No.333, Wanfang Road, Minhang District, Shanghai
Office & Production Address:	Building 7, No.333, Wanfang Road, Minhang District, Shanghai, China
Certification Scope:	R & D and Manufacture of Photovoltaic Inverter

IAF 19
This is to certify that the quality management system established and implemented by the above organization meets the standard requirements.
During the validity period of the certificate, the surveillance audit should be carried out once a year and pass the audit, the certificate will continue to be valid.
The certificate can be checked out at the certification body website (www.acmchina.com) and CNCA website (www.cnca.gov.cn).

Date of first registration	**10/07/2017**
Date of this certificate	**04/07/2024**
Date of expiry	**09/07/2026**

Certificate query

IAS ACCREDITED Management Systems Certification Body MSCB-345

IAF MEMBER OF MULTILATERAL RECOGNITION ARRANGEMENT

General Manager

ACM INTERNATIONAL CERTIFICATION LIMITED
41 Devonshire Street, Ground Floor, Office 1 London, United Kingdom, WIG 7AJ
Local Office-ACM (CHINA) LIMITED, Rm B201, Building 2, No 352, Waihuan Road, Minhang District, Shanghai 201199, China
T: +86 21-64305860 F: +86 21-64881096 W: www.acmchina.com E: info@acmcert.com.cn

Annex 2
IEC 62619 Certificate for used battery

	Ref. Certif. No.
IEC IECEE	FR_723199/M1

IEC SYSTEM FOR MUTUAL RECOGNITION OF TEST CERTIFICATES FOR ELECTRICAL EQUIPMENT (IECEE) CB SCHEME

CB TEST CERTIFICATE

Product	**Lithium-Ion Battery** Rechargeable Li-ion Battery
Name and address of the applicant	**Shenzhen Hailei New Energy Co.,Ltd** Room 101, Building A, No.7, Xiusheng 1st road, Xiuxin Community, Kengzi Street, Pingshan District, Shenzhen City, Guangdong Province - CHINA
Name and address of the manufacturer	**Shenzhen Hailei New Energy Co.,Ltd** Room 101, Building A, No.7, Xiusheng 1st road, Xiuxin Community, Kengzi Street, Pingshan District, Shenzhen City, Guangdong Province - CHINA
Name and address of the factory	**Shenzhen Hailei New Energy Co.,Ltd** Room 101, Building A, No.7, Xiusheng 1st road, Xiuxin Community, Kengzi Street, Pingshan District, Shenzhen City, Guangdong Province - CHINA
Note: *When more than one factory, please report on page 2*	☐ Additional Information on page 2
Ratings and principal characteristics	See Annex
Trademark / Brand (if any)	Hailei
Customer's Testing Facility (CTF) Stage used	/
Model / Type Ref.	See Annex
Additional information (if necessary may also be reported on page 2)	Supersedes CBTC FR_723199 dated 04/12/2025. Update the list of product references ☐ Additional Information on page 2
A sample of the product was tested and found to be in conformity with	IEC 62619:2022
As shown in the Test Report Ref. No. which forms part of this Certificate	CSWQ-ESH-P25090511-R1

This CB Test Certificate is issued by the National Certification Body

LABORATOIRE CENTRAL DES INDUSTRIES ELECTRIQUES - LCIE
33 avenue du Général Leclerc
92260 Fontenay-aux-Roses, FRANCE
www.lcie.fr

Date: 17/12/2025

Signature: Jérôme REYSSON
Certification Officer

1/2

Ref. Certif. No.

FR_723199/M1

ANNEX

References, ratings and main characteristics:

Model	Nominal voltage (Vdc)	Rated capacity (Ah)	Rated Power (kWh)
ATOM HVS-7.68	153,6	50	7,68
ATOM HVS-10.24	204,8	50	10,24
ATOM HVS-12.8	256,0	50	12,80
ATOM HVS-15.36	307,2	50	15,36
ATOM HVS-17.92	358,4	50	17,92
ATOM HVS-20.48	409,6	50	20,48

LABORATOIRE CENTRAL DES INDUSTRIES ELECTRIQUES - LCIE
33 avenue du Général Leclerc
92260 Fontenay-aux-Roses, FRANCE
www.lcie.fr

Date: 17/12/2025

Signature: **Jérome REYSSON**
Certification Officer

Annex 3
Datasheet of the relay

产品规格书 Specification FM-M0608-002 Rev1.5

厦门宏发电声股份有限公司
Xiamen Hongfa Electroacoustic Co.,Ltd.

电话 Tel:（86）- 592-6106688
传真 Fax:（86）- 592-6106678
网址 Web site: www.hongfa.com

产品规格书

Specification

文件编号 File No.：4578914GGS005

宏发产品名称 Our Product Name: 继电器 RELAY

宏发产品型号 Our Product model: HF161F-40W/12-HTF(967)

发布日期 Publish Date: 2020.12.16

生产工厂 Production Plant: 中国厦门

版本 Version: a 更改单号 Number of Modification:

宏发审批签字 Signature by Hongfa			顾客确认 Custom Approval
拟制 Make	审核 Check	批准 Approved	负责人 By:
张茂松	傅飞飞	朱艺青	日期 Date:

特别说明：
1.此规格书请顾客在 2 周内确认，如未在规定时间内答复，则视为同意。
2.自提供规格书之日起 2 年内，顾客没有下单订货，本规格书失效。
Especially claim:
1.This specification is expected to be checked within 2 weeks.Without feedback after 2 weeks, Hongfa will take it as granted that customer approves of this specification.
This specification will be invalid if no order within 2 years.

保存期限:长期 保存部门:技术系统

- 1 -

产品规格书 Specification

变更履历 Revision Record

顾客 Customer		产品型号 Part No.		
变更版 Version No.	变更日期 Change Date	变更内容 Description	原因 Reason	负责人 By

产品规格书 Relay Specification

1 品种 Type Model

1.1 种类 Kinds: 电磁继电器 Electromagnetic Relay

1.2 型号 Type: HF161F-40W/12-HTF(967)

1.3 外形尺寸 Outline: 30.4mm×15.9mm×23.3mm

1.4 触点形式 Contact Arrangement: 一组常开 1 Form A

1.5 触点材料 Contact Material: $AgSnO_2$

1.6 触点间隙 Contact Gap: ≥1.8 mm

2 安全认证 Safety Approval

认证机构 Certification Agency	认证号 File No.
UL/CUL	E134517
TüV	R 50475730
CQC	CQC20002246447

上述认证号代表该产品取得相关认证，但具体认证内容请以我公司提交的认证证书为准。The above certificate No.is just a license No. Please refer to the certificates we supplied for detail information.

3 线圈额定参数 Coil Rating

at 23 ℃

额定电压 Rated Voltage Vd.c.	动作电压 Operate Voltage Vd.c.	释放电压 Release Voltage Vd.c.	保持电压 Holding Voltage Vd.c.	线圈电阻 Coil Resistance Ω	线圈功耗 Coil Power W 大约 Approx.
12	≤9.0	≥0.6	7.2 (at 85 ℃)	90×(1±10%)	1.6

注 1：线圈保持电压为从线圈施加额定电压 100ms 以后的线圈电压。

Note 1: The coil holding voltage is the voltage of coil after being applied nominal voltage for 100 ms.

注 2：磁路系统专门设计用于这种低保持功耗，当环境温度大于 23℃时，如果不降低线圈功耗，则不允许长期使用！

Note 2: The magnetic system is designed for this reduced holding power, continuous operation without power reduction is not permitted for ambient temperatures of > 23℃!

4 触点参数 Contact Specification

4.1 触点额定负载 Contact Rating: Making 20 A, loading40 A, breaking 20 A, 277 Va.c.

4.2 最大切换电流 Max. Switching Current: 43 A

4.3 最大切换电压 Max. Switching Voltage: 277 Va.c.

4.4 最小适用负载 Min. Applicable Load: 6 V, 1 A

5 性能 Performance

5.1 接触电阻 Contact Resistance: 100 mΩ max. (at 6 Vd.c. 1A)。 (四端法 Four Probe Method)

5.2 动作时间 Operate Time: ≤ 20 ms 。

5.3 释放时间 Release Time: ≤ 10 ms 。

5.4 回跳时间 Bounce Time: ≤ 10 ms 。

5.4.1 电耐久性 Electrical Endurance

结构型式 Version	触点材料 Contact Material	触点负载 Contact Rating	环境温度 Ambient Temperature	通断比 ON：OFF	电耐久性 Electrical Endurance
1H	$AgSnO_2$	阻性负载 resistive Load making 20 A, loading 40 A, breaking 20 A, 277 Va.c.	85℃	1 s: 9 s	3×10^4次(ops)
1H	$AgSnO_2$	阻性负载 resistive Load making 10 A, loading 43 A, breaking 10 A, 277 Va.c.	85℃	1 s: 9 s	3×10^4次(ops)

5.4.2 机械耐久性 Mechanical Endurance

触点负载 Contact Rating	环境温度 Ambient Temperature	通断比 ON：OFF	机械耐久性 Mechanical Endurance
无负载 No load	常温 Room Temperature	0.5 s: 0.5 s	1×10^5次 (ops)

5.5 介质耐压 Dielectric Strength (漏电流 Leak Current: 1 mA)

5.5.1 断开触点电路的各引出端之间 Between terminals of each opened contact circuit: 2500 Va.c. (50/60 Hz 1 min) 。

5.5.2 所有线圈引出端与所有触点电路引出端之间 Between all coil terminals and all contact circuit terminals: 4500 Va.c. (50/60 Hz 1 min) 。

5.6 绝缘电阻 Insulation Resistance

5.6.1 断开触点电路的各引出端之间 Between terminals of each opened contact circuit: 1000 MΩ (500 Vd.c.) 。

5.6.2 所有线圈引出端与所有触点电路引出端之间 Between all coil terminals and all contact circuit terminals: 1000 MΩ (500 Vd.c.) 。

5.7 线圈温升 Coil Temperature Rise: 70 K max.

以 100%额定电压激励 100 ms 后降为 60%额定电压保持，触点负载 43 A 。环境温度：85 ℃。

Applied voltage of coil 100% rated voltage for 100 ms holding voltage of coil 60% rated voltage, Carry current of contact 43 A. Environmental temperature is 85 ℃.

5.8 振动 Vibration

稳定性：双振幅 1.5 mm，频率 10 Hz～55 Hz，每个方向各 1 小时，闭合回路的断开或断开回路的闭合时间应不超过 100μs。

Functional:10 Hz～55 Hz,1.5 mm double amplitude,1 hour Per Cross-axis.No opening or closing of any closed or opened contact circuit respectively shall exceed 100 μs.

5.9 冲击 Shock

稳定性: 98 m/s^2（脉冲持续时间 11 ms），6 次(三个相互垂直轴线的每一个方向 6 次，总共 36 次),闭合回路的断开或开路回路的闭合时间应不超过 100μs。

Functional: 98 m/s^2(Duration 11 ms), 6 shocks (six ops in both directions of each of the three mutually perpendicular axes, totally 36 ops), No opening or closing of any closed or opened contact circuit respectively shall exceed 100μs.

强度: 980 m/s^2（脉冲持续时间 6 ms），6 次(三个相互垂直轴线的每一个方向 6 次，总共 36 次）继电器外观、结构和性能不应有异常。

Destructive: 980 m/s^2(Duration 6 ms), 6 shocks (six ops in both directions of each of the three mutually perpendicular axes, totally 36 ops) It shall be no abnormalities in appearance, construction and performance.

5.10 引出脚强度 Terminal Strength

PCB 引出脚：在 PCB 引出脚轴线方向上施加 5 N 拉力或压力，持续时间 10 s，继电器应无异常。

PCB Terminal：The relay shall be no abnormalities while bring or press 5 N force for 10 s on the PCB terminals in the directions of its axis.

5.11 耐焊接热 Soldering Heat Resistance

5.11.1 焊接温度 Soldering Temperature：(260±3) ℃

5.11.2 焊接时间 Soldering Time：(10±1) s

5.12 焊接性能 Soldering Ability: (250±3) ℃, (10±1)s 引出端被浸锡部分应有 90%以上连续覆上一层锡层（90% of the dipped portion shall be soldered）。

5.13 耐温性 Temperature Resistance

5.13.1 耐热 Heat Resistance

(85±2) ℃温度中放置 16 h,恢复常温 2 h 后，继电器的结构及性能应无异常。

Must be free from any abnormality in both the construction and characteristics after the relay is lift in a temperature of (85±2) ℃ for 16h and then in room temperature and humidity for 2 h.

5.13.2 耐寒 Cold Resistance

(-40±2) ℃度中放置 16 h,恢复常温 2 h 后，继电器的结构及性能应无异常。

Must be free from any abnormality in both the construction and characteristics after the relay is lift in a temperature of (-40±2) ℃ for 16h and then in room temperature and humidity for 2 h.

5.13.3 耐湿性 Moisture Resistance

在温度(40±2) ℃相对湿度 90%～95% RH 中放置 16 h，恢复常温 2 h 后，继电器的结构及性能应无异常。且绝缘电阻应不小于 50 MΩ(500 Vd.c.)。

Must be free from any abnormality in both the construction and characteristics after the relay is lift in temperature of (40±2) ℃ and humidity of 90% to 95% RH for 16 h and then in room temperature and humidity for 2 h. Insulation resistance however must be 50 MΩ(500 Vd.c.).

6 产品标识 Marking

6.1 外壳颜色 Case Color: 黑色 Black

6.2 印字位置 Marking Position: 侧面 Flank

6.3 印字颜色 Ink Color: 激光打标 Laser Marking

7 标准测试条件 Standards Test Condition

7.1 温度 Temperature: 23℃±5℃

7.2 湿度 Humidity: 25% ～ 75% RH

7.3 方向 Direction of Measurement: 任意 Free

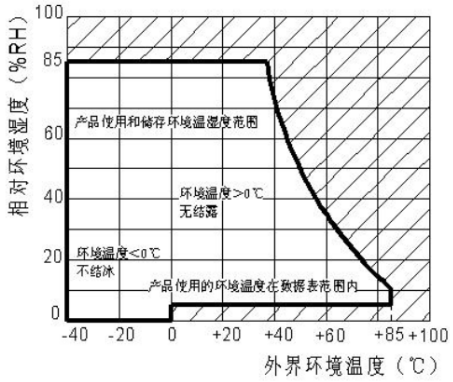
8 使用条件 Operating Condition

8.1 温度 Temperature: -40 ℃～ 85 ℃

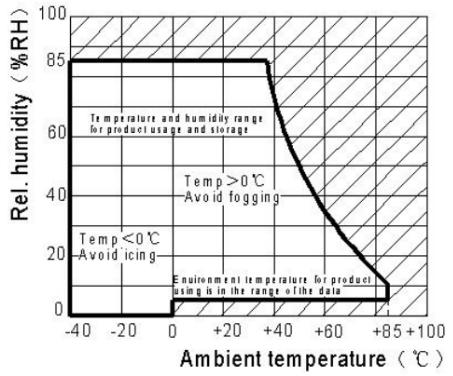
8.2 湿度 Humidity: 5% ～ 85% RH

8.3 安装方向 Mounting Direction: 任意 Free

注：使用环境条件不能导致继电器内部产生结露、结冰，否则会导致继电器失效。另外，湿度范围会随温度而有所不同，因此请控制在下图所示的范围。



Note:The ambient environment of application shall not cause any dewing or icing inside the relay. Otherwise, the relay may fail to work consequently. The humidity range varies with the temperature. Use within the range indicated in the graph below.



9 贮存条件 Storage Condition

9.1 温度 Temperature: 0 ℃ ～ 40 ℃

9.2 湿度 Humidity: 20% ～ 80% RH

9.3 环境 Environment

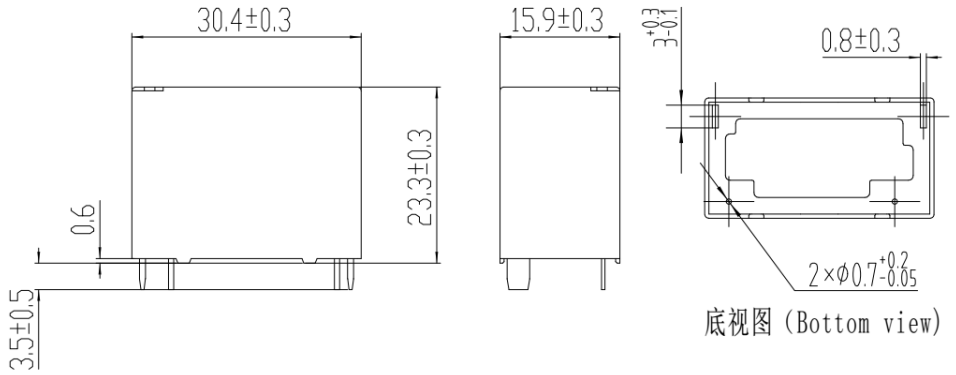
9.3.1 产品贮存场地不能有腐蚀性气体 Store in locations where the product is not exposed to corrosive gas.

9.3.2 贮存中应避免阳光直照产品 Keep product is not exposed to the direct ray of the sun.

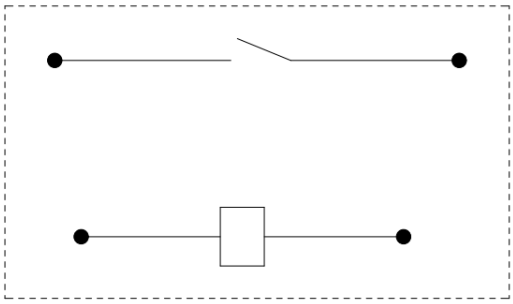
9.3.3 堆码高度 Stacking Height ： ≤ 7 层 layers.

10 产品结构 Configuration

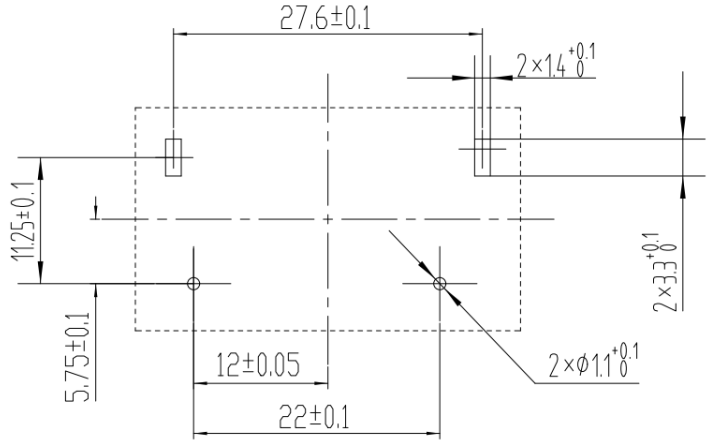
10.1 外形图 Outline Schematic



10.2 接线图(底视) Wiring Diagram(Bottom View)



10.3 安装孔位图 PCB Layout



注：产品外形尺寸未注尺寸公差及 PC 板未注尺寸公差按下表执行。

Note： All unspecified tolerance(including outline dimension and PC board dimension) according to following table.

产品外形尺寸未注尺寸公差 Outline dimensions hadn't specified tolerance		PC板未注尺寸公差 PC board dimensions hadn't specified tolerance
外形尺寸 Outline Dimensions	公差 Tolerance	
≤1	±0.2	±0.1
>1～5	±0.3	
>5	±0.4	

11 订货标记 Ordering Information

HF161F-40W / 12 - H T F (967)

① ② ③ ④ ⑤ ⑥

① 产品型号 Type HF161F-40W

② 线圈电压 Coil voltage 12 Vd.c.

③ 触点形式 Contact arrangement H：一组常开（1 Form A）

④ 触点材料 Contact material T：$AgSnO_2$

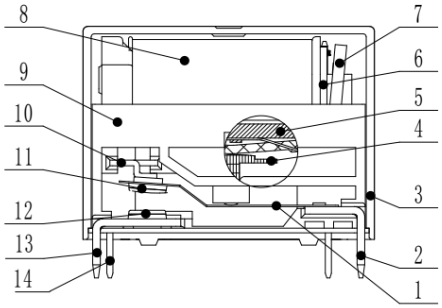
⑤ 绝缘等级 Insulation standard F：F级（Class F）

⑥ 特殊特性代码 Special code （967）：线圈功耗 Coil power 约1.6 W,触点间隙 Contact Gap： ≥1.8 mm

12 主要零部件 Important Part And Components

序号 Serial No.	零部件名称 Part And Components Name	材料名称 Material Name	备注 Remark
1	动簧片 Movable spring	铜合金 Copper alloy	
2	动簧焊片 Terminal	纯铜 Copper	
3	外壳 Cover	工程塑料 Engineering plastic	
4	推动块 Driving block	工程塑料 Engineering plastic	
5	轭铁 Yoke	纯铁 Steel	
6	铁芯 Iron core	纯铁 Steel	
7	衔铁 Armature	纯铁 Steel	
8	线圈 Coil	铜线 Copper wire	
9	底座 Base	工程塑料 Engineering plastic	
10	定位片 Fixing bridge	纯铁 Steel	
11	动触点 Move contact	银合金 Silver alloy	
12	静触点 Stationary contact	银合金 Silver alloy	
13	静簧片 Stationary spring	纯铜 Copper	
14	线圈引出脚 Coil Terminal	铜合金 Copper alloy	

结构图 Construction Schematic

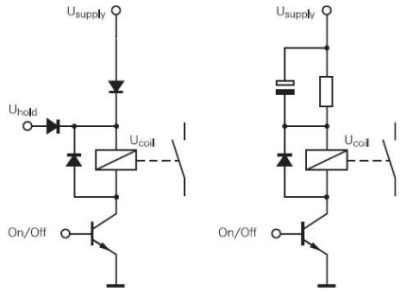


13 其他说明 Others

13.1 非塑封继电器需要防止助焊剂或污染物进入继电器。Unsealed relays should prevent flux or contamination into the relay.

13.2 避免在强磁场条件下使用继电器，外界强磁场会造成继电器动作和释放等参数发生变化。To avoid using relays under strong magnetic field because it will change the parameters of relay such as pull-in and drop-out voltage.

13.3 降低线圈功耗的常用方法是输入线圈额定电压脉冲后降低线圈电压或者使用PWM脉宽调制，如下图所示。Common methods for the reduction of coil power consumption is: reduce coil voltage after a pull-in pulse equivalent to at least the coil’s rated voltage or control the coil voltage by pulse width modulation(PWM).The following figure shows the typical examples.

电容方式 Capacitor Circuit	

PWM	脉冲幅度：1.0～1.5 倍额定电压；脉冲频率：10 kHZ～20 kHz；第一个脉冲宽度：≥100 ms；占空比：≥60%；线圈两端并联续流二极管。即 PWM 驱动下电压有效值为 7.2 Vmin.。If the coil is applied the PWM: pulse amplitude: 1. 0～ 1. 5 times rated voltage; Pulse frequency: 10 kHz～20 kHz; The first pulse width: ≥ 100 ms; Duty cycle: ≥ 60%; The two ends of the coil are connected in parallel with the diode. The voltage effective value of PWM driven is 7.2Vmin..

13.4 对宏发而言，不可能评定继电器在每个应用领域、应用环境的所有性能参数要求，因而，客户应根据具体的使用条件选择与之相匹配的产品，若有疑问，请与宏发联系获得更多的技术支持。但产品的选型责任仅由客户负责。We could not evaluate all the performance and all the parameters for every possible application field and environment.Thus the user should be in a right position to choose the suitable produce for their own application.If there is any query,please contact Hongfa for the technical service.However,it is the use’s responsibility to determine which product should be used only.

13.5 本产品规格书中标称的使用环境温度范围指的是产品在特定负载条件下的最大耐受温度范围。对于防爆规格产品的使用环境温度按相应防爆认证证书的规定。Operating temperature range in this specification refers to the maximum tolerable temperature range under specific load conditions. To explosion-proof product, the ambient temperature should conform to regulations in related explosion-proof certification.

13.6 继电器的电耐久性次数可能会因使用环境条件的不同而有差异。产品的电耐久性能详细情况见认证证书。本产品规格书中电耐久性所列的试验条件、触点负载可能未包含在认证证书中，当使用环境条件与认证条件不同时，电耐久性能需要由具体试验确认。Differences in relay electrical endurance cycles would exist due to difference in operating ambient conditions. The electrical endurance of the products detailed in the safety certificates.The test condition and contact rating for electrical endurance in this specification may not be included in the safety certificates,in case that the condition in real applications is different from safety certificates, the electrical endurance of the relay must be confirmed by tests.

13.7 本产品规格书供客户使用时参考，其中，未明确规定的要求条件，参考“继电器术语解释及使用指南”（见 http://cn.hongfa.com/pdf/Guide_power_signal_cn.pdf）。The specification is for reference only.See to “Terminology and Guidelines”(see http://www.hongfa.com/pdf/Guide_power_signal_en.pdf) for more information.

13.8 为了保持继电器的性能，请注意不要使继电器掉落或受到强冲击。建议掉落后的继电器报废。To maintain the performances of relays, please do not make the relay drop or be shocked strongly. Suggest that the relays dropped be scrapped.

13.9 规格书内的各项性能参数是基于标准测试条件下测得的初始值。All the performance data listed in the datasheet are the initial values tested under standard testing condition.

13.10 环保措施 Environmental Protection

宏发产品均符合 RoHS 要求。Hongfa products are all RoHS compliant.

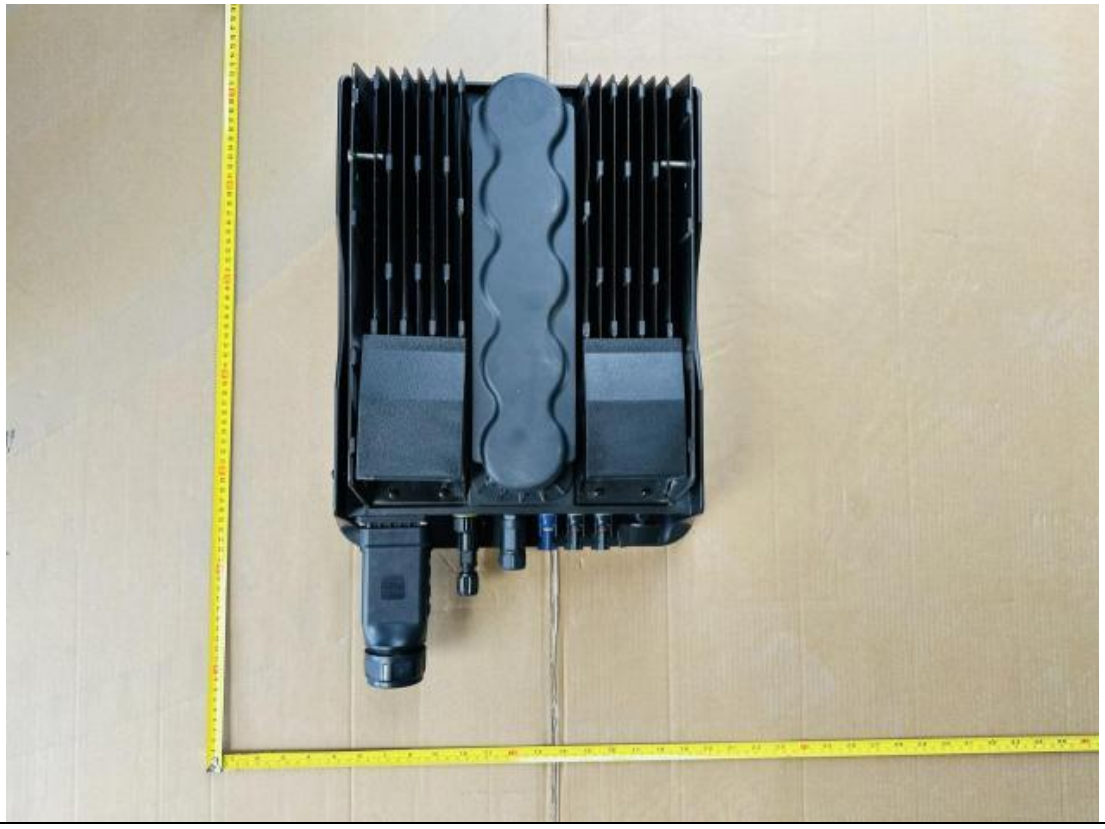
13.11 宏发保留对产品更改的权利，客户在首次下单之前应确认此规格书内容，必要时可要求我司提供新的规格书。Hongfa reserves the right to make changes. Customers should reconfirm the contents of the specification before first orders and ask for us to supply a new specification if necessary.

Annex 4
Pictures of the unit

Enclosure - Front View for AF15K-MTH and AF15K-MTH-0



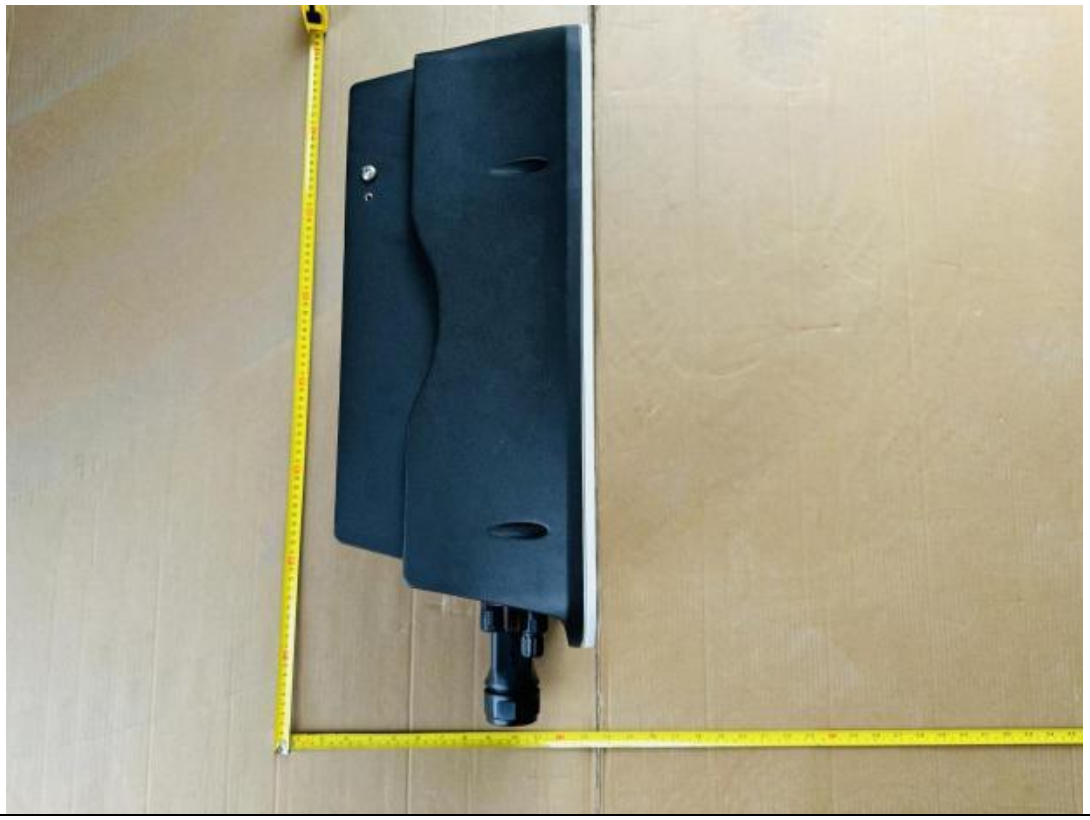
Enclosure - Rear for AF15K-MTH



Enclosure - Rear for AF15K-MTH-0



Enclosure - Side View (Left) for AF15K-MTH



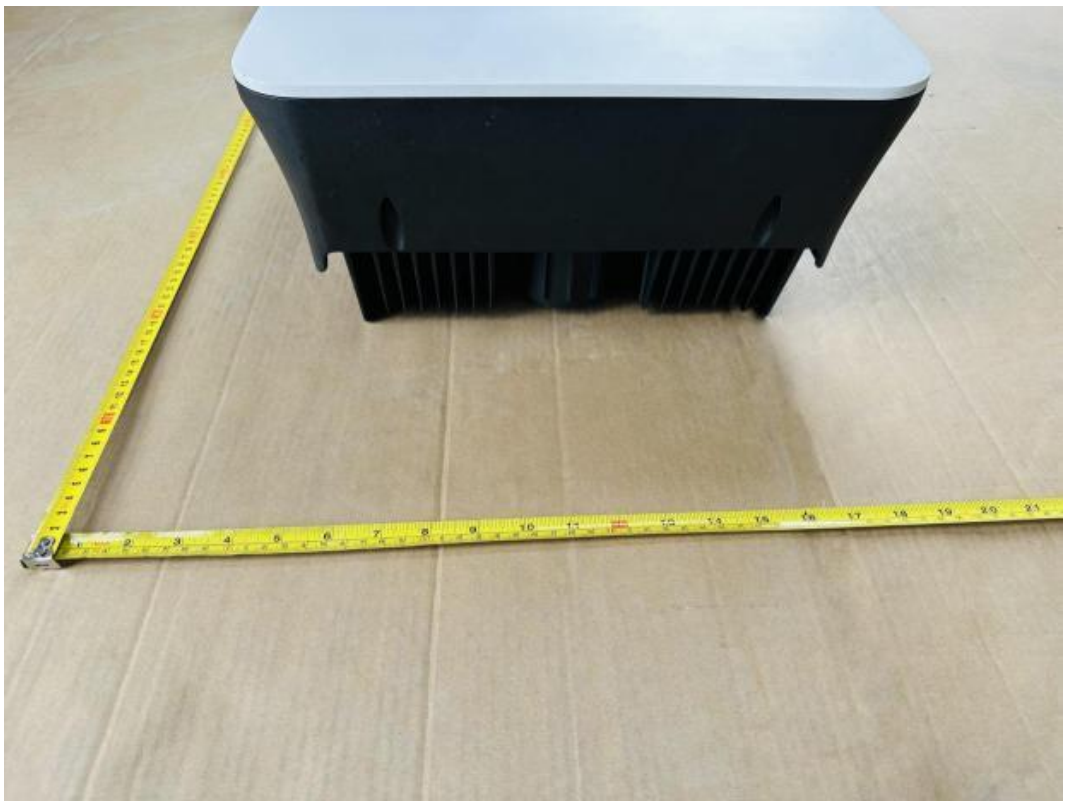
Enclosure - Side View (Left) for AF15K-MTH-0



Enclosure - Side View (Right) for AF15K-MTH and AF15K-MTH-0



Enclosure - Top View for AF15K-MTH and AF15K-MTH-0



Enclosure - Bottom View for AF15K-MTH

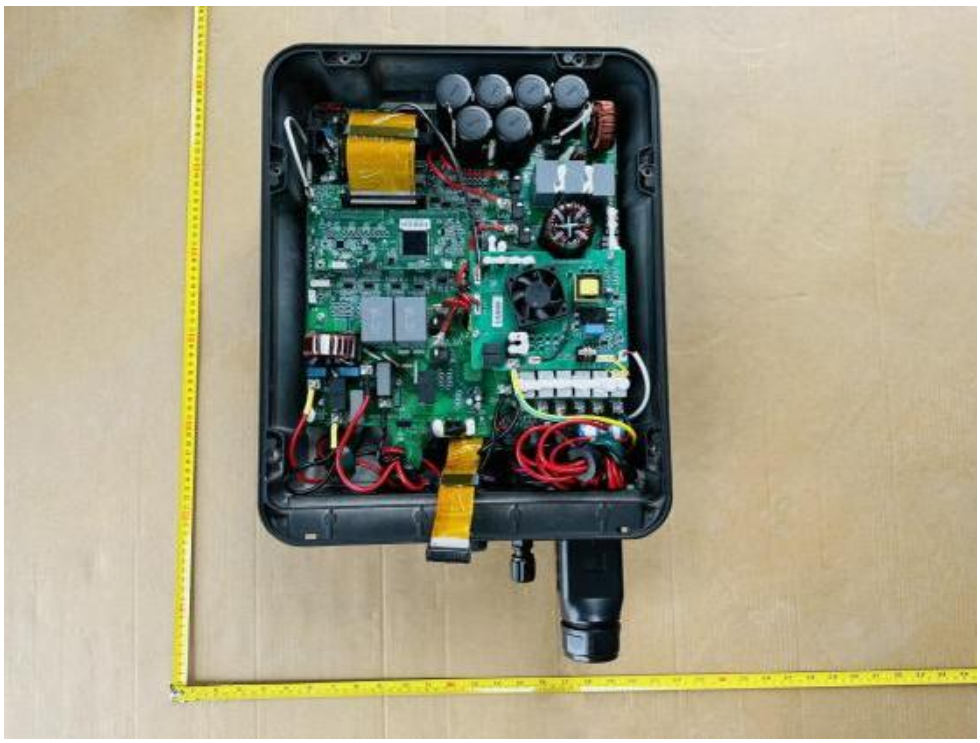


Enclosure - Bottom View for AF15K-MTH-0

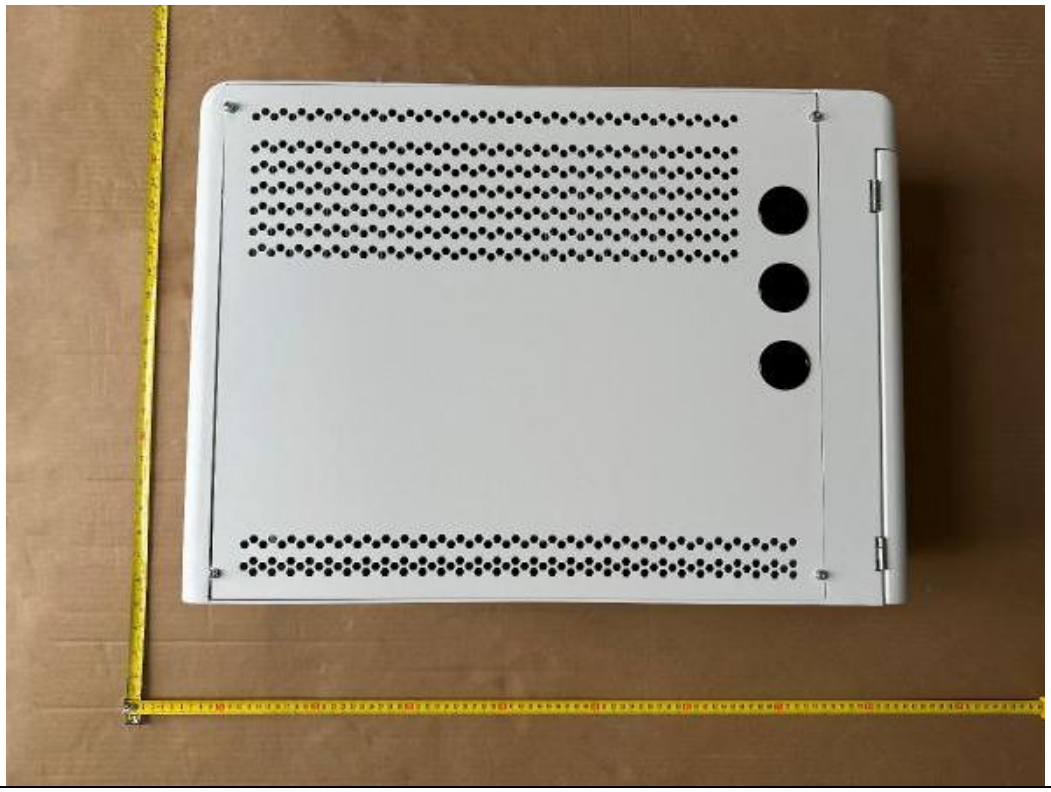


Internal view of inverter for AF15K-MTH



Internal view of inverter for AF15K-MTH-0

Enclosure - Front View for AF15K-ATH and AF15K-ATH-0


Enclosure - Rear View for AF15K-ATH and AF15K-ATH-0



Enclosure - Side View (Left) for AF15K-ATH and AF15K-ATH-0



Enclosure - Side View (Right) for AF15K-ATH and AF15K-ATH-0



Enclosure - Top View for AF15K-ATH and AF15K-ATH-0



Enclosure - Bottom View for AF15K-ATH and AF15K-ATH-0



Internal view for AF15K-ATH



Internal view for AF15K-ATH-0


--- End of test report---