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. .... :	6190323.51
Date of issue.................................... :	2024-05-11
Total number of pages	346 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
Test procedure .... :	Type test
Non-standard test method…………..:	N/A
Test Report Form No. .... :	CEI 0-21_V3.0
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 .... :	AF1K-SL-1, AF1.5K-SL-1, AF2K-SL-1, AF2.5K-SL-1, AF3K-SL-1, AF3.6K-SL-1, AF3K-SL, AF3.6K-SL, AF4K-SL, AF4.6K-SL, AF5K-SL, AF5.5K-SL, AF6K-SL; AF4K-SLP, AF4.6K-SLP, AF5K-SLP, AF5.5K-SLP, AF6K-SLP, AF1K-SL-0, AF1.5K-SL-0, AF2K-SL-0, AF2.5K-SL-0, AF3K-SL-0, AF3.6K-SL-0, AF4K-SL-0, AF4.6K-SL-0, AF5K-SL-0, AF5.5K-SL-0, AF6K-SL-0
Ratings .... :	See product marking plate on page 4 to 6 and ratings of the test products in page 10 to 15.

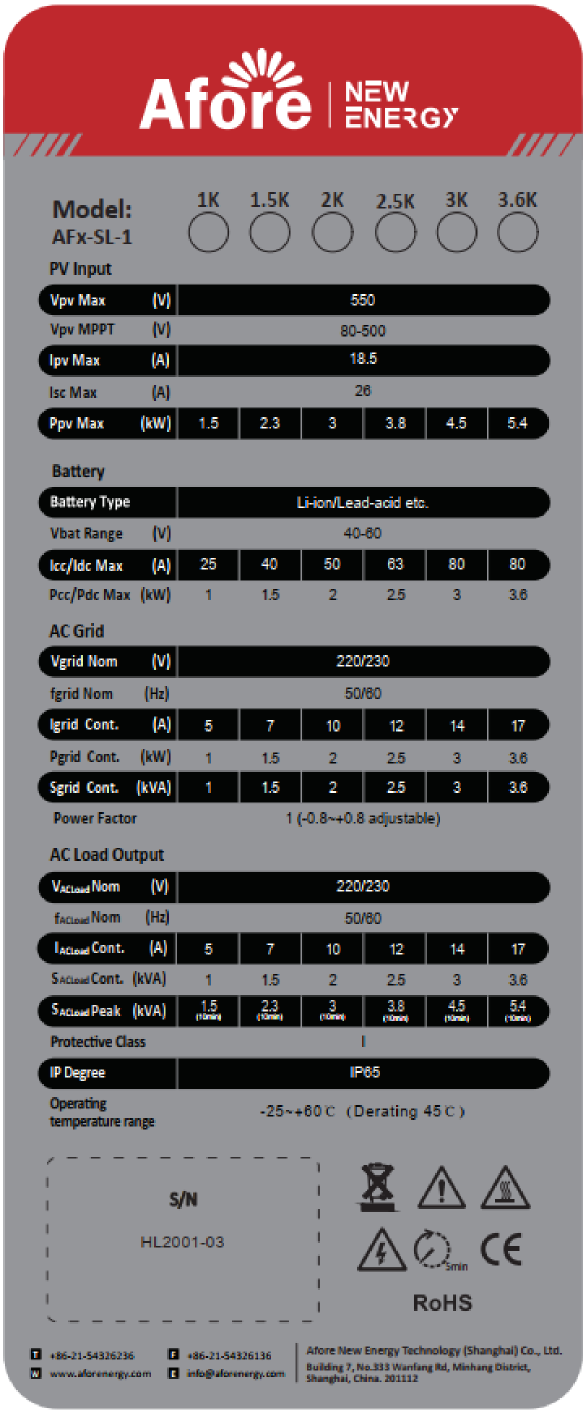
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒	**Testing Laboratory:**	DEKRA Testing and Certification (Suzhou) Co., Ltd.	
Testing location/ address .... :		No. 99, Hongye Road, Suzhou Industrial Park Suzhou, 215006, P.R. China	
☐	~~**Associated Testing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

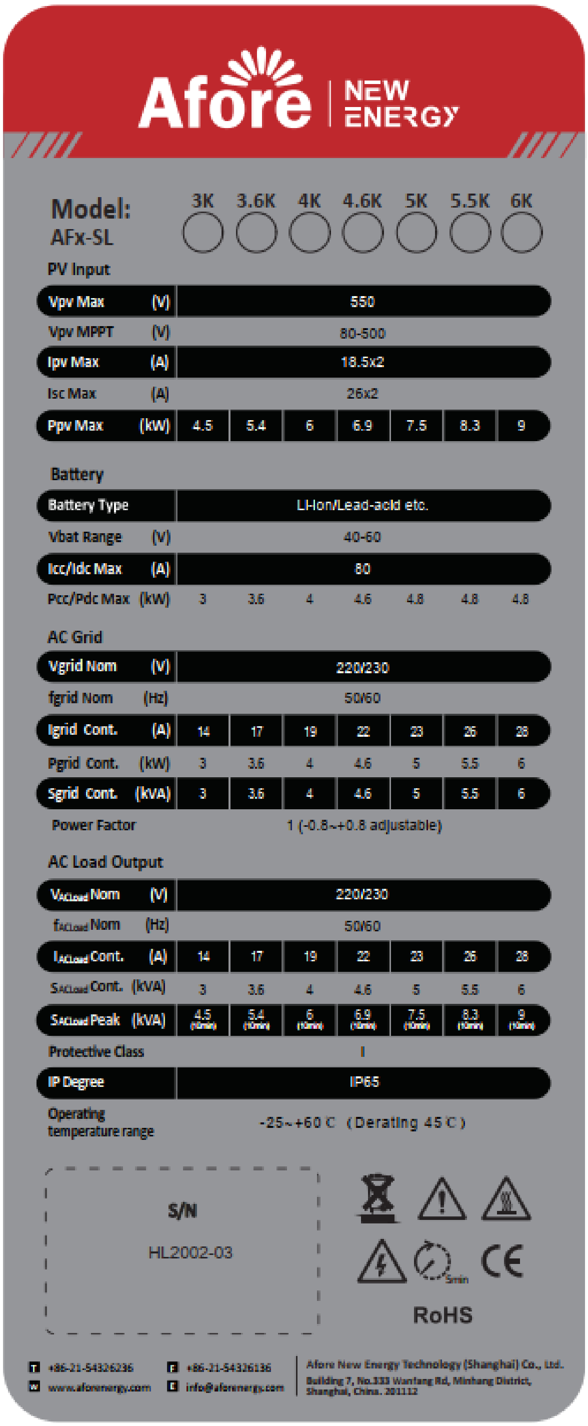
List of Attachments (including a total number of pages in each attachment):	
Annex 1: ISO 9001 certificate (1 pages) Annex 2: IEC 62619 Certificate for used battery (2 pages) Annex 3: Datasheet of the relay (2 pages) Annex 4: Pictures of the unit (5 pages)	
Summary of testing:	
Tests performed (name of test and test clause):	**Testing location:**
All tests (except clause 4.6 EMC tests)	DEKRA Testing and Certification (Suzhou) Co., Ltd. No.99, Hongye Road, Suzhou Industrial Park, Suzhou, Jiangsu, P.R. China
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.: 230601235SHA-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.: J23-429-WT-02 Accreditation Number: L0130 (CNAS-ILAC)

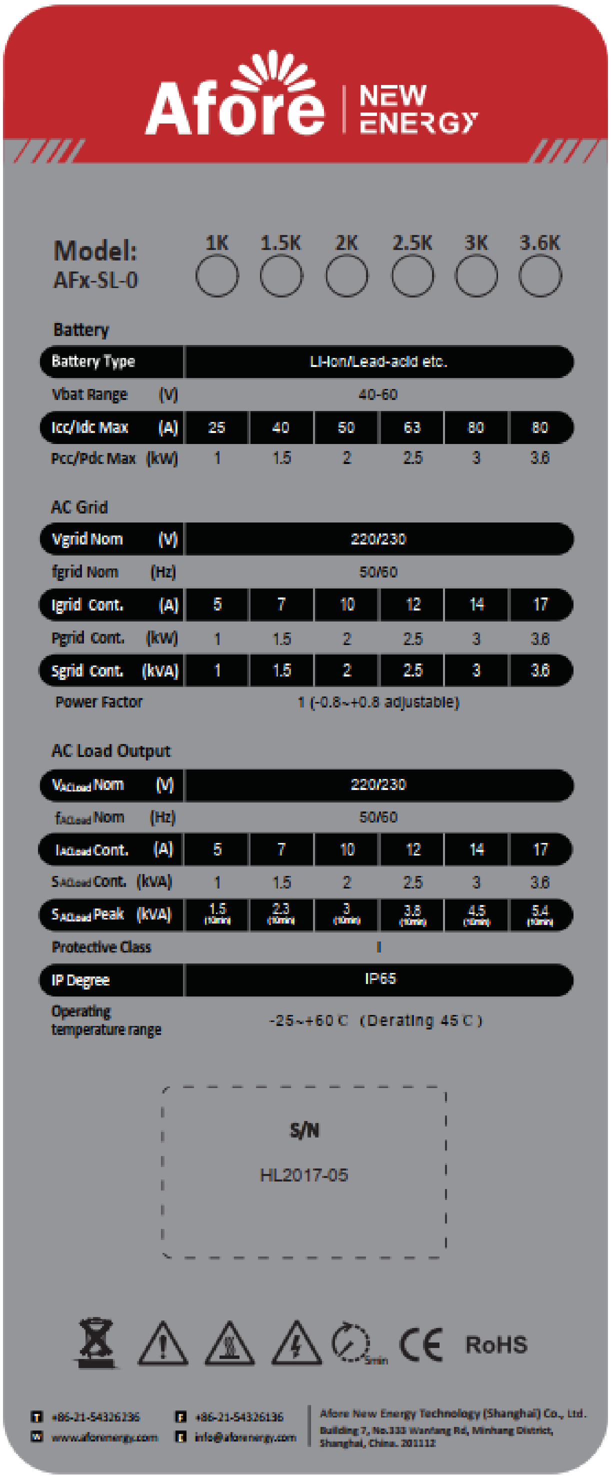
Copy of marking plate:

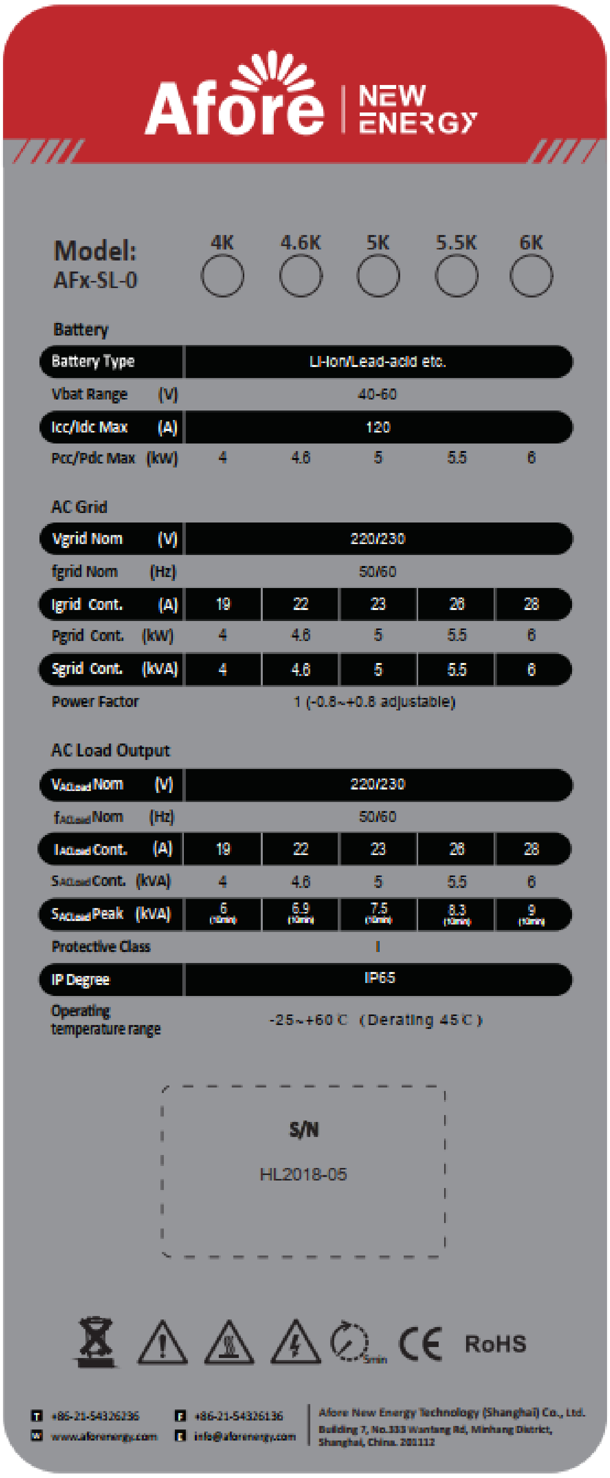
The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

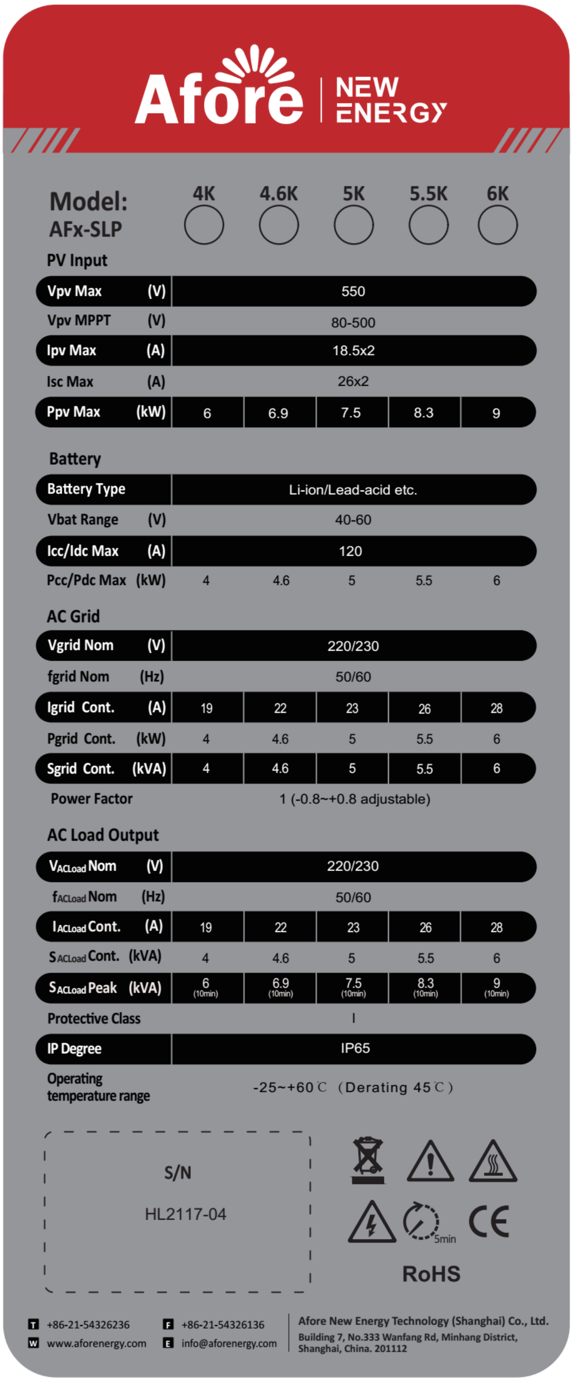
Marking label:





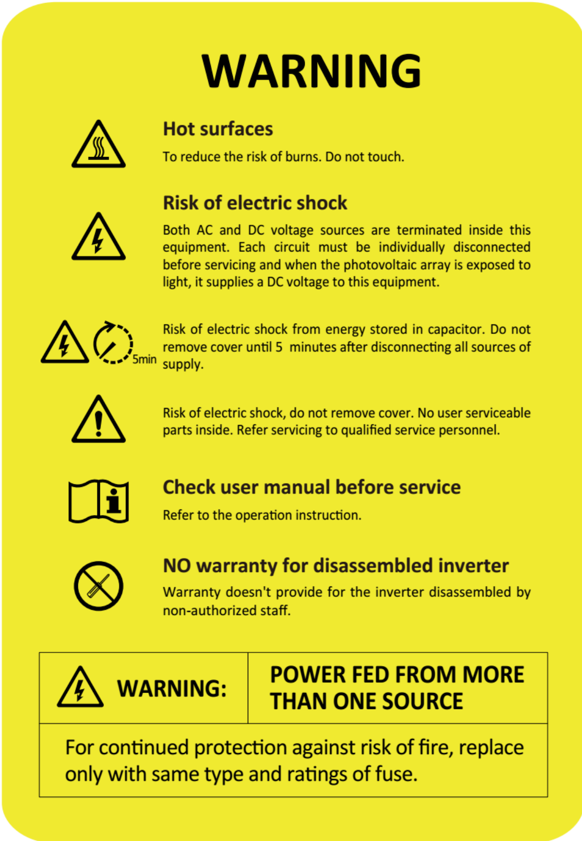

Afore NEW ENERGY
Model: AFx-SL-0 1K 1.5K 2K 2.5K 3K 3.6K
Battery
Battery Type Li-Ion/Lead-acid etc.
Vbat Range (V) 40-60
Icc/Idc Max (A) 25 40 50 63 80 80
Pcc/Pdc Max (kW) 1 1.5 2 2.5 3 3.6
AC Grid
Vgrid Nom (V) 220/230
fgrid Nom (Hz) 50/60
Igrid Cont. (A) 5 7 10 12 14 17
Pgrid Cont. (kW) 1 1.5 2 2.5 3 3.6
Sgrid Cont. (kVA) 1 1.5 2 2.5 3 3.6
Power Factor 1 (-0.8~+0.8 adjustable)
AC Load Output
VACLoad Nom (V) 220/230
fACLoad Nom (Hz) 50/60
IACLoad Cont. (A) 5 7 10 12 14 17
SACLoad Cont. (kVA) 1 1.5 2 2.5 3 3.6
SACLoad Peak (kVA) 1.5 (10min) 2.3 (10min) 3 (10min) 3.8 (10min) 4.5 (10min) 5.4 (10min)
Protective Class I
IP Degree IP65
Operating temperature range -25~+60℃ (Derating 45℃)
S/N
HL2017-05
RoHS
5min
+86-21-54326236
www.aforenergy.com
+86-21-54326136
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-SL-0 4K 4.6K 5K 5.5K 6K
Battery
Battery Type Li-Ion/Lead-acid etc.
Vbat Range (V) 40-60
Icc/Idc Max (A) 120
Pcc/Pdc Max (kW) 4 4.6 5 5.5 6
AC Grid
Vgrid Nom (V) 220/230
fgrid Nom (Hz) 50/60
Igrid Cont. (A) 19 22 23 26 28
Pgrid Cont. (kW) 4 4.6 5 5.5 6
Sgrid Cont. (kVA) 4 4.6 5 5.5 6
Power Factor 1 (-0.8~+0.8 adjustable)
AC Load Output
VACLoad Nom (V) 220/230
fACLoad Nom (Hz) 50/60
IACLoad Cont. (A) 19 22 23 26 28
SACLoad Cont. (kVA) 4 4.6 5 5.5 6
SACLoad Peak (kVA) 6 (10min) 6.9 (10min) 7.5 (10min) 8.3 (10min) 9 (10min)
Protective Class I
IP Degree IP65
Operating temperature range -25~+60℃ (Derating 45℃)
S/N
HL2018-05
RoHS
5min
+86-21-54326236
www.aforenergy.com
+86-21-54326136
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 hand-held stationary <u>fixed</u> transportable for building-in
Connection to the mains ....:	pluggable equipment direct plug-in <u>permanent connection</u> for building-in
Enviromental category ....:	<u>outdoor</u> indoor unconditional indoor conditional
Over voltage category Mains.....................................:	OVC I OVC II <u>OVC III</u> OVC IV
Over voltage category PV ....:	OVC I <u>OVC II</u> 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...:	<u>Class I</u> Class II Class III Not classified
Mass of equipment (kg) ....:	Max 20.5 kg
Pollution degree ....:	Outside PD3; Inside PD2
IP protection class ....:	IP65
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 ....:	2022-06-09 (samples provided by applicant) 2023-11-07 (Amendment 1 report) No samples (Amendment 2 report)
Date (s) of performance of tests ....:	2022-06-09 to 2022-10-24 2023-11-07 to 2024-03-04 (Amendment 1 report) No tests (Amendment 2 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.

Determination of the test result includes consideration of measurement uncertainty from the test equipment and methods.

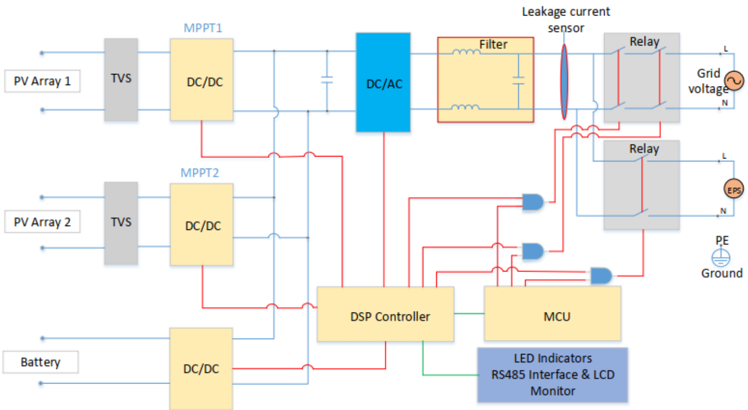
Name and address of factory (ies):

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 single phase Hybrid inverter and non-isolated between PV and AC output that convert DC voltage into AC voltage and feed it into the low-voltage public grid or supply local load.
The final used earth System shall comply the local code requirement.
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.
Description of the power circuit:
The internal control is redundant built, it consists of master controller and slave controller, the master controller can control relays, measures voltage, frequency, AC current with injected DC, insulation resistance and residual current. The slave controller can control the relays, measures the voltage and frequency. Both controllers communicate with each other.
The voltage and frequency measurement achieved with resistors in serial, which are connected directly to line and neutral. Both controllers get these signals and calculate the data.
The unit provides two relays in series in each phase. The relays were test before each start up. In addition, both controllers can stop the power bridge.

Block Diagram



Model difference:
1) The model AF*-SL-1 (* = 1K, 1.5K, 2K, 2.5K, 3K, 3.6K) have single MPPT input channel and are identical in hardware and just derating power by software.
2) The model AF*-SL (* = 3K, 3.6K, 4K, 4.6K, 5K, 5.5K, 6K) have dual MPPT input channel and are identical in hardware and just derating power by software.
3) The model AF*-SL-0 (*= 1K, 1.5K, 2K, 2.5K, 3K, 3.6K, 4K, 4.6K, 5K, 5.5K, 6K) have no PV input circuit and are identical in hardware and just derating power by software.
4) The BAT port current of model AF*-SL (*= 4K, 4.6K, 5K, 5.5K, 6K) is 80A, and the BAT port current of model AF*-SLP (*= 4K, 4.6K, 5K, 5.5K, 6K) is 120A. The output power is derated by software.

The product was tested on:
Hardware version: 1.01
Software version: V02
Amendment 1:
The report 6182549.51 was based on the report 6136775.50 issued by DEKRA Testing and Certification (Suzhou) Co., Ltd., issued on 2022-12-16, and COC No.: 6136775.01 issued by DEKRA Testing and Certification (Shanghai) Ltd., issued on 2022-12-16. It was issued due to below modifications:
---Change the specification of the battery.
After technical review, tests were considered necessary, see the “summary of testing”.
Amendment 2:
The report 6190323.51 was based on the report 6182549.51 issued by DEKRA Testing and Certification (Suzhou) Co., Ltd., issued on 2024-04-12, and COC No.: 6182549.02 issued by DEKRA Testing and Certification (Shanghai) Ltd., issued on 2024-04-12. It was issued due to below modifications:
---Update the CB certificate of the battery.
After technical review, tests were not considered necessary.

Model list / Ratings of the test product:						
Models	**AF1K-SL-1**	**AF1.5K-SL-1**	**AF2K-SL-1**	**AF2.5K-SL-1**	**AF3K-SL-1**	**AF3.6K-SL-1**
PV input:						
Max PV voltage (V)	550					
MPPT voltage range (V)	80-500					
Max PV current (A)	18.5					
Isc PV (A)	26					
Max PV power (W)	1500	2300	3000	3800	4500	5400
Battery port:						
Battery type	Rechargeable Li-ion Battery/ LiFePO4/ Lead-acid					
Battery normal voltage (range) (Vdc)	51.2 (40-60)					
Max charge/ discharge current (A)	25	40	50	63	80	80
Max charge/ discharge power (W)	1000	1500	2000	2500	3000	3600
AC grid (input and output):						
Rated voltage (V)	L/N/PE, 230Vac					
Rated frequency (Hz)	50					
Max AC current (A)	5	7	10	12	14	17
Rated AC power (W)	1000	1500	2000	2500	3000	3600
Max AC apparent power (VA)	1000	1500	2000	2500	3000	3600
Power factor range	1.0 (-0.8~ +0.8 adjustable)					
AC load output (stand alone):						
Rated voltage (V)	L/N/PE, 230Vac					
Rated frequency (Hz)	50					
Max AC current (A)	5	7	10	12	14	17
Rated continuous AC power (W)	1000	1500	2000	2500	3000	3600
Max continuous AC apparent power (VA)	1000	1500	2000	2500	3000	3600
General:						
Protection class	I					
Degree of protection	IP65					
Overvoltage category	II(DC), III(AC)					
Ambient temperature	-25...+60°C (Derating > 45°C)					

Models	**AF3K-SL**	**AF3.6K-SL**	**AF4K-SL**	**AF4.6K-SL**	**AF5K-SL**	**AF5.5K-SL**	**AF6K-SL**
PV input:							
Max PV voltage (V)	550						
MPPT voltage range (V)	80-500						
Max PV current (A)	18.5 x 2						
Isc PV (A)	26 x 2						
Max PV power (W)	4500	5400	6000	6900	7500	8300	9000
Battery port:							
Battery type	Rechargeable Li-ion Battery/ LiFePO4/ Lead-acid						
Battery normal voltage (range) (Vdc)	51.2 (40-60)						
Max charge/ discharge current (A)	80						
Max charge/ discharge power (W)	3000	3600	4000	4600	4800	4800	4800
AC grid (input and output):							
Rated voltage (V)	L/N/PE, 230Vac						
Rated frequency (Hz)	50						
Max AC current (A)	14	17	19	22	23	26	28
Rated AC power (W)	3000	3600	4000	4600	5000	5500	6000
Max AC apparent power (VA)	3000	3600	4000	4600	5000	5500	6000
Power factor range	1.0 (-0.8~ +0.8 adjustable)						
AC load output (stand alone):							
Rated voltage (V)	L/N/PE, 230Vac						
Rated frequency (Hz)	50						
Max AC current (A)	14	17	19	22	23	26	28
Rated continuous AC power (W)	3000	3600	4000	4600	5000	5500	6000
Max continuous AC apparent power (VA)	3000	3600	4000	4600	5000	5500	6000
General:							
Protection class	I						
Degree of protection	IP65						
Overvoltage category	II(DC), III(AC)						
Ambient temperature	-25...+60°C (Derating > 45°C)						

Models	AF4K-SLP	AF4.6K-SLP	AF5K-SLP	AF5.5K-SLP	AF6K-SLP
PV input:					
Max PV voltage (V)	550				
MPPT voltage range (V)	80-500				
Max PV current (A)	18.5 x 2				
Isc PV (A)	26 x 2				
Max PV power (W)	6000	6900	7500	8300	9000
Battery port:					
Battery type	Rechargeable Li-ion Battery/ LiFePO4/ Lead-acid				
Battery normal voltage (range) (Vdc)	51.2 (40-60)				
Max charge/ discharge current (A)	120				
Max charge/ discharge power (W)	4000	4600	5000	5500	6000
AC grid (input and output):					
Rated voltage (V)	L/N/PE, 230Vac				
Rated frequency (Hz)	50				
Max AC current (A)	19	22	23	26	28
Rated AC power (W)	4000	4600	5000	5500	6000
Max AC apparent power (VA)	4000	4600	5000	5500	6000
Power factor range	1.0 (-0.8~ +0.8 adjustable)				
AC load output (stand alone):					
Rated voltage (V)	L/N/PE, 230Vac				
Rated frequency (Hz)	50				
Max AC current (A)	19	22	23	26	28
Rated continuous AC power (W)	4000	4600	5000	5500	6000
Max continuous AC apparent power (VA)	4000	4600	5000	5500	6000
General:					
Protection class	I				
Degree of protection	IP65				
Overvoltage category	II(DC), III(AC)				
Ambient temperature	-25...+60°C (Derating > 45°C)				

Models	**AF1K-SL-0**	**AF1.5K-SL-0**	**AF2K-SL-0**	**AF2.5K-SL-0**	**AF3K-SL-0**	**AF3.6K-SL-0**
Battery port:						
Battery type	Rechargeable Li-ion Battery/ LiFePO4/ Lead-acid					
Battery normal voltage (range) (Vdc)	51.2 (40-60)					
Max charge/ discharge current (A)	25	40	50	63	80	80
Max charge/ discharge power (W)	1000	1500	2000	2500	3000	3600
AC grid (input and output):						
Rated voltage (V)	L/N/PE, 230Vac					
Rated frequency (Hz)	50					
Max AC current (A)	5	7	10	12	14	17
Rated AC power (W)	1000	1500	2000	2500	3000	3600
Max AC apparent power (VA)	1000	1500	2000	2500	3000	3600
Power factor range	1.0 (-0.8~ +0.8 adjustable)					
AC load output (stand alone):						
Rated voltage (V)	L/N/PE, 230Vac					
Rated frequency (Hz)	50					
Max AC current (A)	5	7	10	12	14	17
Rated continuous AC power (W)	1000	1500	2000	2500	3000	3600
Max continuous AC apparent power (VA)	1000	1500	2000	2500	3000	3600
General:						
Protection class	I					
Degree of protection	IP65					
Overvoltage category	II(DC), III(AC)					
Ambient temperature	-25...+60°C (Derating > 45°C)					

Models	**AF4K-SL-0**	**AF4.6K-SL-0**	**AF5K-SL-0**	**AF5.5K-SL-0**	**AF6K-SL-0**
Battery port:					
Battery type	Rechargeable Li-ion Battery/ LiFePO4/ Lead-acid				
Battery normal voltage (range) (Vdc)	51.2 (40-60)				
Max charge/ discharge current (A)	120	120	120	120	120
Max charge/ discharge power (W)	4000	4600	5000	5500	6000
AC grid (input and output):					
Rated voltage (V)	L/N/PE, 230Vac				
Rated frequency (Hz)	50				
Max AC current (A)	19	22	23	26	28
Rated AC power (W)	4000	4600	5000	5500	6000
Max AC apparent power (VA)	4000	4600	5000	5500	6000
Power factor range	1.0 (-0.8~ +0.8 adjustable)				
AC load output (stand alone):					
Rated voltage (V)	L/N/PE, 230Vac				
Rated frequency (Hz)	50				
Max AC current (A)	19	22	23	26	28
Rated continuous AC power (W)	4000	4600	5000	5500	6000
Max continuous AC apparent power (VA)	4000	4600	5000	5500	6000
General:					
Protection class	I				
Degree of protection	IP65				
Overvoltage category	II(DC), III(AC)				
Ambient temperature	-25...+60°C (Derating > 45°C)				

Type of generating unit:

Static Conversion Device *Dipositivo di conversione statica*	Interface Protection *Protezione di interfaccia*	Interface Protection Device *Dispositivo di interfaccia*	Rotating Generator Device *Dispositivo di generazione rotante*
Yes/*Si*	Yes/*Si*	Yes/*Si*	No

The battery used for testing with the Hybrid Inverter:

Battery Models	AF10000W-LG			
Manufacturer	Afore New Energy Technology (Shanghai) Co., Ltd.			
Number of battery module in parallel	1	2	3	4
Nominal Voltage	51.2 V			
Nominal capacity	200 Ah	400 Ah	600 Ah	800 Ah
Battery System Capacity	10.24 kWh	20.48 kWh	30.72 kWh	40.96 kWh
Number of battery module in parallel	5	6	7	8
Nominal Voltage	51.2 V			
Nominal capacity	1000 Ah	1200 Ah	1400 Ah	1600 Ah
Battery System Capacity	51.20 kWh	61.44 kWh	71.68 kWh	81.92 kWh
Number of battery module in parallel	9	10	11	12
Nominal Voltage	51.2 V			
Nominal capacity	1800 Ah	2000 Ah	2200 Ah	2400 Ah
Battery System Capacity	92.16 kWh	102.40 kWh	112.64 kWh	122.88 kWh
Number of battery module in parallel	13	14	15	-
Nominal Voltage	51.2 V			
Nominal capacity	2600 Ah	2800 Ah	3000 Ah	-
Battery System Capacity	133.12 kWh	143.36 kWh	153.60 kWh	-

Remark:

The CB test certificate No. of the battery: FR_718746
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.*			

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	AF6K-SL					
	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]:	47.51	47.50	47.51	51.50	51.49	51.51
Trip time limit [ms]:	100 ms			100 ms		
Measurement the trip time [ms]:	96.0	85.0	86.0	99.0	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]:	47.50	47.50	47.51	51.51	51.50	51.50
Trip time limit [ms]:	100 ms			100 ms		
Measurement the trip time [ms]:	95.0	96.4	98.8	91.0	92.0	93.0
+60°C temperature						
Limit [ms]:	47.50 Hz (81<.S2)			51.50 Hz (81>.S2)		
Measurement accuracy of the tripping value [Hz]:	47.50	47.49	47.50	51.49	51.50	51.49
Trip time limit [ms]:	100 ms			100 ms		
Measurement the trip time [ms]:	98.0	98.8	96.8	97.0	100.0	91.0

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	AF6K-SL					
	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	47.51	47.51	51.51	51.50	51.51
Trip time limit [ms]:	4000 ms			1000 ms		
Measurement the trip time [ms]:	3978	3990	3970	991	998	994
-25°C temperature						
Limit [Hz]:	47.50 Hz (81<.S2)			51.50 Hz (81>.S2)		
Measurement accuracy of the tripping value [Hz]:	47.50	47.50	47.51	51.50	51.50	51.51
Trip time limit [ms]:	4000 ms			1000 ms		
Measurement the trip time [ms]:	3980	3990	3990	994	990	994
+60°C temperature						
Limit [ms]:	47.50 Hz (81<.S2)			51.50 Hz (81>.S2)		
Measurement accuracy of the tripping value [Hz]:	47.50	47.51	47.51	51.51	51.51	51.50
Trip time limit [ms]:	4000 ms			1000 ms		
Measurement the trip time [ms]:	3990	3980	3990	990	998	998

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	AF6K-SL					
	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]:	49.82	49.81	49.80	50.20	50.21	50.21
Trip time limit [ms]:	100			100		
Measurement the trip time [ms]:	98.0	96.0	92.0	94.0	97.0	92.0
-25°C temperature						
Tripping threshold limit [Hz]:	49.80 (81<.S1)			50.20 (81>.S1)		
Measurement accuracy of the tripping value [Hz]:	49.81	49.80	49.79	50.21	50.21	50.20
Trip time limit [ms]:	100			100		
Measurement the trip time [ms]:	94.8	95.8	95.0	94.0	88.0	88.0
+60°C temperature						
Tripping threshold limit [Hz]:	49.80 (81<.S1)			50.20 (81>.S1)		
Measurement accuracy of the tripping value [Hz]:	49.81	49.79	49.81	50.21	50.20	50.21
Trip time limit [ms]:	100			100		
Measurement the trip time [ms]:	90.4	92.8	94.8	99.0	98.0	100.0
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).

A.4.3.1 & A.4.3.2	**TABLE: Test procedure for maximum/minimum voltage (27.S1)**		**P**
Model:	AF6K-SL		
	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]:	195.54	195.42	195.36
Trip time limit [ms]:	1500 ms		
Measurement the trip time [ms]:	1490	1480	1490
-25°C temperature			
Limit [V]:	195.5 V (27.S1)		
Measurement accuracy of the tripping value [V]:	195.38	195.71	196.01
Trip time limit [ms]:	1500 ms		
Measurement the trip time [ms]:	1498	1490	1490
+60°C temperature			
Limit [V]:	195.5 V (27.S1)		
Measurement accuracy of the tripping value [V]:	195.69	195.82	195.55
Trip time limit [ms]:	1500 ms		
Measurement the trip time [ms]:	1490	1498	1480

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

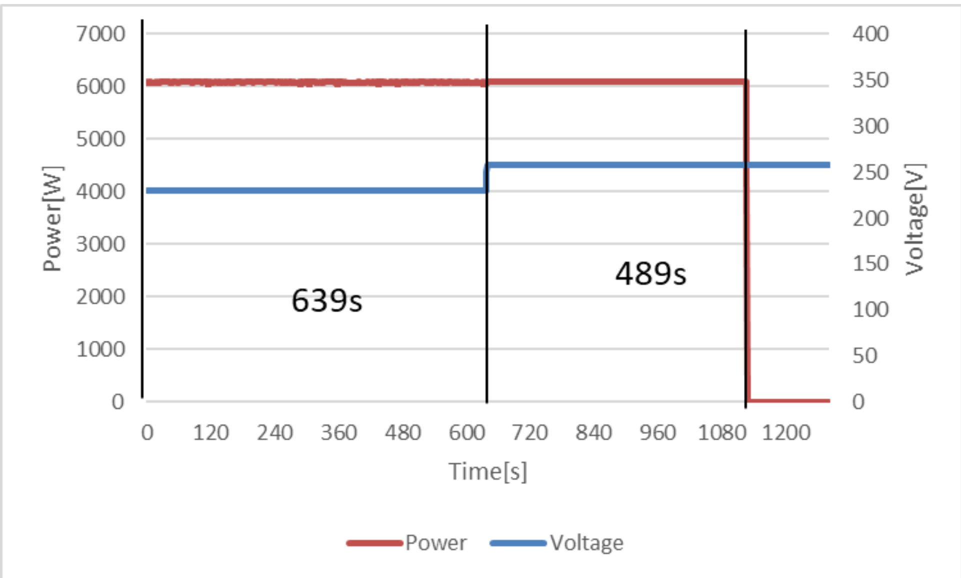
A.4.3.1 & A.4.3.2	**TABLE: Test procedure for maximum/minimum voltage (27.S2) (59.S2)**					**P**
Model	AF6K-SL					
	Under voltage:			**Over voltage:**		
A) STEPS for trip value [V to V]:	1.1 threshold -> decrease by 0.5% Vn steps			0.9 threshold -> increase by 0.5% Vn steps		
D) STEP for trip time [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]:	34.51	34.53	34.51	264.52	264.58	265.12
Trip time limit [ms]:	200 ms			200 ms		
Measurement the trip time [ms]:	198.0	196.0	198.8	190.0	198.0	188.0
-25°C temperature						
Limit [V]:	34.5 V (27.S2)			264.5 V (59.S2)		
Measurement accuracy of the tripping value [V]:	34.49	34.50	34.51	264.58	264.51	264.56
Trip time limit [ms]:	200 ms			200 ms		
Measurement the trip time [ms]:	196.8	188.0	196.0	196.0	190.0	190.0
+60°C temperature						
Limit [V]:	34.5 V (27.S2)			264.5 V (59.S2)		
Measurement accuracy of the tripping value [V]:	34.48	34.52	34.51	264.59	264.55	264.59
Trip time limit [ms]:	200 ms			200 ms		
Measurement the trip time [ms]:	194.4	188.8	199.6	189.0	192.0	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).

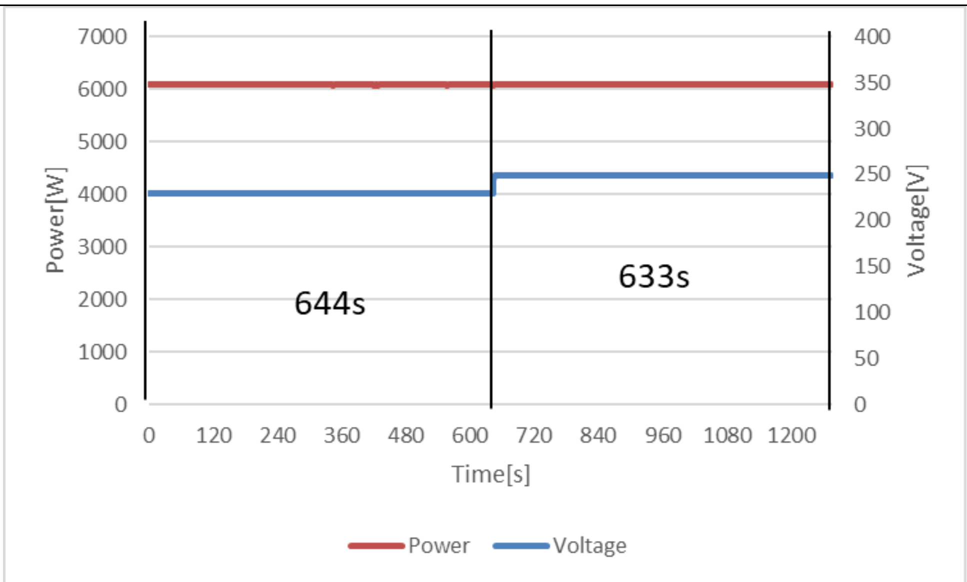
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

A.4.3.1 & A.4.3.2	**TABLE: Measuring the rise-in voltage protection as a running 10-minute mean value (59.S1)**		**P**
Model:	AF6K-SL		
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	489	≤ 603 s
	Phase 2	-	
	Phase 3	-	
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	-	
	Phase 3	-	
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	292	The disconnection time should be about 50 % of the value measured in a). *
	Phase 2	-	
	Phase 3	-	
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.			

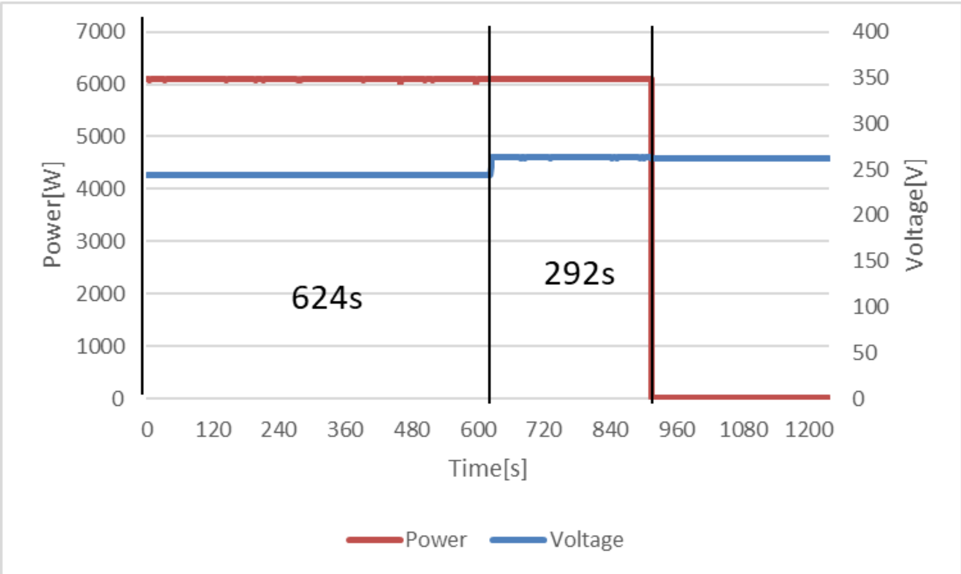


a)

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



b)



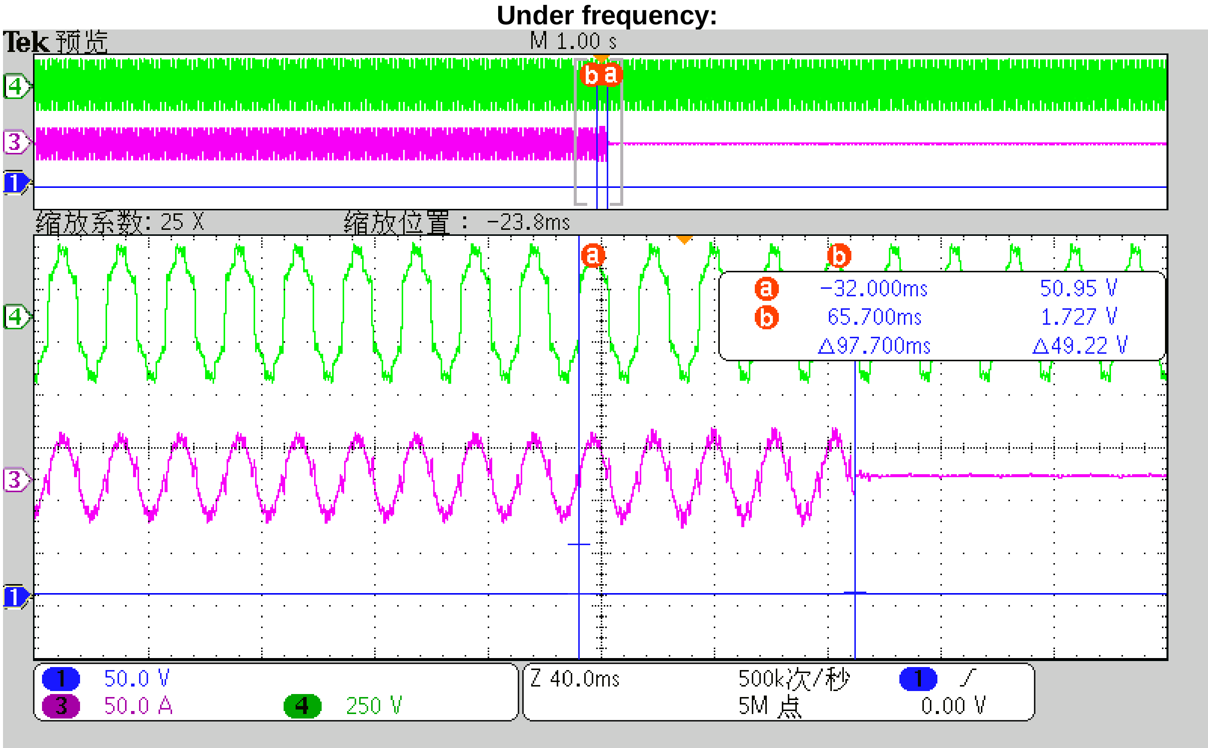
c)

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

A.4.3.3.1	**TABLE: Insensitivity to harmonics of the frequency relay**								**P**
Mode	AF6K-SL								
Grid simulator settings according to Table 17:	Harmonics order:	2nd	3rd	5th	7th	9th	11th	13th	17th
	%Un:	4.0	10,0	12,0	10,0	3,0	7,0	6,0	4,0

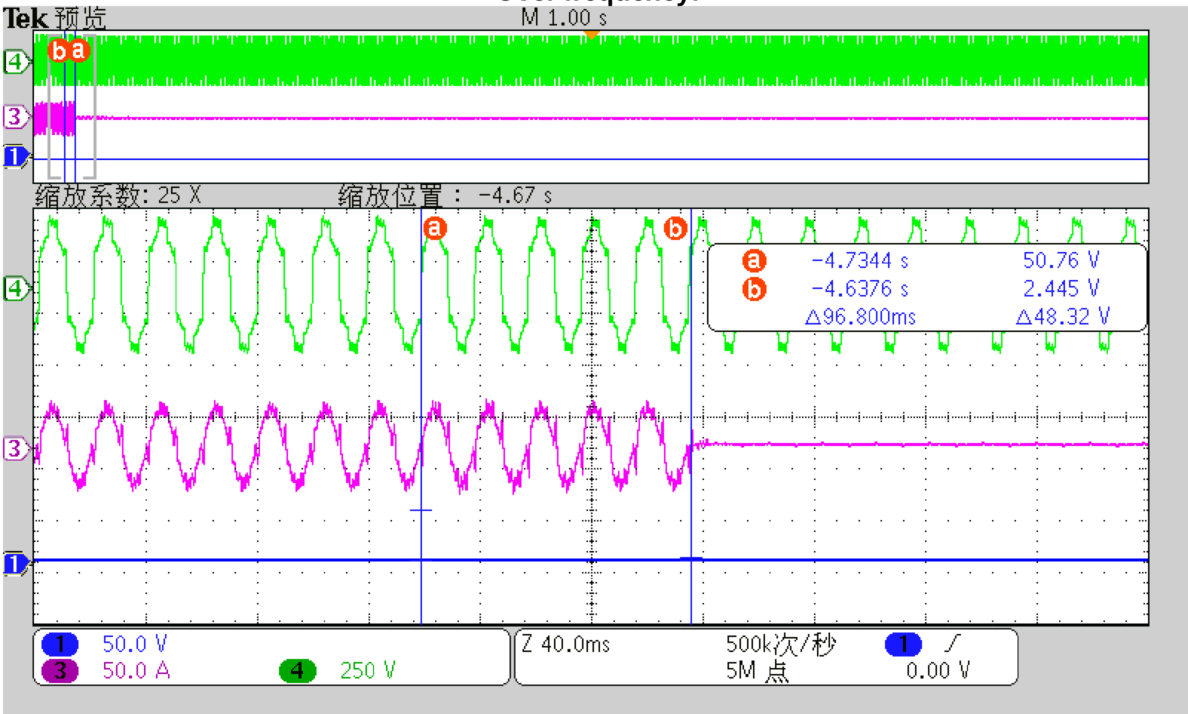
Operating time of the monitoring device:						
	Under frequency:			**Over frequency:**		
A) STEPS for trip value [Hz to Hz]:	1.01 threshold -> decrease by max 10mHz steps			0.99 threshold -> increase by max 10mHz steps		
D) STEP trip time [Hz to Hz]:	1.01 threshold -> 0.99 threshold			0.99 threshold -> 1.01 threshold		
Limit [Hz]:	47.50 Hz			51.50 Hz		
Measurement accuracy of the tripping value [V]:	47.49	47.49	47.48	51.51	51.52	51.51
	100 ms			100 ms		
Measurement the trip time [ms]:	97.7	96.8	97.2	96.8	97.6	96.0

Under frequency:



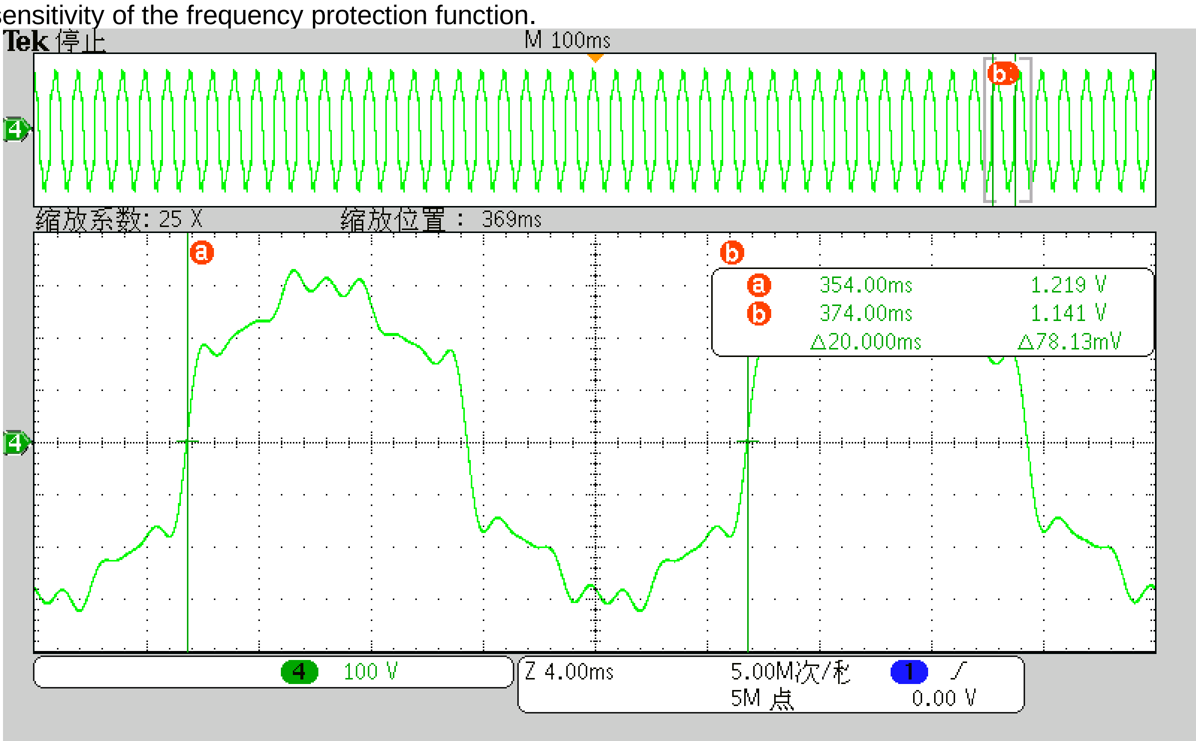
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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.**

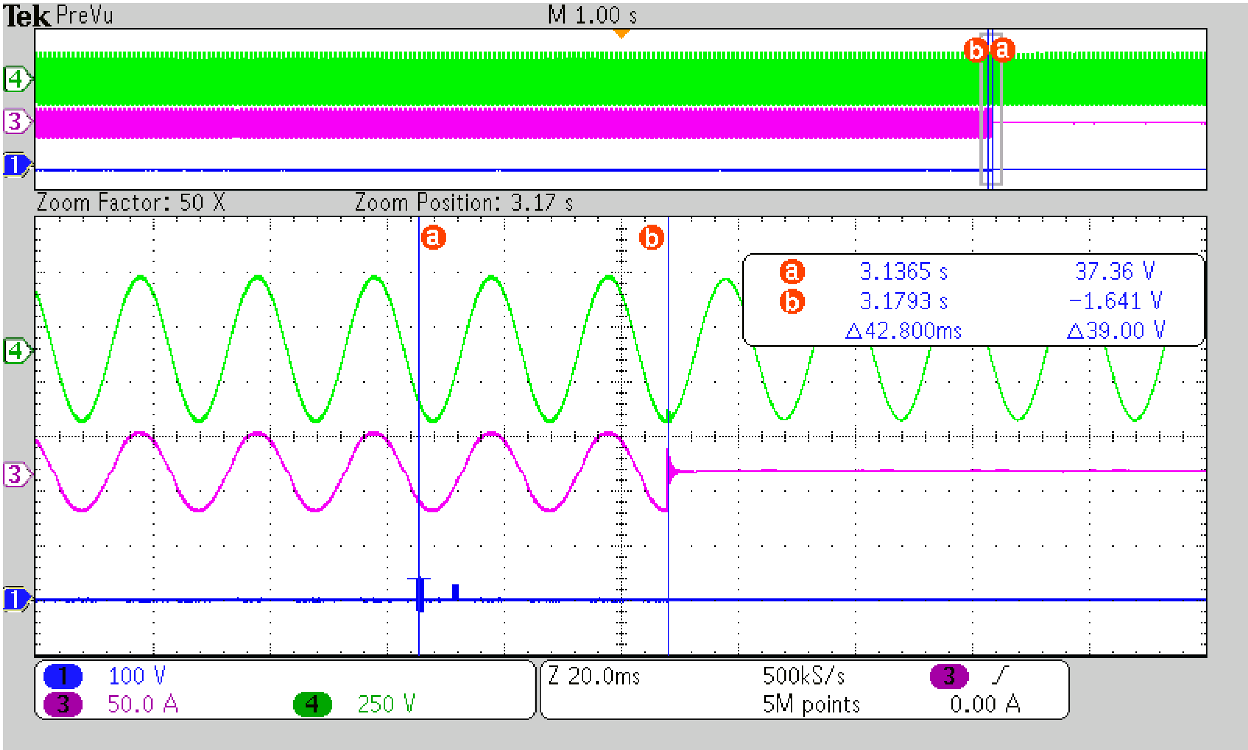
Screenshot of voltage waveform, distorted as required by CEI 0-21 Table 17 – Harmonics for the insensitivity of the frequency protection function.



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

A.4.3.3.2	TABLE: Remote trip signal	P
Model	AF6K-SL	
Test:	Remote tripping signal for the external disconnection	
Limit [ms]:	50	
Measurement time of the tripping value [ms]:	42.8	

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	AF6K-SL		

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:

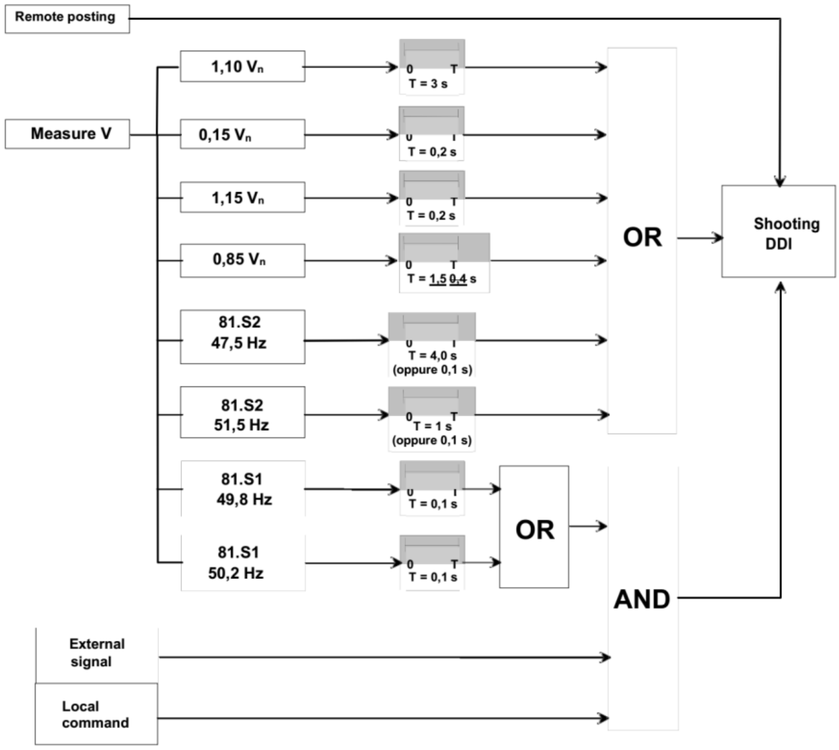


Figure 35 - Functional logic diagram of the SPI of the power park modules (the values in brackets refer to the transitory operating mode of the SPI)

A.4.3.4	TABLE: Verification of insensitivity to the frequency derivative (ROCOF)						P
Model	AF6K-SL						
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	5890.42	Continuous operation	Stay connected
2)	47.55 Hz	51.45 Hz	1.56 s	5531.60	Continuous operation	Stay connected
3)	51.45 Hz	47.55 Hz	1.56 s	5782.43	Continuous operation	Stay connected
2)	47.55 Hz	51.45 Hz	1.56 s	5358.43	Continuous operation	Stay connected
3)	51.45 Hz	47.55 Hz	1.56 s	5444.25	Continuous operation	Stay connected
2)	47.55 Hz	51.45 Hz	1.56 s	5490.13	Continuous operation	Stay connected
3)	51.45 Hz	47.55 Hz	1.56 s	5746.13	Continuous operation	Stay connected
2)	47.55 Hz	51.45 Hz	1.56 s	5437.57	Continuous operation	Stay connected
3)	51.45 Hz	47.55 Hz	1.56 s	5644.50	Continuous operation	Stay connected
2)	47.55 Hz	51.45 Hz	1.56 s	5466.25	Continuous operation	Stay connected
3)	51.45 Hz	47.55 Hz	1.56 s	5636.43	Continuous operation	Stay connected
5)	47.55 Hz	47.55 Hz	10.0 s	5901.80	Continuous operation	Stay connected

Test procedure:

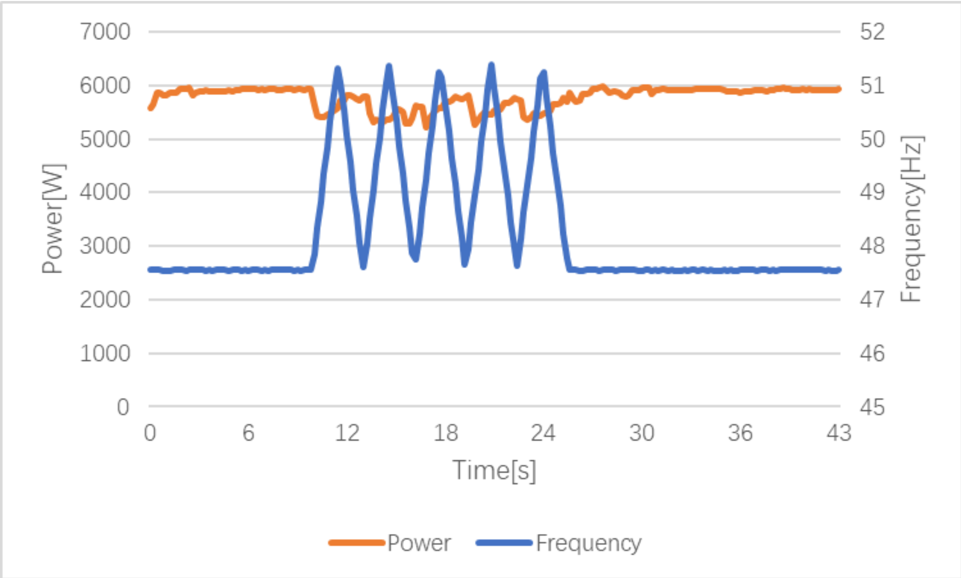
1) Apply a three-phase of symmetrical voltages of direct cyclic sequence having an amplitude of 100% of the rated voltage and a frequency of 47.550 Hz;
2) increase the frequency of the three-phase voltages, with ramp steps having an amplitude of 12.5 mHz and duration of 5 ms, until reaching the frequency 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	AF6K-SL				
Software version: Control board: V06, Display board: V06					
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	253.0V	600492ms	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	264.6V	198ms		
	Default	264.5 V	200 ms		
Undervoltage 27.S1	Reading	195.4V	1490ms		
	Default	195.5 V	1500 ms		
Undervoltage 27.S2	Reading	34.4V	196ms		
	Default	34.5 V	200 ms		
Overfrequency 81>.S1	Reading	50.2 Hz	95 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	98 ms		
	Default	51.5 Hz	100 ms		
Underfrequency 81<.S1	Reading	49.8 Hz	99 ms		
	Default	49.8 Hz	100 ms		
Underfrequency 81<.S2	Reading	47.5 Hz	97 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

Test 59.S1	
V_Thr:	253.0V
V_Ave:	253.1V
V_59.S1:	253.0V
T_59.S1:	492ms

Overvoltage 59.S2

Test 59.S2	
V_Thr:	264.5V
V:	264.8V
V_59.S2:	264.6V
T_59.S2:	198ms

Undervoltage 27.S1

Test 27.S1	
V_Thr:	195.5V
V:	195.3V
V_27.S1:	195.4V
T_27.S1:	1490ms

Undervoltage 27.S2

Test 27.S2	
V_Thr:	34.5V
V:	34.2V
V_27.S2:	34.4V
T_27.S2:	196ms

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Clause	Requirement - Test	Result - Remark	Verdict

Overfrequency 81>S1 Test 81>.S1 F_Thr: 50.20Hz F: 50.20Hz F_81>.S1: 50.20Hz T_81>.S1: 95ms
Overfrequency 81>S2 Test 81>.S2 F_Thr: 51.50Hz F: 51.50Hz F_81>.S2: 51.50Hz T_81>.S2: 98ms
Underfrequency 81<S1 Test 81<.S1 F_Thr: 49.80Hz F: 49.80Hz F_81<.S1: 49.80Hz T_81<.S1: 99ms
Underfrequency 81<S2 Test 81<.S2 F_Thr: 47.50Hz F: 47.50Hz F_81<.S2: 47.50Hz T_81<.S2: 97ms

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

A.4.5	**TABLE: Single fault tolerance**				**P**
Model	AF6K-SL				
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	360Vdc-230Vac	3min	Unit can’t operating, error massage: Iso Fault. No danger, no hazard, no fire.
2	Monitoring Relay – L (K1)	Pin3 to Pin4 short circuit before start up inverter	360Vdc-230Vac	3min	Unit can’t operating, error massage:GridRelay Fault. No danger, no hazard, no fire.
3	Monitoring Relay – L (K1)	Pin3 to Pin4 open circuit before start up inverter	360Vdc-230Vac	3min	Unit can’t operating, error massage: GridRelay Fault. No danger, no hazard, no fire.
4	Monitoring Relay - N(K3)	Pin3 to Pin4 short circuit before start up inverter	360Vdc-230Vac	3min	Unit can’t operating, error massage: GridRelay Fault. No danger, no hazard, no fire.
5	Monitoring Relay - N(K3)	Pin3 to Pin4 open circuit before start up inverter	360Vdc-230Vac	3min	Unit can’t operating, error massage: GridRelay Fault. No danger, no hazard, no fire.
6	AC voltage measure1 (D4)	Pin2-Pin3	360Vdc-230Vac	3min	Unit shut down, Error message：GridOverVolt Fault. No danger, no hazard, no fire.
7	AC voltage measure1(D4)	Pin1-Pin3 Short circuit	360Vdc-230Vac	3min	Unit shut down, Error message：GridOverVolt Fault. No danger, no hazard, no fire.
8	AC current measure1(D19)	Pin1-Pin3 Short circuit	360Vdc-230Vac	3min	Unit can't operating, error message: RInvCurAdChaFault. No danger, no hazard, no fire.
9	AC current measure1(D19)	Pin2-Pin3 Short circuit	360Vdc-230Vac	3min	Unit can't operating, error message: RInvCurAdChaFault. No danger, no hazard, no fire.
10	AC frequency measure(R255)	Pin1-Pin2 Short circuit	360Vdc-230Vac	3min	Unit shut down, error message: GridOverFreq Fault. No danger, no hazard, no fire.
11	V-busmeasure (D31)	Pin2-Pin3 Short circuit	360Vdc-230Vac	3min	Unit can't operating,Error massage: BusAllVoltHwOveFault. No danger, no hazard, no fire.
12	DC current measure1(R247)	Pin1-Pin2 Short circuit	360Vdc-230Vac	3min	Unit shut down,error message: Pv1HwOverCurrFault. No danger, no hazard, no fire.
13	DC current measure2(R248)	Pin1-Pin2 Short circuit	360Vdc-230Vac	3min	Unit shut down,error message: Pv2HwOverCurrFault. No danger, no hazard, no fire.

14	T measure(R180)	Pin1-Pin2 Short circuit	360Vdc-230Vac	3min	Unit can't operating,Error massage: TemperatureAdChanFault.No damage, no hazard, no fire.
15	power tube Boost(Q2)	Pin2-Pin3 Short circuit before start up	360Vdc-230Vac	3min	Unit can not start up, No damage, no hazard, no fire.
16	Diode(D2)	Short circuit	360Vdc-230Vac	3min	Unit normal operation, No danger, no hazard, no fire.
17	power tube IGBT(QA5)	Pin2-Pin3 Short circuit before start up	360Vdc-230Vac	3min	Unit can’t operating, error massage: InvOpenTestErr. No danger, no hazard, no fire.
18	power tube IGBT(QA6)	Pin2-Pin3 Short circuit before start up	360Vdc-230Vac	3min	Unit shut down, error message: InvOpenTestErr. No danger, no hazard, no fire.
19	GFCI check	Short circuit	360Vdc-230Vac	3min	Unit shut down, error message: LeakCurrFault. No danger, no hazard, no fire.
20	Bus cap(C208)	Pin1-Pin2 Short circuit before start up	360Vdc-230Vac	3min	Unit can not start up, No damage, no hazard, no fire.
21	Transformer short circuit tests (T4)	Pin22-Pin24 Short circuit	360Vdc-230Vac	3min	Unit can not start up, No damage, no hazard, no fire.
22	Transformer short circuit tests(T4)	Pin32-Pin36 Short circuit	360Vdc-230Vac	3min	Unit can not start up, No damage, no hazard, no fire.
23	power tube MOS-SPS(Q-MOS1)	G-D Short circuit	360Vdc-230Vac	3min	SPS no output, No danger, no hazard, no fire.
24	power tube MOS-SPS(Q-MOS1)	D-S Short circuit	360Vdc-230Vac	3min	SPS no output, No danger, no hazard, no fire.
25	Output L to N	short circuit	360Vdc-230Vac	3min	Unit shut down, error message:GridUnderVoltFault. No danger, no hazard, no fire.
26	Output L to PE	short circuit	360Vdc-230Vac	3min	Unit shut down ,error message:GridLossFault. No danger, no hazard, no fire.
27	DC	--	360Vdc-230Vac	3min	Vac=0, VBAT=0
28	AC	--	360Vdc-230Vac	3min	Vdc=0, VBAT=0
29	BAT	--	360Vdc-230Vac	3min	Vdc=0, Vac=0
30	Overload	Output overload (110%)	360Vdc-230Vac	3min	Unit normal operation. No danger, no hazard, no fire.
31	Cooling system failure – Blanketing test	Put the unit to box	360Vdc-230Vac	1 hour	1 hour power run at 50%

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Clause	Requirement - Test	Result - Remark	Verdict

32	PV+ to PV-	Reverse polarity	360Vdc-230Vac	3min	Unit can not start up. No danger, no hazard, no fire.
33	Output L - N	Reverse polarity before start up	360Vdc-230Vac	3min	Unit normal operation. 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.					

A.4.7	**TABLE: Climatic compatibility tests**		**P**
Model	AF6K-SL		
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.			

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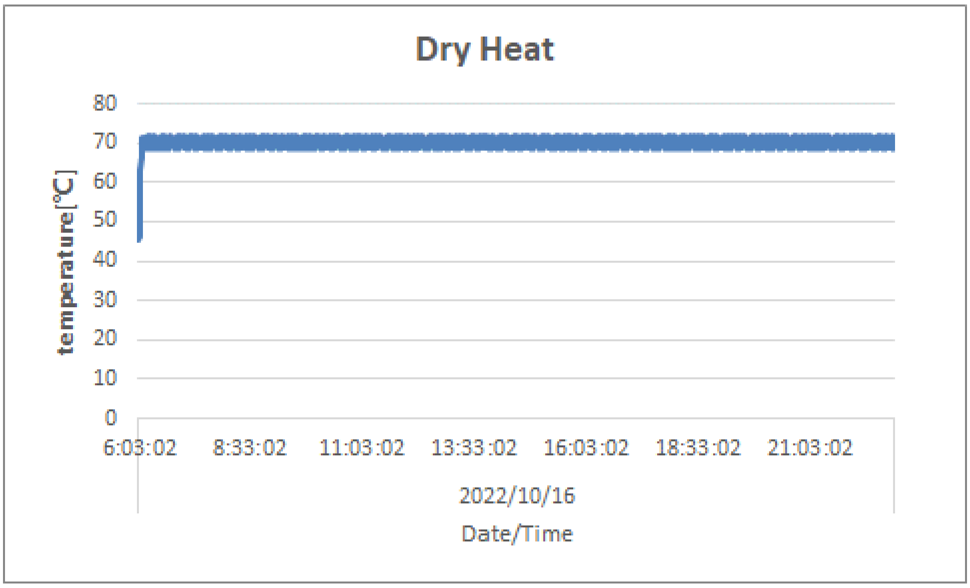
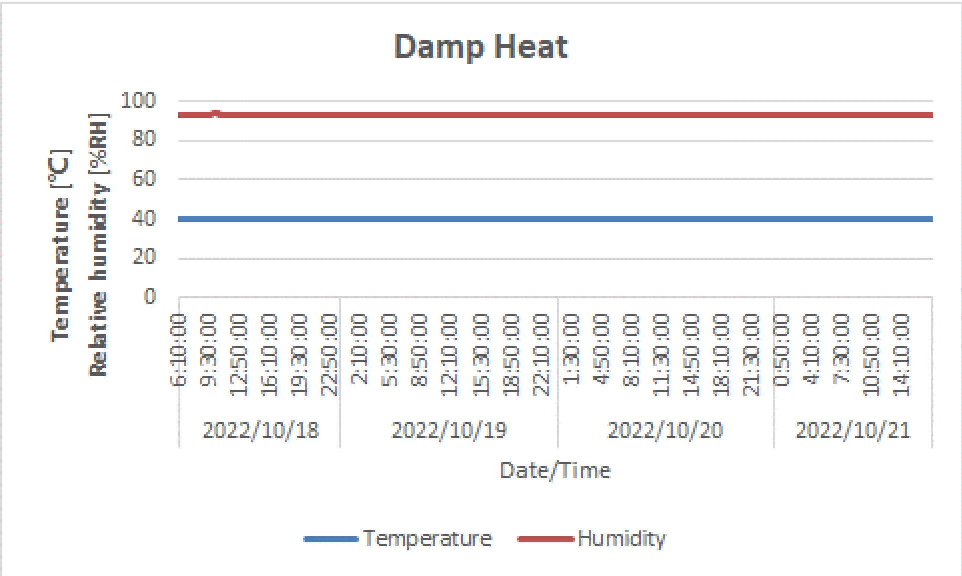
Clause	Requirement - Test	Result - Remark	Verdict

Temperature diagram of unpowered equipment:

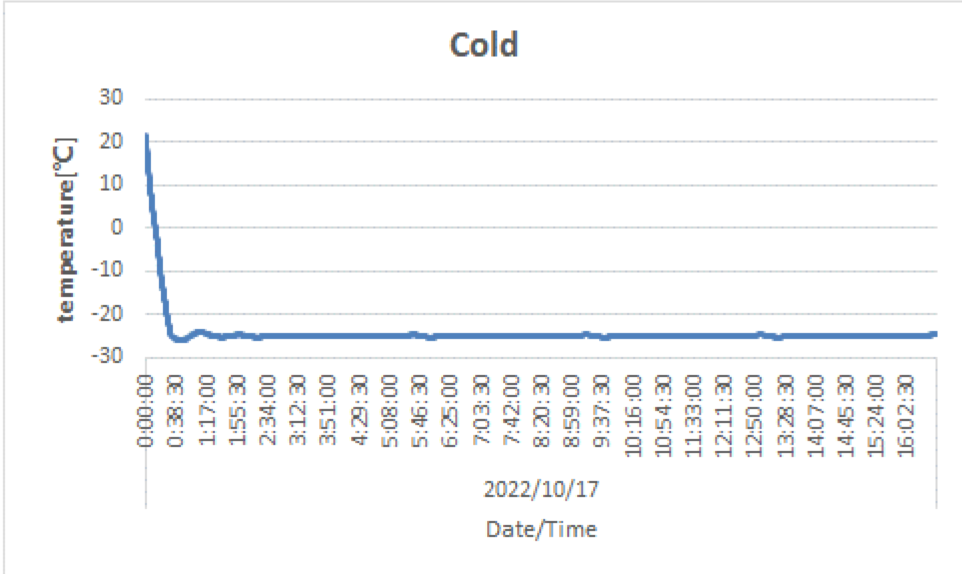


Temperature diagram of unpowered equipment:

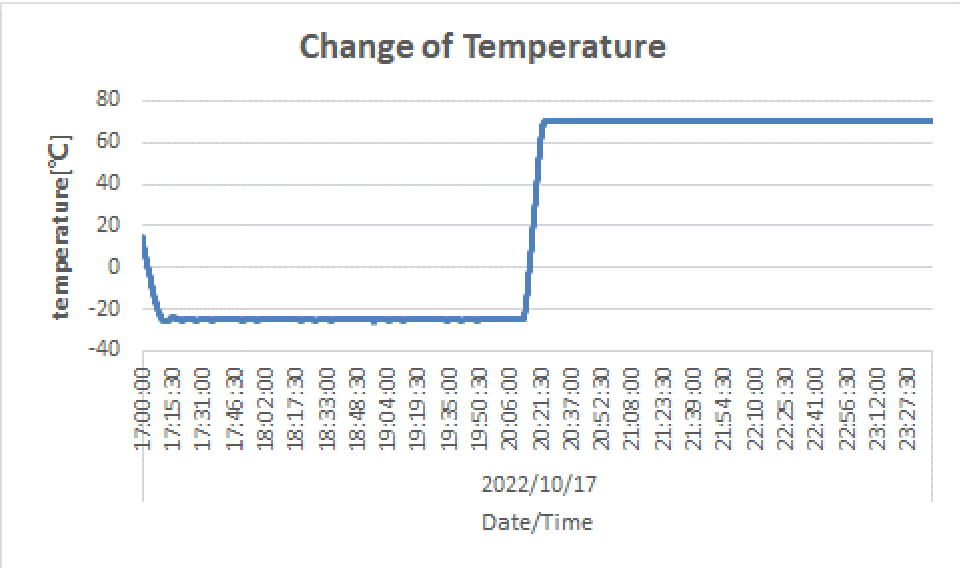


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Temperature diagram of unpowered equipment:

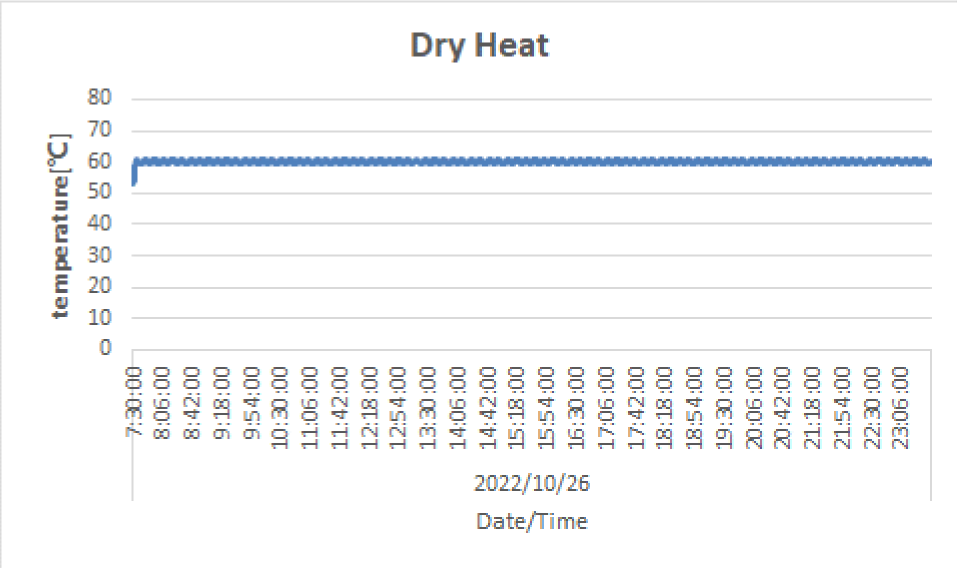


Temperature diagram of unpowered equipment:

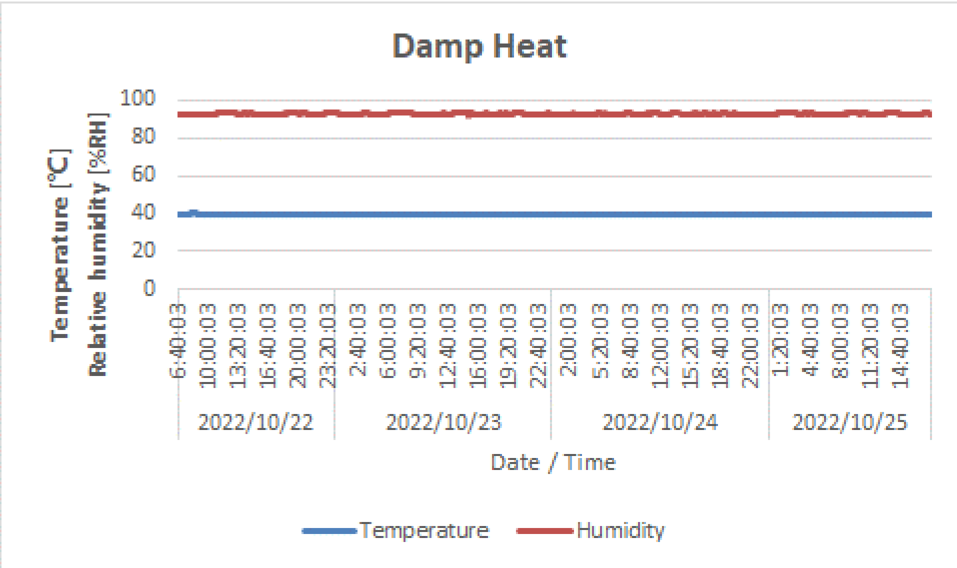


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Temperature diagram of unpowered equipment:

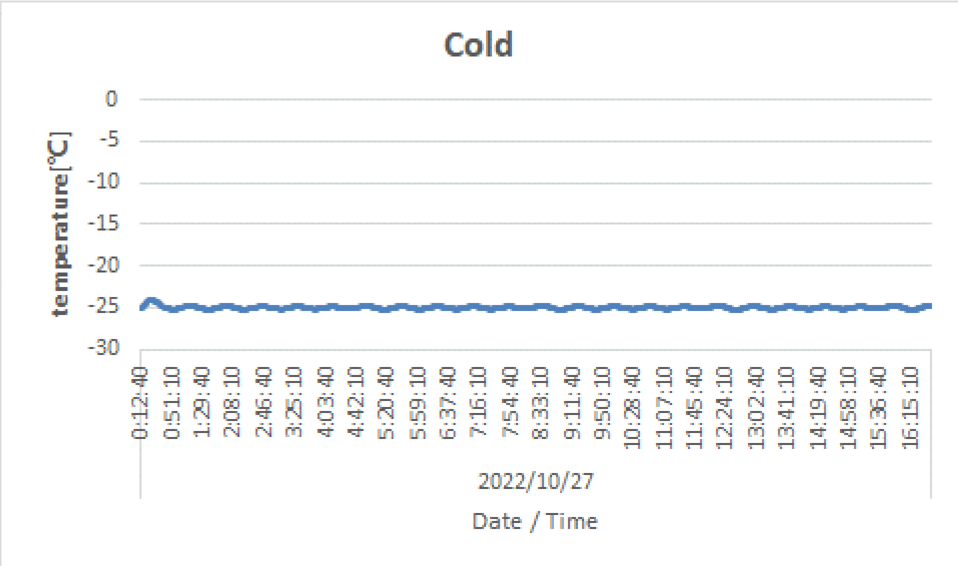


Temperature diagram of unpowered equipment:

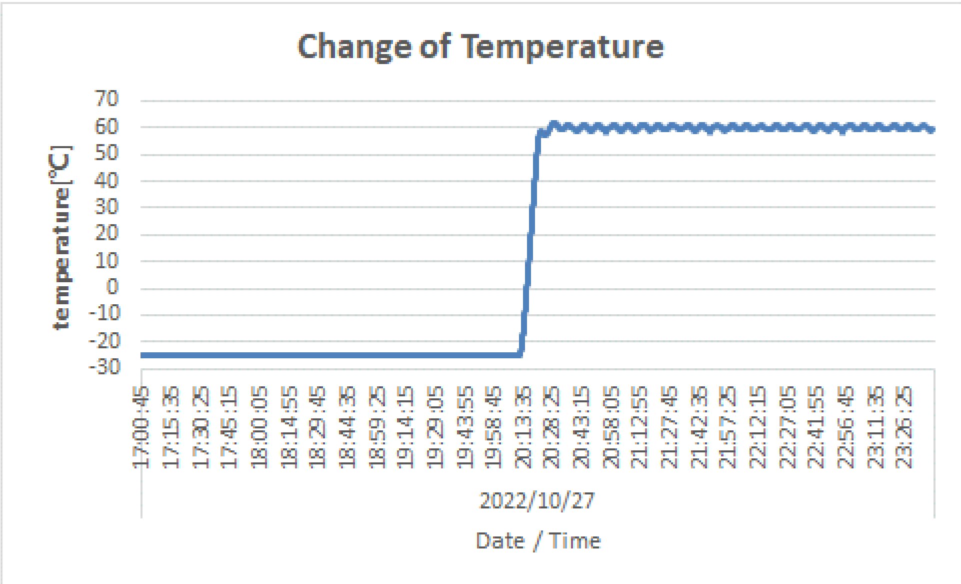


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Temperature diagram of unpowered equipment:



Temperature diagram of unpowered equipment:



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

A.4.8	**TABLE: Insulation tests (CEI EN 60255-5)**		**P**
Model	AF6K-SL		
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	AF6K-SL		
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.			

A.4.11	TABLE: Automatic mechanism to prevent current imbalance during production		N/A
Model	AF6K-SL		
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	AF6K-SL	
☒ 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	AF6K-SL	

Active power (W)	6072.30 (100% P_n , 60°C)
Voltage (V)	230.00
Current (A)	26.45
Power Factor	0.998
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	26.087	--	Single phase	--
2nd	0.096	0.369	Single phase	8
3rd	0.621	2.381	Single phase	21,6
4th	0.053	0.202	Single phase	4
5th	0.471	1.804	Single phase	10,7
6th	0.014	0.054	Single phase	2,7
7th	0.359	1.376	Single phase	7,2
8th	0.007	0.026	Single phase	2
9th	0.268	1.029	Single phase	3,8
10th	0.042	0.161	Single phase	1,6
11th	0.201	0.769	Single phase	3,1
12th	0.011	0.041	Single phase	1,3
13th	0.122	0.469	Single phase	2
14th	0.020	0.075	Single phase	N/A
15th	0.085	0.325	Single phase	N/A
16th	0.024	0.090	Single phase	N/A
17th	0.055	0.210	Single phase	N/A
18th	0.014	0.054	Single phase	N/A
19th	0.039	0.149	Single phase	N/A
20th	0.012	0.046	Single phase	N/A
21st	0.041	0.157	Single phase	N/A
22nd	0.012	0.048	Single phase	N/A
23rd	0.030	0.114	Single phase	N/A
24th	0.006	0.024	Single phase	N/A
25th	0.028	0.106	Single phase	N/A
26th	0.006	0.025	Single phase	N/A
27th	0.024	0.094	Single phase	N/A
28th	0.005	0.020	Single phase	N/A
29th	0.019	0.074	Single phase	N/A
30th	0.004	0.015	Single phase	N/A
31st	0.018	0.068	Single phase	N/A
32nd	0.004	0.016	Single phase	N/A
33rd	0.013	0.049	Single phase	N/A
34th	0.006	0.023	Single phase	N/A
35th	0.013	0.049	Single phase	N/A
36th	0.004	0.016	Single phase	N/A
37th	0.012	0.047	Single phase	N/A
38th	0.005	0.018	Single phase	N/A
39th	0.011	0.042	Single phase	N/A
40th	0.005	0.021	Single phase	N/A
THD	--	3.700	Single phase	23
PWHD	--	2.189	Single phase	23

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	AF6K-SL	

Active power (W)	6071.02 (100% P_n , -25°C)
Voltage (V)	230.03
Current (A)	26.44
Power Factor	0.998
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	26.087	--	Single phase	--
2nd	0.097	0.373	Single phase	8
3rd	0.617	2.366	Single phase	21,6
4th	0.052	0.201	Single phase	4
5th	0.464	1.781	Single phase	10,7
6th	0.014	0.055	Single phase	2,7
7th	0.355	1.361	Single phase	7,2
8th	0.008	0.030	Single phase	2
9th	0.264	1.011	Single phase	3,8
10th	0.039	0.150	Single phase	1,6
11th	0.197	0.754	Single phase	3,1
12th	0.010	0.038	Single phase	1,3
13th	0.121	0.463	Single phase	2
14th	0.020	0.077	Single phase	N/A
15th	0.086	0.329	Single phase	N/A
16th	0.024	0.093	Single phase	N/A
17th	0.054	0.208	Single phase	N/A
18th	0.015	0.056	Single phase	N/A
19th	0.039	0.148	Single phase	N/A
20th	0.015	0.056	Single phase	N/A
21st	0.039	0.150	Single phase	N/A
22nd	0.014	0.053	Single phase	N/A
23rd	0.030	0.114	Single phase	N/A
24th	0.008	0.030	Single phase	N/A
25th	0.027	0.102	Single phase	N/A
26th	0.007	0.028	Single phase	N/A
27th	0.024	0.091	Single phase	N/A
28th	0.006	0.024	Single phase	N/A
29th	0.019	0.072	Single phase	N/A
30th	0.004	0.016	Single phase	N/A
31st	0.016	0.063	Single phase	N/A
32nd	0.005	0.018	Single phase	N/A
33rd	0.013	0.049	Single phase	N/A
34th	0.006	0.024	Single phase	N/A
35th	0.012	0.046	Single phase	N/A
36th	0.004	0.015	Single phase	N/A
37th	0.013	0.050	Single phase	N/A
38th	0.005	0.020	Single phase	N/A
39th	0.012	0.045	Single phase	N/A
40th	0.005	0.018	Single phase	N/A
THD	--	3.700	Single phase	23
PWHD	--	2.261	Single phase	23

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	AF6K-SL	

Active power (W)	6070.70 (100% P_n , 25°C)
Voltage (V)	230.03
Current (A)	26.44
Power Factor	0.998
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	26.087	--	Single phase	--
2nd	0.096	0.370	Single phase	8
3rd	0.627	2.405	Single phase	21,6
4th	0.054	0.207	Single phase	4
5th	0.466	1.787	Single phase	10,7
6th	0.014	0.053	Single phase	2,7
7th	0.356	1.363	Single phase	7,2
8th	0.009	0.033	Single phase	2
9th	0.265	1.015	Single phase	3,8
10th	0.041	0.158	Single phase	1,6
11th	0.198	0.759	Single phase	3,1
12th	0.008	0.030	Single phase	1,3
13th	0.122	0.467	Single phase	2
14th	0.021	0.081	Single phase	N/A
15th	0.085	0.327	Single phase	N/A
16th	0.023	0.090	Single phase	N/A
17th	0.054	0.206	Single phase	N/A
18th	0.013	0.050	Single phase	N/A
19th	0.038	0.146	Single phase	N/A
20th	0.014	0.053	Single phase	N/A
21st	0.041	0.156	Single phase	N/A
22nd	0.012	0.047	Single phase	N/A
23rd	0.029	0.112	Single phase	N/A
24th	0.007	0.029	Single phase	N/A
25th	0.027	0.103	Single phase	N/A
26th	0.007	0.025	Single phase	N/A
27th	0.024	0.093	Single phase	N/A
28th	0.005	0.020	Single phase	N/A
29th	0.019	0.074	Single phase	N/A
30th	0.004	0.015	Single phase	N/A
31st	0.017	0.066	Single phase	N/A
32nd	0.004	0.015	Single phase	N/A
33rd	0.013	0.048	Single phase	N/A
34th	0.005	0.020	Single phase	N/A
35th	0.012	0.045	Single phase	N/A
36th	0.004	0.016	Single phase	N/A
37th	0.013	0.050	Single phase	N/A
38th	0.005	0.018	Single phase	N/A
39th	0.011	0.042	Single phase	N/A
40th	0.004	0.017	Single phase	N/A
THD	--	3.731	Single phase	23
PWHD	--	2.221	Single phase	23

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	AF6K-SL	

Active power (W)	4026.52 (66% P_n , 60°C)
Voltage (V)	230.15
Current (A)	17.55
Power Factor	0.997
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	17.217	--	Single phase	--
2nd	0.080	0.466	Single phase	8
3rd	0.563	3.268	Single phase	21,6
4th	0.030	0.176	Single phase	4
5th	0.418	2.425	Single phase	10,7
6th	0.011	0.063	Single phase	2,7
7th	0.297	1.728	Single phase	7,2
8th	0.015	0.085	Single phase	2
9th	0.204	1.187	Single phase	3,8
10th	0.009	0.051	Single phase	1,6
11th	0.133	0.770	Single phase	3,1
12th	0.014	0.083	Single phase	1,3
13th	0.077	0.450	Single phase	2
14th	0.011	0.064	Single phase	N/A
15th	0.066	0.383	Single phase	N/A
16th	0.014	0.079	Single phase	N/A
17th	0.052	0.305	Single phase	N/A
18th	0.017	0.098	Single phase	N/A
19th	0.042	0.242	Single phase	N/A
20th	0.009	0.050	Single phase	N/A
21st	0.037	0.214	Single phase	N/A
22nd	0.007	0.039	Single phase	N/A
23rd	0.027	0.158	Single phase	N/A
24th	0.006	0.032	Single phase	N/A
25th	0.021	0.124	Single phase	N/A
26th	0.004	0.023	Single phase	N/A
27th	0.015	0.088	Single phase	N/A
28th	0.004	0.022	Single phase	N/A
29th	0.012	0.070	Single phase	N/A
30th	0.005	0.030	Single phase	N/A
31st	0.010	0.060	Single phase	N/A
32nd	0.005	0.026	Single phase	N/A
33rd	0.006	0.035	Single phase	N/A
34th	0.005	0.031	Single phase	N/A
35th	0.007	0.040	Single phase	N/A
36th	0.004	0.023	Single phase	N/A
37th	0.010	0.060	Single phase	N/A
38th	0.004	0.025	Single phase	N/A
39th	0.009	0.052	Single phase	N/A
40th	0.004	0.021	Single phase	N/A
THD	--	4.871	Single phase	23
PWHD	--	2.865	Single phase	23

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	AF6K-SL	

Active power (W)	4026.17 (66% P_n ,-25°C)
Voltage (V)	230.15
Current (A)	17.55
Power Factor	0.997
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	17.217	--	Single phase	--
2nd	0.079	0.458	Single phase	8
3rd	0.561	3.259	Single phase	21,6
4th	0.031	0.178	Single phase	4
5th	0.417	2.423	Single phase	10,7
6th	0.012	0.068	Single phase	2,7
7th	0.296	1.721	Single phase	7,2
8th	0.015	0.087	Single phase	2
9th	0.205	1.191	Single phase	3,8
10th	0.009	0.050	Single phase	1,6
11th	0.132	0.768	Single phase	3,1
12th	0.014	0.083	Single phase	1,3
13th	0.076	0.442	Single phase	2
14th	0.008	0.049	Single phase	N/A
15th	0.066	0.385	Single phase	N/A
16th	0.013	0.075	Single phase	N/A
17th	0.052	0.304	Single phase	N/A
18th	0.016	0.091	Single phase	N/A
19th	0.043	0.248	Single phase	N/A
20th	0.008	0.045	Single phase	N/A
21st	0.038	0.219	Single phase	N/A
22nd	0.007	0.041	Single phase	N/A
23rd	0.028	0.161	Single phase	N/A
24th	0.004	0.025	Single phase	N/A
25th	0.022	0.126	Single phase	N/A
26th	0.004	0.023	Single phase	N/A
27th	0.016	0.095	Single phase	N/A
28th	0.004	0.021	Single phase	N/A
29th	0.013	0.073	Single phase	N/A
30th	0.005	0.030	Single phase	N/A
31st	0.010	0.059	Single phase	N/A
32nd	0.004	0.024	Single phase	N/A
33rd	0.006	0.034	Single phase	N/A
34th	0.004	0.021	Single phase	N/A
35th	0.007	0.039	Single phase	N/A
36th	0.004	0.021	Single phase	N/A
37th	0.010	0.060	Single phase	N/A
38th	0.005	0.029	Single phase	N/A
39th	0.008	0.048	Single phase	N/A
40th	0.004	0.022	Single phase	N/A
THD	--	4.842	Single phase	23
PWHD	--	2.859	Single phase	23

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	AF6K-SL	

Active power (W)	4025.66 (66% P_n , 25°C)
Voltage (V)	230.16
Current (A)	17.54
Power Factor	0.997
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	17.217	--	Single phase	--
2nd	0.080	0.466	Single phase	8
3rd	0.560	3.253	Single phase	21,6
4th	0.031	0.180	Single phase	4
5th	0.416	2.413	Single phase	10,7
6th	0.013	0.075	Single phase	2,7
7th	0.295	1.714	Single phase	7,2
8th	0.014	0.084	Single phase	2
9th	0.204	1.187	Single phase	3,8
10th	0.008	0.046	Single phase	1,6
11th	0.132	0.767	Single phase	3,1
12th	0.015	0.088	Single phase	1,3
13th	0.078	0.452	Single phase	2
14th	0.010	0.059	Single phase	N/A
15th	0.067	0.388	Single phase	N/A
16th	0.015	0.086	Single phase	N/A
17th	0.053	0.306	Single phase	N/A
18th	0.017	0.100	Single phase	N/A
19th	0.042	0.242	Single phase	N/A
20th	0.009	0.050	Single phase	N/A
21st	0.037	0.214	Single phase	N/A
22nd	0.008	0.044	Single phase	N/A
23rd	0.027	0.158	Single phase	N/A
24th	0.005	0.027	Single phase	N/A
25th	0.021	0.120	Single phase	N/A
26th	0.005	0.027	Single phase	N/A
27th	0.016	0.091	Single phase	N/A
28th	0.004	0.023	Single phase	N/A
29th	0.013	0.074	Single phase	N/A
30th	0.005	0.027	Single phase	N/A
31st	0.009	0.052	Single phase	N/A
32nd	0.005	0.029	Single phase	N/A
33rd	0.006	0.037	Single phase	N/A
34th	0.004	0.025	Single phase	N/A
35th	0.006	0.038	Single phase	N/A
36th	0.003	0.020	Single phase	N/A
37th	0.010	0.055	Single phase	N/A
38th	0.005	0.026	Single phase	N/A
39th	0.009	0.053	Single phase	N/A
40th	0.004	0.023	Single phase	N/A
THD	--	4.860	Single phase	23
PWHD	--	2.851	Single phase	23

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	AF6K-SL	

Active power (W)	2014.49 (33% P_n , 60°C)
Voltage (V)	229.96
Current (A)	8.83
Power Factor	0.992
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	8.609	--	Single phase	--
2nd	0.031	0.354	Single phase	8
3rd	0.524	6.090	Single phase	21,6
4th	0.009	0.106	Single phase	4
5th	0.321	3.730	Single phase	10,7
6th	0.013	0.151	Single phase	2,7
7th	0.176	2.045	Single phase	7,2
8th	0.026	0.301	Single phase	2
9th	0.118	1.373	Single phase	3,8
10th	0.013	0.156	Single phase	1,6
11th	0.081	0.936	Single phase	3,1
12th	0.006	0.066	Single phase	1,3
13th	0.041	0.476	Single phase	2
14th	0.007	0.077	Single phase	N/A
15th	0.032	0.371	Single phase	N/A
16th	0.004	0.049	Single phase	N/A
17th	0.017	0.196	Single phase	N/A
18th	0.006	0.066	Single phase	N/A
19th	0.010	0.121	Single phase	N/A
20th	0.005	0.059	Single phase	N/A
21st	0.014	0.165	Single phase	N/A
22nd	0.008	0.096	Single phase	N/A
23rd	0.007	0.081	Single phase	N/A
24th	0.006	0.071	Single phase	N/A
25th	0.012	0.135	Single phase	N/A
26th	0.003	0.041	Single phase	N/A
27th	0.013	0.151	Single phase	N/A
28th	0.004	0.046	Single phase	N/A
29th	0.010	0.112	Single phase	N/A
30th	0.005	0.062	Single phase	N/A
31st	0.008	0.090	Single phase	N/A
32nd	0.004	0.045	Single phase	N/A
33rd	0.005	0.062	Single phase	N/A
34th	0.004	0.042	Single phase	N/A
35th	0.005	0.058	Single phase	N/A
36th	0.005	0.055	Single phase	N/A
37th	0.007	0.082	Single phase	N/A
38th	0.003	0.039	Single phase	N/A
39th	0.006	0.075	Single phase	N/A
40th	0.005	0.055	Single phase	N/A
THD	--	7.968	Single phase	23
PWHD	--	2.708	Single phase	23

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	AF6K-SL	

Active power (W)	2009.97 (33% P_n , -25°C)
Voltage (V)	229.97
Current (A)	8.81
Power Factor	0.992
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	8.609	--	Single phase	--
2nd	0.031	0.358	Single phase	8
3rd	0.527	6.122	Single phase	21,6
4th	0.010	0.118	Single phase	4
5th	0.322	3.738	Single phase	10,7
6th	0.014	0.159	Single phase	2,7
7th	0.177	2.053	Single phase	7,2
8th	0.026	0.301	Single phase	2
9th	0.117	1.355	Single phase	3,8
10th	0.013	0.147	Single phase	1,6
11th	0.080	0.931	Single phase	3,1
12th	0.005	0.061	Single phase	1,3
13th	0.041	0.475	Single phase	2
14th	0.007	0.080	Single phase	N/A
15th	0.031	0.362	Single phase	N/A
16th	0.005	0.052	Single phase	N/A
17th	0.016	0.185	Single phase	N/A
18th	0.006	0.070	Single phase	N/A
19th	0.010	0.119	Single phase	N/A
20th	0.005	0.058	Single phase	N/A
21st	0.014	0.164	Single phase	N/A
22nd	0.008	0.094	Single phase	N/A
23rd	0.007	0.082	Single phase	N/A
24th	0.005	0.063	Single phase	N/A
25th	0.011	0.133	Single phase	N/A
26th	0.004	0.043	Single phase	N/A
27th	0.013	0.155	Single phase	N/A
28th	0.004	0.048	Single phase	N/A
29th	0.009	0.106	Single phase	N/A
30th	0.005	0.063	Single phase	N/A
31st	0.008	0.090	Single phase	N/A
32nd	0.004	0.048	Single phase	N/A
33rd	0.006	0.070	Single phase	N/A
34th	0.004	0.045	Single phase	N/A
35th	0.005	0.055	Single phase	N/A
36th	0.004	0.050	Single phase	N/A
37th	0.007	0.083	Single phase	N/A
38th	0.004	0.044	Single phase	N/A
39th	0.007	0.077	Single phase	N/A
40th	0.004	0.047	Single phase	N/A
THD	--	7.950	Single phase	23
PWHD	--	2.694	Single phase	23

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	AF6K-SL	

Active power (W)	2015.11 (33% P_n , 25°C)
Voltage (V)	229.97
Current (A)	8.83
Power Factor	0.992
Frequency (Hz)	50.00

Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	8.609	--	Single phase	--
2nd	0.033	0.381	Single phase	8
3rd	0.523	6.075	Single phase	21,6
4th	0.009	0.101	Single phase	4
5th	0.322	3.741	Single phase	10,7
6th	0.012	0.144	Single phase	2,7
7th	0.177	2.059	Single phase	7,2
8th	0.029	0.332	Single phase	2
9th	0.118	1.368	Single phase	3,8
10th	0.014	0.164	Single phase	1,6
11th	0.080	0.924	Single phase	3,1
12th	0.006	0.070	Single phase	1,3
13th	0.041	0.478	Single phase	2
14th	0.006	0.074	Single phase	N/A
15th	0.031	0.364	Single phase	N/A
16th	0.004	0.046	Single phase	N/A
17th	0.016	0.181	Single phase	N/A
18th	0.006	0.069	Single phase	N/A
19th	0.010	0.121	Single phase	N/A
20th	0.005	0.060	Single phase	N/A
21st	0.014	0.167	Single phase	N/A
22nd	0.009	0.104	Single phase	N/A
23rd	0.008	0.088	Single phase	N/A
24th	0.006	0.070	Single phase	N/A
25th	0.012	0.139	Single phase	N/A
26th	0.004	0.041	Single phase	N/A
27th	0.014	0.158	Single phase	N/A
28th	0.004	0.047	Single phase	N/A
29th	0.010	0.118	Single phase	N/A
30th	0.005	0.062	Single phase	N/A
31st	0.008	0.094	Single phase	N/A
32nd	0.004	0.047	Single phase	N/A
33rd	0.006	0.070	Single phase	N/A
34th	0.004	0.046	Single phase	N/A
35th	0.005	0.053	Single phase	N/A
36th	0.004	0.048	Single phase	N/A
37th	0.007	0.083	Single phase	N/A
38th	0.004	0.041	Single phase	N/A
39th	0.006	0.070	Single phase	N/A
40th	0.004	0.052	Single phase	N/A
THD	--	7.971	Single phase	23
PWHD	--	2.678	Single phase	23

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)				
60°C, 100% P_n power condition:				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.014	--	--	1.080
3rd	0.311	--	--	2.300
4th	0.010	--	--	0.430
5th	0.177	--	--	1.140
6th	0.006	--	--	0.300
7th	0.067	--	--	0.770
8th	0.008	--	--	0.230
9th	0.014	--	--	0.400
10th	0.005	--	--	0.184
11th	0.019	--	--	0.330
12th	0.004	--	--	0.153
13th	0.027	--	--	0.210
14th	0.005	--	--	0.131
15th	0.031	--	--	0.150
16th	0.005	--	--	0.115
17th	0.018	--	--	0.132
18th	0.005	--	--	0.102
19th	0.017	--	--	0.118
20th	0.003	--	--	0.092
21th	0.007	--	--	0.107
22th	0.007	--	--	0.084
23th	0.011	--	--	0.098
24th	0.003	--	--	0.077
25th	0.012	--	--	0.090
26th	0.004	--	--	0.071
27th	0.013	--	--	0.083
28th	0.004	--	--	0.066
29th	0.007	--	--	0.078
30th	0.003	--	--	0.061
31th	0.007	--	--	0.073
32th	0.003	--	--	0.058
33th	0.004	--	--	0.068
34th	0.004	--	--	0.054
35th	0.008	--	--	0.064
36th	0.003	--	--	0.051
37th	0.008	--	--	0.061
38th	0.003	--	--	0.048
39th	0.008	--	--	0.058
40th	0.003	--	--	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)				
60°C, 66% P_n power condition:				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.013	--	--	1.080
3rd	0.331	--	--	2.300
4th	0.009	--	--	0.430
5th	0.122	--	--	1.140
6th	0.007	--	--	0.300
7th	0.020	--	--	0.770
8th	0.008	--	--	0.230
9th	0.058	--	--	0.400
10th	0.007	--	--	0.184
11th	0.057	--	--	0.330
12th	0.008	--	--	0.153
13th	0.033	--	--	0.210
14th	0.008	--	--	0.131
15th	0.017	--	--	0.150
16th	0.004	--	--	0.115
17th	0.029	--	--	0.132
18th	0.006	--	--	0.102
19th	0.028	--	--	0.118
20th	0.004	--	--	0.092
21th	0.017	--	--	0.107
22th	0.005	--	--	0.084
23th	0.017	--	--	0.098
24th	0.004	--	--	0.077
25th	0.016	--	--	0.090
26th	0.003	--	--	0.071
27th	0.016	--	--	0.083
28th	0.003	--	--	0.066
29th	0.008	--	--	0.078
30th	0.004	--	--	0.061
31th	0.010	--	--	0.073
32th	0.003	--	--	0.058
33th	0.010	--	--	0.068
34th	0.003	--	--	0.054
35th	0.009	--	--	0.064
36th	0.004	--	--	0.051
37th	0.007	--	--	0.061
38th	0.003	--	--	0.048
39th	0.009	--	--	0.058
40th	0.003	--	--	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)				
60°C, 33% P_n power condition:				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.014	--	--	1.080
3rd	0.297	--	--	2.300
4th	0.009	--	--	0.430
5th	0.096	--	--	1.140
6th	0.009	--	--	0.300
7th	0.134	--	--	0.770
8th	0.007	--	--	0.230
9th	0.053	--	--	0.400
10th	0.008	--	--	0.184
11th	0.073	--	--	0.330
12th	0.007	--	--	0.153
13th	0.050	--	--	0.210
14th	0.007	--	--	0.131
15th	0.052	--	--	0.150
16th	0.008	--	--	0.115
17th	0.039	--	--	0.132
18th	0.004	--	--	0.102
19th	0.038	--	--	0.118
20th	0.004	--	--	0.092
21th	0.031	--	--	0.107
22th	0.005	--	--	0.084
23th	0.024	--	--	0.098
24th	0.003	--	--	0.077
25th	0.018	--	--	0.090
26th	0.004	--	--	0.071
27th	0.017	--	--	0.083
28th	0.003	--	--	0.066
29th	0.013	--	--	0.078
30th	0.004	--	--	0.061
31th	0.011	--	--	0.073
32th	0.003	--	--	0.058
33th	0.011	--	--	0.068
34th	0.003	--	--	0.054
35th	0.009	--	--	0.064
36th	0.004	--	--	0.051
37th	0.008	--	--	0.061
38th	0.003	--	--	0.048
39th	0.009	--	--	0.058
40th	0.003	--	--	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)				
-25°C, 100% P_n power condition:				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.013	--	--	1.080
3rd	0.312	--	--	2.300
4th	0.010	--	--	0.430
5th	0.176	--	--	1.140
6th	0.006	--	--	0.300
7th	0.067	--	--	0.770
8th	0.008	--	--	0.230
9th	0.015	--	--	0.400
10th	0.006	--	--	0.184
11th	0.019	--	--	0.330
12th	0.005	--	--	0.153
13th	0.027	--	--	0.210
14th	0.005	--	--	0.131
15th	0.031	--	--	0.150
16th	0.005	--	--	0.115
17th	0.017	--	--	0.132
18th	0.005	--	--	0.102
19th	0.017	--	--	0.118
20th	0.003	--	--	0.092
21th	0.007	--	--	0.107
22th	0.006	--	--	0.084
23th	0.011	--	--	0.098
24th	0.003	--	--	0.077
25th	0.011	--	--	0.090
26th	0.004	--	--	0.071
27th	0.013	--	--	0.083
28th	0.004	--	--	0.066
29th	0.007	--	--	0.078
30th	0.003	--	--	0.061
31th	0.006	--	--	0.073
32th	0.003	--	--	0.058
33th	0.004	--	--	0.068
34th	0.004	--	--	0.054
35th	0.008	--	--	0.064
36th	0.004	--	--	0.051
37th	0.008	--	--	0.061
38th	0.003	--	--	0.048
39th	0.008	--	--	0.058
40th	0.003	--	--	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)				
-25°C, 66% P_n power condition:				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.012	--	--	1.080
3rd	0.331	--	--	2.300
4th	0.010	--	--	0.430
5th	0.121	--	--	1.140
6th	0.006	--	--	0.300
7th	0.020	--	--	0.770
8th	0.008	--	--	0.230
9th	0.057	--	--	0.400
10th	0.007	--	--	0.184
11th	0.056	--	--	0.330
12th	0.009	--	--	0.153
13th	0.032	--	--	0.210
14th	0.008	--	--	0.131
15th	0.017	--	--	0.150
16th	0.004	--	--	0.115
17th	0.028	--	--	0.132
18th	0.005	--	--	0.102
19th	0.028	--	--	0.118
20th	0.003	--	--	0.092
21th	0.016	--	--	0.107
22th	0.004	--	--	0.084
23th	0.017	--	--	0.098
24th	0.004	--	--	0.077
25th	0.016	--	--	0.090
26th	0.003	--	--	0.071
27th	0.016	--	--	0.083
28th	0.003	--	--	0.066
29th	0.008	--	--	0.078
30th	0.004	--	--	0.061
31th	0.010	--	--	0.073
32th	0.003	--	--	0.058
33th	0.010	--	--	0.068
34th	0.003	--	--	0.054
35th	0.009	--	--	0.064
36th	0.003	--	--	0.051
37th	0.007	--	--	0.061
38th	0.003	--	--	0.048
39th	0.009	--	--	0.058
40th	0.003	--	--	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)				
-25°C, 33% P_n power condition:				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.014	--	--	1.080
3rd	0.295	--	--	2.300
4th	0.008	--	--	0.430
5th	0.095	--	--	1.140
6th	0.010	--	--	0.300
7th	0.134	--	--	0.770
8th	0.006	--	--	0.230
9th	0.053	--	--	0.400
10th	0.008	--	--	0.184
11th	0.073	--	--	0.330
12th	0.006	--	--	0.153
13th	0.050	--	--	0.210
14th	0.007	--	--	0.131
15th	0.052	--	--	0.150
16th	0.008	--	--	0.115
17th	0.039	--	--	0.132
18th	0.004	--	--	0.102
19th	0.038	--	--	0.118
20th	0.004	--	--	0.092
21th	0.030	--	--	0.107
22th	0.004	--	--	0.084
23th	0.025	--	--	0.098
24th	0.003	--	--	0.077
25th	0.017	--	--	0.090
26th	0.004	--	--	0.071
27th	0.018	--	--	0.083
28th	0.003	--	--	0.066
29th	0.014	--	--	0.078
30th	0.003	--	--	0.061
31th	0.010	--	--	0.073
32th	0.003	--	--	0.058
33th	0.011	--	--	0.068
34th	0.003	--	--	0.054
35th	0.009	--	--	0.064
36th	0.003	--	--	0.051
37th	0.008	--	--	0.061
38th	0.003	--	--	0.048
39th	0.009	--	--	0.058
40th	0.003	--	--	0.046

B.1 a) Harmonics measurement under test condition 25°C /-25°C / 60°C (CEI EN 61000-3-2)				
25°C, 100% P_n power condition:				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.014	--	--	1.080
3rd	0.312	--	--	2.300
4th	0.010	--	--	0.430
5th	0.177	--	--	1.140
6th	0.006	--	--	0.300
7th	0.067	--	--	0.770
8th	0.009	--	--	0.230
9th	0.014	--	--	0.400
10th	0.006	--	--	0.184
11th	0.019	--	--	0.330
12th	0.005	--	--	0.153
13th	0.027	--	--	0.210
14th	0.006	--	--	0.131
15th	0.031	--	--	0.150
16th	0.005	--	--	0.115
17th	0.018	--	--	0.132
18th	0.004	--	--	0.102
19th	0.017	--	--	0.118
20th	0.003	--	--	0.092
21th	0.008	--	--	0.107
22th	0.006	--	--	0.084
23th	0.011	--	--	0.098
24th	0.003	--	--	0.077
25th	0.011	--	--	0.090
26th	0.004	--	--	0.071
27th	0.013	--	--	0.083
28th	0.004	--	--	0.066
29th	0.007	--	--	0.078
30th	0.003	--	--	0.061
31th	0.007	--	--	0.073
32th	0.003	--	--	0.058
33th	0.004	--	--	0.068
34th	0.003	--	--	0.054
35th	0.008	--	--	0.064
36th	0.004	--	--	0.051
37th	0.008	--	--	0.061
38th	0.003	--	--	0.048
39th	0.008	--	--	0.058
40th	0.003	--	--	0.046

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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_n power condition:				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.013	--	--	1.080
3rd	0.331	--	--	2.300
4th	0.010	--	--	0.430
5th	0.121	--	--	1.140
6th	0.006	--	--	0.300
7th	0.020	--	--	0.770
8th	0.008	--	--	0.230
9th	0.057	--	--	0.400
10th	0.007	--	--	0.184
11th	0.057	--	--	0.330
12th	0.009	--	--	0.153
13th	0.033	--	--	0.210
14th	0.007	--	--	0.131
15th	0.017	--	--	0.150
16th	0.004	--	--	0.115
17th	0.028	--	--	0.132
18th	0.005	--	--	0.102
19th	0.028	--	--	0.118
20th	0.004	--	--	0.092
21th	0.017	--	--	0.107
22th	0.004	--	--	0.084
23th	0.017	--	--	0.098
24th	0.004	--	--	0.077
25th	0.016	--	--	0.090
26th	0.003	--	--	0.071
27th	0.016	--	--	0.083
28th	0.003	--	--	0.066
29th	0.008	--	--	0.078
30th	0.003	--	--	0.061
31th	0.010	--	--	0.073
32th	0.003	--	--	0.058
33th	0.010	--	--	0.068
34th	0.003	--	--	0.054
35th	0.009	--	--	0.064
36th	0.004	--	--	0.051
37th	0.007	--	--	0.061
38th	0.003	--	--	0.048
39th	0.010	--	--	0.058
40th	0.003	--	--	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_n power condition:				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.013	--	--	1.080
3rd	0.295	--	--	2.300
4th	0.008	--	--	0.430
5th	0.095	--	--	1.140
6th	0.010	--	--	0.300
7th	0.134	--	--	0.770
8th	0.007	--	--	0.230
9th	0.053	--	--	0.400
10th	0.008	--	--	0.184
11th	0.073	--	--	0.330
12th	0.007	--	--	0.153
13th	0.051	--	--	0.210
14th	0.007	--	--	0.131
15th	0.053	--	--	0.150
16th	0.008	--	--	0.115
17th	0.039	--	--	0.132
18th	0.004	--	--	0.102
19th	0.038	--	--	0.118
20th	0.004	--	--	0.092
21th	0.031	--	--	0.107
22th	0.004	--	--	0.084
23th	0.025	--	--	0.098
24th	0.003	--	--	0.077
25th	0.017	--	--	0.090
26th	0.004	--	--	0.071
27th	0.017	--	--	0.083
28th	0.003	--	--	0.066
29th	0.013	--	--	0.078
30th	0.003	--	--	0.061
31th	0.010	--	--	0.073
32th	0.003	--	--	0.058
33th	0.011	--	--	0.068
34th	0.003	--	--	0.054
35th	0.009	--	--	0.064
36th	0.004	--	--	0.051
37th	0.008	--	--	0.061
38th	0.003	--	--	0.048
39th	0.008	--	--	0.058
40th	0.003	--	--	0.046

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

B1 c)	**TABLE: Flicker emission**			**P**
Model	AF6K-SL			
Normal ambient				
Output power:	Flicker limits according to*:	Result:		
		Plt	Pst	dc%
33%	EN61000-3-3 / EN61000-3-11	0.101	0.107	0.023
66%	EN61000-3-3 / EN61000-3-11	0.099	0.105	0.024
100%	EN61000-3-3 / EN61000-3-11	0.103	0.108	0.061
Minimum ambient rating (-25°C) or -10°C				
Output power:	Flicker limits according to*:	Result:		
		Plt	Pst	dc%
33%	EN61000-3-3 / EN61000-3-11	0.099	0.105	0.024
66%	EN61000-3-3 / EN61000-3-11	0.103	0.108	0.089
100%	EN61000-3-3 / EN61000-3-11	0.116	0.137	0.024
Maximum ambient rating (+60°C) or +55°C				
Output power:	Flicker limits according to*:	Result:		
		Plt	Pst	dc%
33%	EN61000-3-3 / EN61000-3-11	0.098	0.104	0.024
66%	EN61000-3-3 / EN61000-3-11	0.102	0.107	0.088
100%	EN61000-3-3 / EN61000-3-11	0.116	0.137	0.023

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).

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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	0.010	Pass	0.304	Pass	0.0	Pass	0.107	Pass		
2	0.020	Pass	0.301	Pass	0.0	Pass	0.105	Pass		
3	0.016	Pass	0.282	Pass	0.0	Pass	0.106	Pass		
4	0.018	Pass	0.341	Pass	0.0	Pass	0.105	Pass		
5	0.020	Pass	0.280	Pass	0.0	Pass	0.103	Pass		
6	0.013	Pass	0.364	Pass	0.0	Pass	0.103	Pass		
7	0.016	Pass	0.321	Pass	0.0	Pass	0.102	Pass		
8	0.020	Pass	0.316	Pass	0.0	Pass	0.100	Pass		
9	0.015	Pass	0.336	Pass	0.0	Pass	0.127	Pass		
10	0.023	Pass	0.345	Pass	0.0	Pass	0.137	Pass		
11	0.016	Pass	0.293	Pass	0.0	Pass	0.136	Pass		
12	0.014	Pass	0.361	Pass	0.0	Pass	0.136	Pass		
Result		Pass		Pass		Pass		Pass	0.116	Pass

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Clause	Requirement - Test	Result - Remark	Verdict

B.1.1	**TABLE: Conditions of connection, reconnection and gradual power supply**			**P**
Model	AF6K-SL			
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]		33.4	31.0	
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]		304.2	303.6	
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]		33.8	31.2	
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]		304.2	303.4	
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		
file name a) b) and c):				

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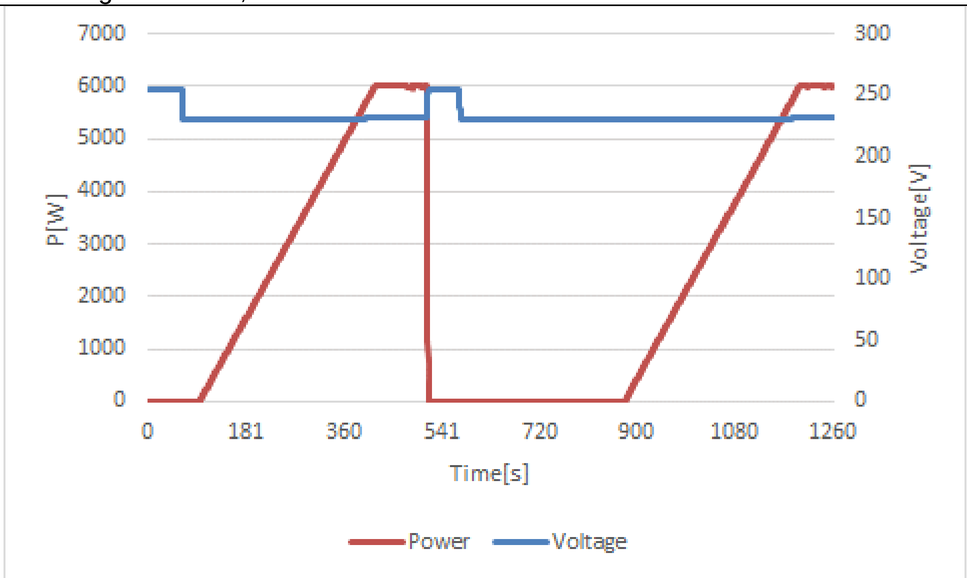
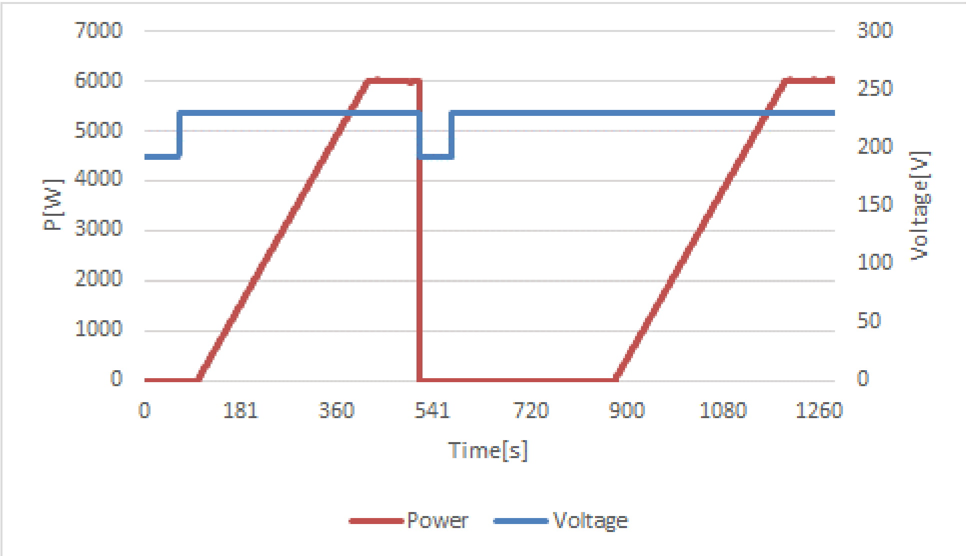
Clause	Requirement - Test	Result - Remark	Verdict

file name d), e) and f):		
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





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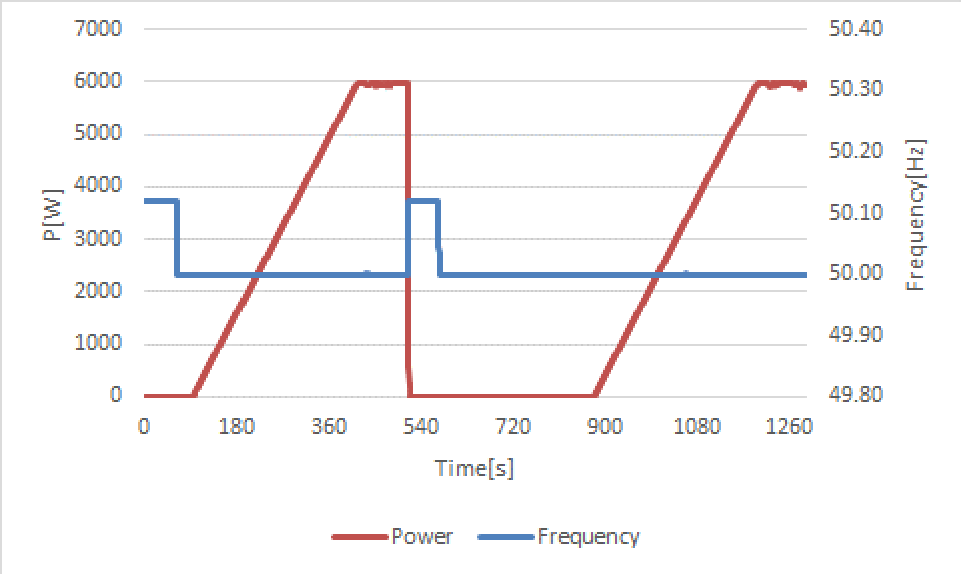
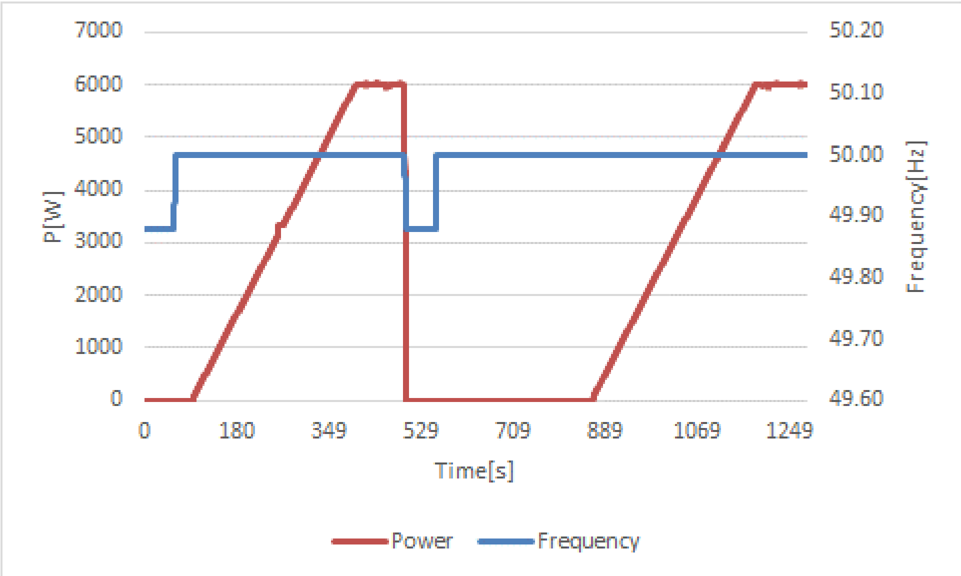
Clause	Requirement - Test	Result - Remark	Verdict





B.1.2.2.2	TABLE: Reactive power capability - Inverter in systems with total capacity greater than 11.08 kW	P
Model	AF6K-SL	

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
0% -10%(*)	539	8.99%	-118	-1.96%	671	11.19%	0.9770
10% -20%(**)	1147	19.12%	-123	-2.06%	1283	21.38%	0.9943
20% -30%	1754	29.24%	-136	-2.26%	1901	31.68%	0.9970
30% -40%	2300	38.34%	-147	-2.45%	2455	40.91%	0.9980
40% -50%	2907	48.45%	-159	-2.65%	3072	51.21%	0.9985
50% -60%	3513	58.55%	-171	-2.85%	3692	61.53%	0.9988
60% -70%	4119	68.65%	-183	-3.05%	4309	71.82%	0.9990
70% -80%	4724	78.74%	-197	-3.29%	4929	82.16%	0.9991
80% -90%	5329	88.82%	-212	-3.54%	5550	92.50%	0.9992
90% -100%(***)	5931	98.85%	-231	-3.85%	6168	102.80%	0.9992

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
0% -10%(*)	543	9.05%	-157	-2.62%	623	10.39%	0.9604
10% -20%(**)	1155	19.24%	-162	-2.69%	1240	20.66%	0.9903
20% -30%	1765	29.42%	-2910	-48.50%	1871	31.19%	0.5183
30% -40%	2315	38.58%	-2915	-48.58%	2433	40.55%	0.6216
40% -50%	2926	48.76%	-2916	-48.60%	3059	50.99%	0.7078
50% -60%	3536	58.93%	-2920	-48.67%	3686	61.43%	0.7706
60% -70%	4146	69.09%	-2926	-48.77%	4314	71.89%	0.8166
70% -80%	4755	79.25%	-2930	-48.83%	4941	82.35%	0.8510
80% -90%	5364	89.40%	-2934	-48.89%	5570	92.83%	0.8770
90% -100%(***)	5439	90.65%	-2938	-48.97%	5636	93.93%	0.8795

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
0% -10%(*)	544	9.06%	-144	-2.39%	596	9.93%	0.9669
10% -20%(**)	1156	19.26%	-147	-2.45%	1212	20.19%	0.9920
20% -30%	1768	29.47%	2918	48.64%	1824	30.40%	0.5179

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Clause	Requirement - Test	Result - Remark	Verdict

30% -40%	2318	38.64%	2923	48.71%	2382	39.69%	0.6210
40% -50%	2930	48.83%	2925	48.75%	3000	50.00%	0.7072
50% -60%	3539	58.99%	2932	48.86%	3627	60.45%	0.7697
60% -70%	4150	69.17%	2939	48.98%	4255	70.92%	0.8157
70% -80%	4762	79.36%	2944	49.07%	4885	81.42%	0.8501
80% -90%	5374	89.57%	2949	49.14%	5518	91.97%	0.8764
90% -100%(***)	5602	93.37%	2955	49.26%	5755	95.92%	0.8841

Note:
The PV inverter maximum reactive power set point Q = 48.43%P_D.
(*) 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	AF6K-SL			
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% Pn	Reactive power Set point Q/P_n [%]	Reactive power measured Q/P_n [%]	Deviation from set point $\Delta Q/P_n$ [%]	Limit [%]
$-Q_{min}$	-50.00%	-50.70%	0.70%	$\Delta Q \leq \pm 2.5\%\ P_n$
0	0.00%	-2.30%	2.30%	$\Delta Q \leq \pm 2.5\%\ P_n$
$+Q_{max}$	50.00%	50.41%	-0.41%	$\Delta Q \leq \pm 2.5\%\ P_n$

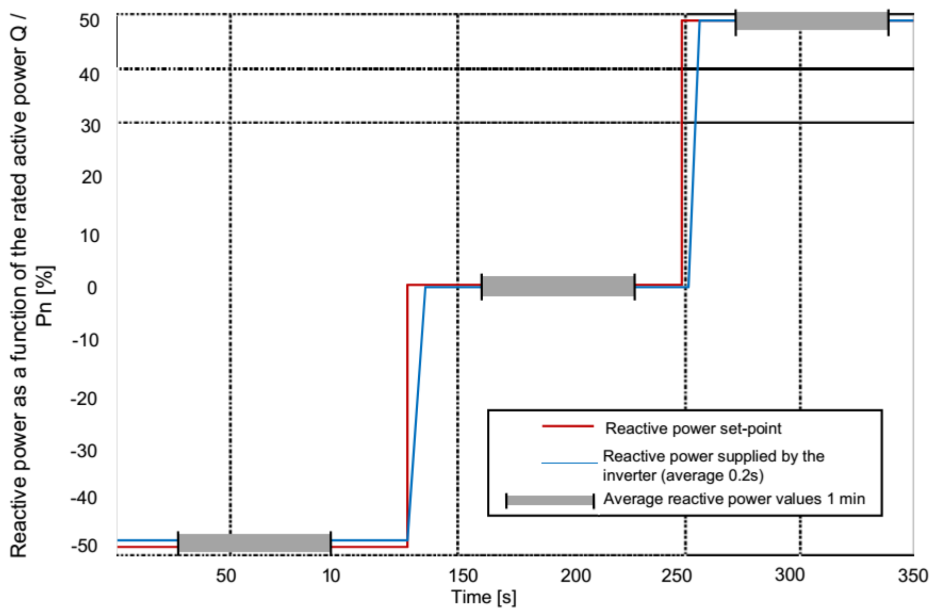


Figure 48 - Measurement of the reactive power delivered based on an external command, accuracy check

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	AF6K-SL		
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.

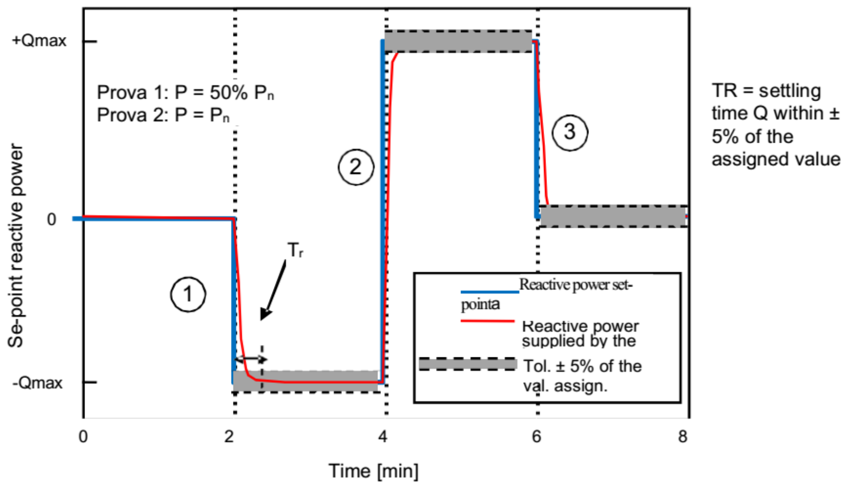
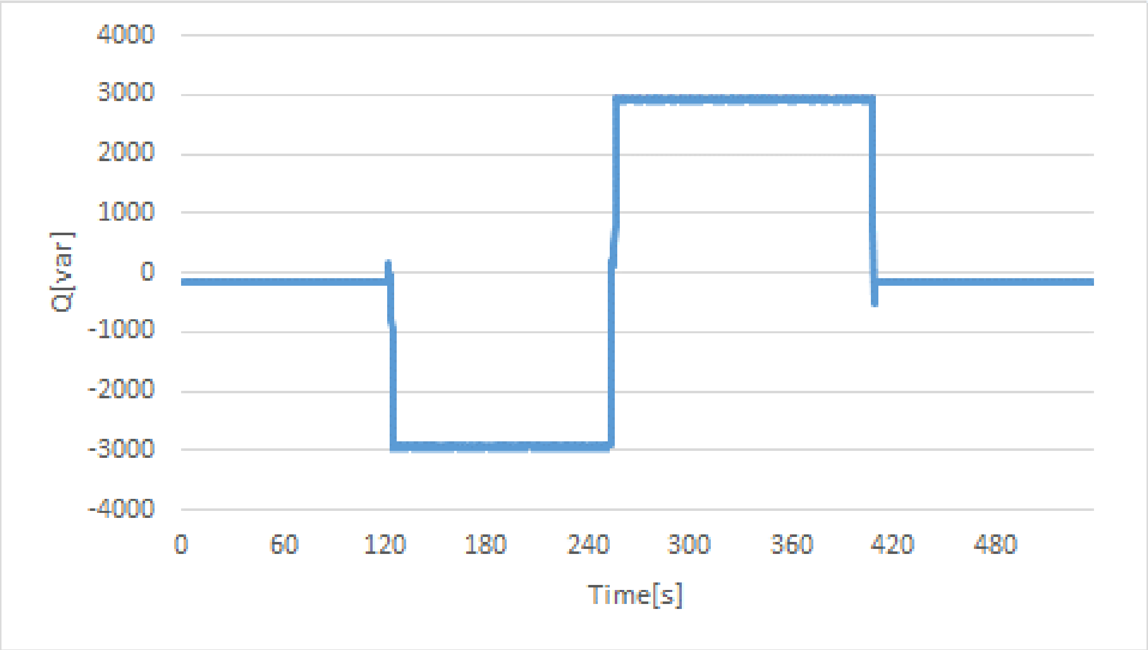


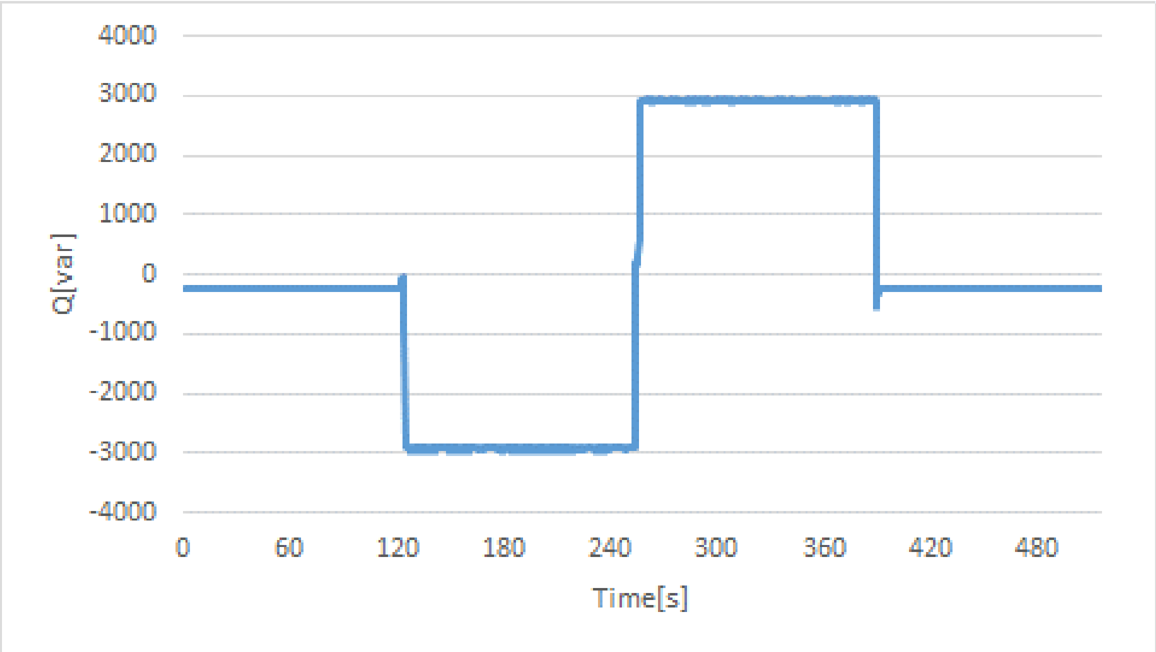
Figure 49 - Measurement of the response time to step changes of the set-point assigned for the reactive power

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

50%Pn:



100%Pn:



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	AF6K-SL	

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

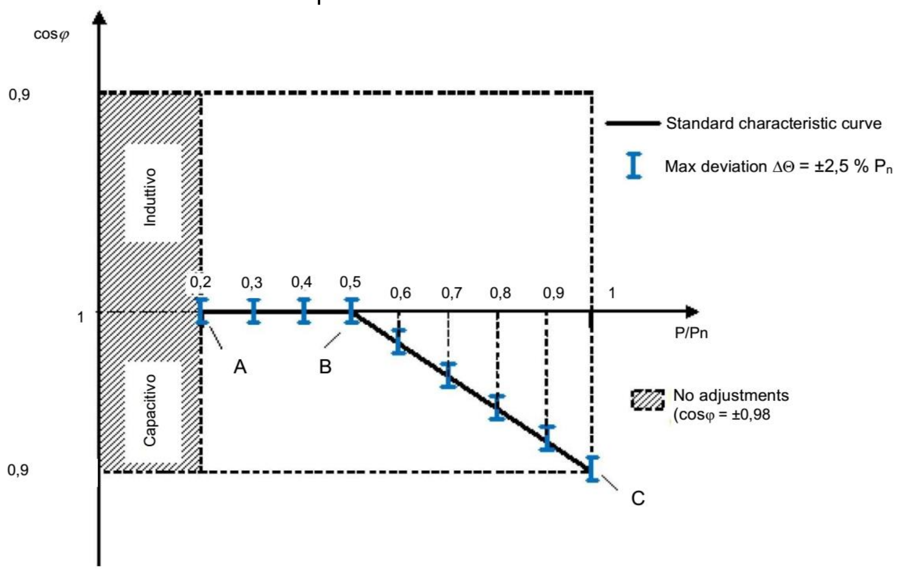


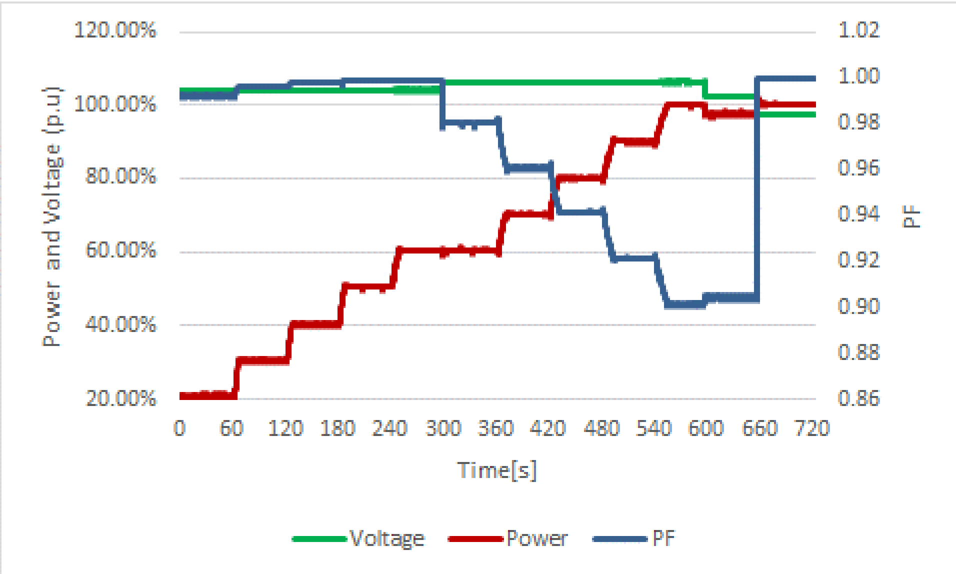
Figure 50 - Standard characteristic curve cosφ = f(P)

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:	AF6K-SL							
P/P_{SMAX}[%]	P[W]	Vout[V]	Q[Var]	Cos φSetpoint	Cos φmeasured	ΔCosφ	Limit Δcosφ_max	Result
20	1253	104.00	157	1.00	0.992	-0.008	≤ ± 0.01	P
30	1833	104.05	159	1.00	0.996	-0.004	≤ ± 0.01	P
40	2421	104.10	156	1.00	0.998	-0.002	≤ ± 0.01	P
50	3023	104.15	154	1.00	0.998	-0.002	≤ ± 0.01	P
60	3603	104.20	135	1.00	0.999	-0.001	≤ ± 0.01	P
60	3627	106.19	-731	0.98	0.980	0.000	≤ ± 0.01	P
70	4209	106.23	-1210	0.96	0.961	0.001	≤ ± 0.01	P
80	4802	106.28	-1721	0.94	0.941	0.001	≤ ± 0.01	P
90	5406	106.32	-2284	0.92	0.921	0.001	≤ ± 0.01	P
100	5589	106.37	-2863	0.90	0.902	0.002	≤ ± 0.01	P
100	5469	102.40	-2761	0.90	0.905	0.005	≤ ± 0.01	P
100	6016	97.48	-122	1.00	0.999	-0.001	≤ ± 0.01	P

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



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 $\Delta Q \leq \pm 2.5\%$ of P_n
The inverter must be able to delay the activation of the curve from 0s - 30s (in 1s steps / default setting: 3s)

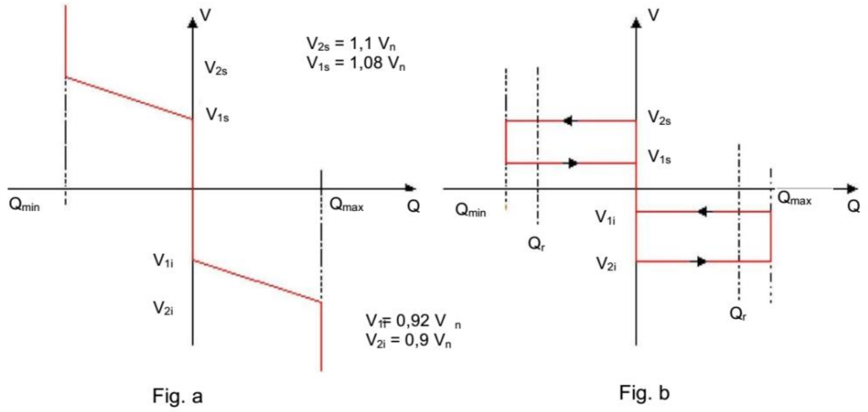


Figure 51 - **Standard characteristic curves Q = f (V)**

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	AF6K-SL					
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	18.20	246.21	143	≈0(<±2.5%Pn)	-2.39%
< 20%	1.09Vn	18.18	250.78	148	≈0(<±2.5%Pn)	-2.47%
< 20%-> 30%	1.09Vn	30.37	250.77	-1183	-0.5 Q_{min} (within 10s)	-2.07%
40%	1.09V_n	40.54	250.79	-1272	-0.5 Q_{min}	-0.59%
50%	1.09V_n	50.70	250.79	-1276	-0.5 Q_{min}	-0.53%
60%	1.09V_n	60.87	250.73	-1234	-0.5 Q_{min}	-1.22%
70%	1.09V_n	71.04	250.76	-1252	-0.5 Q_{min}	-0.92%
80%	1.09V_n	81.22	250.80	-1296	-0.5 Q_{min}	-0.19%
90%	1.09V_n	91.39	250.72	-1266	-0.5 Q_{min}	-0.70%
100%	1.09V_n	98.62	250.73	-1274	-0.5 Q_{min}	-0.56%
100%	1.1 V_n	90.49	253.06	-2571	- Q_{min}	-0.74%
100%->10%	1.1 V_n	9.99	253.05	-2499	- Q_{min}	-1.93%
10%-> ≤5%	1.1 V_n	3.91	253.10	133	≈0 (<±5%P_n)	-2.21%
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	18.29	213.97	-135	≈0 (<±2.5%P_n)	2.24%
< 20%	0.91V_n	18.31	209.39	-135	≈0 (<±2.5%P_n)	2.25%
< 20%-30%	0.91V_n	30.60	209.41	1405	-0.5 Q_{max} (within 10s)	-1.63%
40%	0.91V_n	40.76	209.38	1351	-0.5 Q_{max}	-0.73%
50%	0.91V_n	50.94	209.34	1370	-0.5 Q_{max}	-1.04%
60%	0.91V_n	61.13	209.32	1357	-0.5 Q_{max}	-0.83%
70%	0.91V_n	71.30	209.35	1327	-0.5 Q_{max}	-0.33%
80%	0.91V_n	81.50	209.32	1323	-0.5 Q_{max}	-0.26%
90%	0.91V_n	91.41	209.36	1300	-0.5 Q_{max}	0.13%
100%	0.91V_n	91.55	209.37	1301	-0.5 Q_{max}	0.11%
100%	0.90V_n	89.33	207.03	2606	- Q_{max}	0.14%
100%-10%	0.90V_n	10.24	207.12	2613	- Q_{max}	0.04%
10%-5%	0.90V_n	5.06	207.06	-131	≈0(<±5%P_n)	2.18%

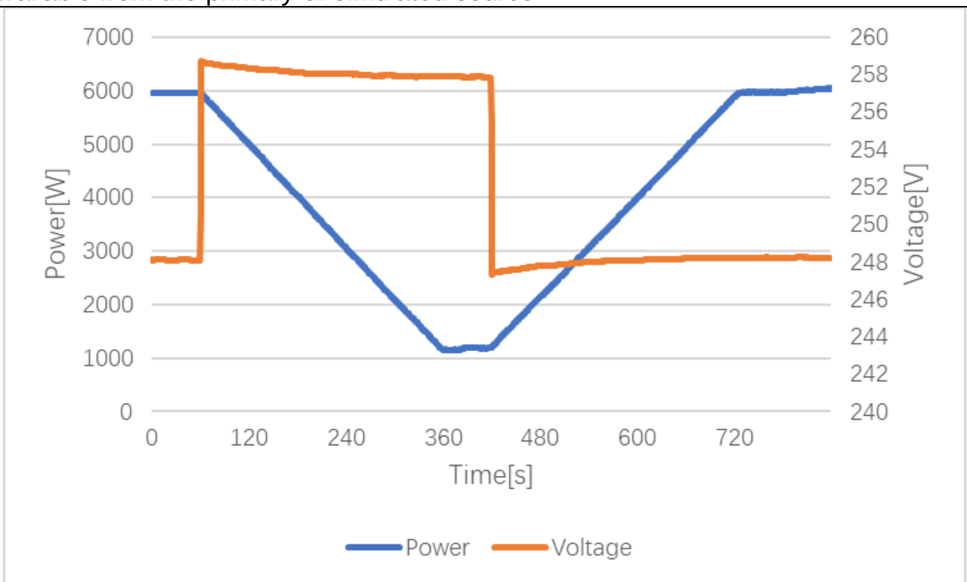
Note:
The lock-in value is adjustable between V_n and 1.1V_n and the lock-out value between V_n and 0.9V_n in 0.01V steps.
The inverter voltage on the AC side of the (inverter) is rated to 400V line to line.
In reference to the circular characteristic, the inverter reduces the active output power to 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	AF6K-SL					
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	248.14	5950.18	99.17%	--	P
2	1,12	258.08	1173.29	19.55%	P <20%P_n	P
3	1,08	248.04	5966.98	99.45%	--	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	AF6K-SL							
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

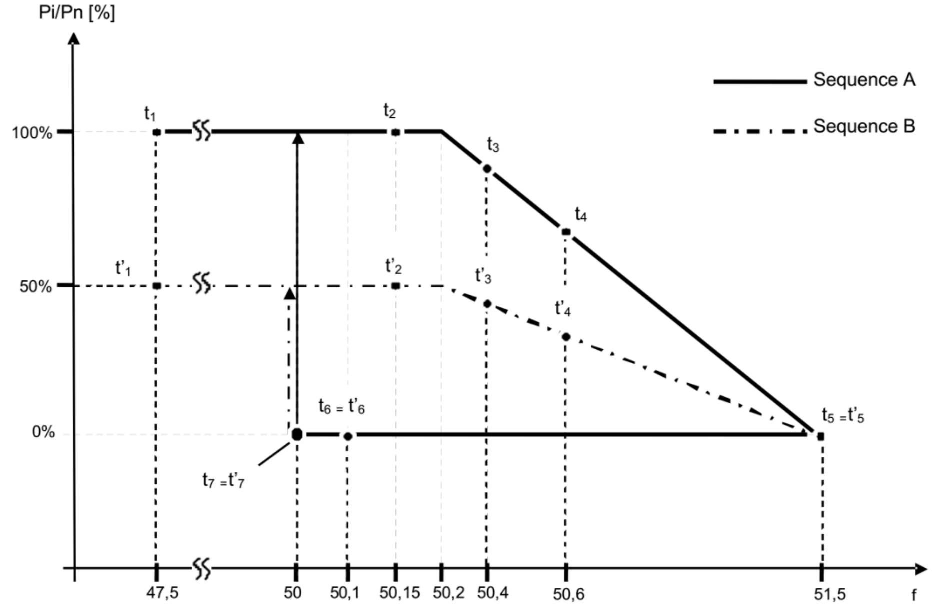
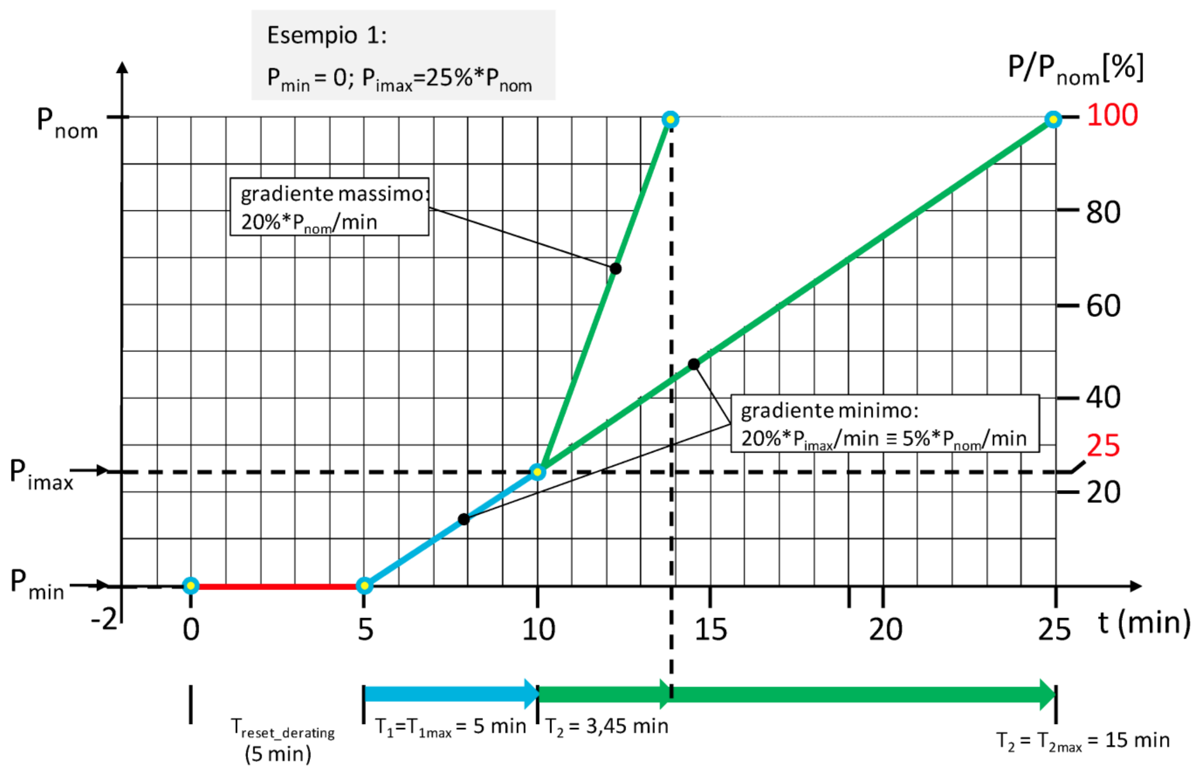


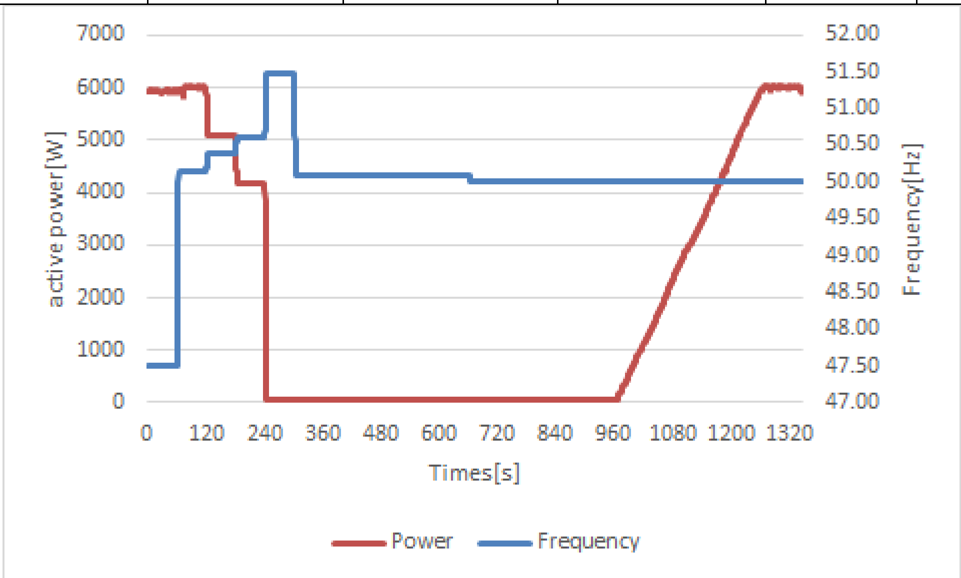
Figure 52 - Curves for limiting active power with respect to frequency

The total tolerance is ΔP ≤ ±2,5% of P_n

Limits of the power-up gradient

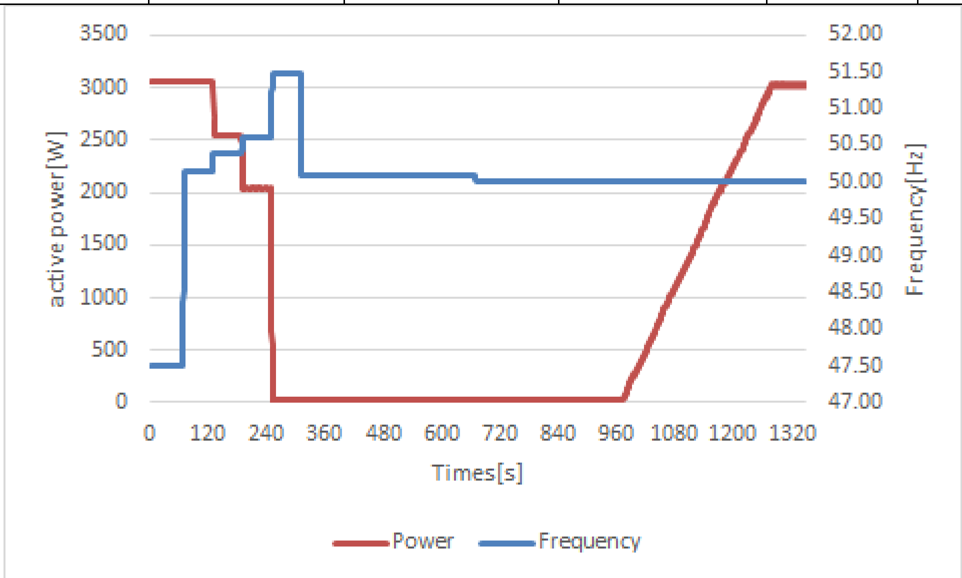


Sequence A						
Step No.	Set output power [%]	Frequency[Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	100	47.51	6000	5940	± 2.5% Pn	t_1
2	100	50.15	6000	6002	± 2.5% Pn	t_2
3	100	50.40	5077	5067	± 2.5% Pn	t_3
4	100	50.60	4154	4153	± 2.5% Pn	t_4
5	100	51.49	46	45	± 2.5% Pn	t_5
6	100	50.10	46	43	± 2.5% Pn	t_6
7	100	50.00	6000	5993	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	3000	3062	± 2.5% Pn	t’$_1$
2	50	50.15	3000	3065	± 2.5% Pn	t’$_2$
3	50	50.40	2538	2537	± 2.5% Pn	t’$_3$
4	50	50.60	2077	2032	± 2.5% Pn	t’$_4$
5	50	51.49	23	29	± 2.5% Pn	t’$_5$
6	50	50.10	23	28	± 2.5% Pn	t’$_6$
7	50	50.00	3000	3003	50% Pn	t’$_7$

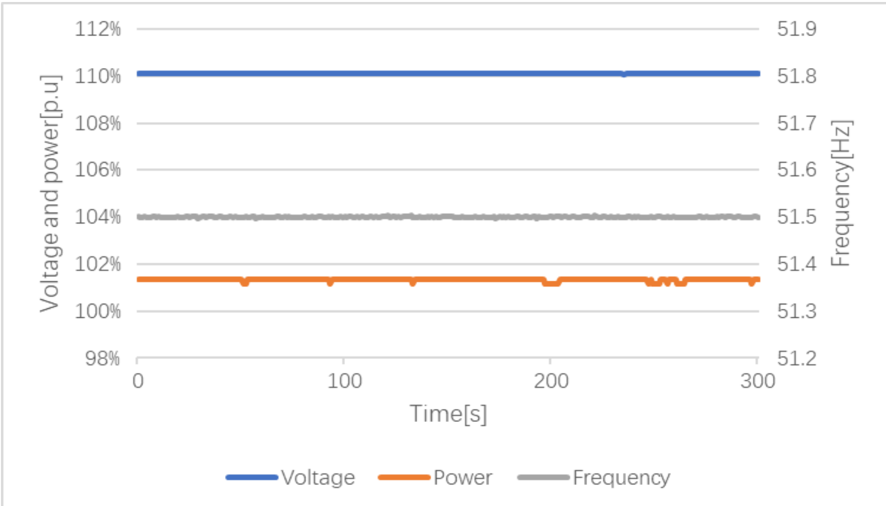


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

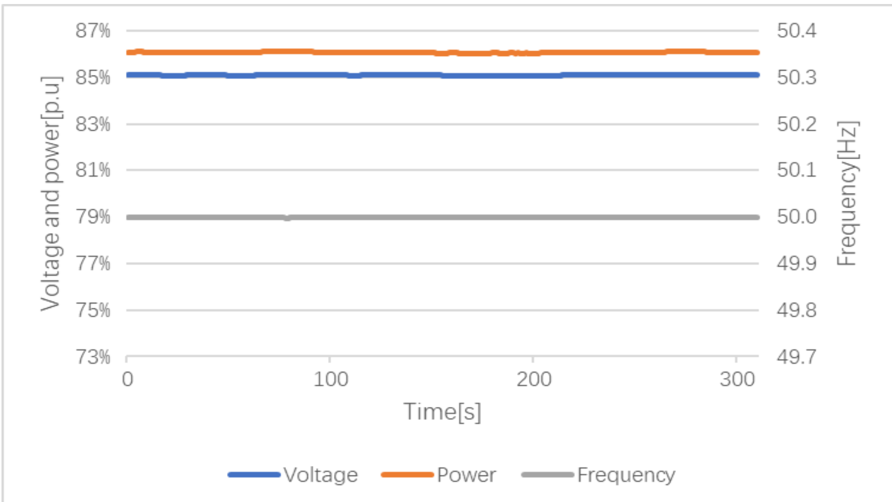
B.1.3.3	**TABLE: Verification of the operating range in voltage and frequency**					**P**
Model	AF6K-SL					
Test No.	Voltage (V)	Frequency (Hz)	P (W)	Cos φ	Time (s)	Limit (%P_n)
Test 1	253.26	51.50	6080	0.998	>5min	± 5
Test 2	195.74	50.00	5164	0.998	>5min	± 15

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



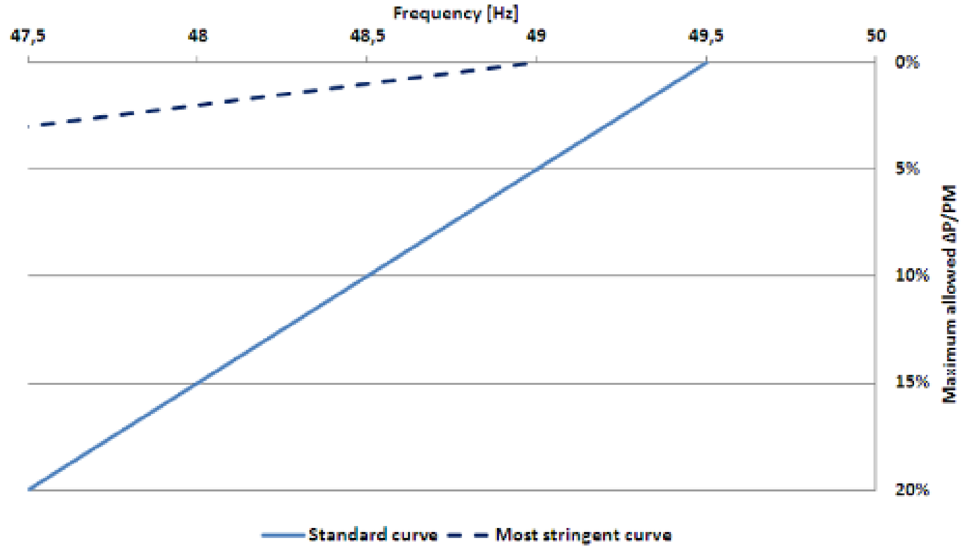
Test 2



B.1.3.3.1	**TABLE: Reduction of active power in the presence of transient under-frequency on transmission network**					**P**
Model:	AF6K-SL					
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]:	6014	6017	6018	6016	6017	6017

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.

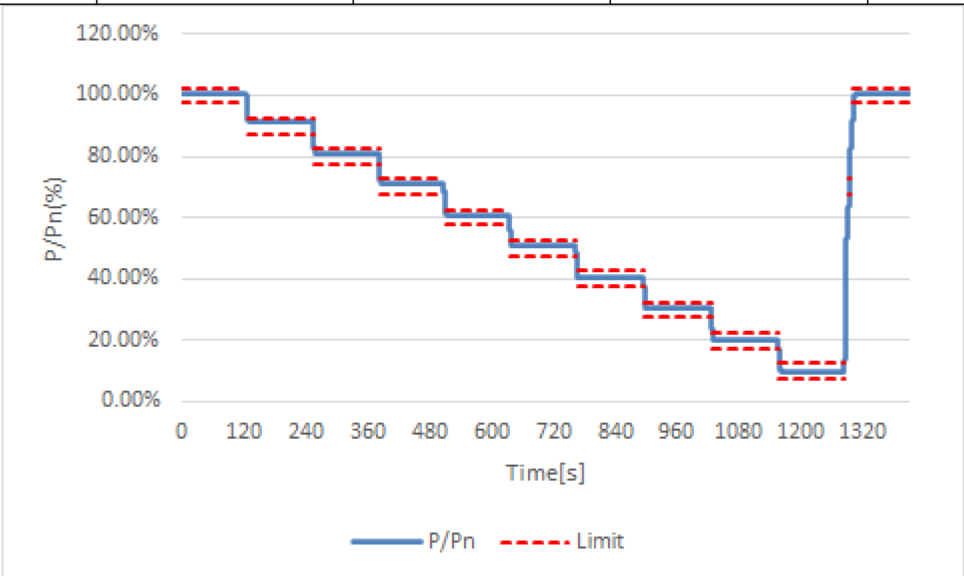
Assessment criterion:
The test is regarded as passed if:
the results should be presented in a table, and on the basis they must extrapolate the trend on a graph that must be greater than the threshold identified by continuous tract of fig. 12a contained in the 8.4.4.
• the power reduction in point c) 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	AF6K-SL			
Set point P [P/P_n]	Set point P [W]	P measured [W]	Deviation (%)	Limit (%P_n)
100	6000	6026	-0.43%	--
90	5400	5478	-1.30%	± 2.5
80	4800	4870	-1.16%	± 2.5
70	4200	4260	-1.00%	± 2.5
60	3600	3651	-0.85%	± 2.5
50	3000	3043	-0.71%	± 2.5
40	2400	2433	-0.56%	± 2.5
30	1800	1823	-0.39%	± 2.5
20	1200	1214	-0.23%	± 2.5
10	600	605	-0.08%	± 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:

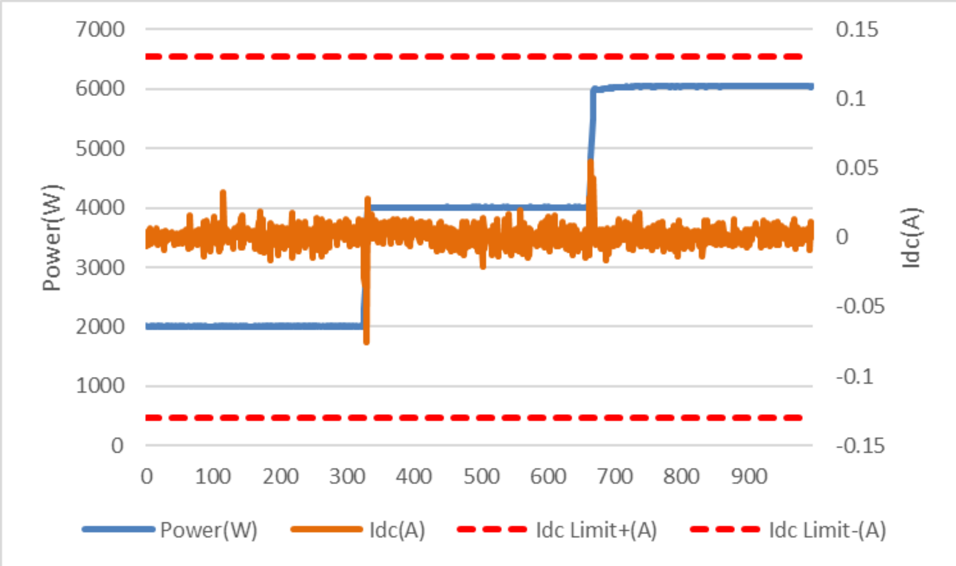
a) for adjustable PGUs:
- no network disconnection above 12,5% P_n
- the active power value does not exceed the setpoint by more than 2,5% P_n
- the setting time determined this way is ≤ 1min

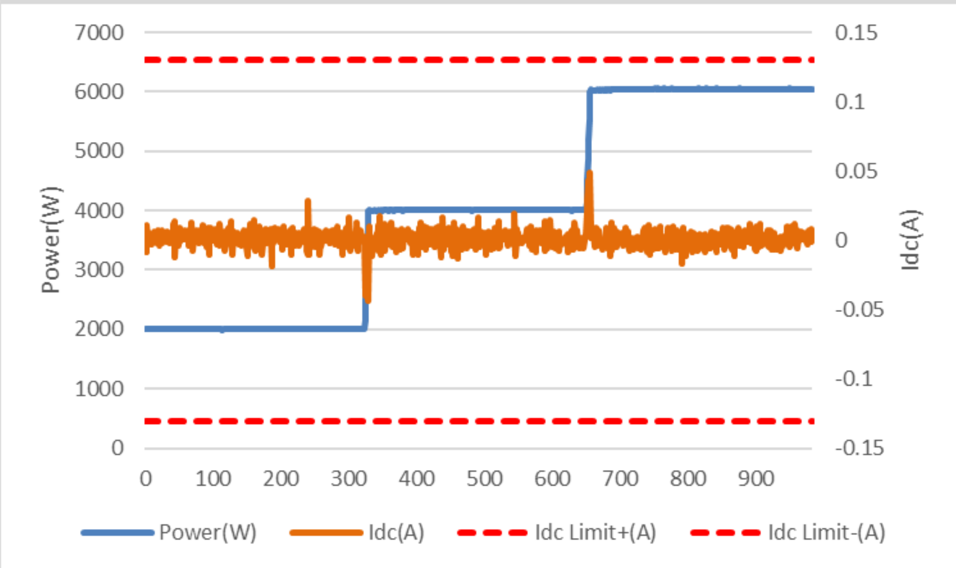
Note:

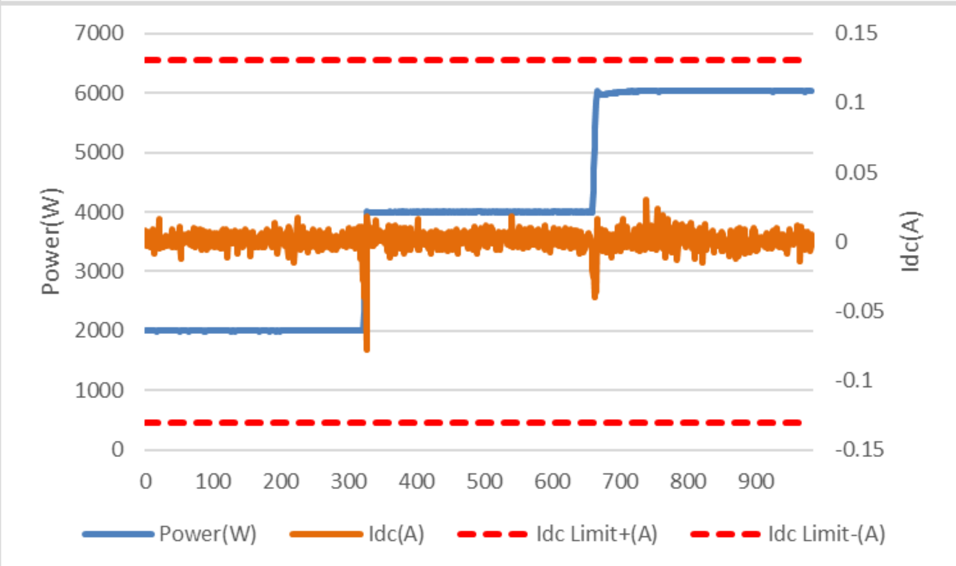
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.4.1	**TABLE: Checking the DC component output**		**P**
Model	AF6K-SL		
Power Level	(33 ± 5)%	(66 ± 5)%	(100 ± 5)%
Ambient			
Total output Power (W)	2011	4005	6032
Output Vrms	230.27	230.27	230.68
Output Arms	8.76	17.41	26.16
Cos φ	0.999	0.999	0.999
L1 DC Component (A)	0.006	0.006	0.005
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.021%	0.023%	0.019%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-
Minimum ambient rating (-25°C) or -10°C			
Total output Power (W)	2010	4005	6035
Output Vrms	230.28	230.27	230.69
Output Arms	8.76	17.40	26.18
Cos φ	0.999	0.999	0.999
L1 DC Component (A)	0.005	0.005	0.005
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.019%	0.020%	0.018%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-
Maximum ambient rating (+60°C) or +55°C			
Total output Power (W)	2010	4000	6021
Output Vrms	230.28	230.27	230.69
Output Arms	8.76	17.38	26.11
Cos φ	0.999	0.999	0.999
L1 DC Component (A)	0.005	0.005	0.005
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.020%	0.020%	0.021%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-

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



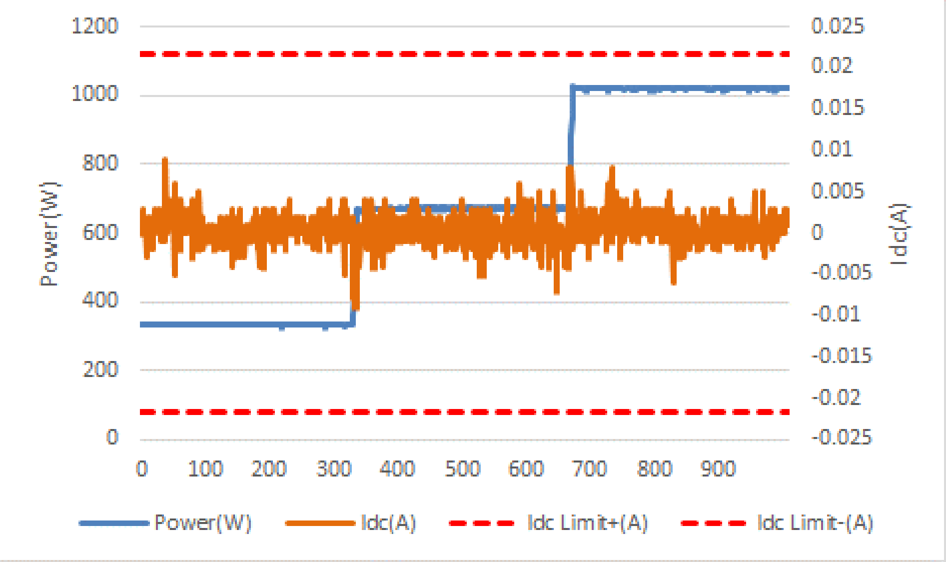


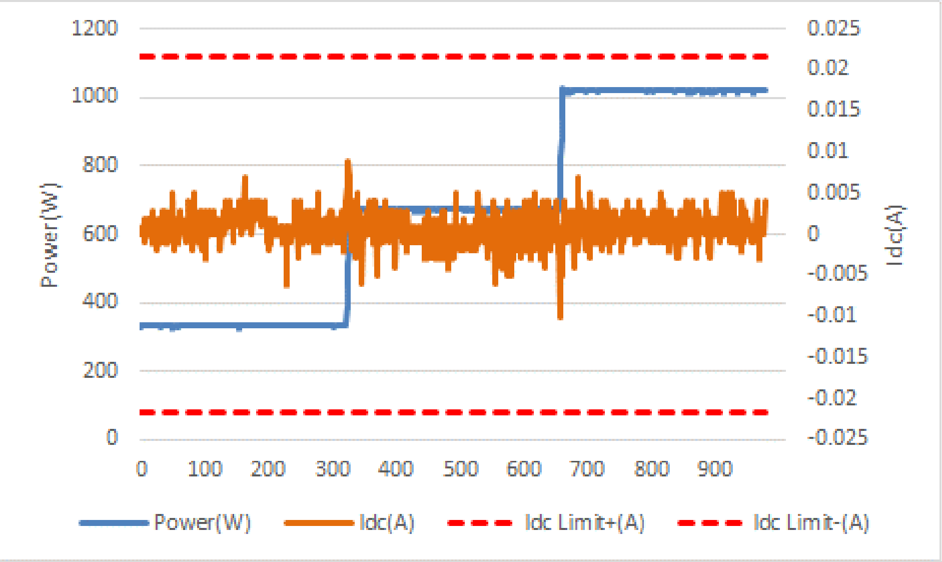


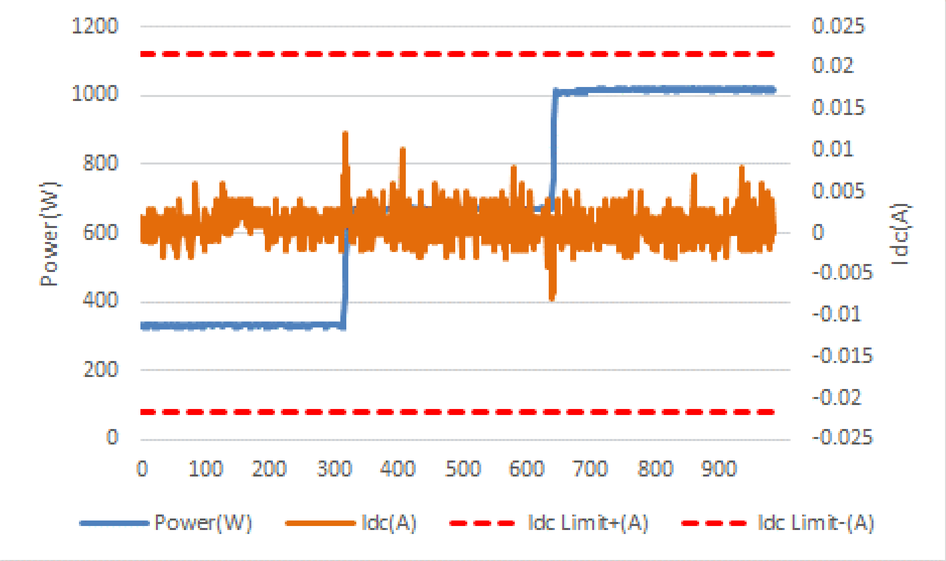
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

B.1.4.1	**TABLE: Checking the DC component output**		**P**
Model	AF1K-SL-1		
Power Level	(33 ± 5)%	(66 ± 5)%	(100 ± 5)%
Ambient			
Total output Power (W)	335	672	1019
Output Vrms	229.87	229.86	230.07
Output Arms	1.47	2.93	4.44
Cos φ	0.997	0.998	0.999
L1 DC Component (A)	0.002	0.002	0.002
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.042%	0.043%	0.040%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-
Minimum ambient rating (-25°C) or -10°C			
Total output Power (W)	335	673	1019
Output Vrms	230.07	230.06	230.27
Output Arms	1.46	2.93	4.43
Cos φ	0.998	0.998	0.999
L1 DC Component (A)	0.002	0.002	0.002
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.044%	0.048%	0.042%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-
Maximum ambient rating (+60°C) or +55°C			
Total output Power (W)	333	670	1016
Output Vrms	230.07	230.07	230.27
Output Arms	1.46	2.92	4.42
Cos φ	0.998	0.998	0.999
L1 DC Component (A)	0.002	0.002	0.002
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.044%	0.048%	0.042%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-

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







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

B.1.4.2	**TABLE: Checking the protection against DC injection**			P
Model	AF6K-SL			
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	131.0	130.4	992.4
66%	+0,5%I_{nom} /1s	134.4	130.4	994.2
100%	+0,5%I_{nom} /1s	134.5	130.4	980.0
I_{dc} = 1A				
33%	+1A Idc/200ms	1018	1000	194.4
66%	+1A Idc/200ms	1020	1000	188.9
100%	+1A Idc/200ms	1019	1000	194.6
Model	AF1K-SL			
Actual Power	Limits	Measurement:(mA)	Limiting value:(mA)	Disconnection time:(ms)
I_{dc} = 0,5% of I_{nom}				
33%	+0,5%I_{nom} /1s	22.03	21.7	985.0
66%	+0,5%I_{nom} /1s	22.01	21.7	983.4
100%	+0,5%I_{nom} /1s	22.04	21.7	990.4
I_{dc} = 1A				
33%	+1A Idc/200ms	1006	1000	183.6
66%	+1A Idc/200ms	1019	1000	195.9
100%	+1A Idc/200ms	1018	1000	187.6
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:	AF6K-SL				
Minimum ambient rating (-25°C) or -10°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	134.3	130.4	997.4	
66%	+0,5%I_{nom} /1s	134.4	130.4	985.6	
100%	+0,5%I_{nom} /1s	134.5	130.4	998.1	
I_{dc} = 1A					
33%	+1A Idc/200ms	1020	1000	193.2	
66%	+1A Idc/200ms	1019	1000	198.1	
100%	+1A Idc/200ms	1020	1000	185.4	
Model:	AF1K-SL				
Actual Power	Limits	Measurement:(mA)	Limiting value: (mA)	Disconnection time:(ms)	
I_{dc} = 0,5% of I_{nom}					
33%	+0,5%I_{nom} /1s	22.06	21.74	992.7	
66%	+0,5%I_{nom} /1s	22.01	21.74	987.6	
100%	+0,5%I_{nom} /1s	22.07	21.74	989.6	
I_{dc} = 1A					
33%	+1A Idc/200ms	1007	1000	188.6	
66%	+1A Idc/200ms	1016	1000	189.9	
100%	+1A Idc/200ms	1017	1000	193.0	
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:	AF6K-SL			
Maximum ambient rating (+60°C) or +55°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	134.1	130.4	996.2
66%	+0,5%I_{nom} /1s	134.6	130.4	985.2
100%	+0,5%I_{nom} /1s	134.5	130.4	985.3
I_{dc} = 1A				
33%	+1A Idc/200ms	1019	1000	187.4
66%	+1A Idc/200ms	1019	1000	184.3
100%	+1A Idc/200ms	1018	1000	194.6
Model:	AF1K-SL			
Actual Power	Limits	Measurement:(mA)	Limiting value: (mA)	Disconnection time:(ms)
I_{dc} = 0,5% of I_{nom}				
33%	+0,5%I_{nom} /1s	22.05	21.74	991.2
66%	+0,5%I_{nom} /1s	22.05	21.74	989.4
100%	+0,5%I_{nom} /1s	22.05	21.74	997.6
I_{dc} = 1A				
33%	+1A Idc/200ms	1005	1000	182.1
66%	+1A Idc/200ms	1020	1000	188.7
100%	+1A Idc/200ms	1018	1000	190.4
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	AF6K-SL	

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

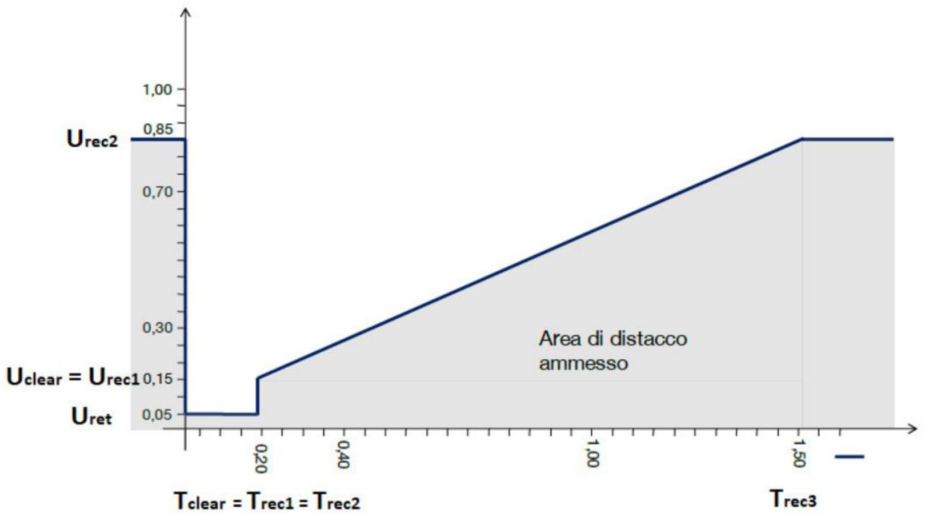
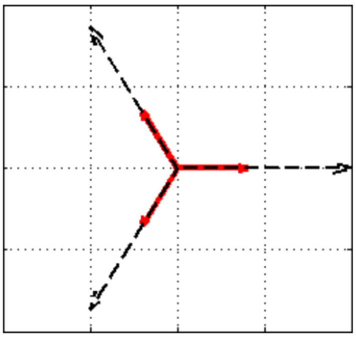


Figure 29 - Fault-ride-through profile of power park modules over 11.08 kW

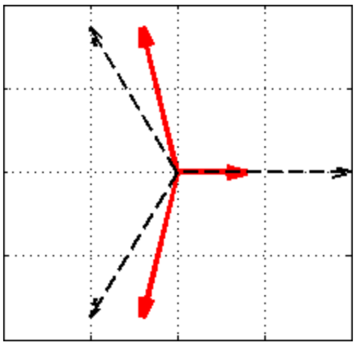
Test sequence:

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

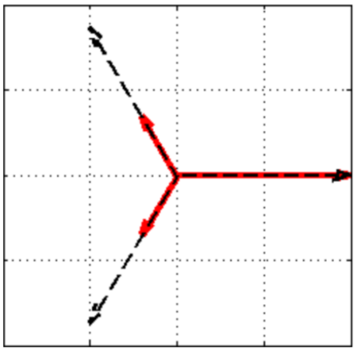


2) two-phase asymmetric fault (Table 31, Tests N.1a, N2a, N.3a and N.4a)

   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)



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	

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°
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

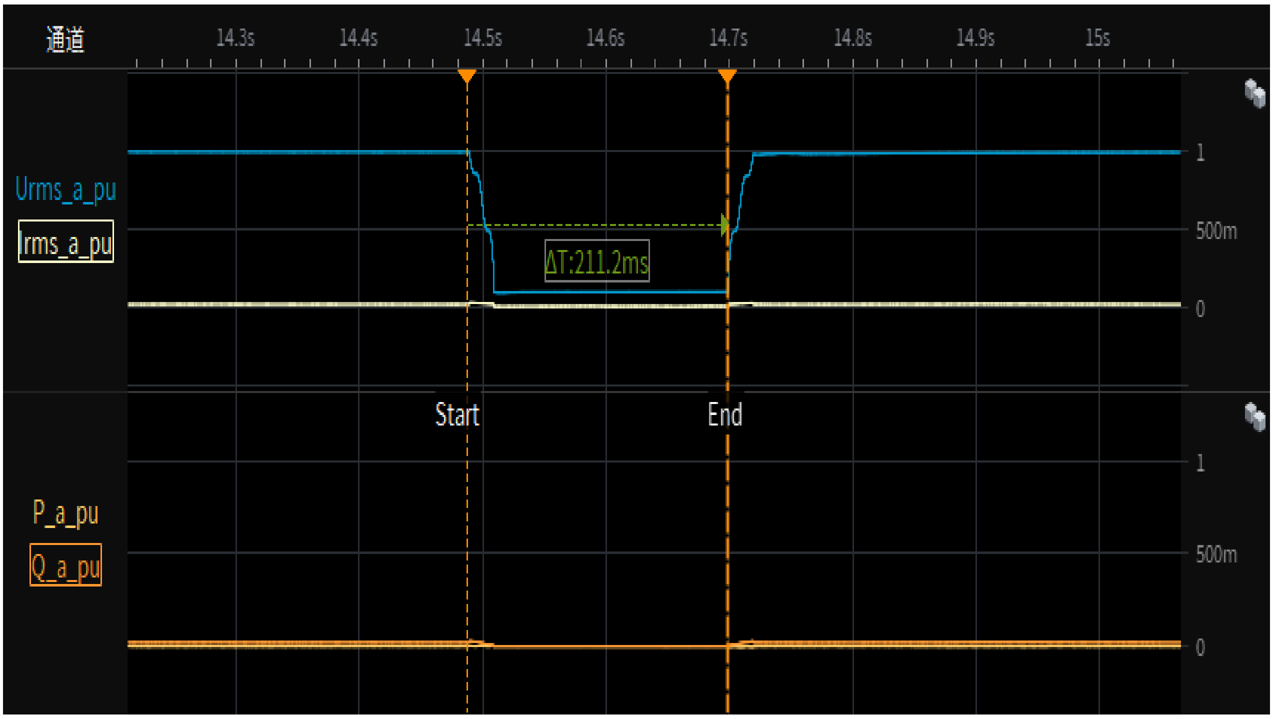
Graph of LVRT and OVRT test:

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	211	151
1s – three-phase symmetrical fault (P > 0,9)	0,10 ± 0,05 (V_1/Vn)	200 +20	211	168
1a – two-phase asymmetrical fault (P = 0,1 - 0,3)	0,10 ± 0,05 (V_1/Vn)	200 +20	211	124
1a – two-phase asymmetrical fault (P > 0,9)	0,10 ± 0,05 (V_1/Vn)	200 +20	211	119
2s – three-phase symmetrical fault (P = 0,1 - 0,3)	0,25 ± 0,05 (V_2/Vn)	400 +20	407	162
2s – three-phase symmetrical fault (P > 0,9)	0,25 ± 0,05 (V_2/Vn)	400 +20	407	157
2a – three-phase symmetrical fault (P = 0,1 - 0,3)	0,25 ± 0,05 (V_2/Vn)	400 +20	411	173
2a – three-phase symmetrical fault (P > 0,9)	0,25 ± 0,05 (V_2/Vn)	400 +20	411	141
3s – three-phase symmetrical fault (P = 0,1 - 0,3)	0,50 ± 0,05 (V_3/Vn)	850 ± 20	860	151
3s – three-phase symmetrical fault (P > 0,9)	0,50 ± 0,05 (V_3/Vn)	850 ± 20	860	160
3a – two-phase asymmetrical fault (P = 0,1 - 0,3)	0,50 ± 0,05 (V_3/Vn)	850 ± 20	860	176
3a – two-phase asymmetrical fault (P > 0,9)	0,50 ± 0,05 (V_3/Vn)	850 ± 20	860	144
4s – three-phase symmetrical fault (P = 0,1 - 0,3)	0,75 ± 0,05 (V_4/Vn)	1300 ± 20	1312	151
4s – three-phase symmetrical fault (P > 0,9)	0,75 ± 0,05 (V_4/Vn)	1300 ± 20	1312	156
4a – two-phase asymmetrical fault (P = 0,1 - 0,3)	0,75 ± 0,05 (V_4/Vn)	1300 ± 20	1312	159
4a – two-phase asymmetrical fault (P > 0,9)	0,75 ± 0,05 (V_4/Vn)	1300 ± 20	1312	119
5 – LV two-phase asymmetrical fault (P = 0,1 - 0,3)	0,10 ± 0,05 (V_5/Vn)	200 +20	210	0
5 – LV two-phase asymmetrical fault (P > 0,9)	0,10 ± 0,05 (V_5/Vn)	200 +20	210	0
6 – LV two-phase asymmetrical fault (P = 0,1 - 0,3)	0,50 ± 0,05 (V_6/Vn)	400 +20	851	0
6 – LV two-phase asymmetrical fault (P > 0,9)	0,50 ± 0,05 (V_6/Vn)	400 +20	851	0
7– HV three-phase symmetrical fault (P = 0,1 - 0,3)	1,20 ± 0,05 (V_7/Vn)	500 +20	511	152
7– HV three-phase symmetrical fault (P > 0,9)	1,20 ± 0,05 (V_7/Vn)	500 +20	511	117
8– HV three-phase symmetrical fault (P = 0,1 - 0,3)	1,25 ± 0,05 (V_8/Vn)	100 +20	110	140
8– HV three-phase symmetrical fault (P > 0,9)	1,25 ± 0,05 (V_8/Vn)	100 +20	110	132

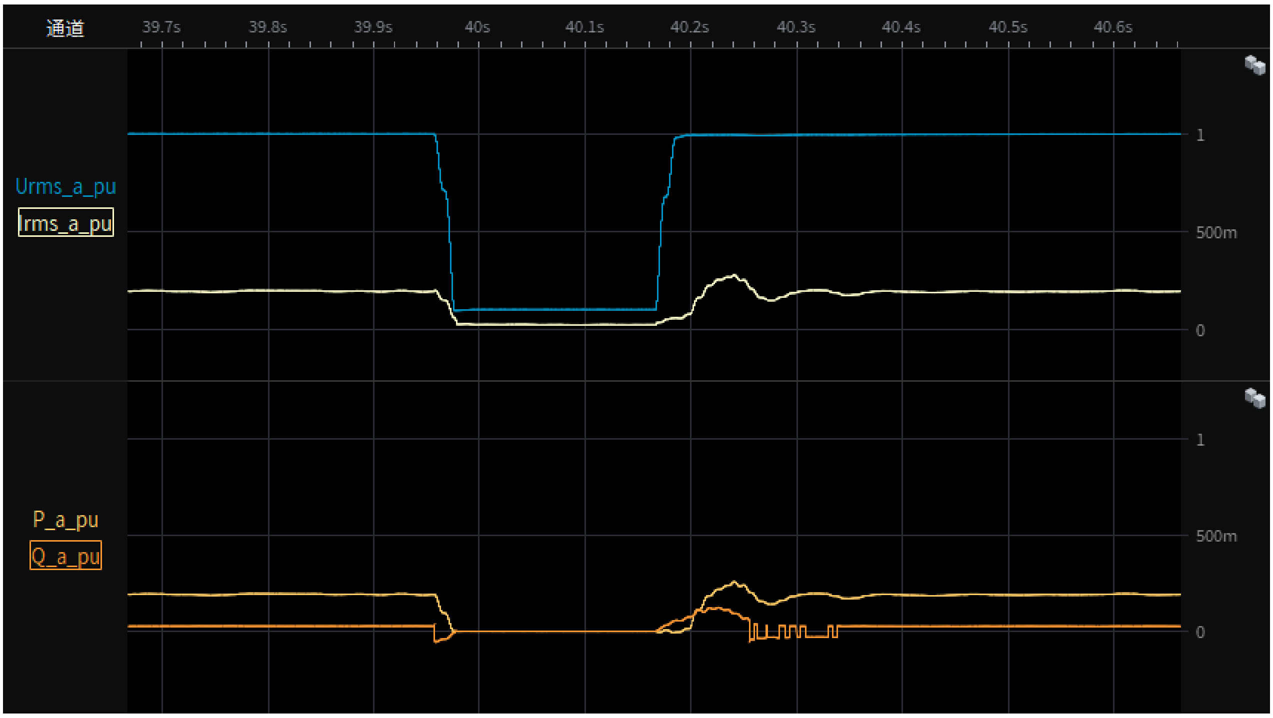
Note:
(*) Regardless of the method used to simulate transients (simulator or impedance network), the rise and fall time of the voltage must be less than 10 ms
The interface protection shall be disabled or adjusted to avoid spurious tripping during testing.
The test conditions are performed as worst case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

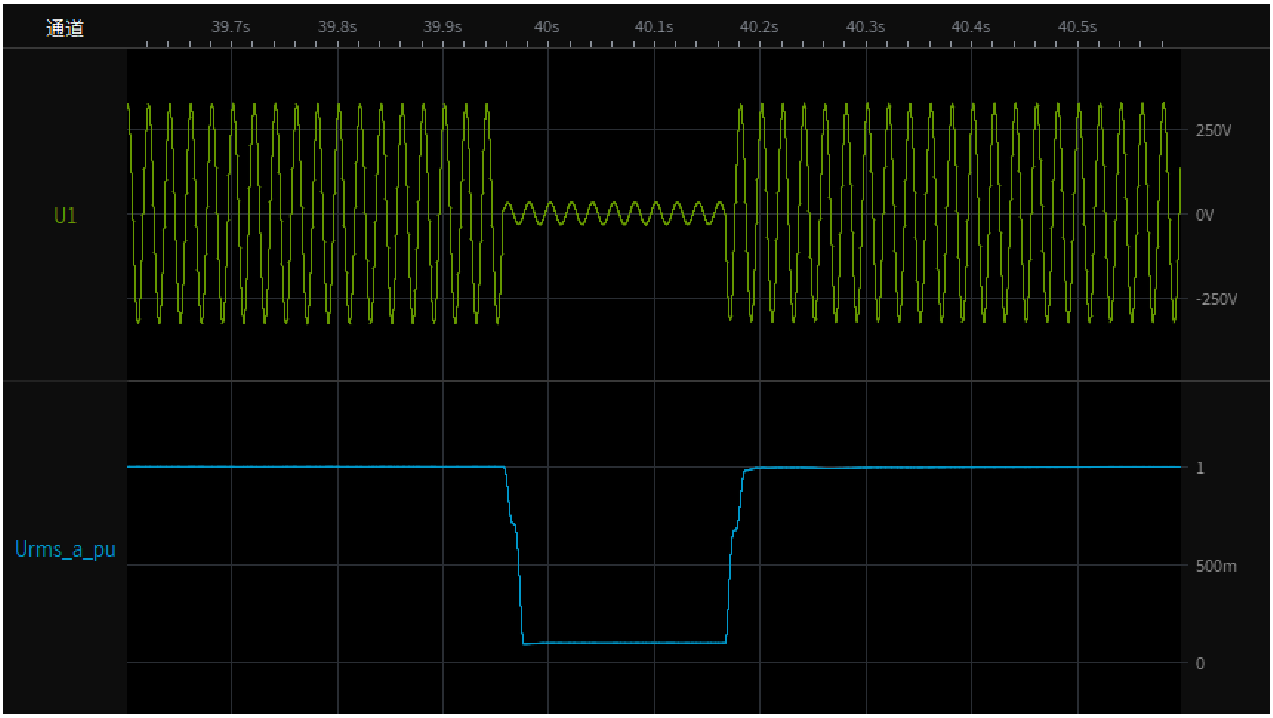


Test 1s-1.1 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)

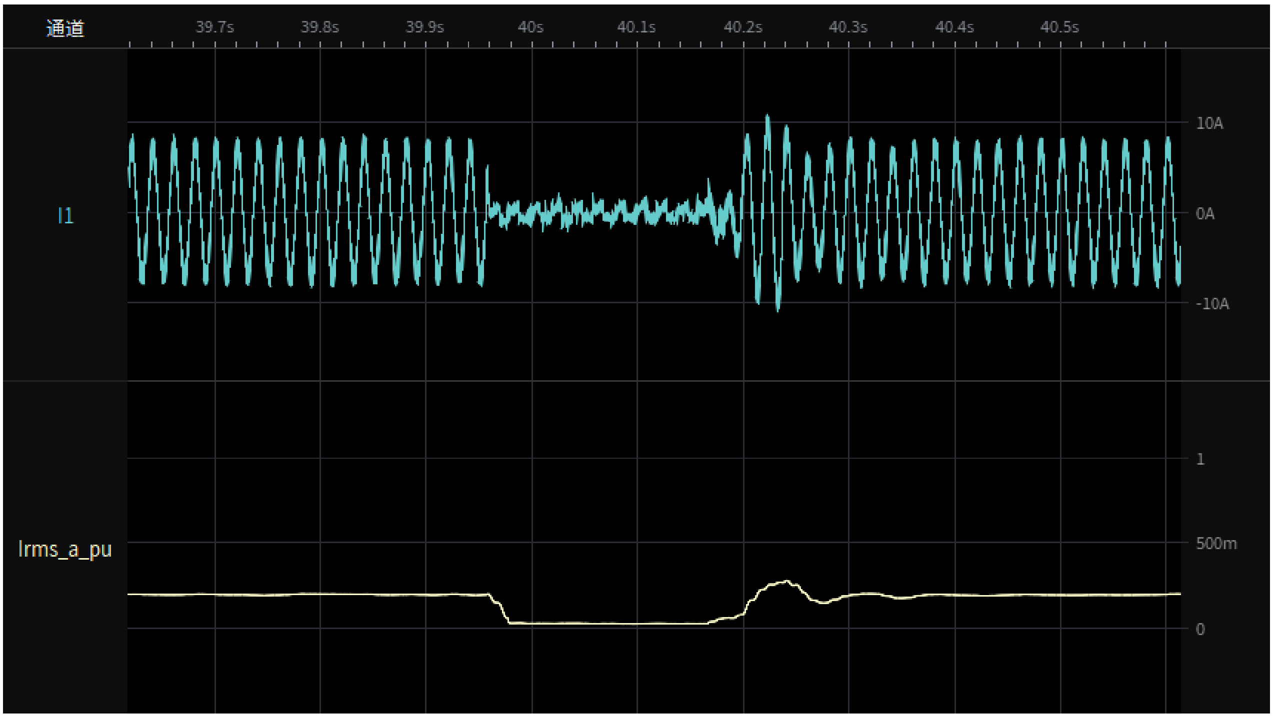


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

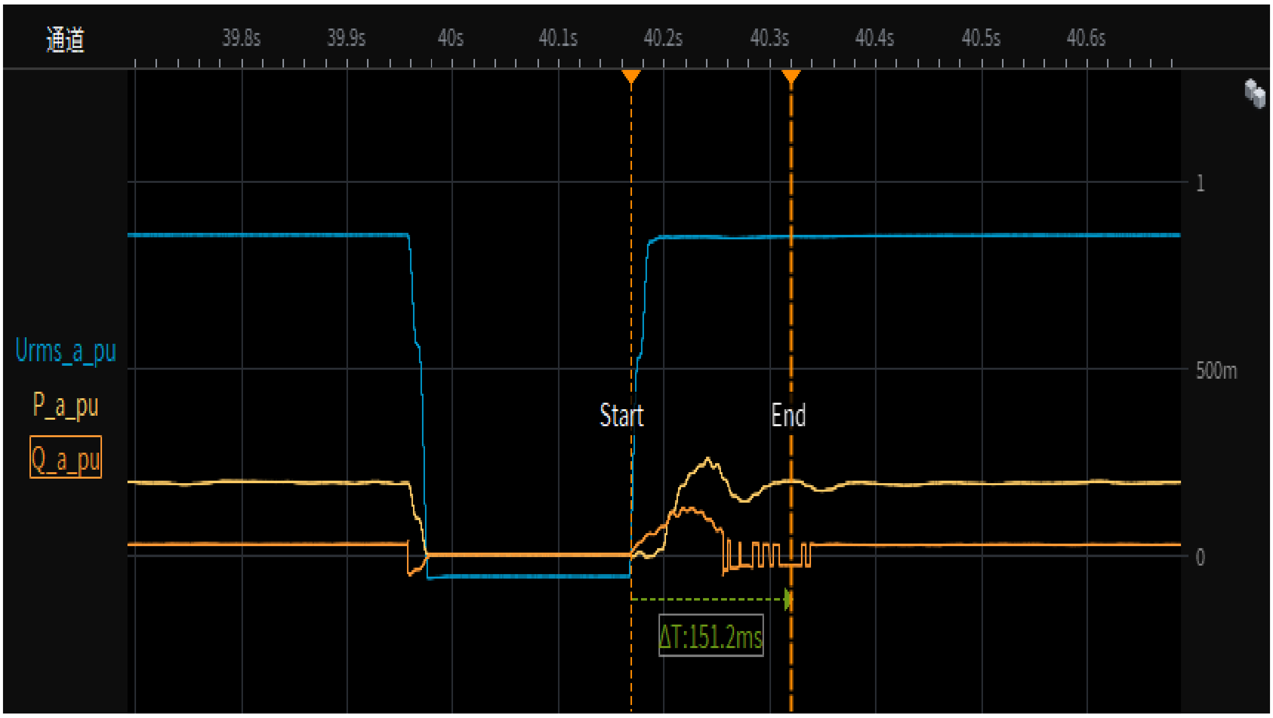
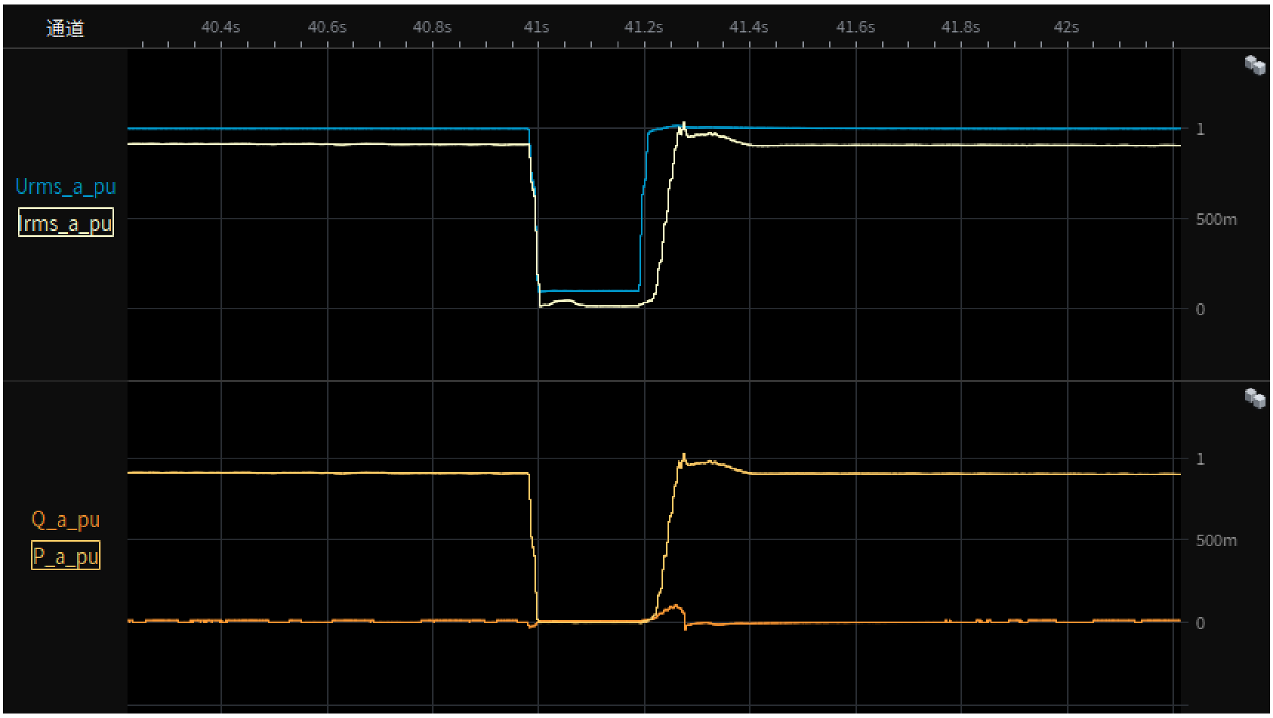
Test 1s-1.2 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages



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

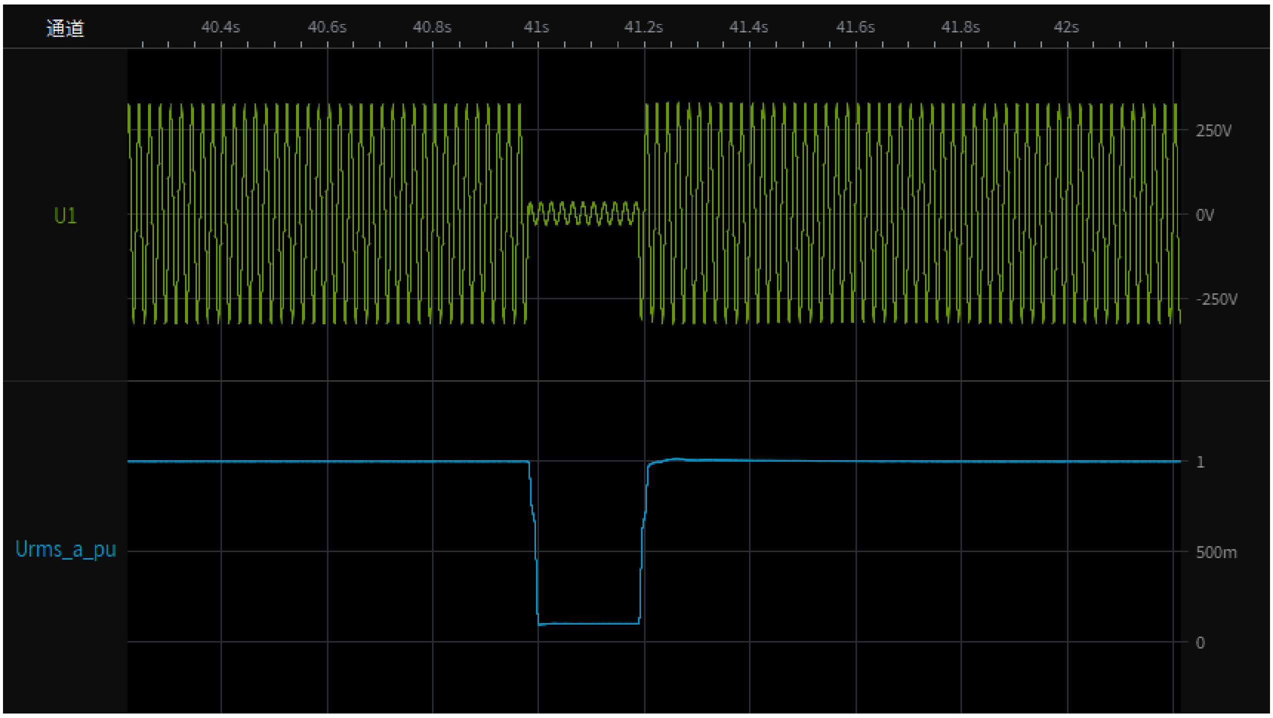


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

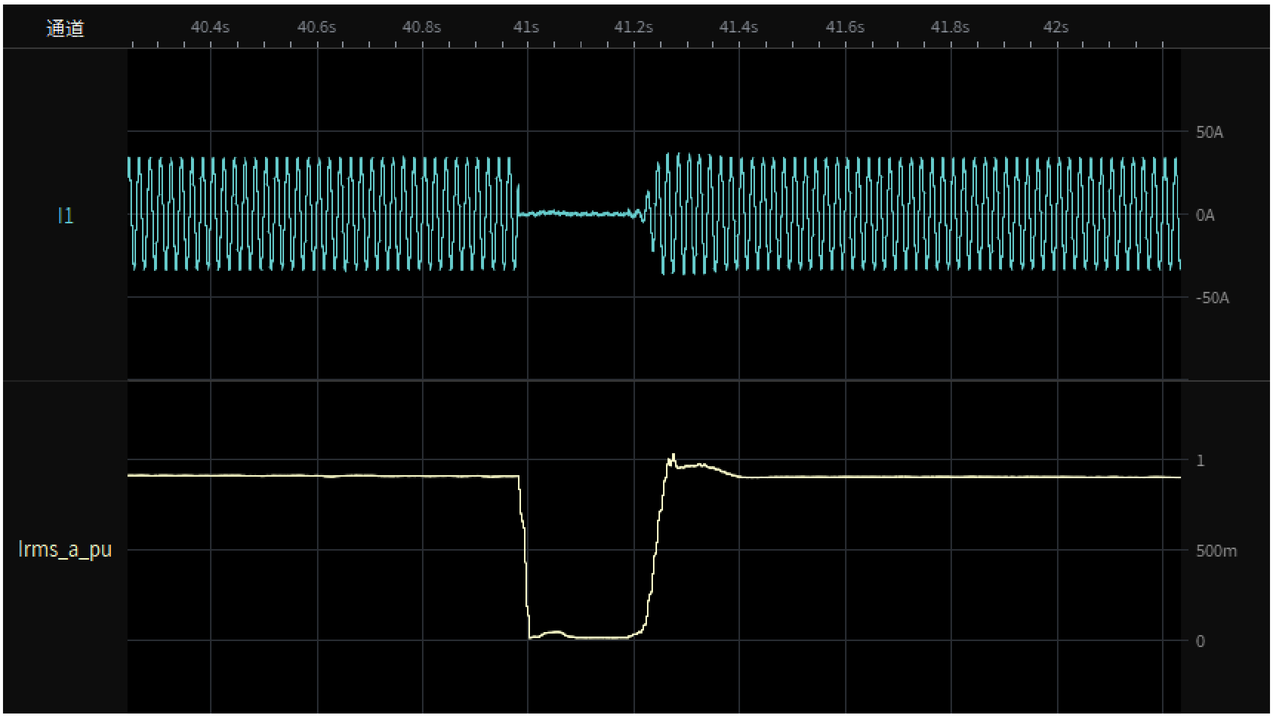
Test 1s-1.4 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),20% load restoring time

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



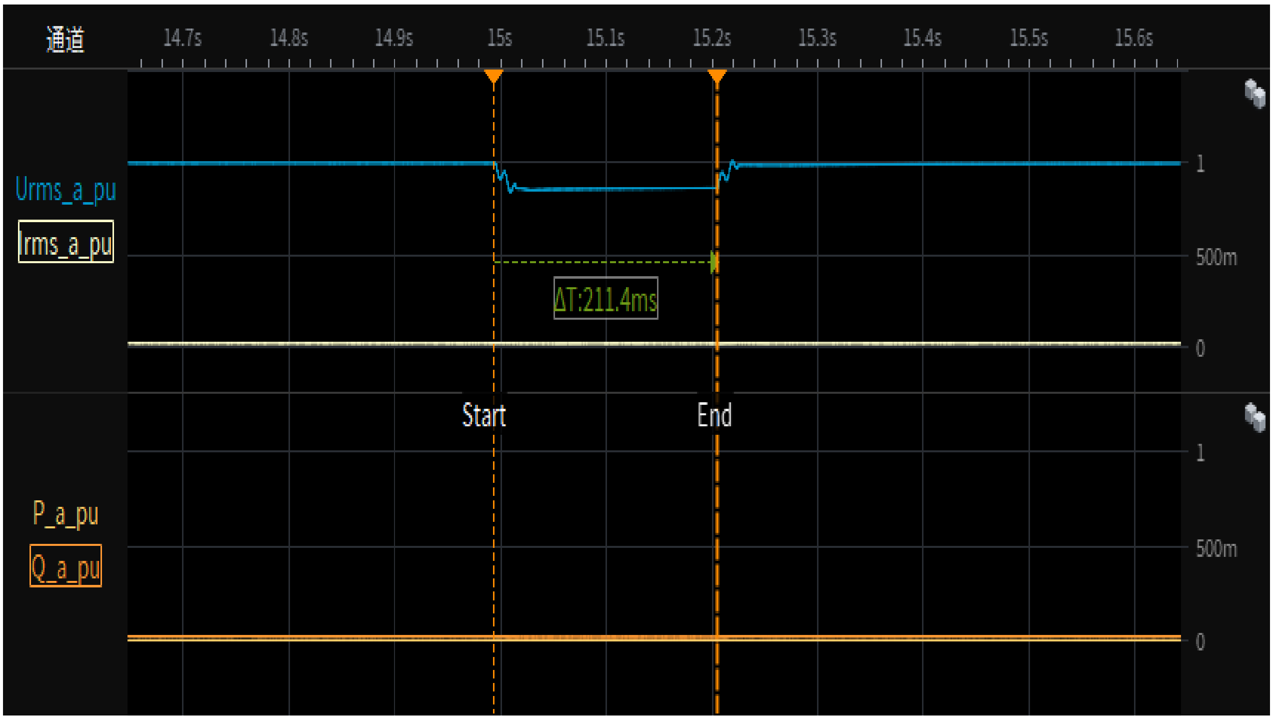
Test 1s-2.3 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents



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

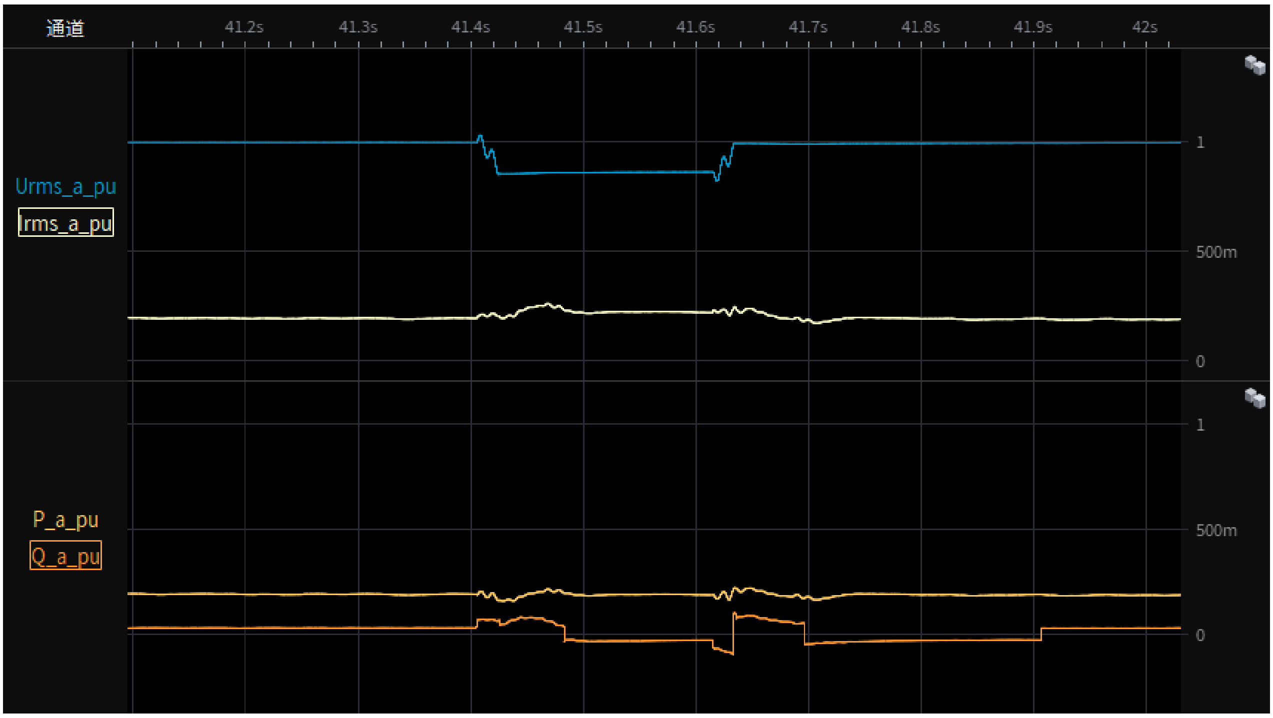
Test 1s-2.4 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A), 95% load
restoring time

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

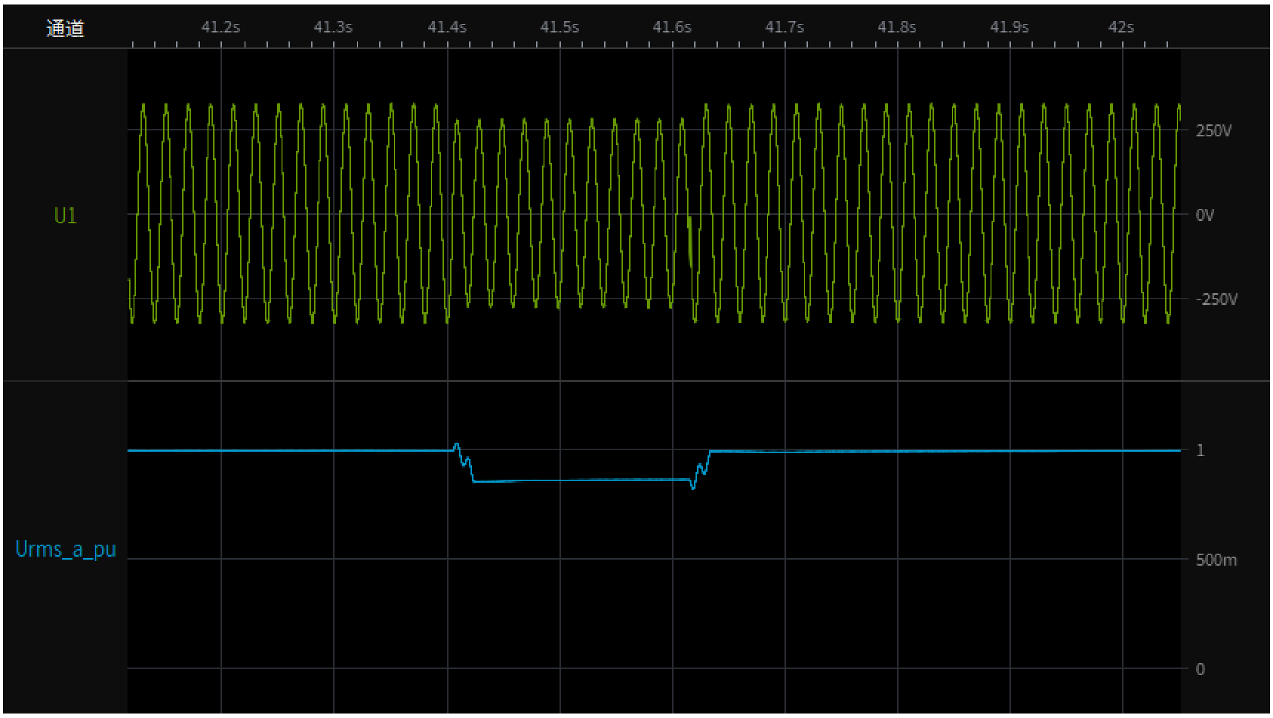


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

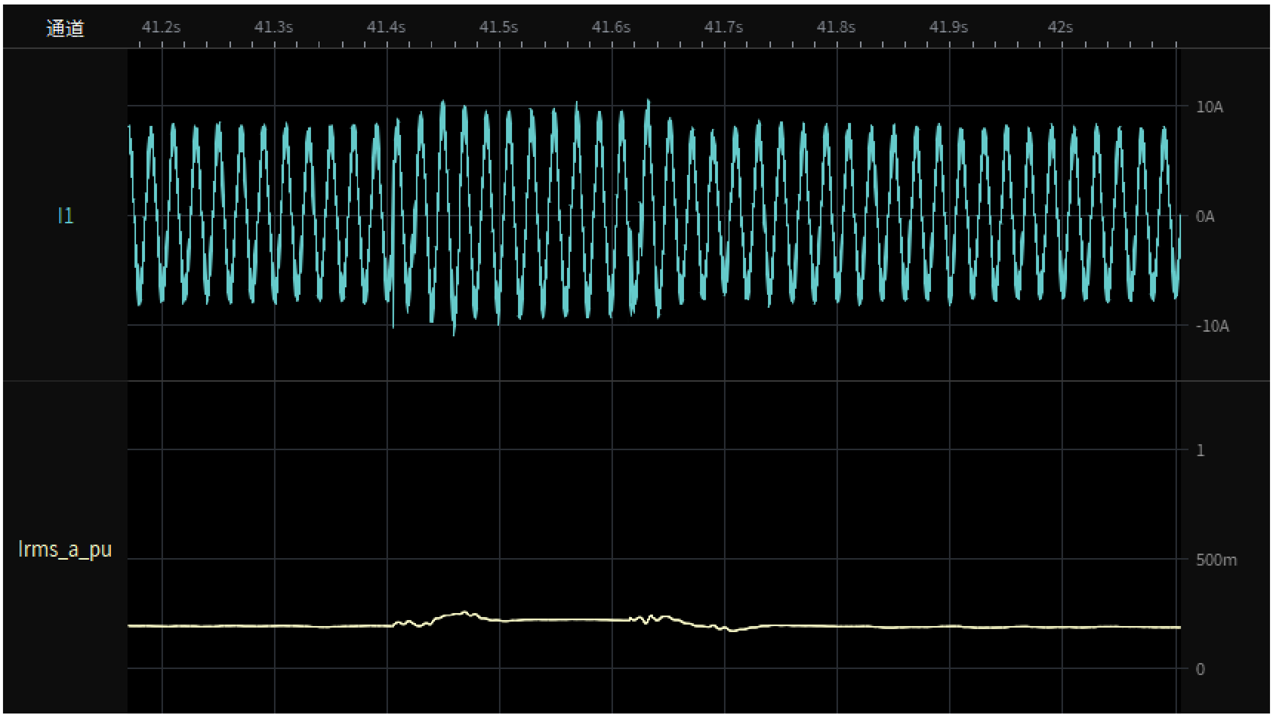


Test 1a-1.2 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

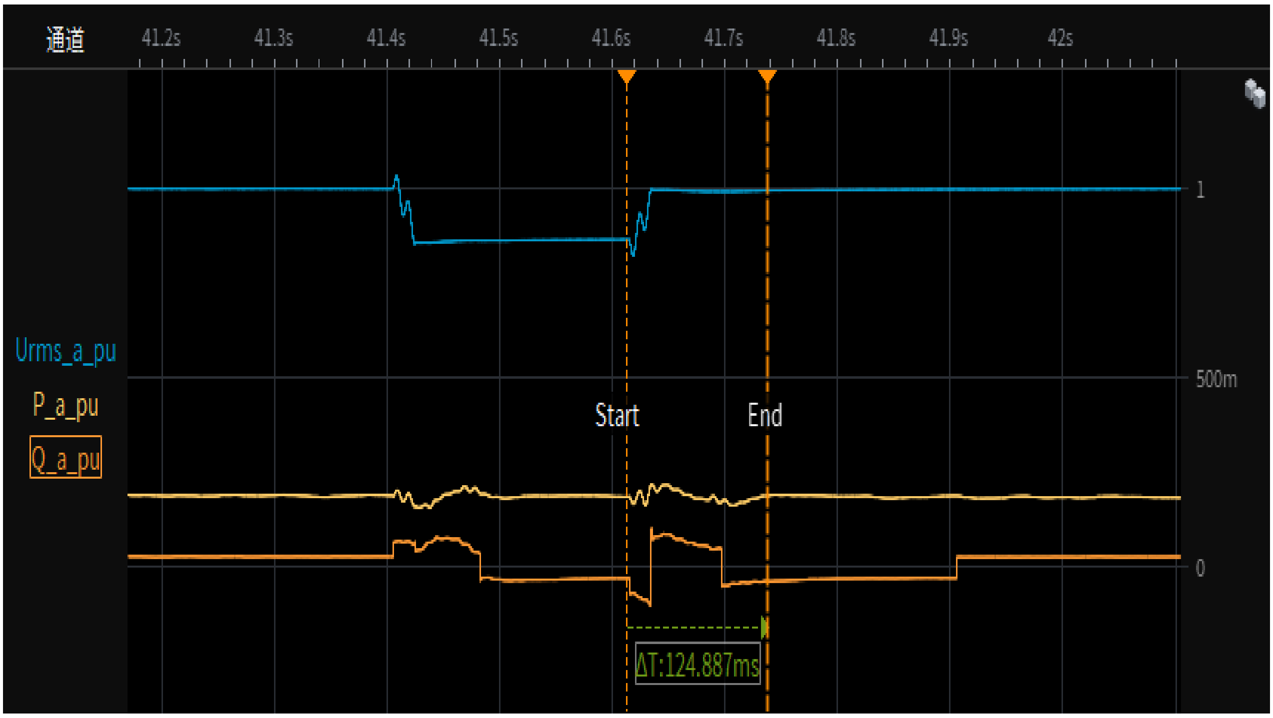


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

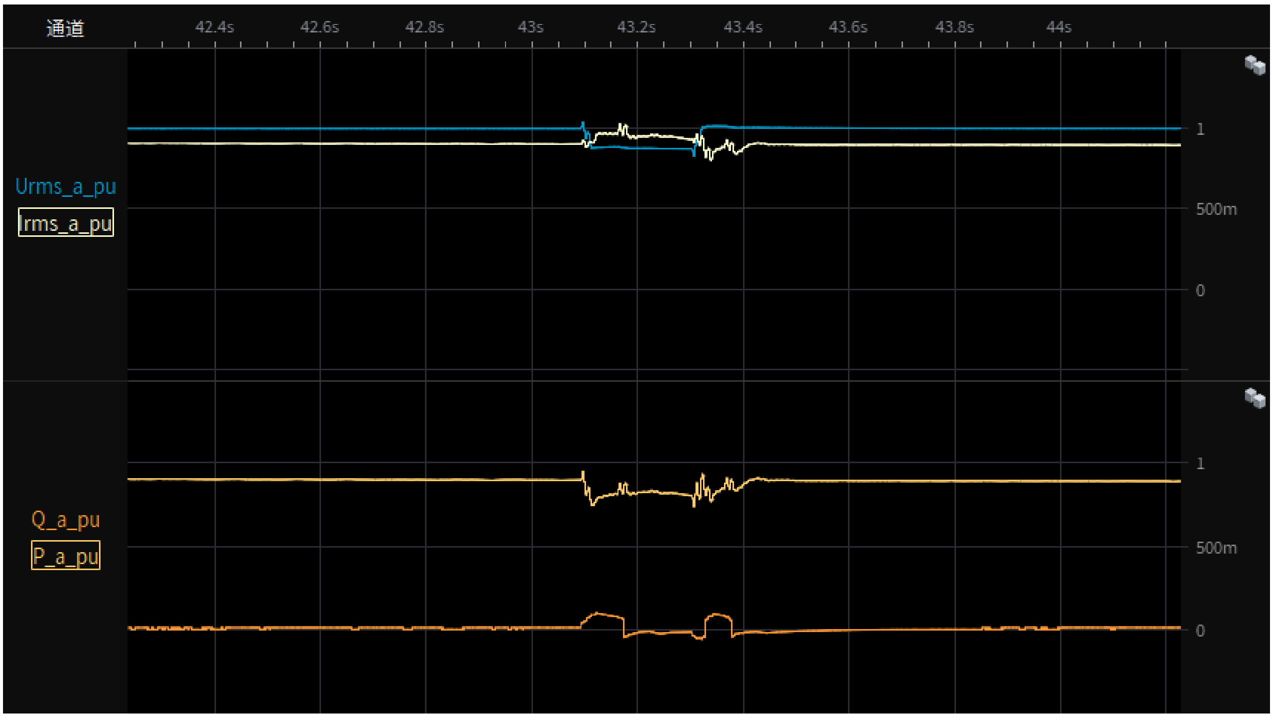


Test 1a-1.4 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),20% load
restoring time

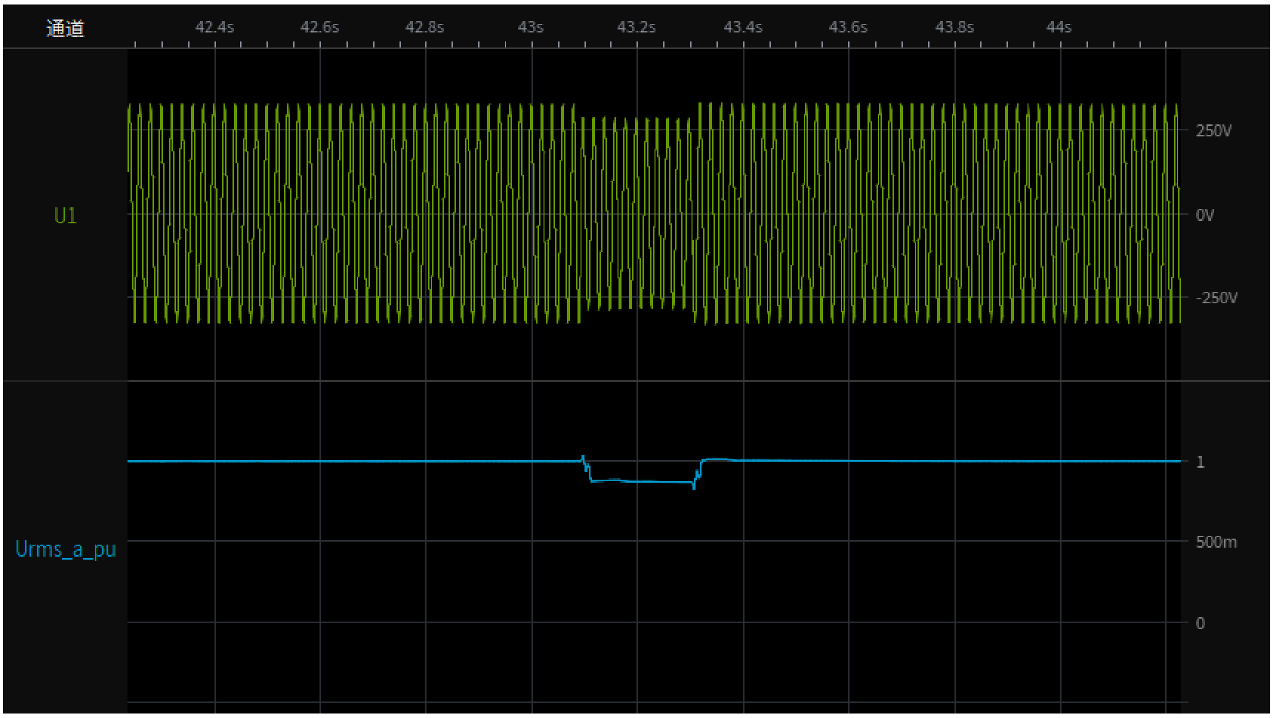


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

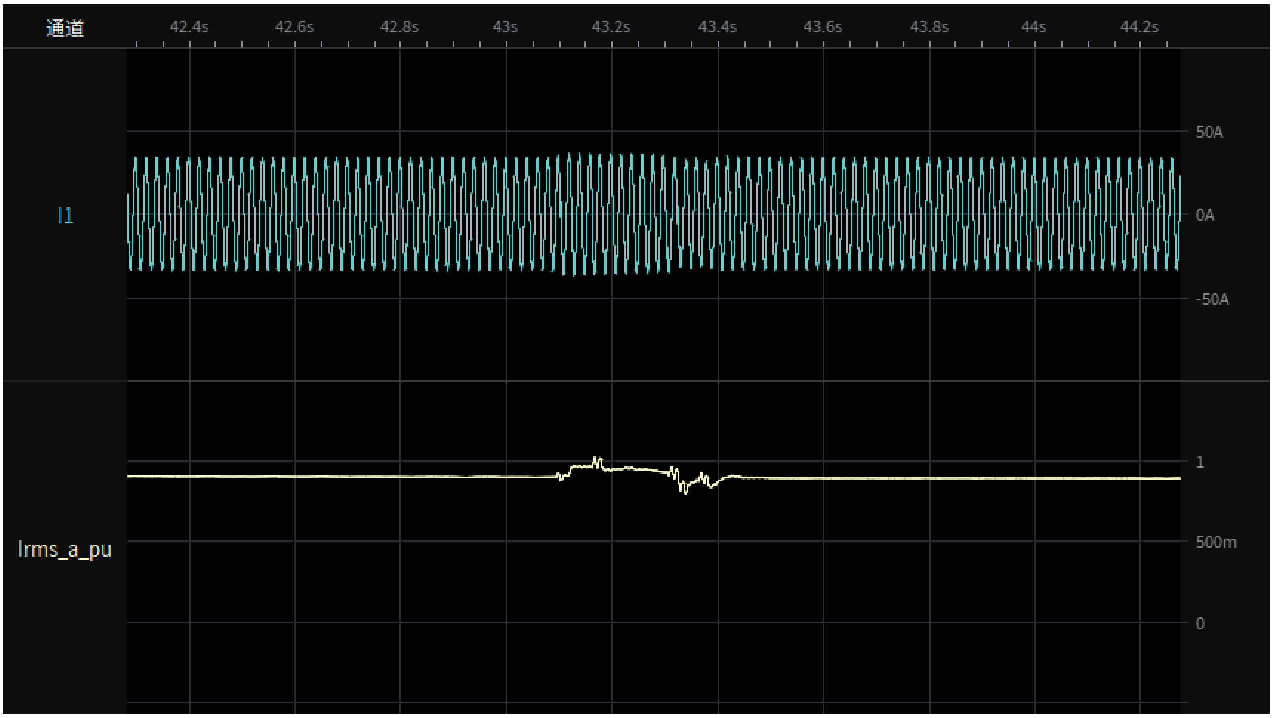
Test 1a-2.1 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),95% load
Test overview(voltage,current,active and reactive power)



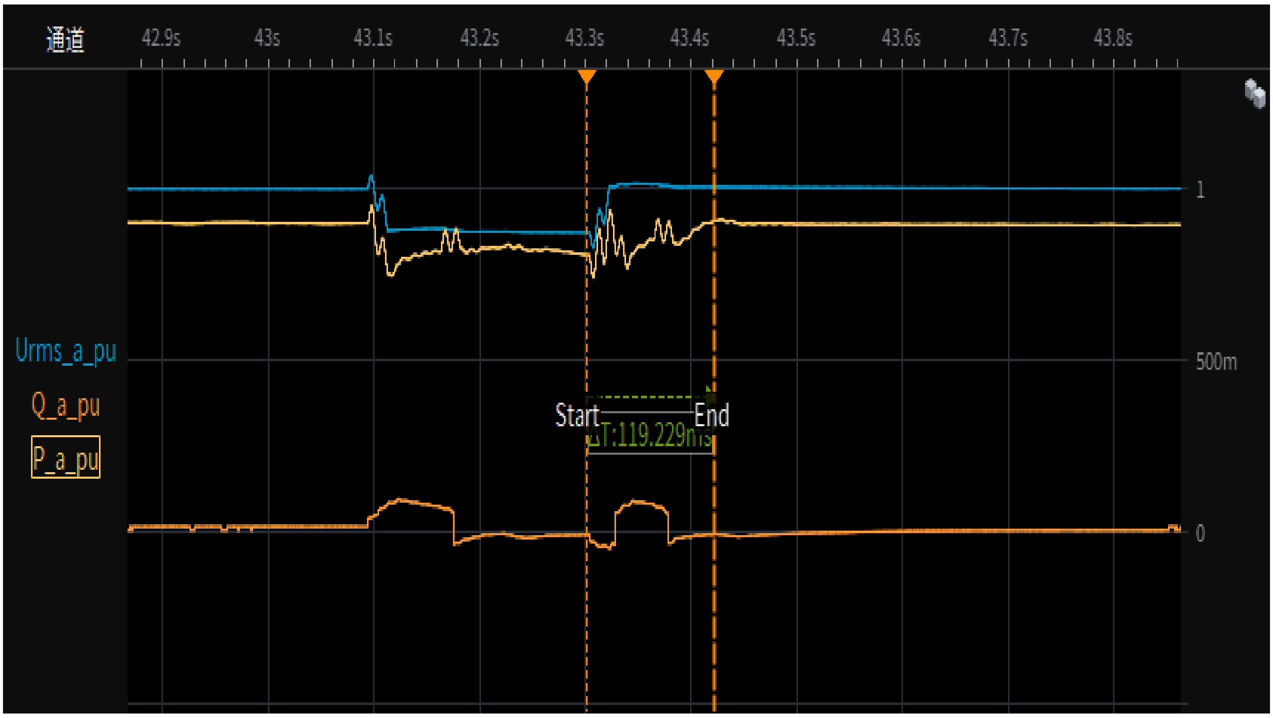
Test 1a-2.2 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages



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

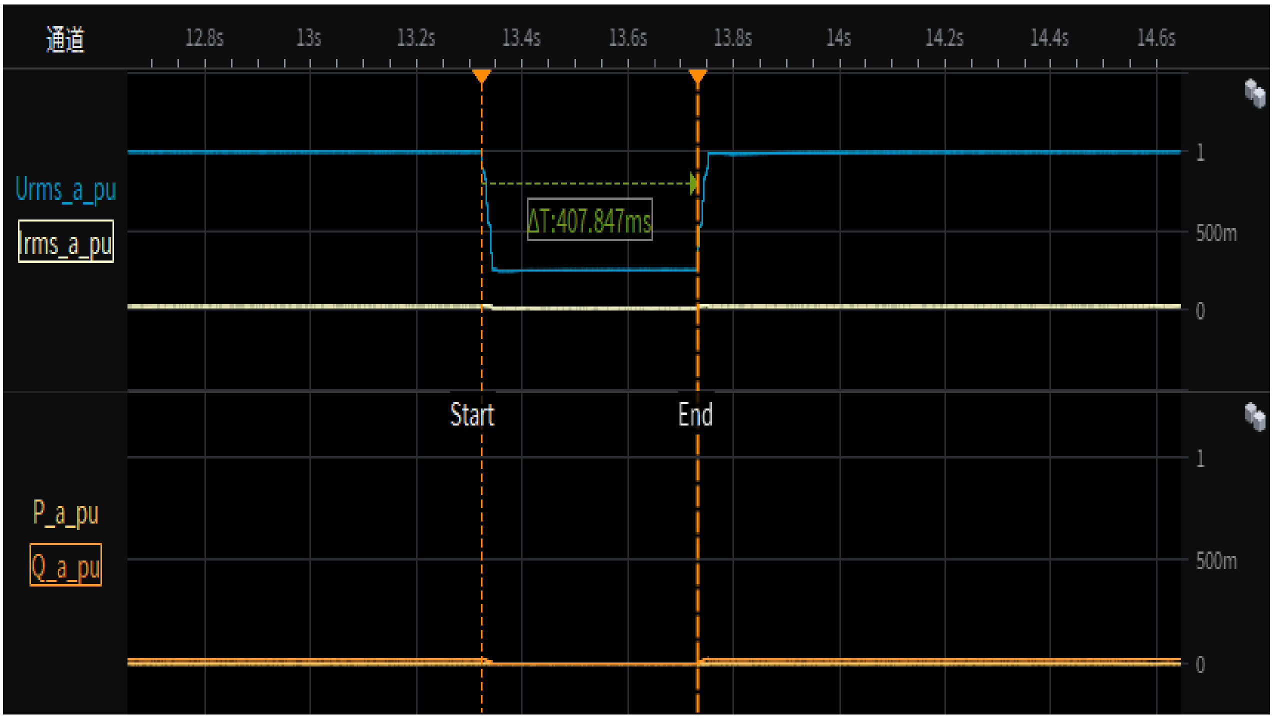


Test 1a-2.4 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D), 95% load
restoring time

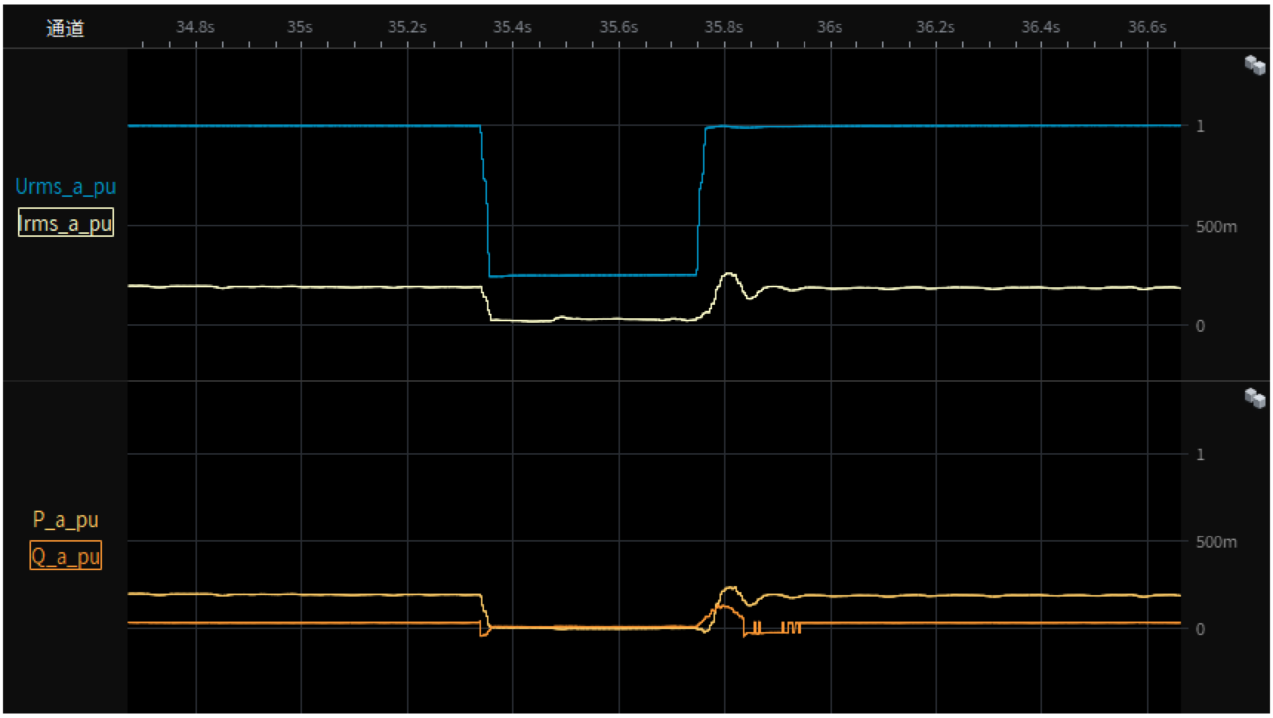


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

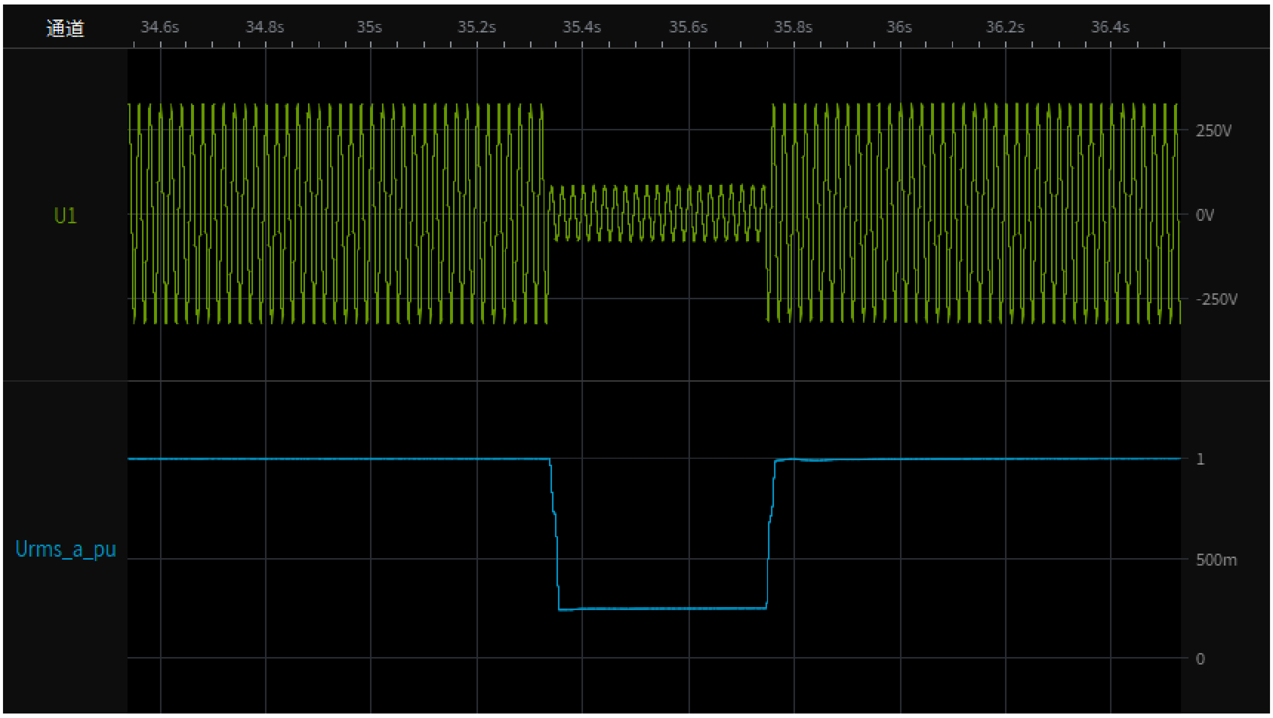


Test 2s-1.1 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)

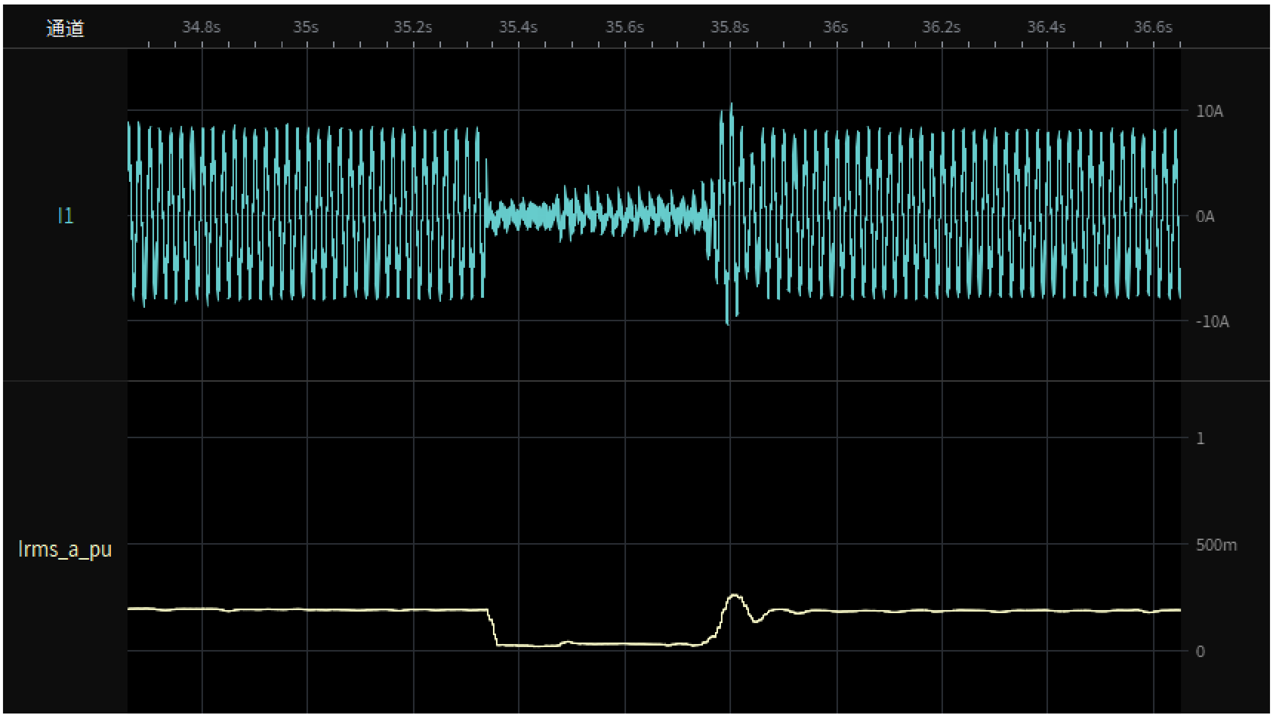


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

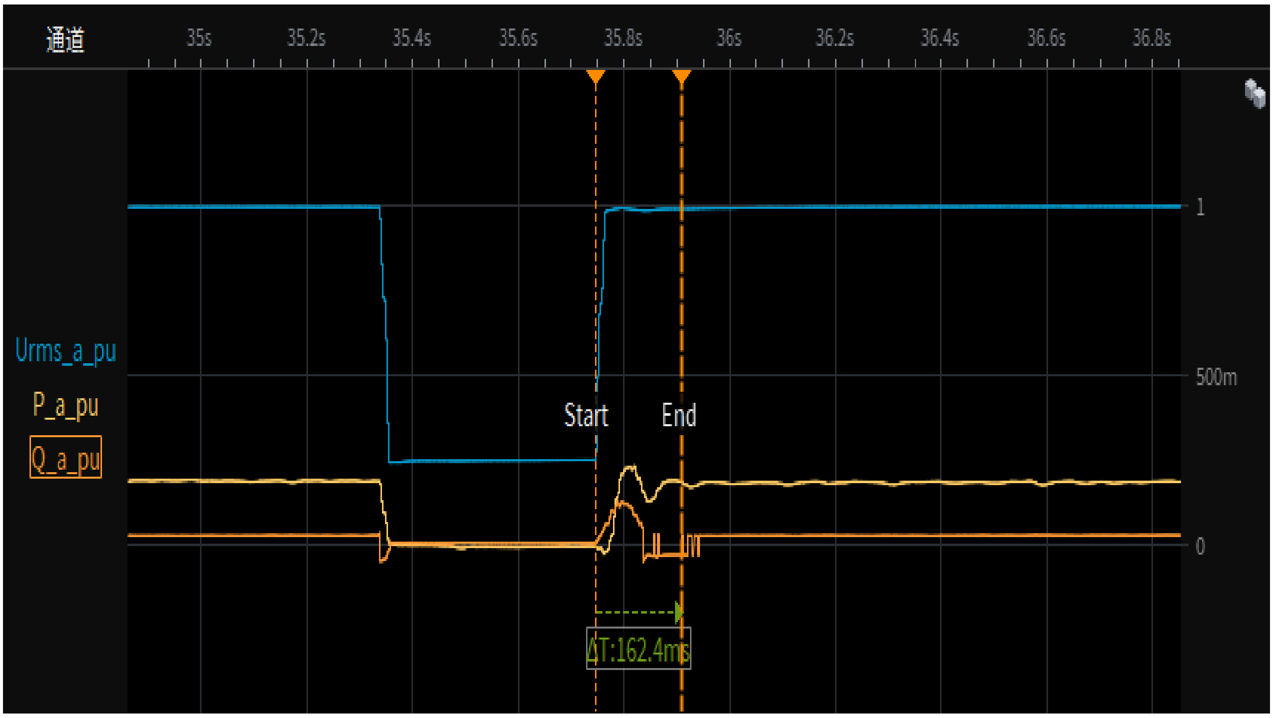
Test 2s-1.2 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages



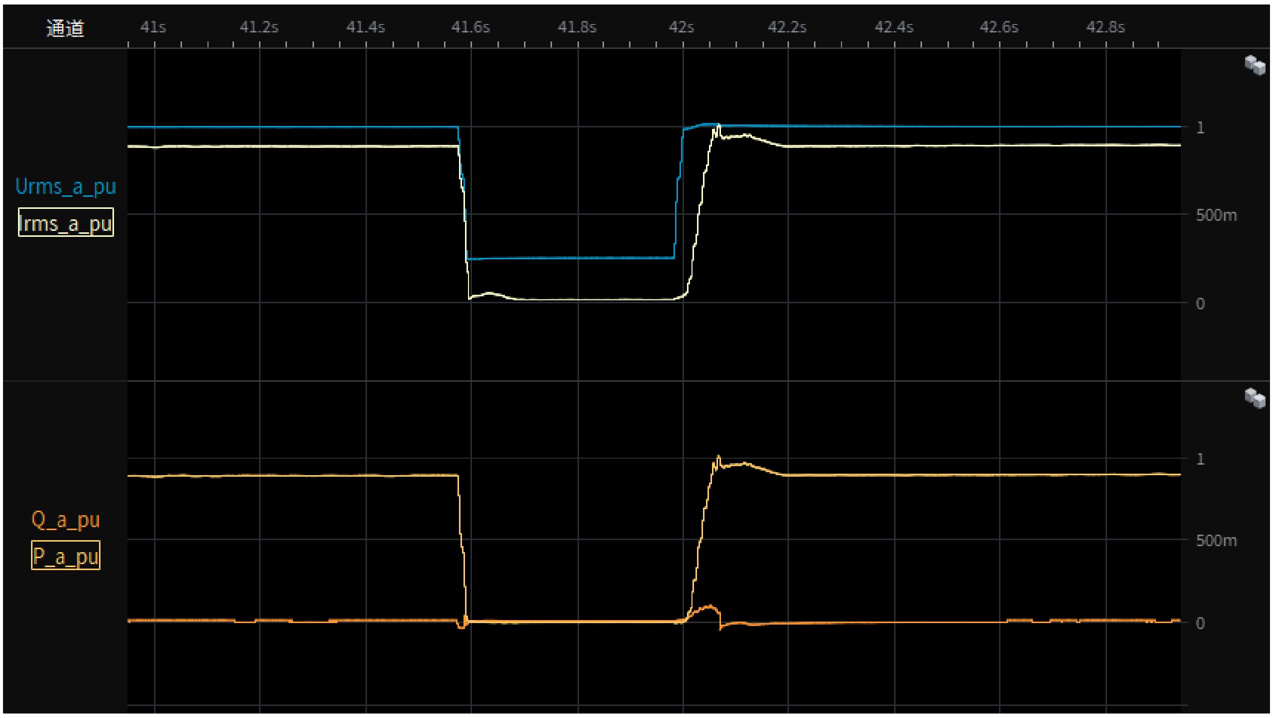
Test 2s-1.3 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents



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

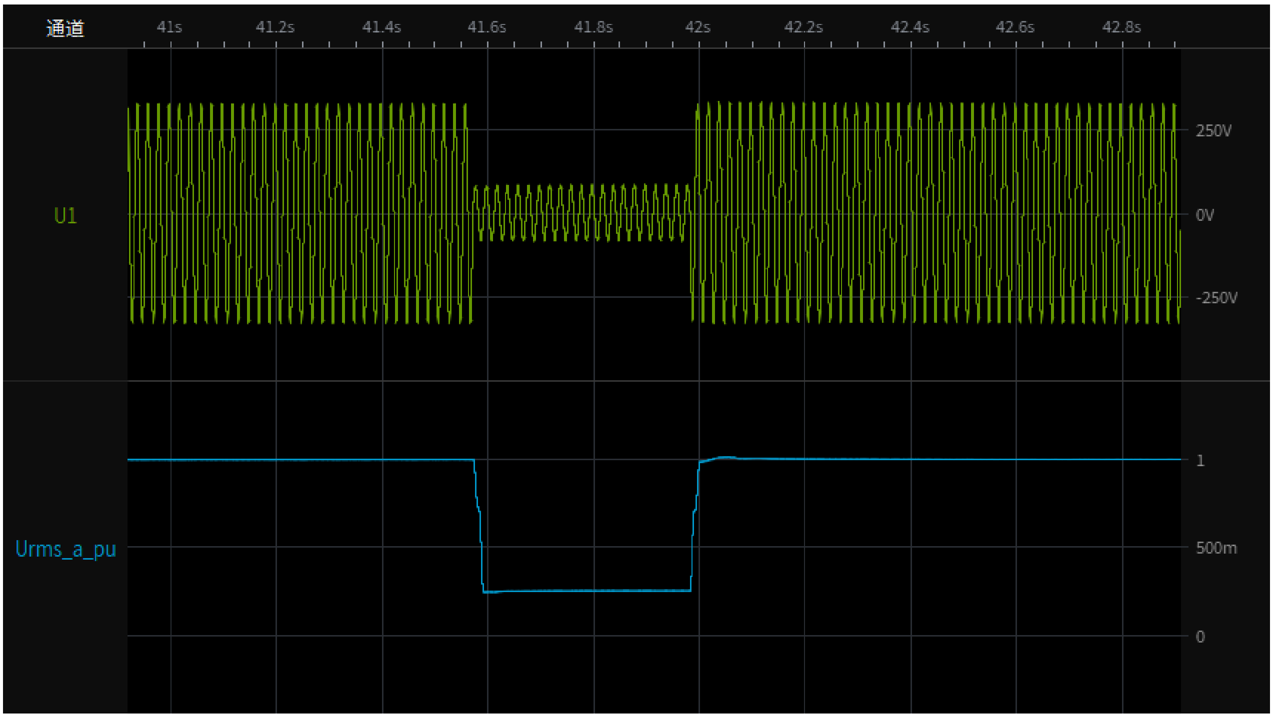


Test 2s-2.1 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),95% load
Test overview(voltage,current,active and reactive power)

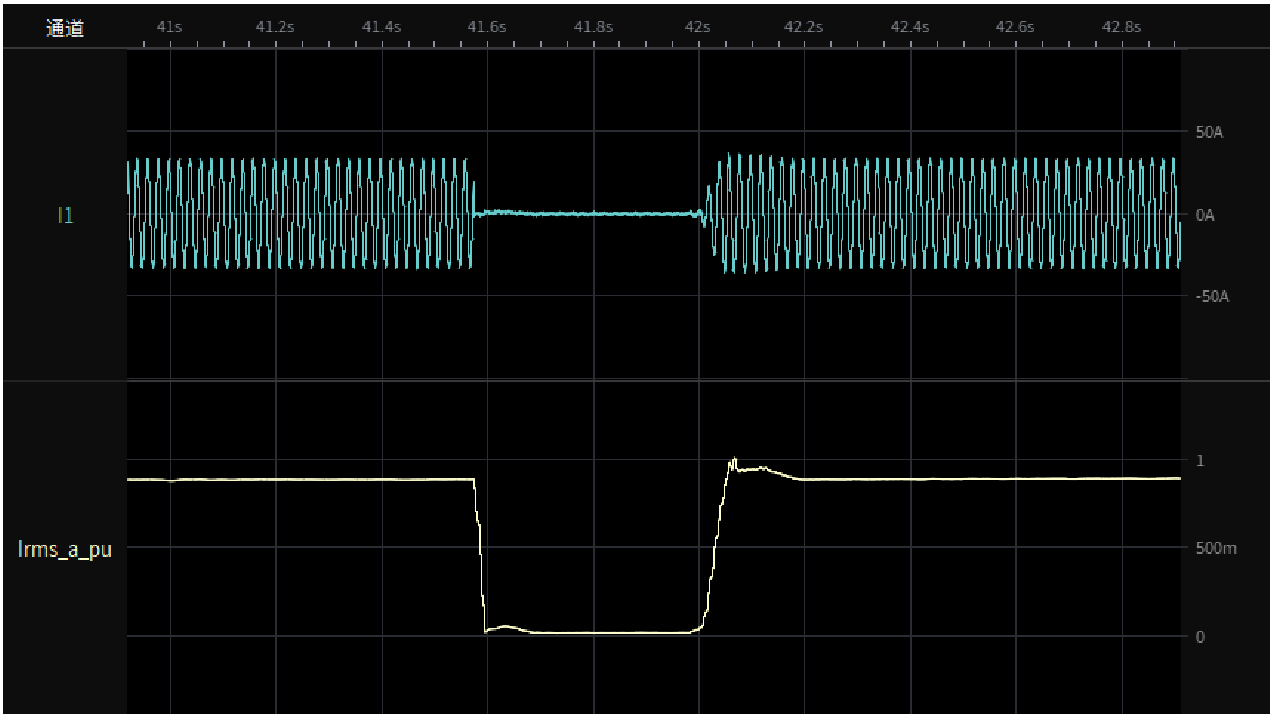


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

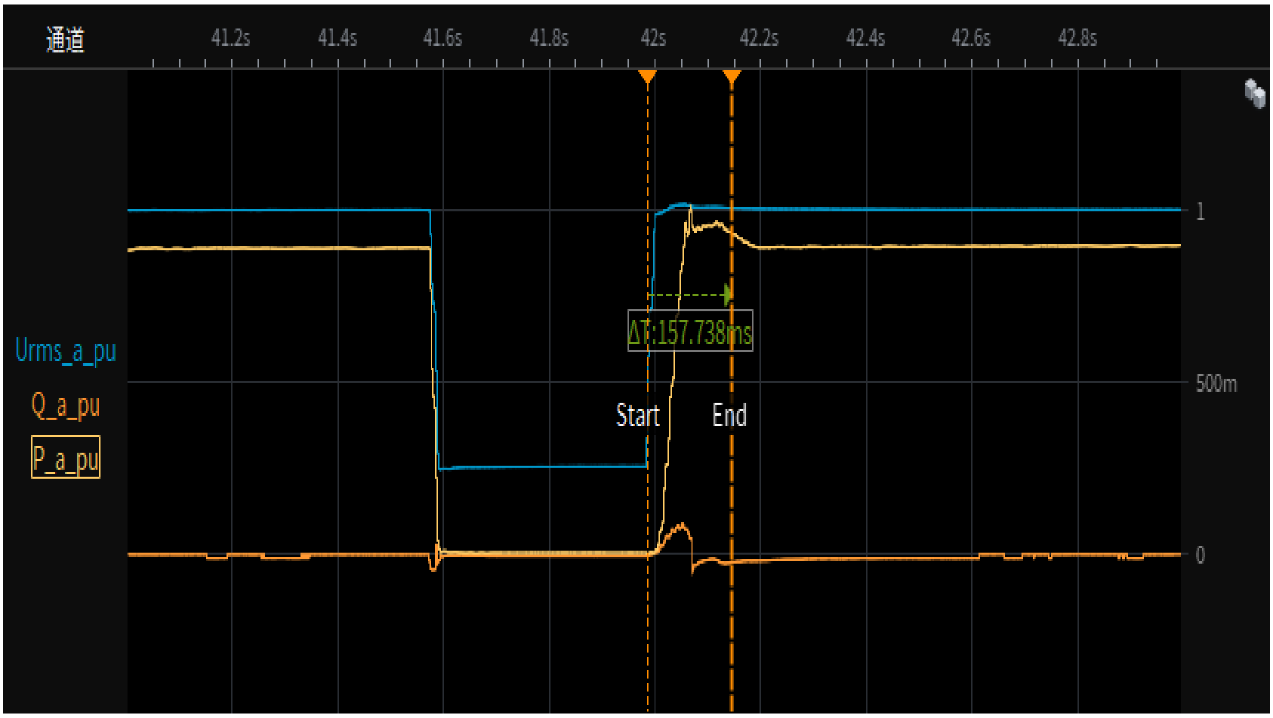


Test 2s-2.3 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents

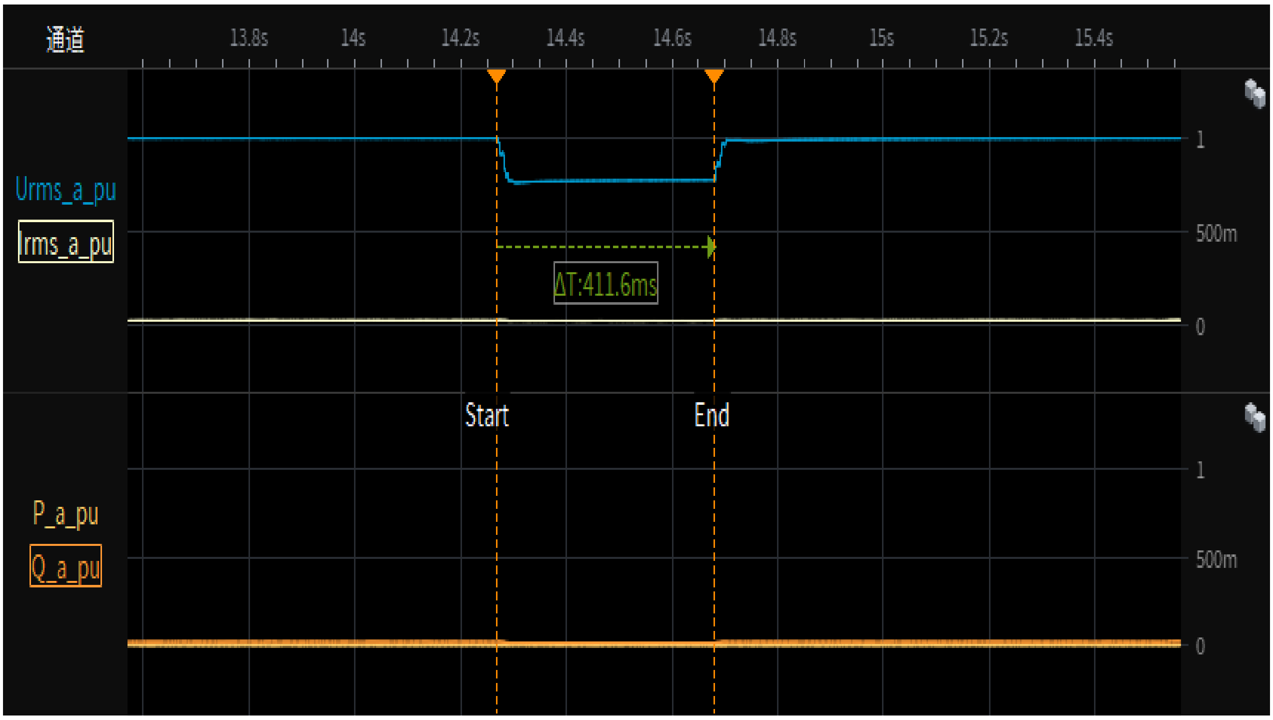


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

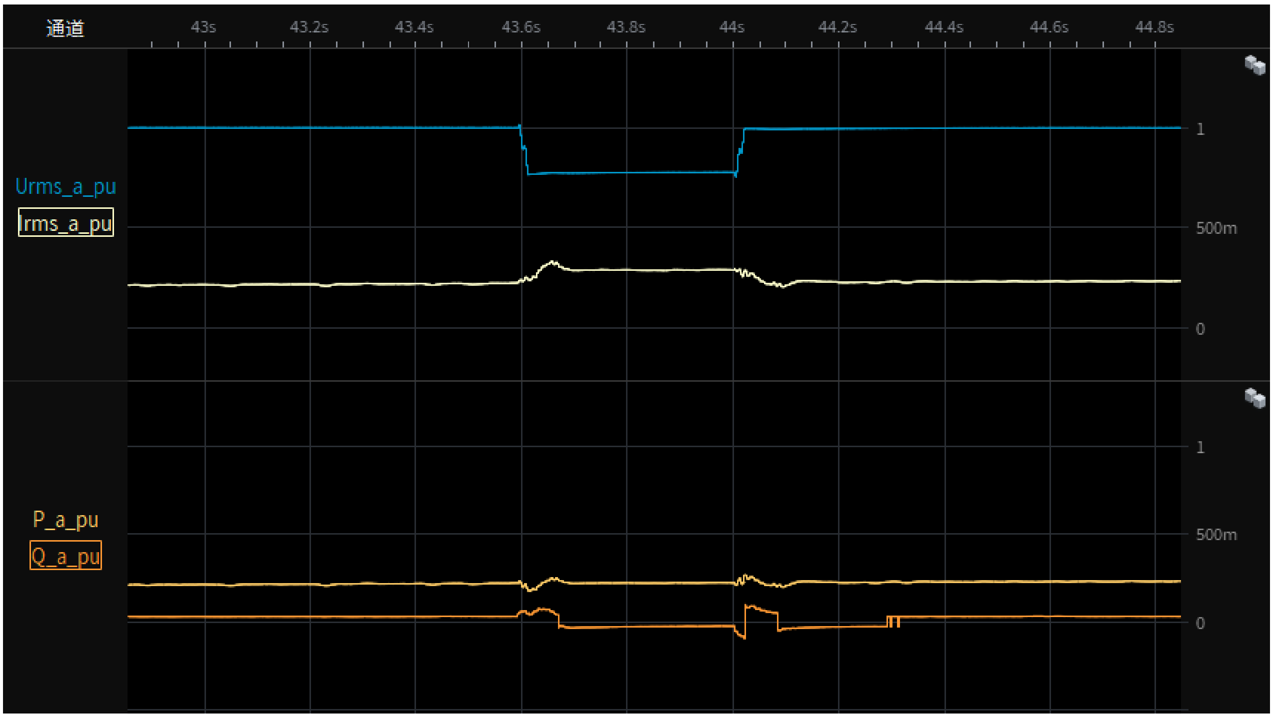


Test 2a-Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D), 0% load Test overview(voltage,current,active and reactive power)

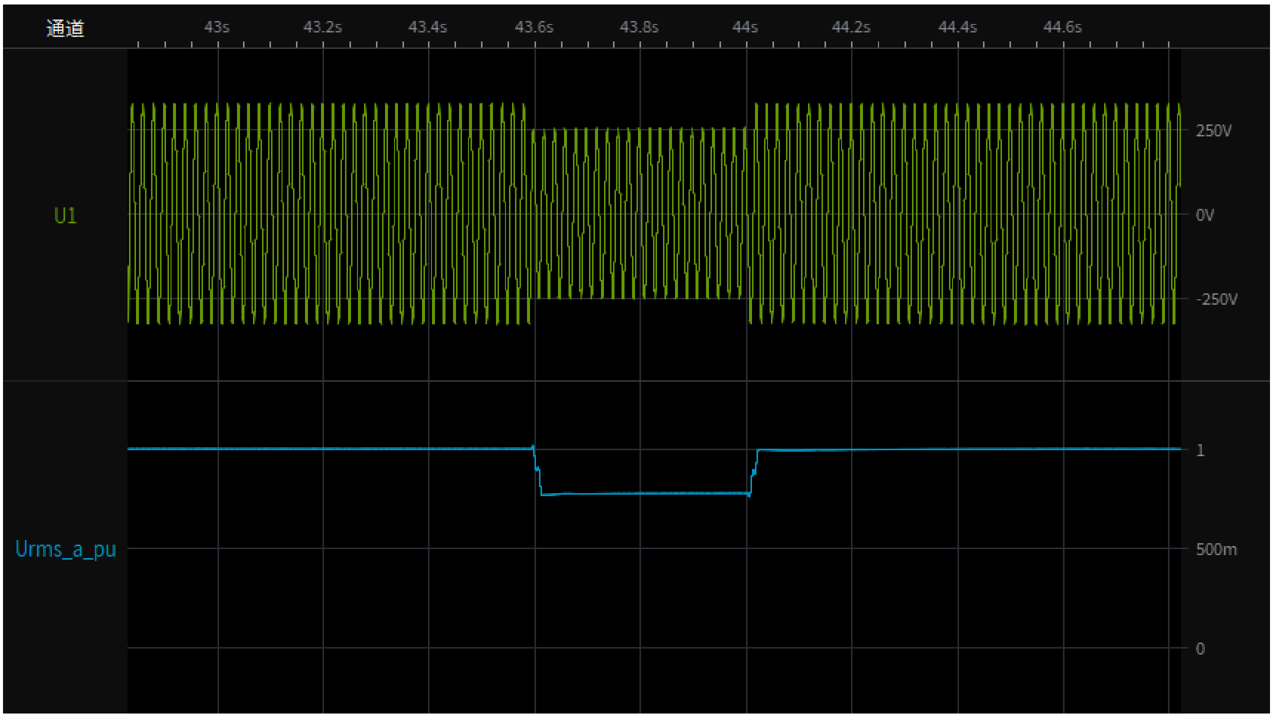


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

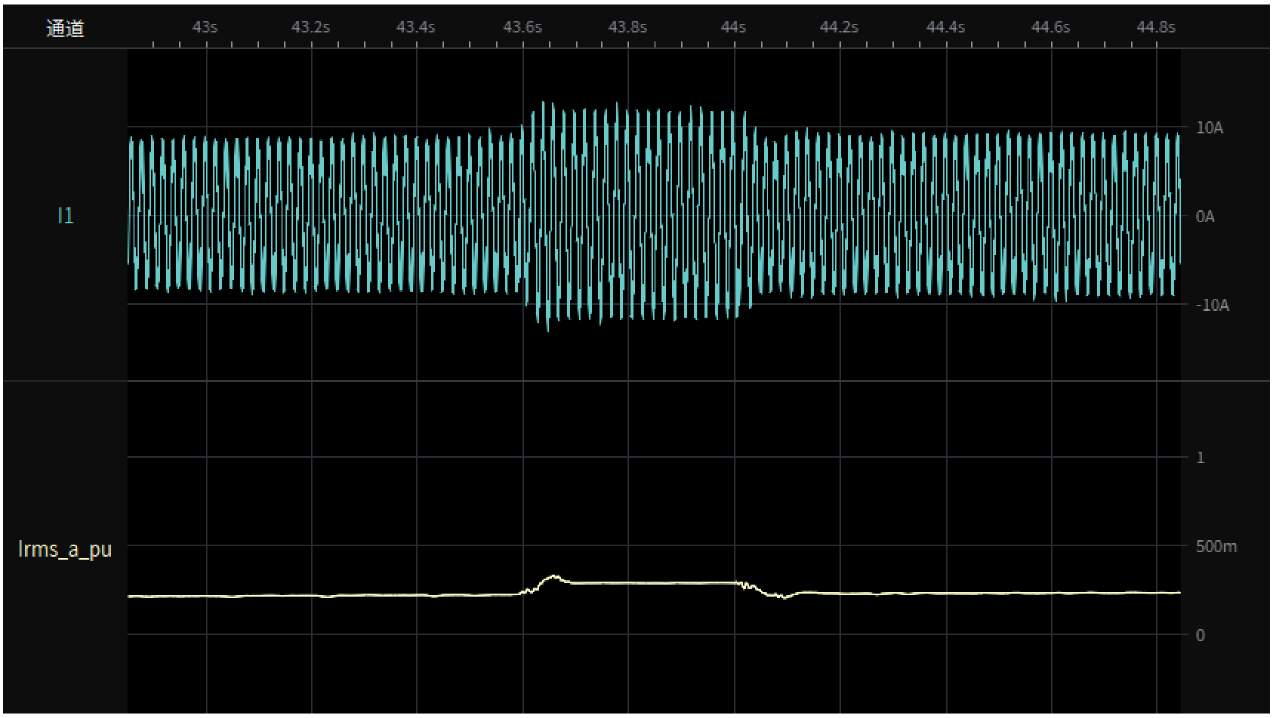


Test 2a-1.2 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

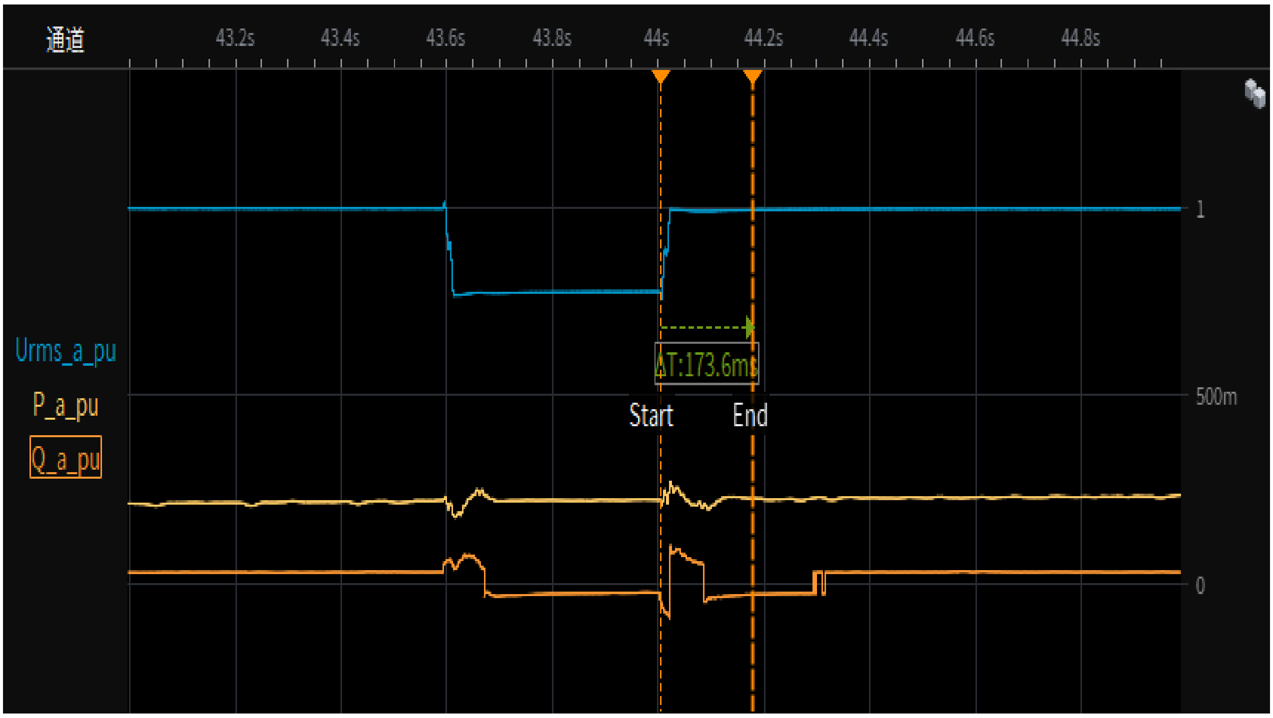


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

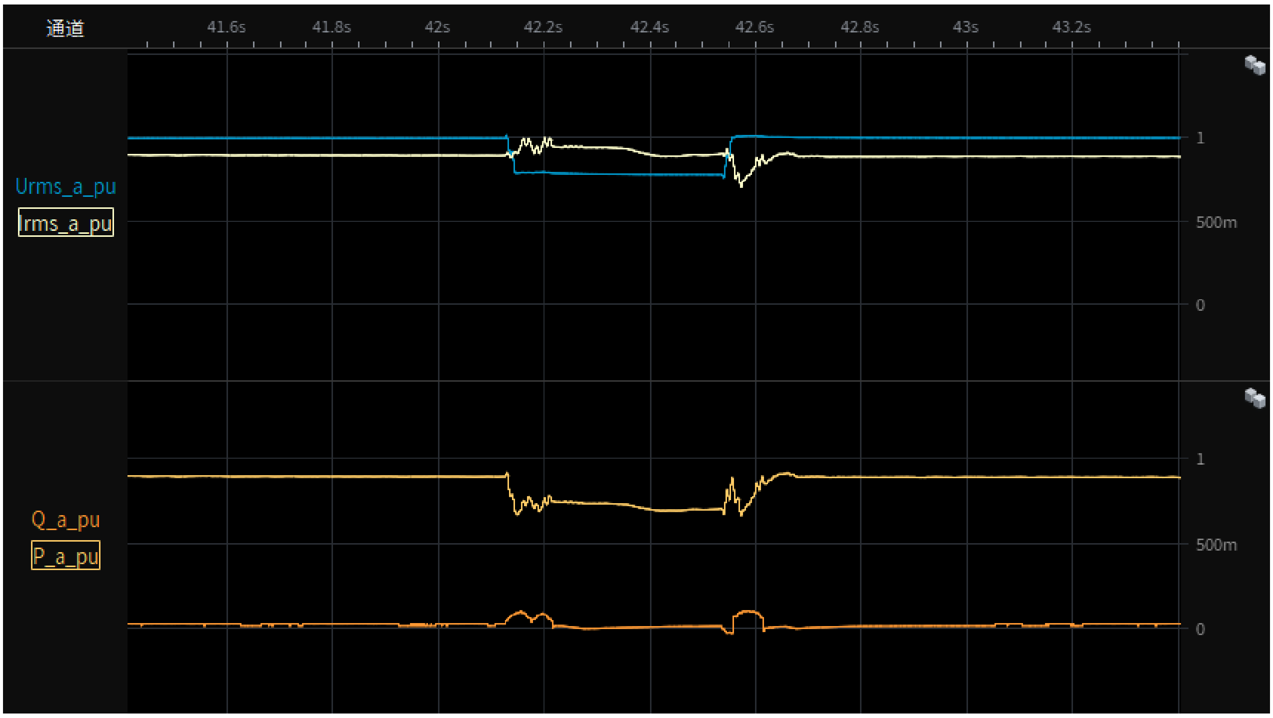


Test 2a-1.4 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),20% load
restoring time

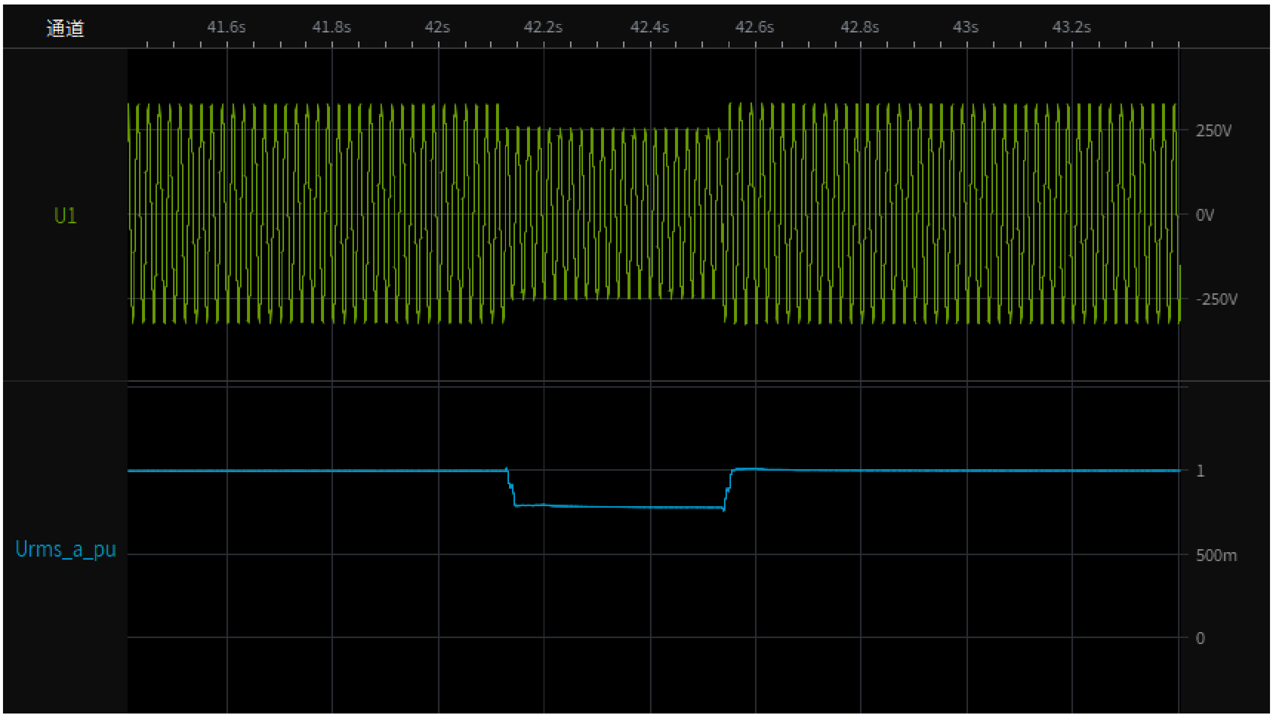


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

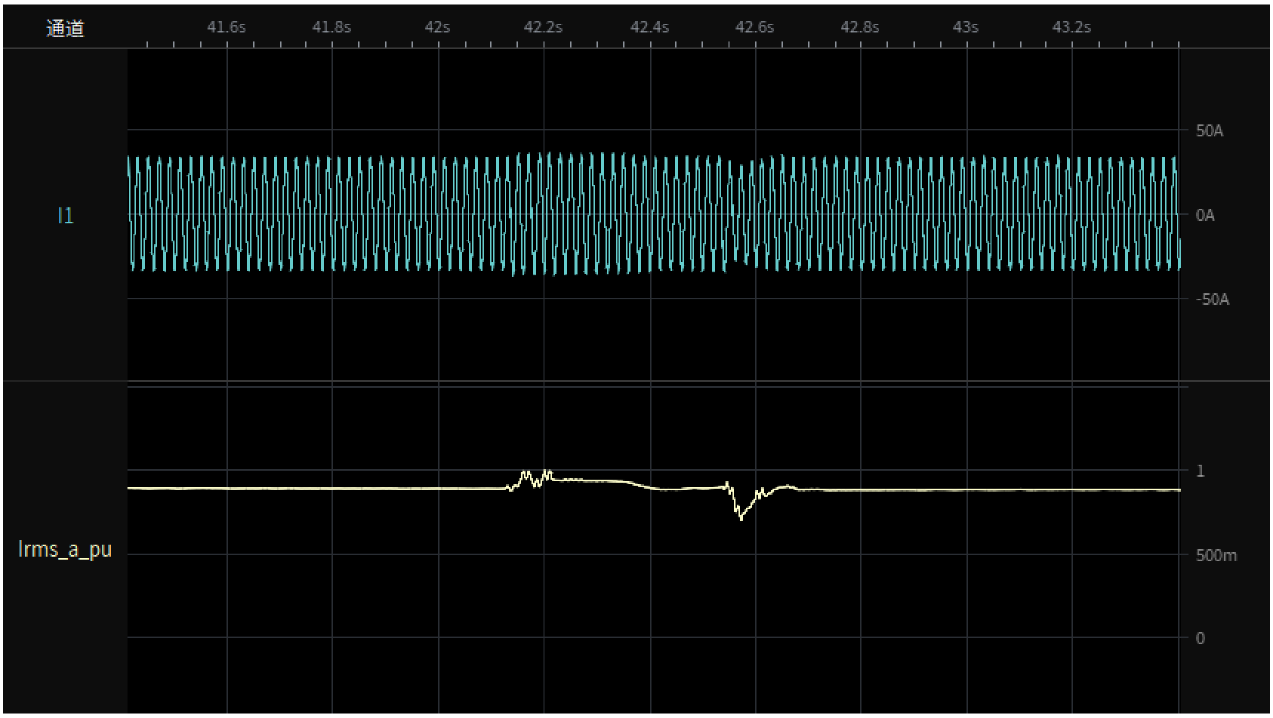


Test 2a-2.2 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

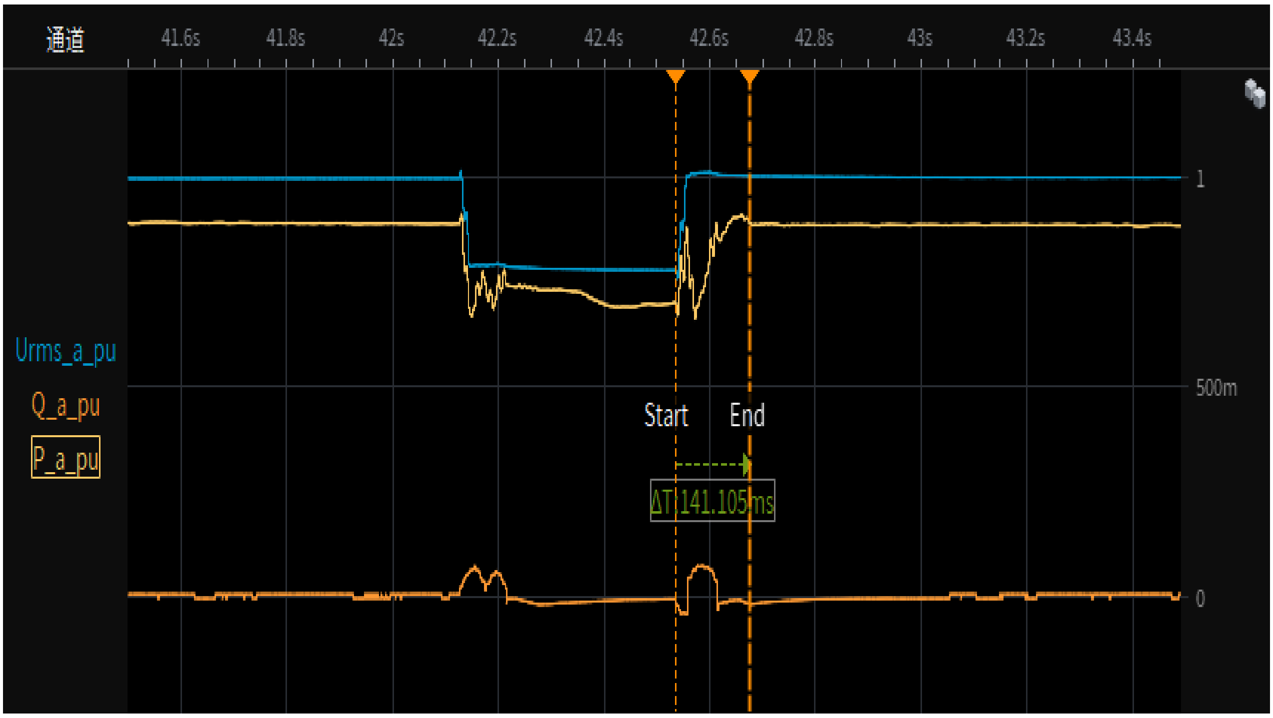


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

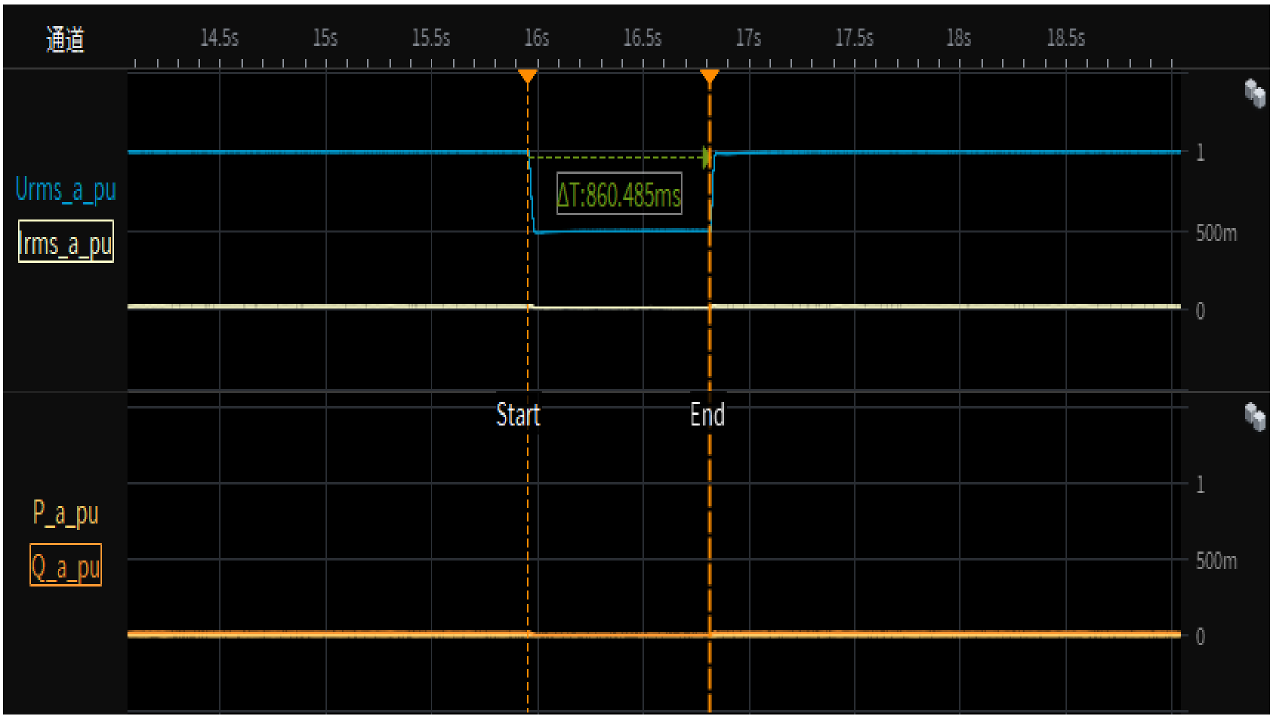
Test 2a-2.3 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase currents



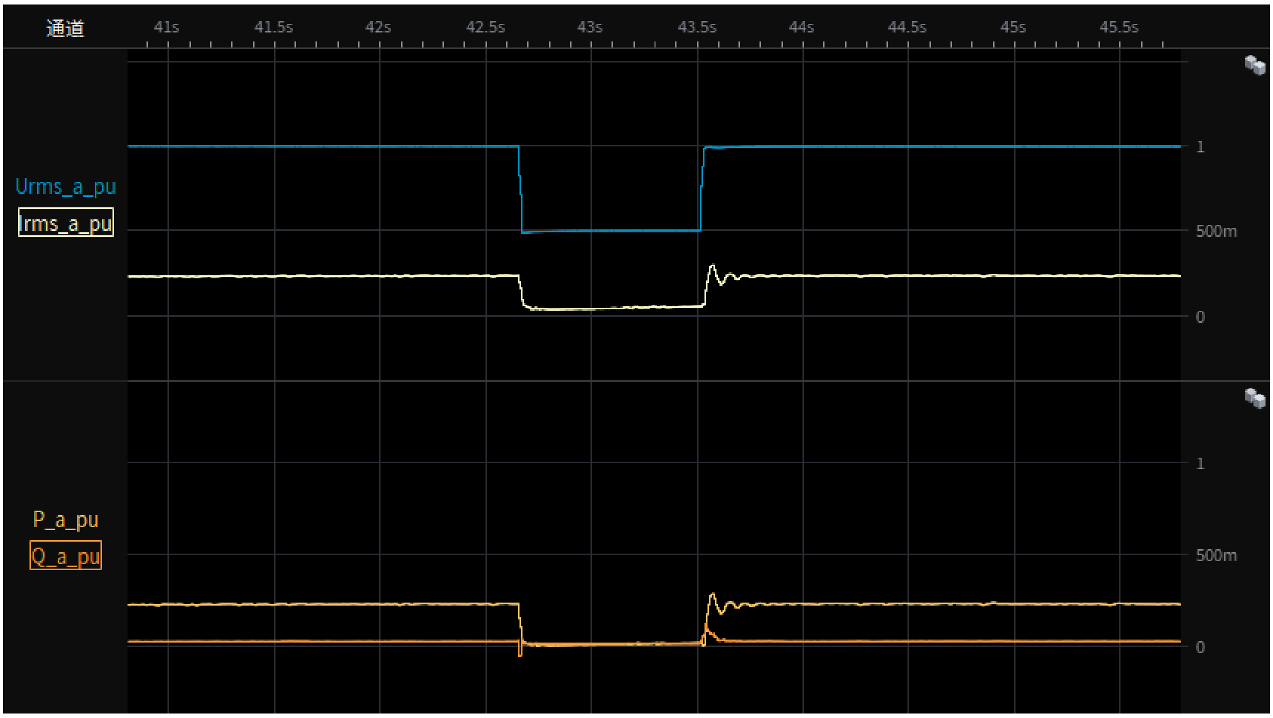
Test 2a-2.4 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D), 95% load
restoring time



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

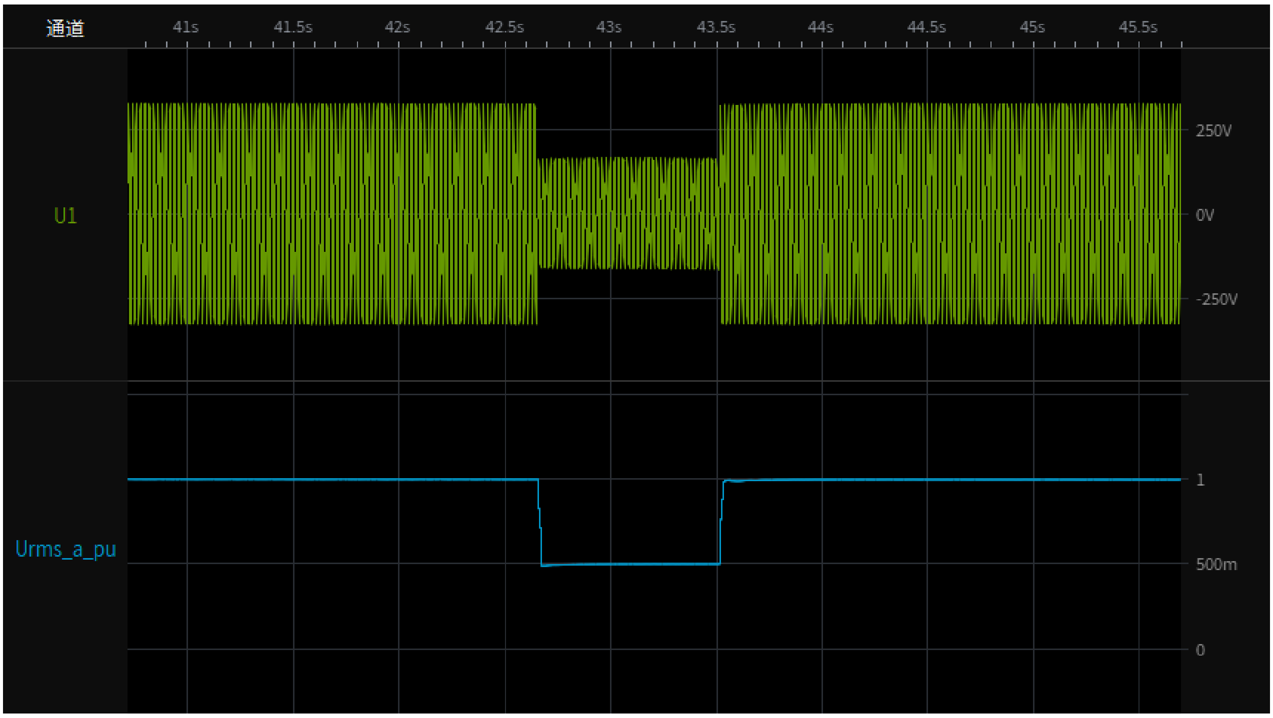


Test 3s-1.1 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)

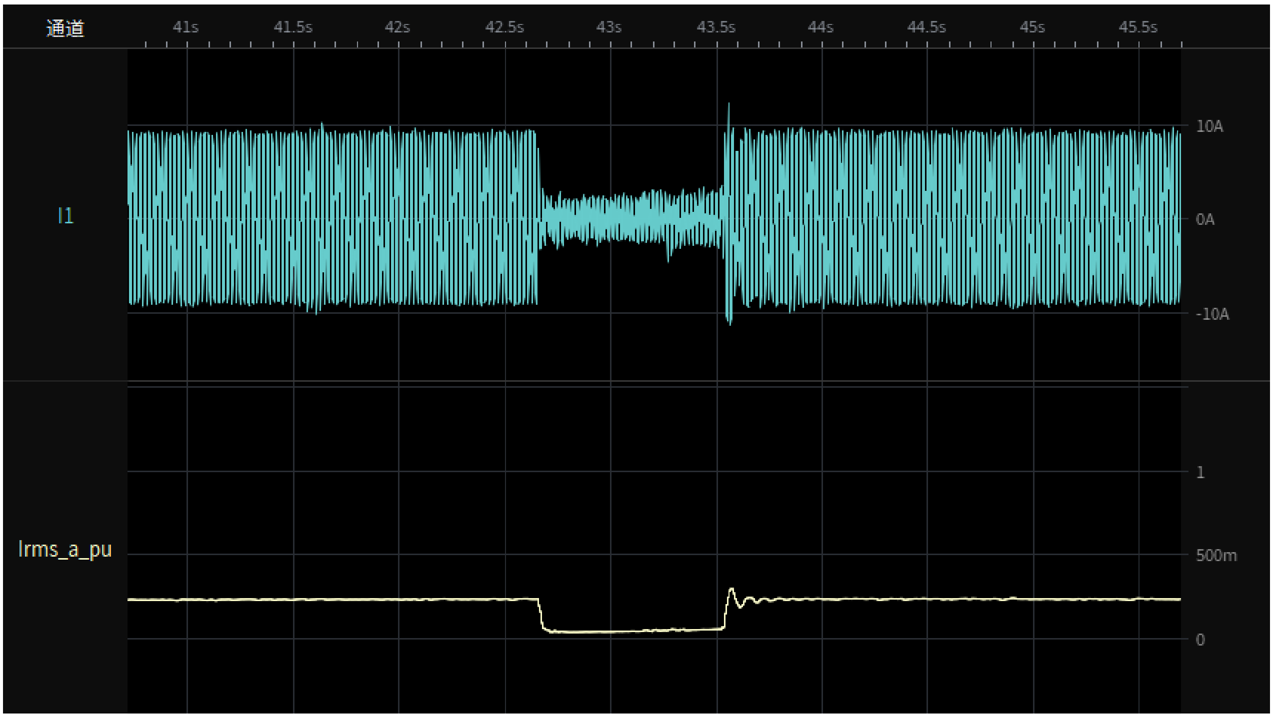


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

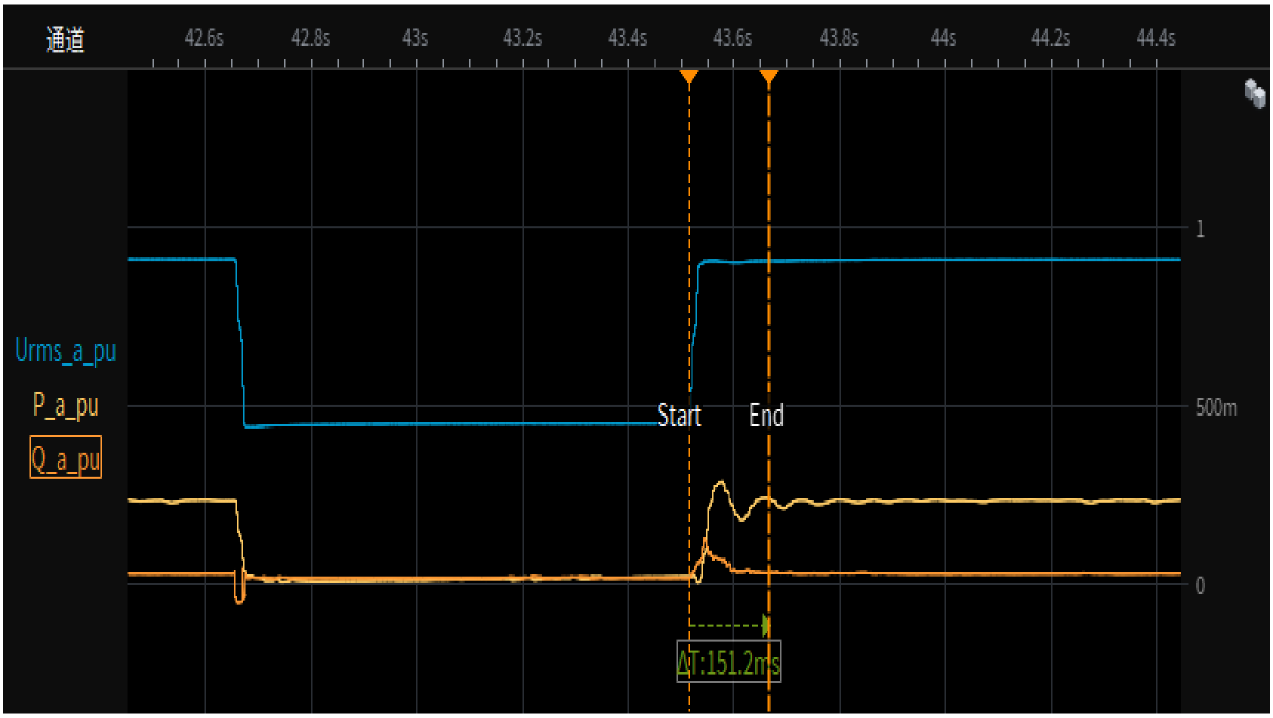


Test 3s-1.3 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents

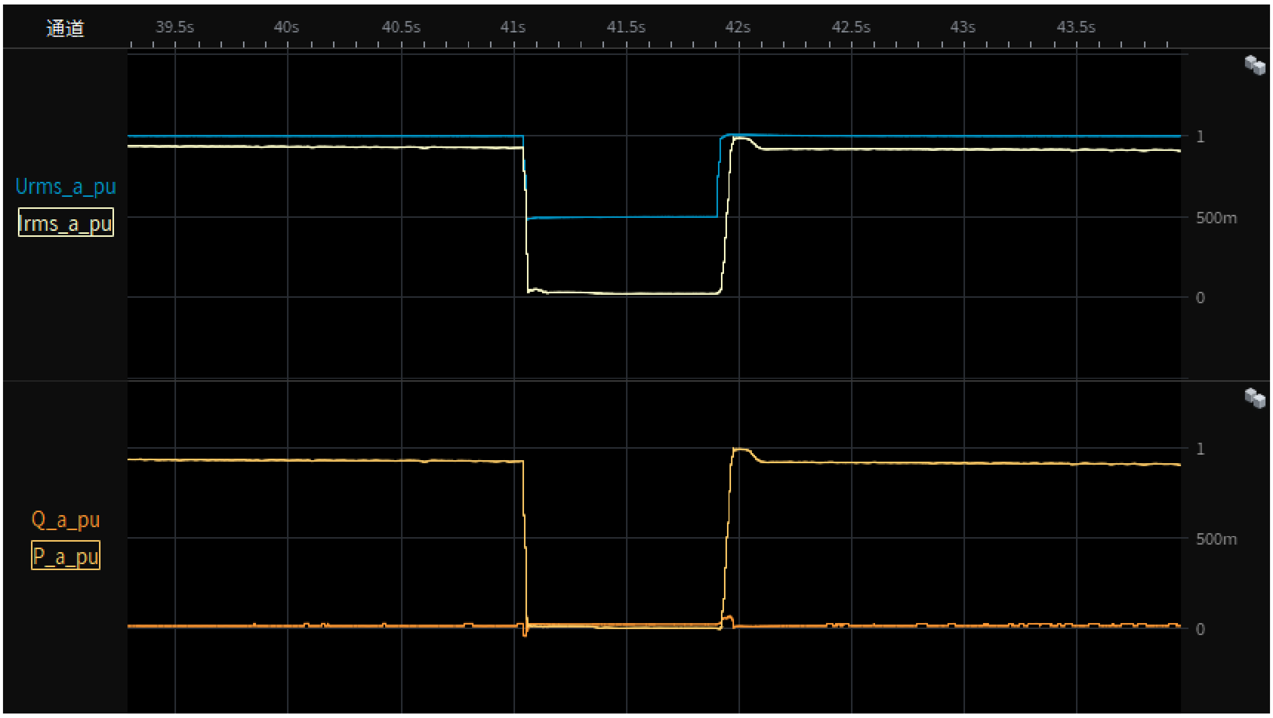


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

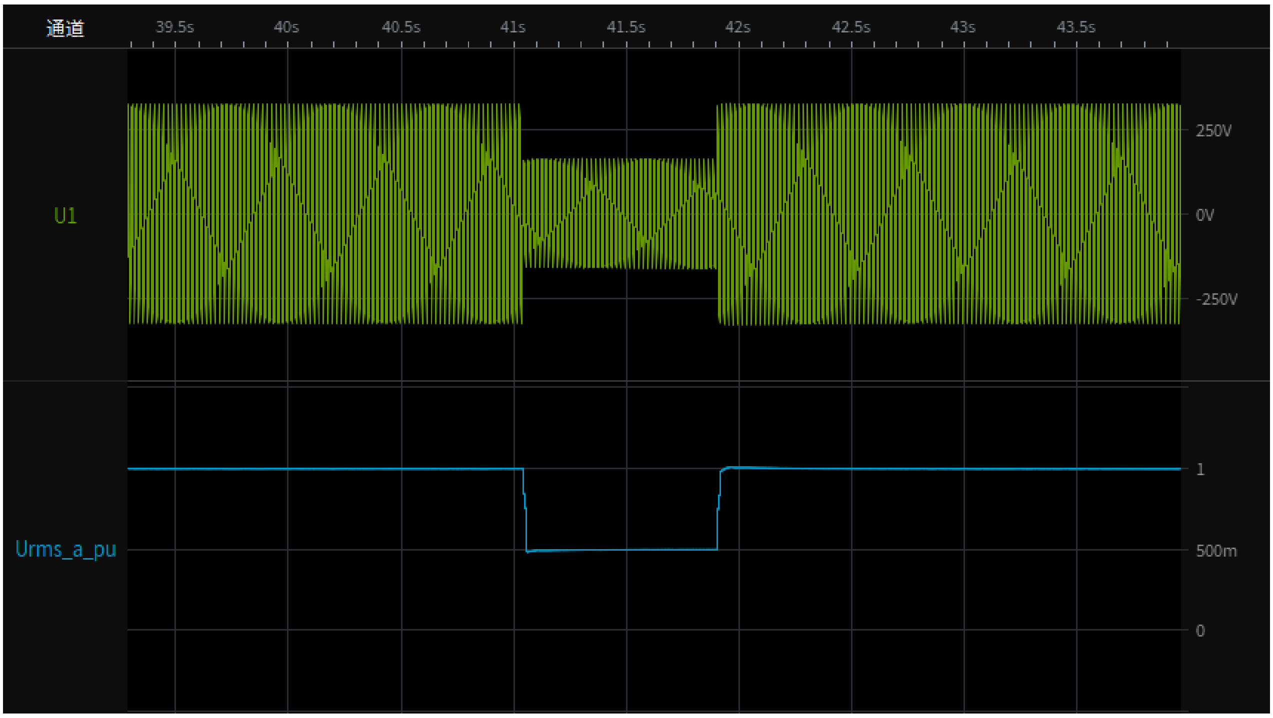


Test 3s-2.1 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),95% load
Test overview(voltage,current,active and reactive power)

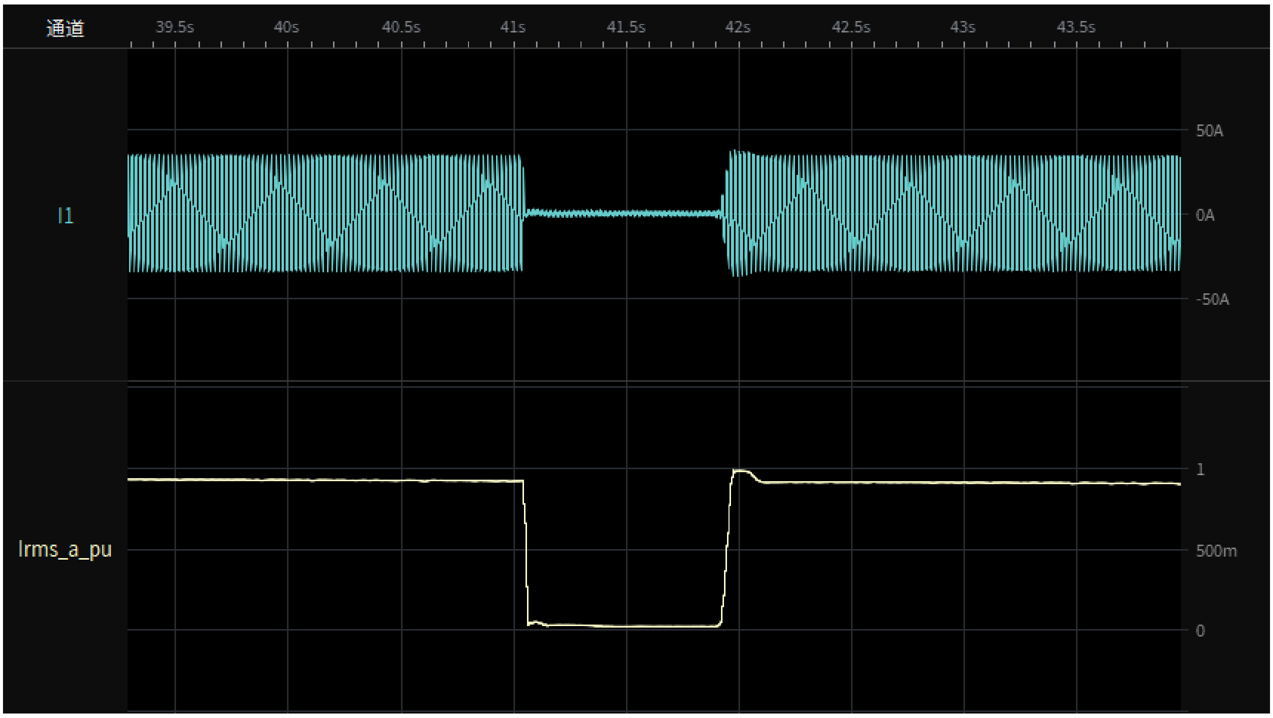


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

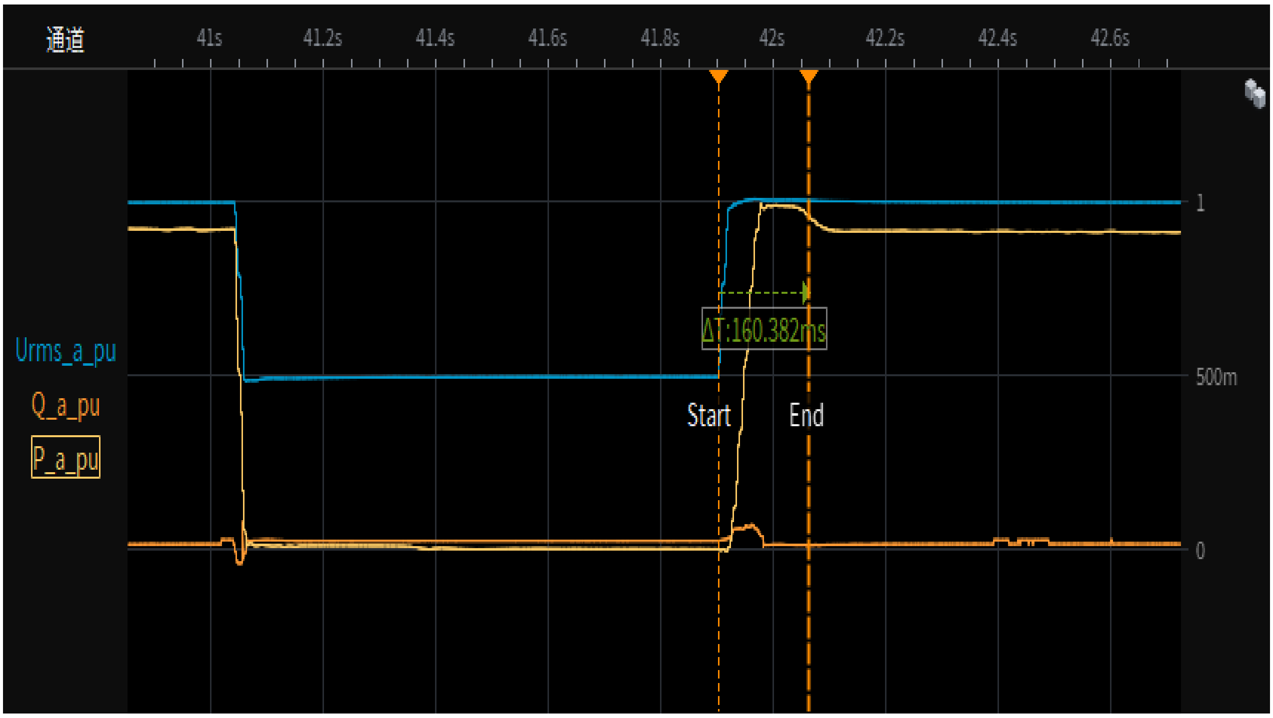


Test 3s-2.3 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents

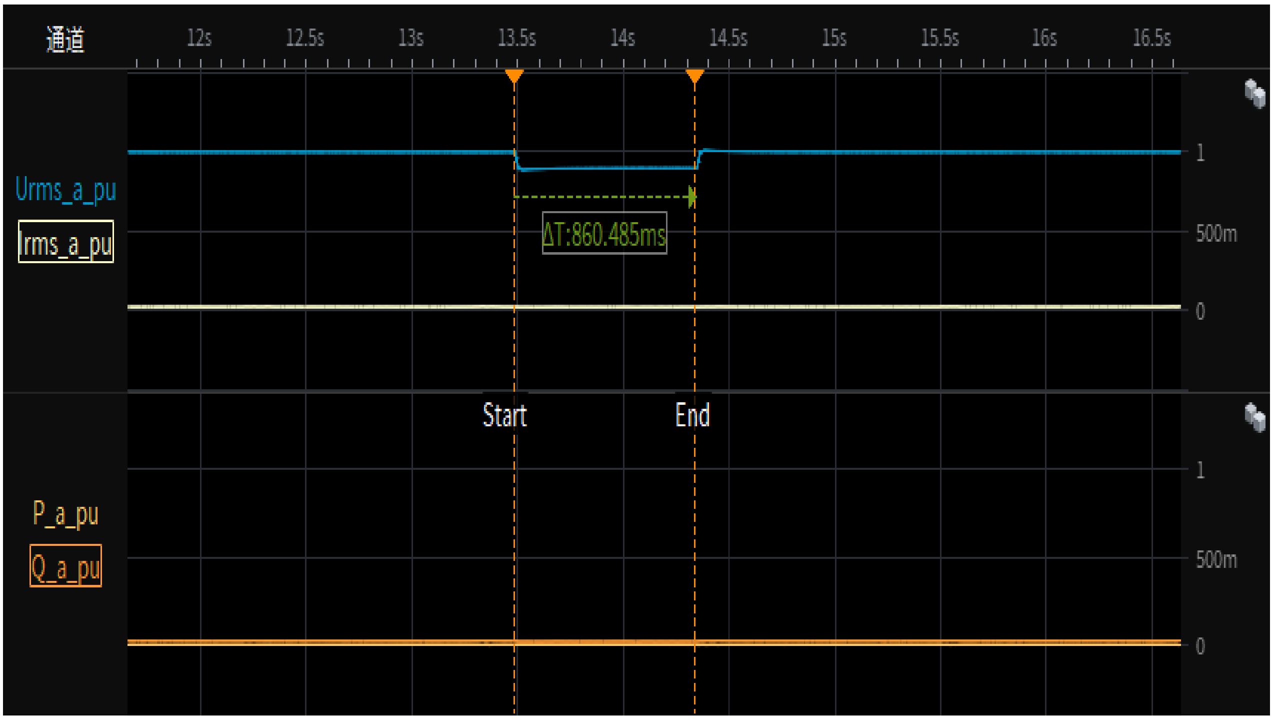


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

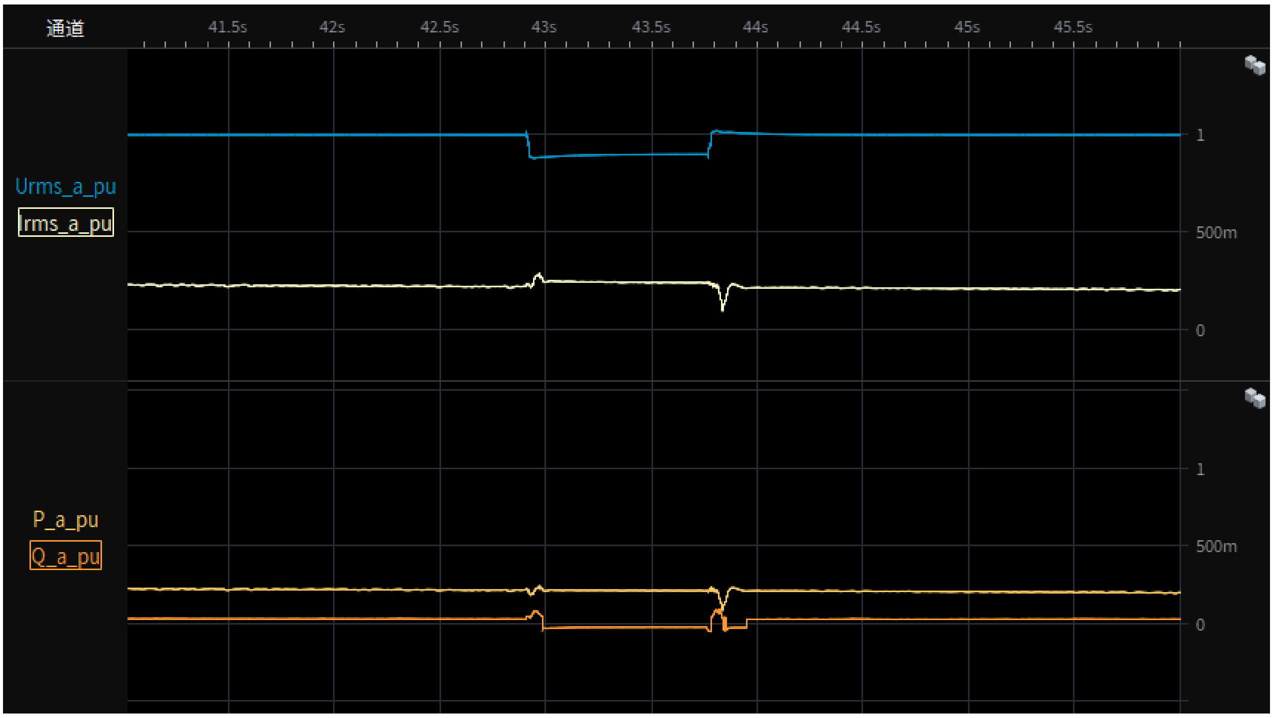


Test 3a-Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D), 0% load
Test overview(voltage,current,active and reactive power)

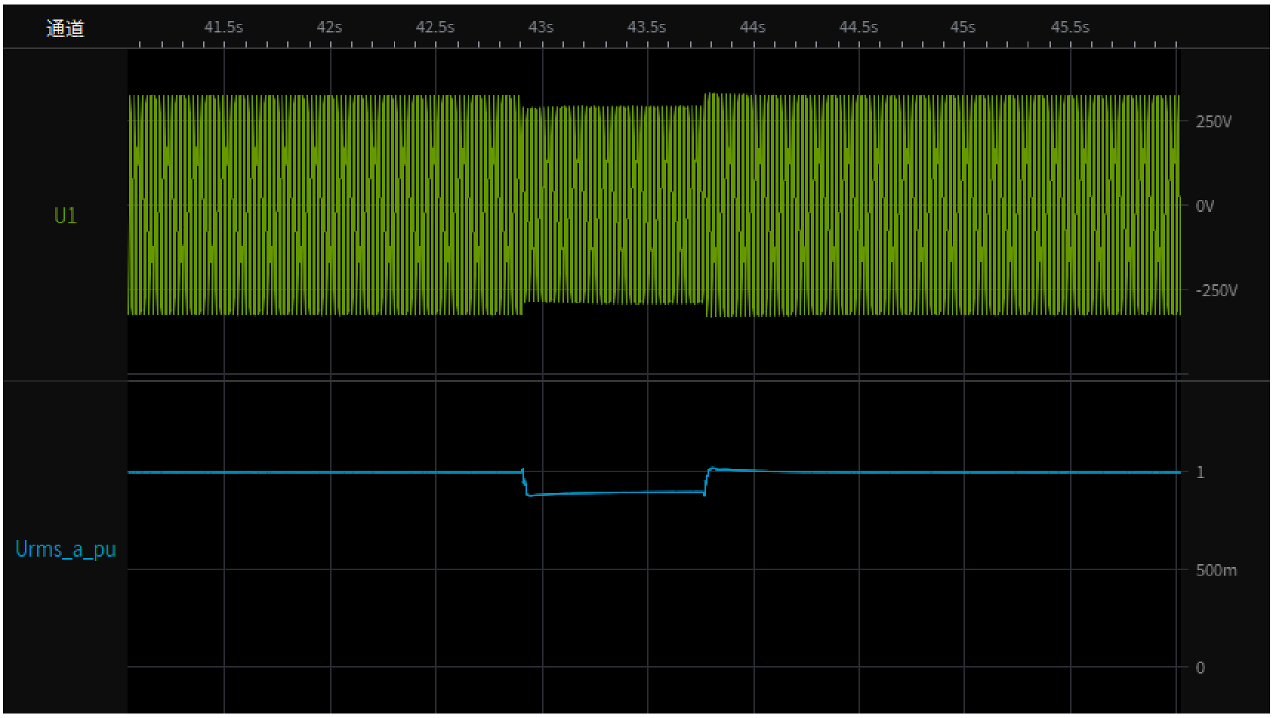


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

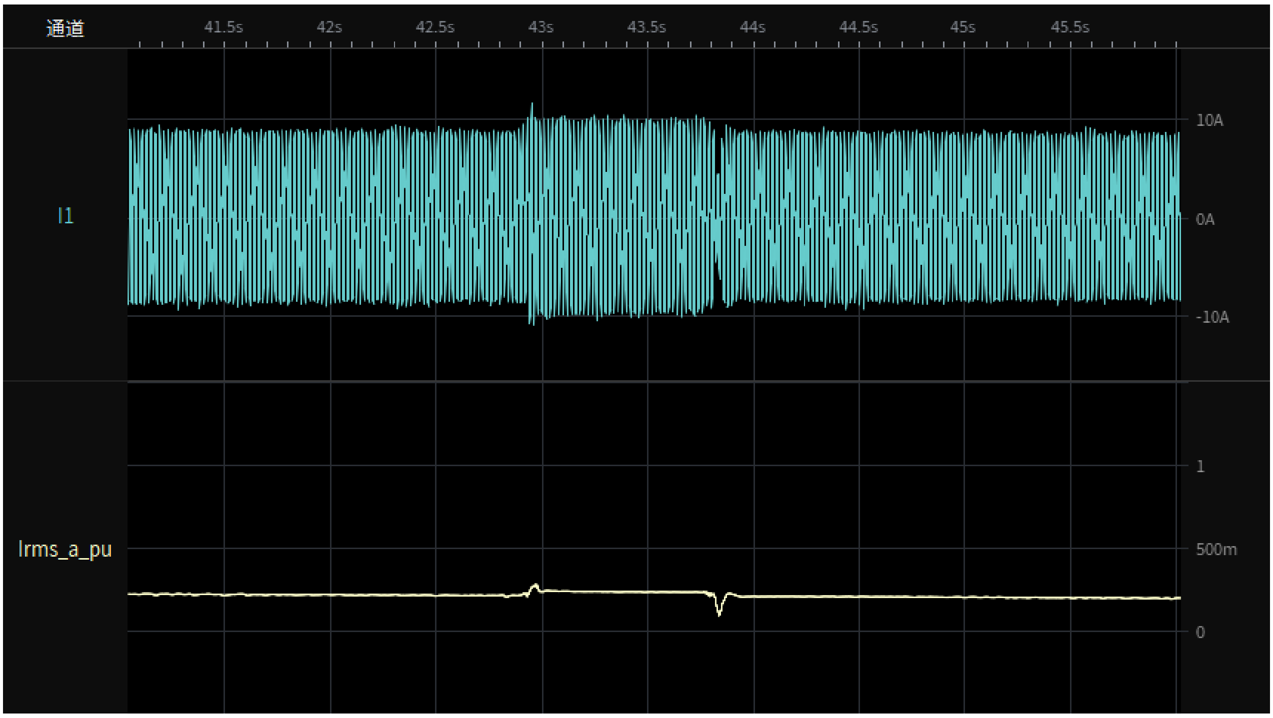


Test 3a-1.2 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

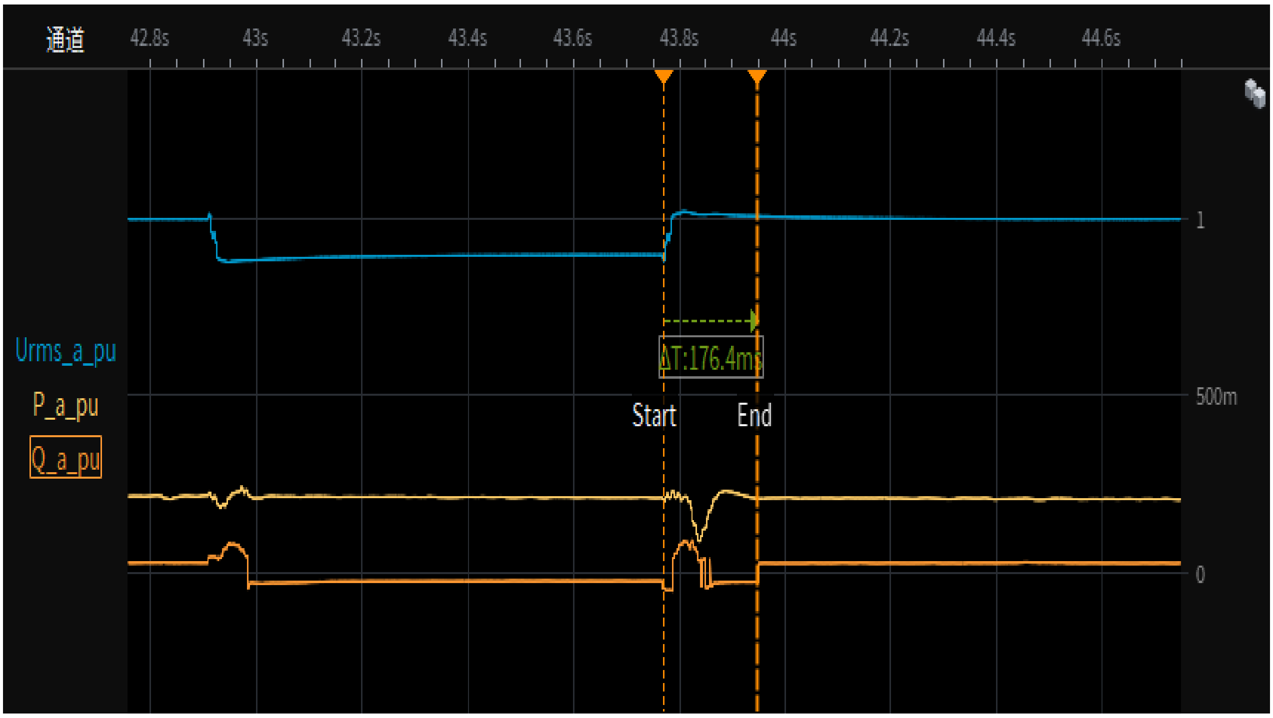


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

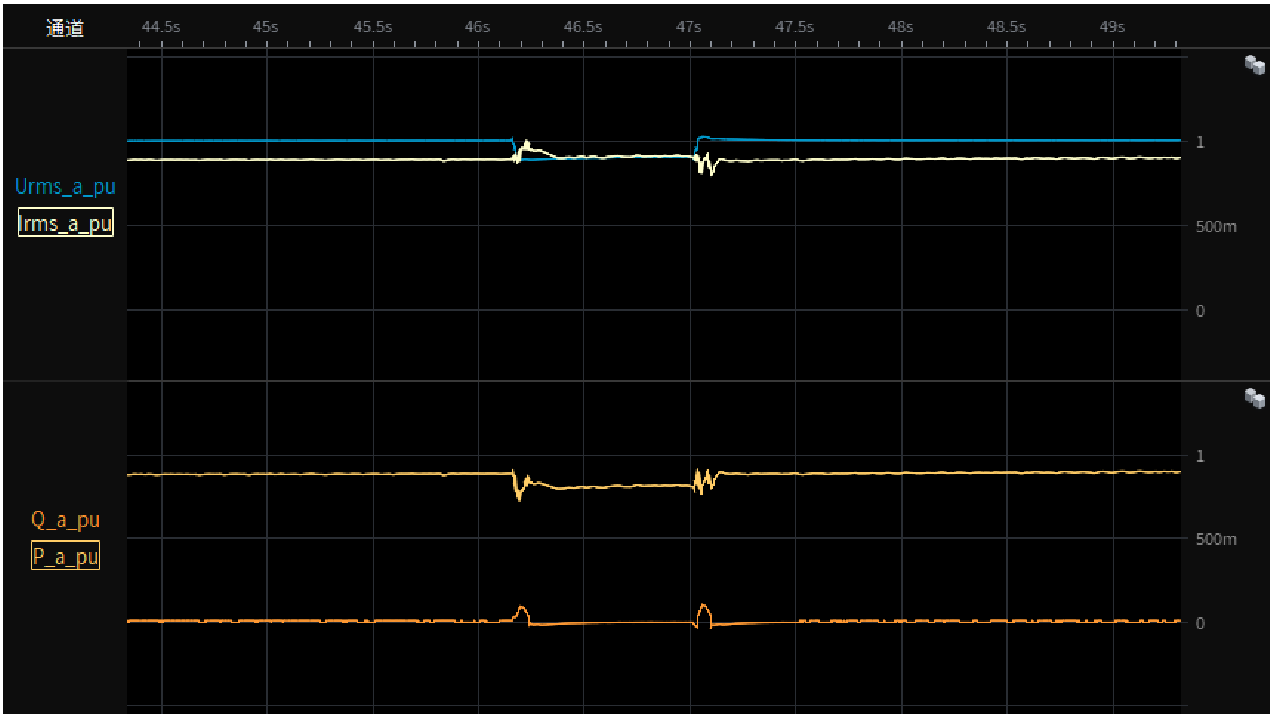


Test 3a-1.4 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),20% load
restoring time

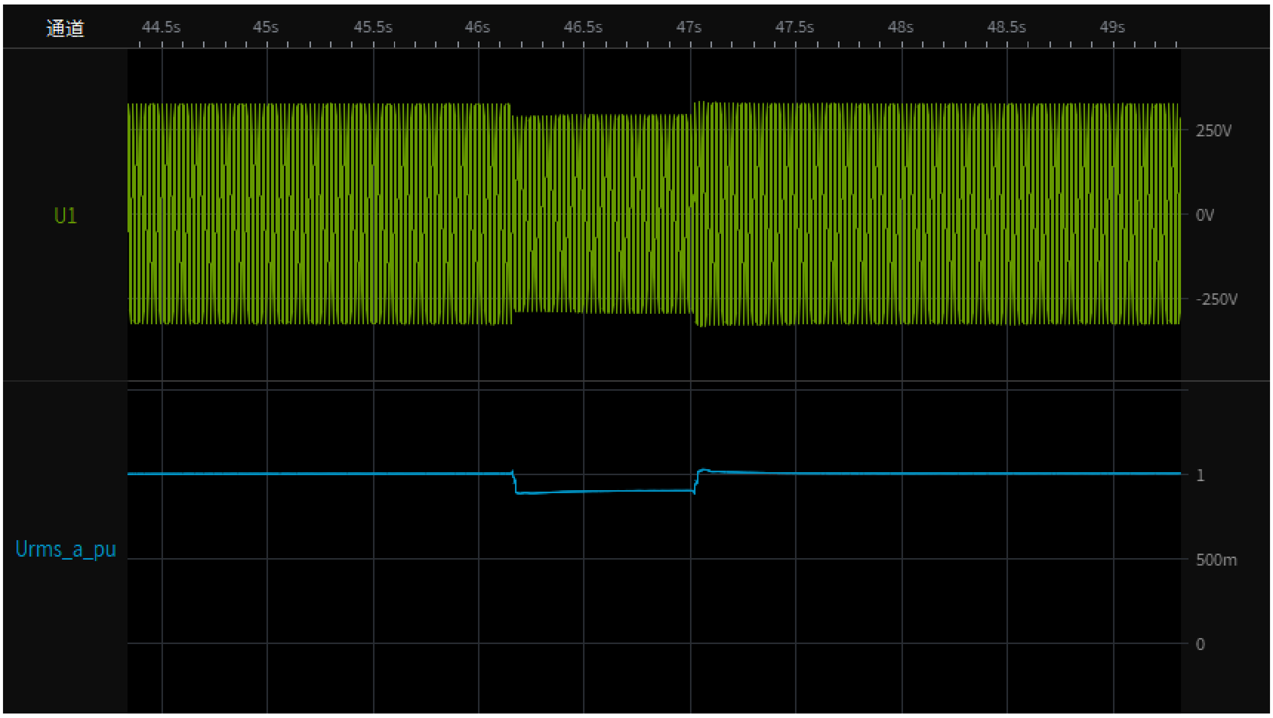


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

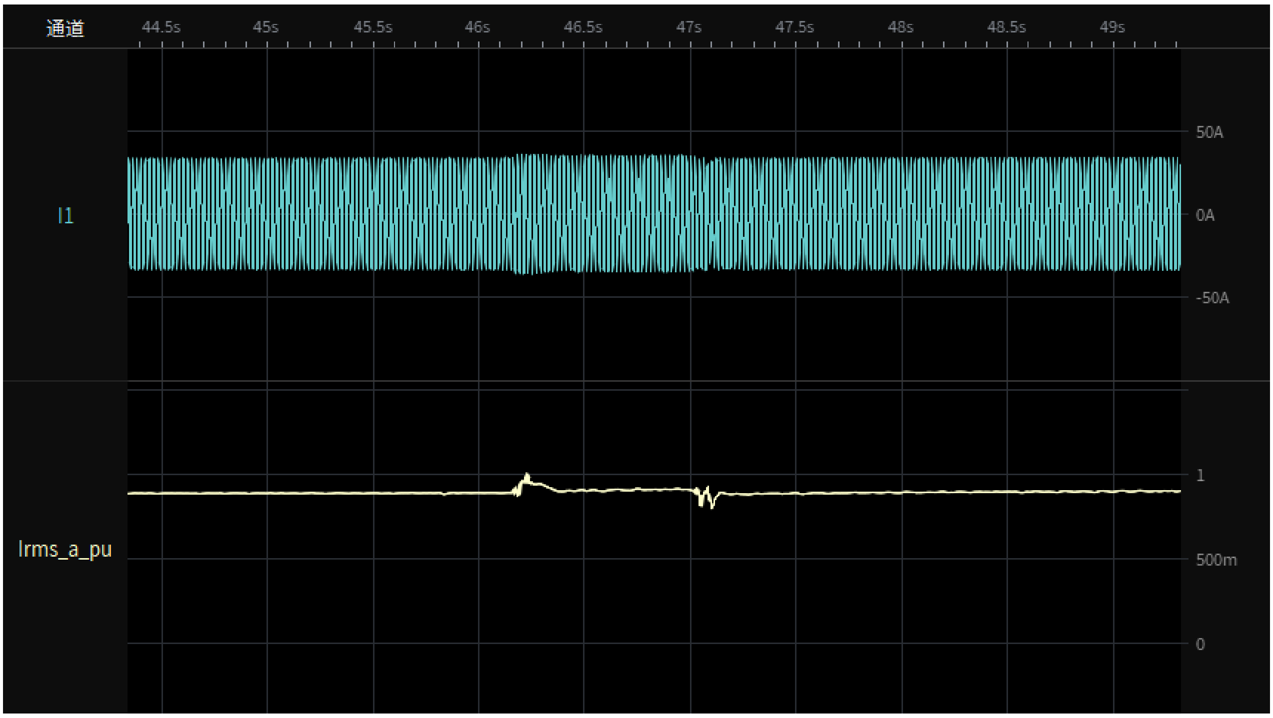


Test 3a-2.2 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

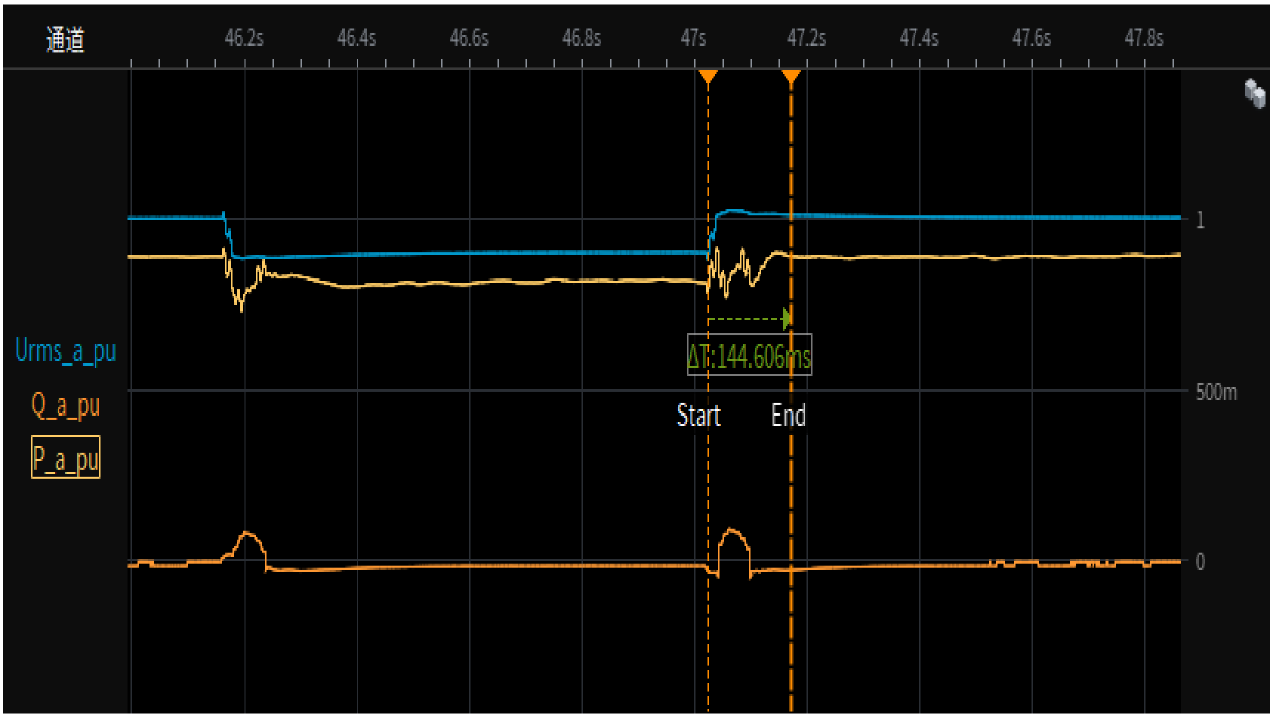


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

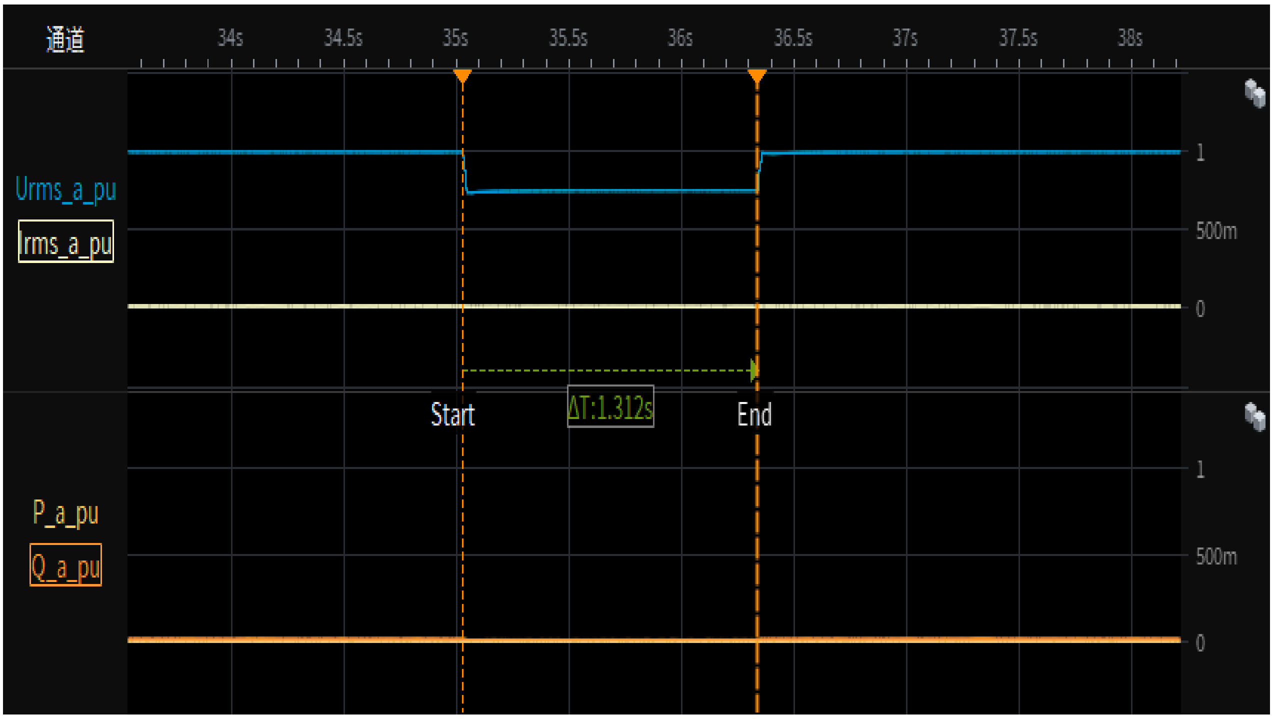


Test 3a-2.4 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D), 95% load
restoring time

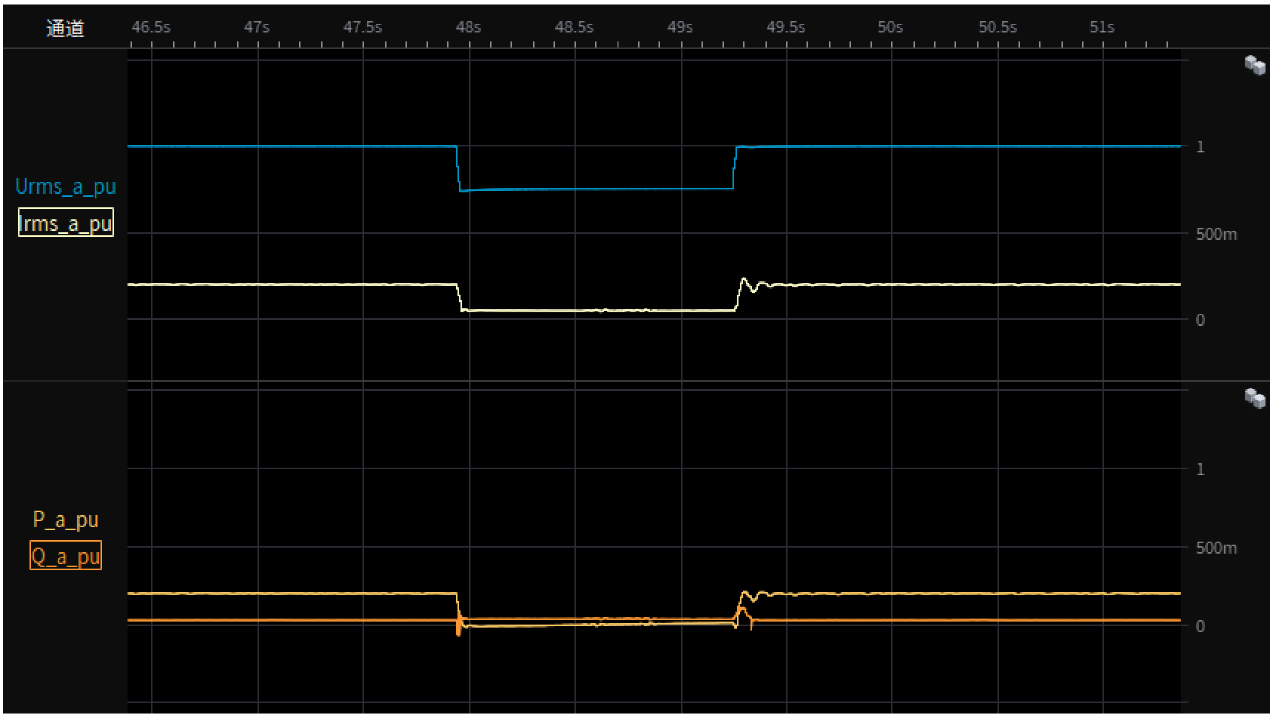


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

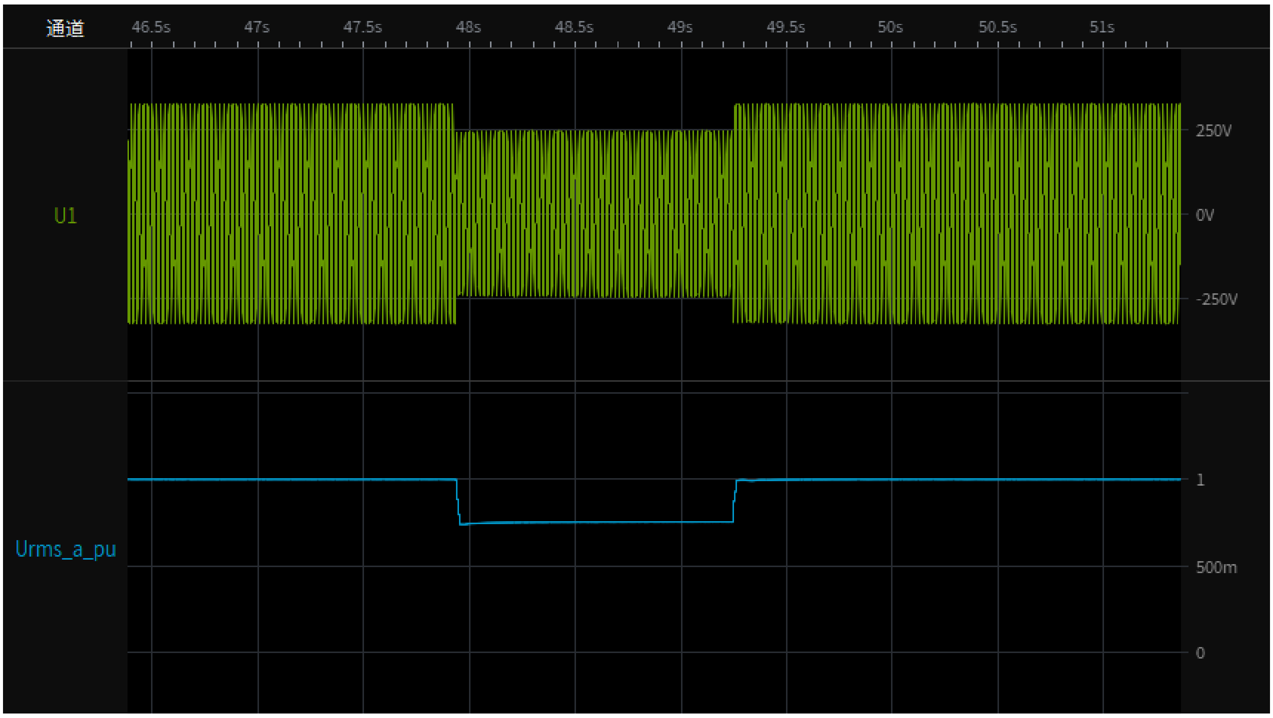


Test 4s-1.1 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)

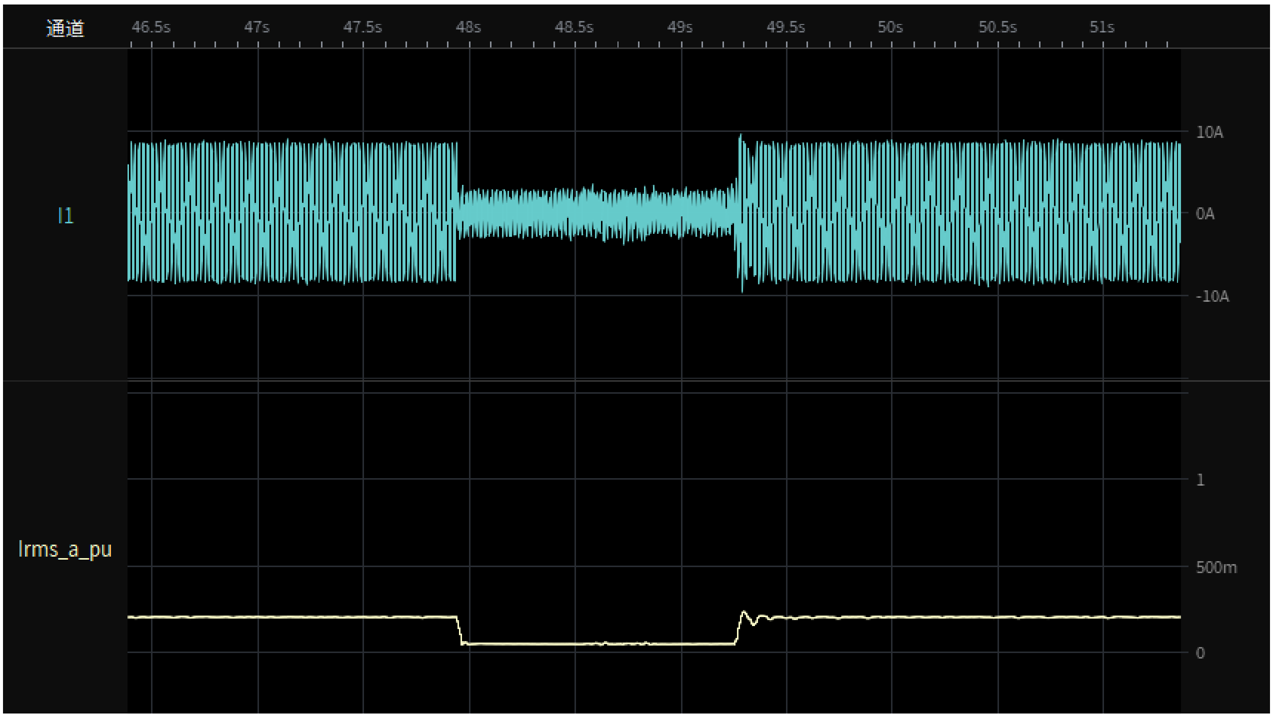


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

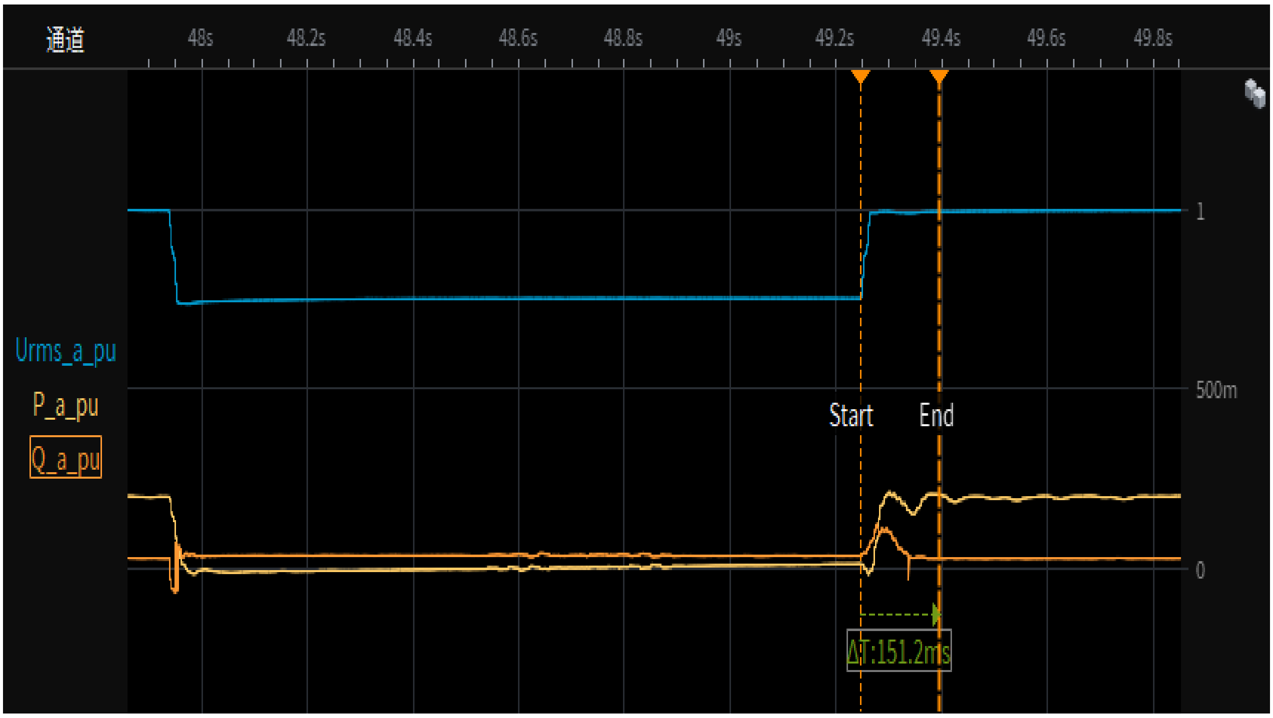


Test 4s-1.3 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents

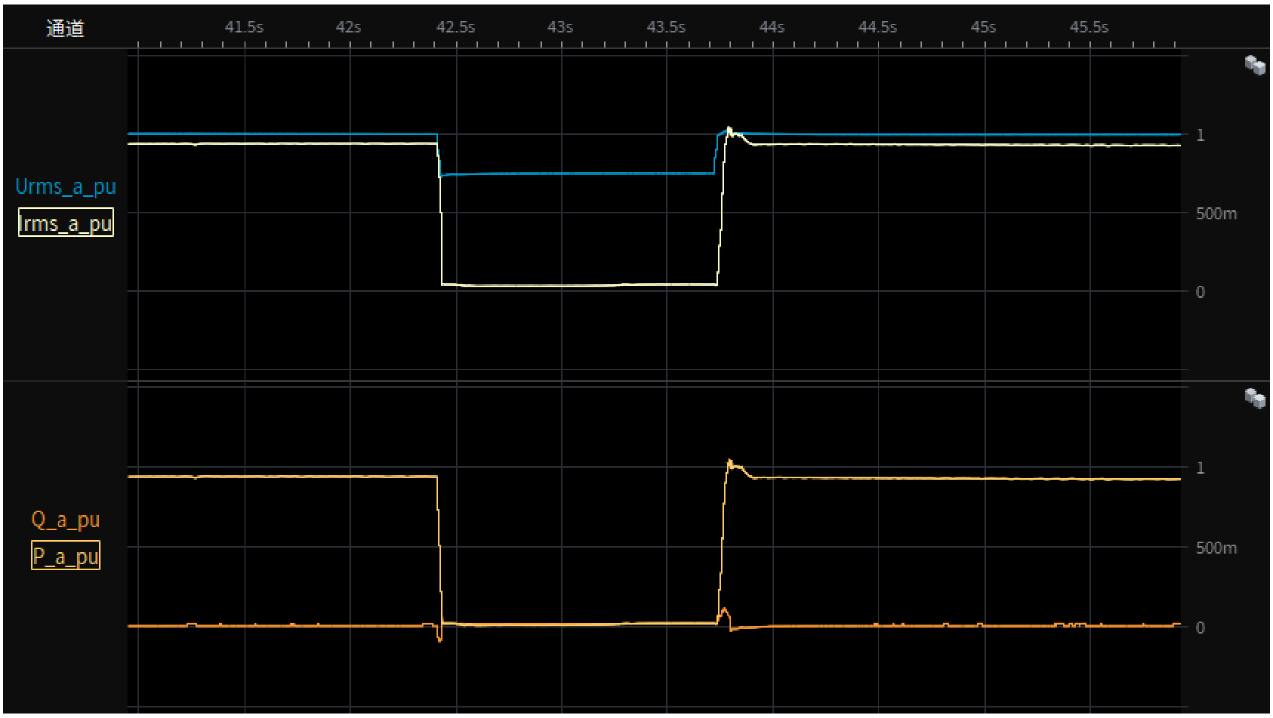


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

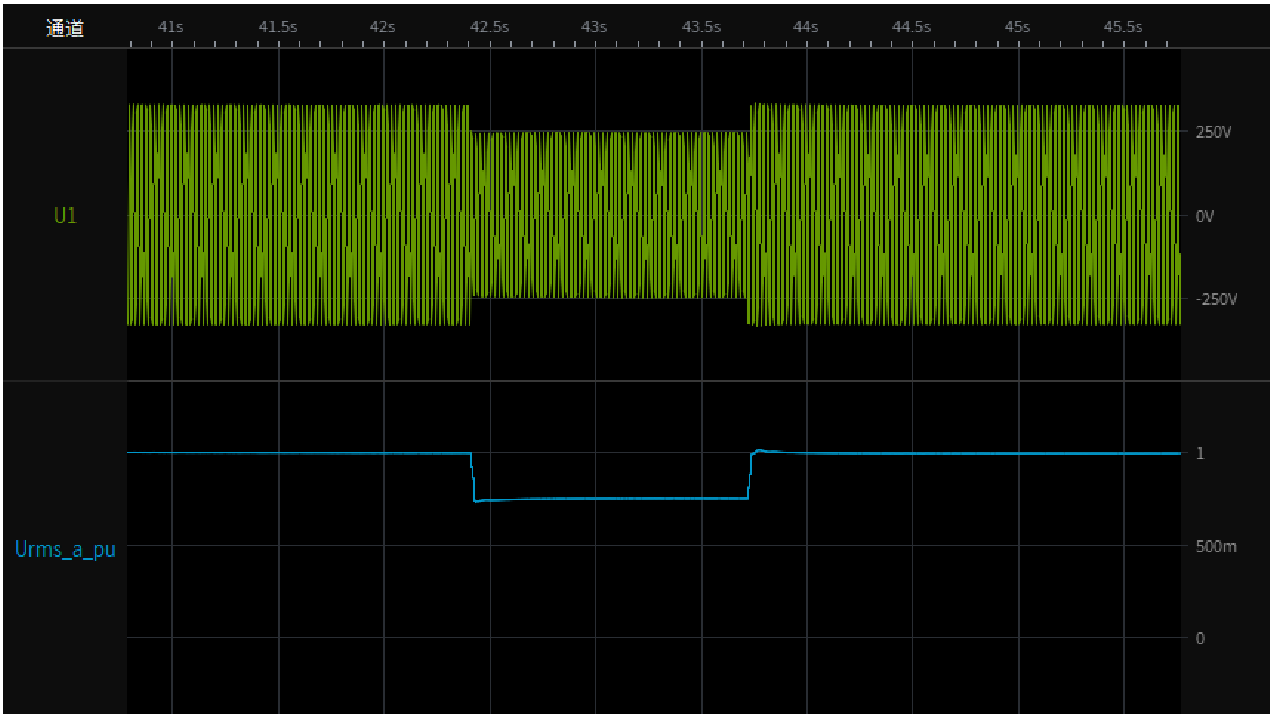


Test 4s-2.1 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),95% load Test overview(voltage,current,active and reactive power)

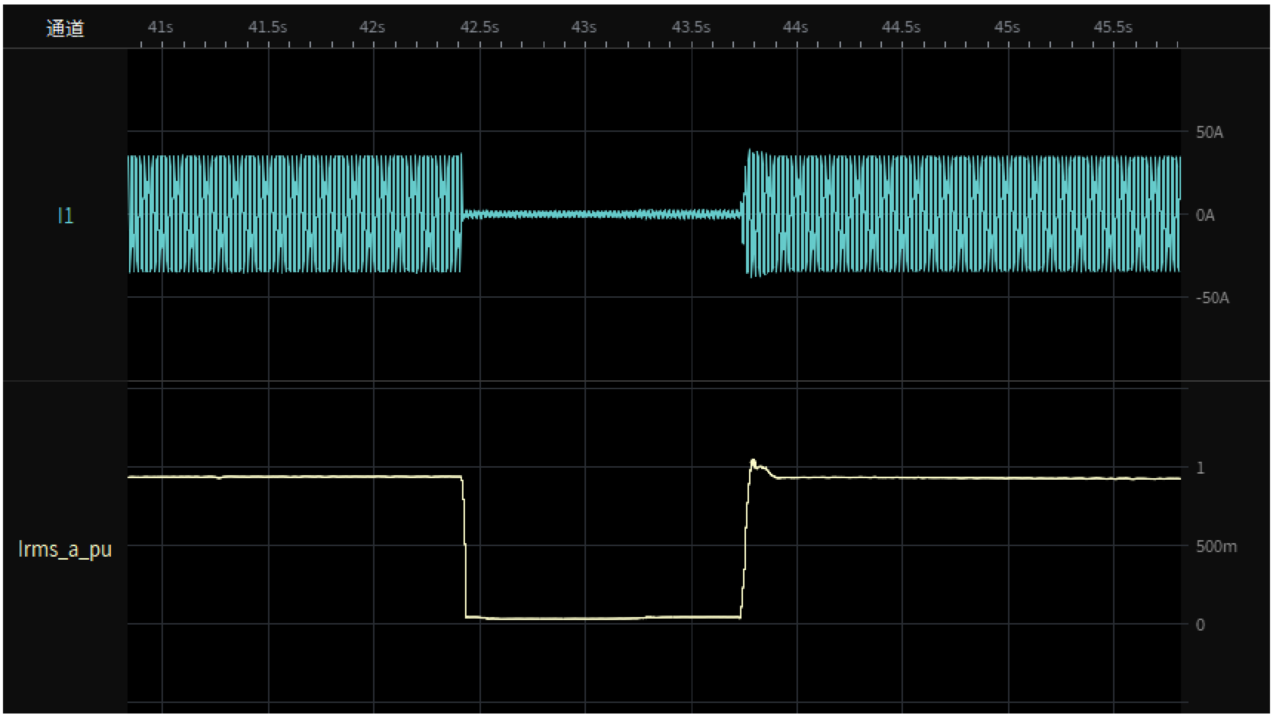


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

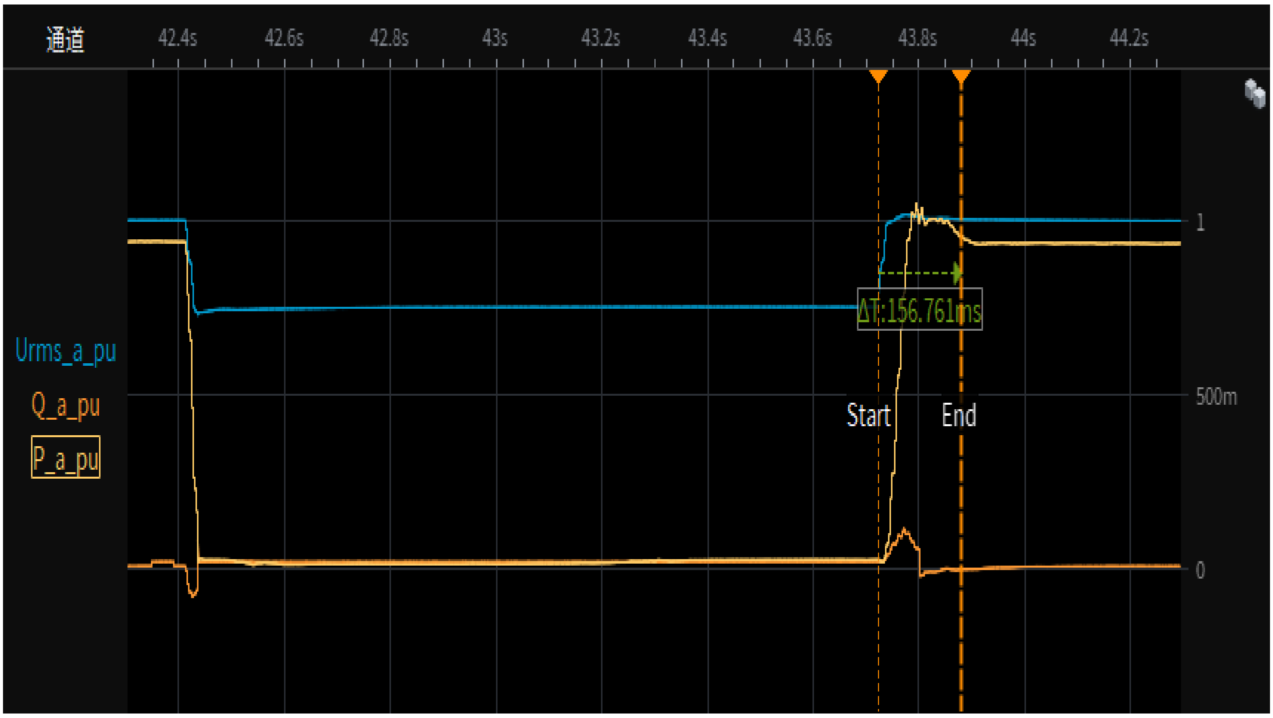


Test 4s-2.3 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents

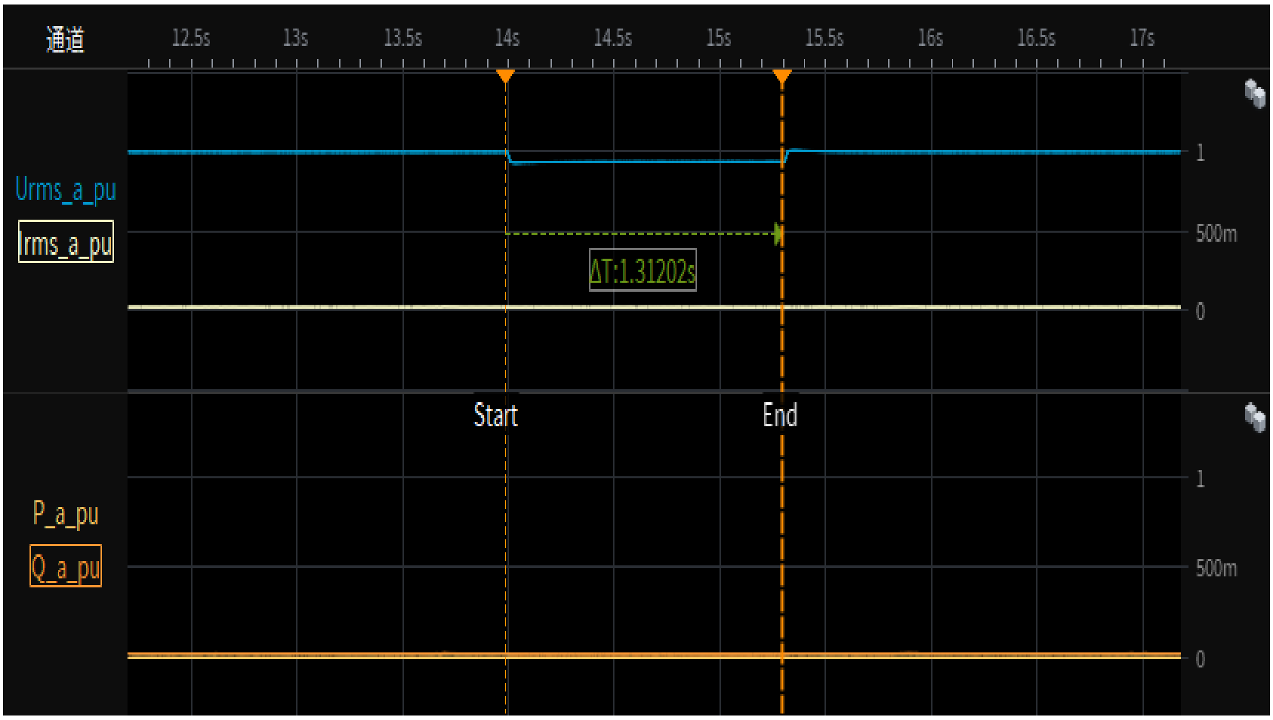


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

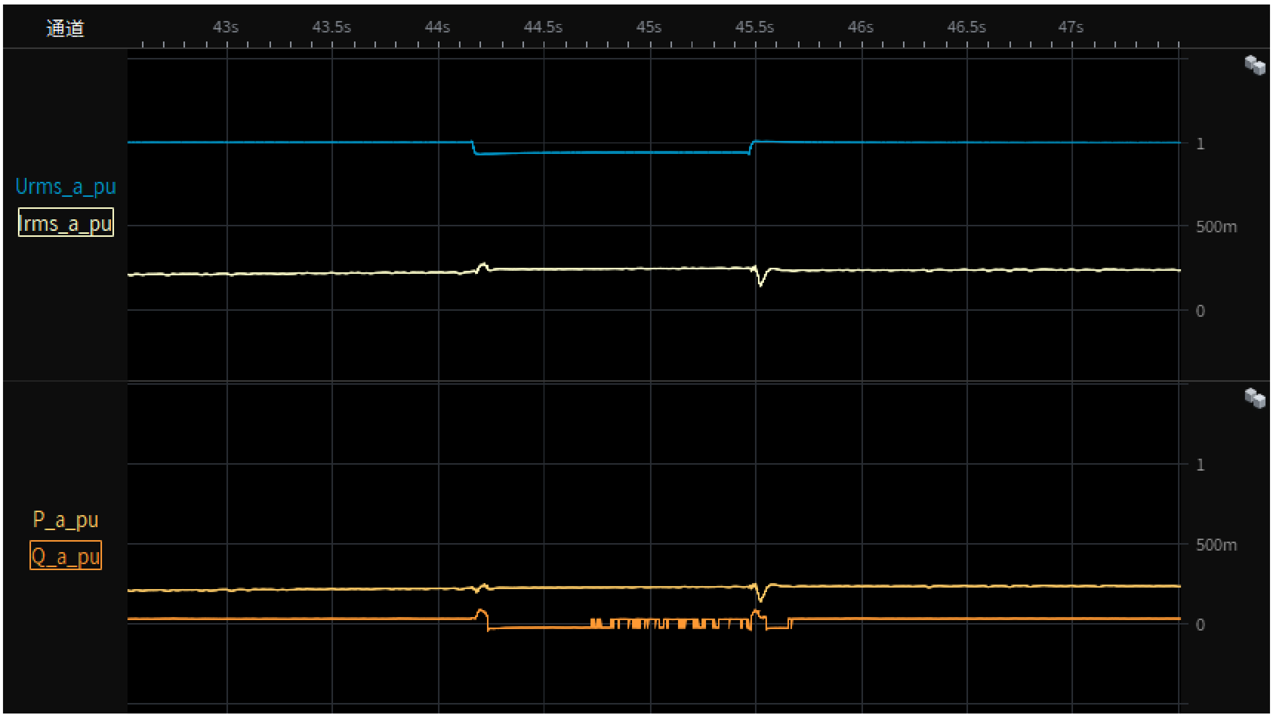


Test 4a-Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D), 0% load
Test overview(voltage,current,active and reactive power)

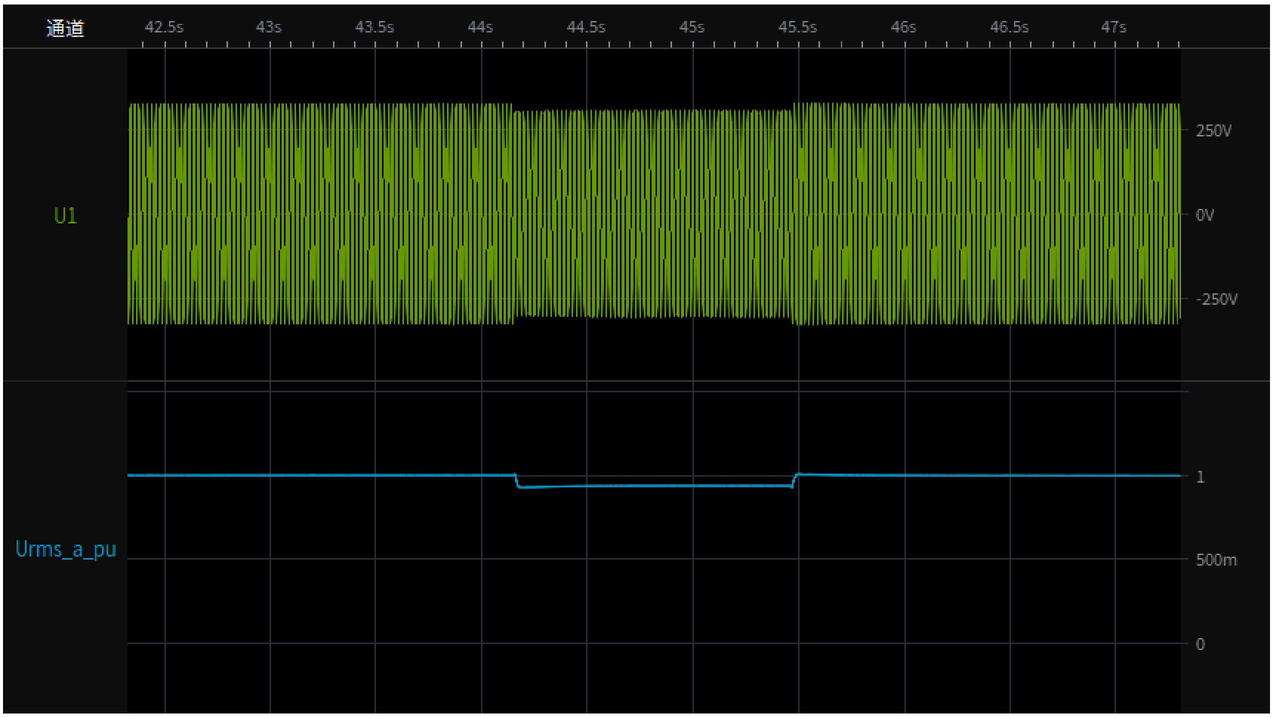


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

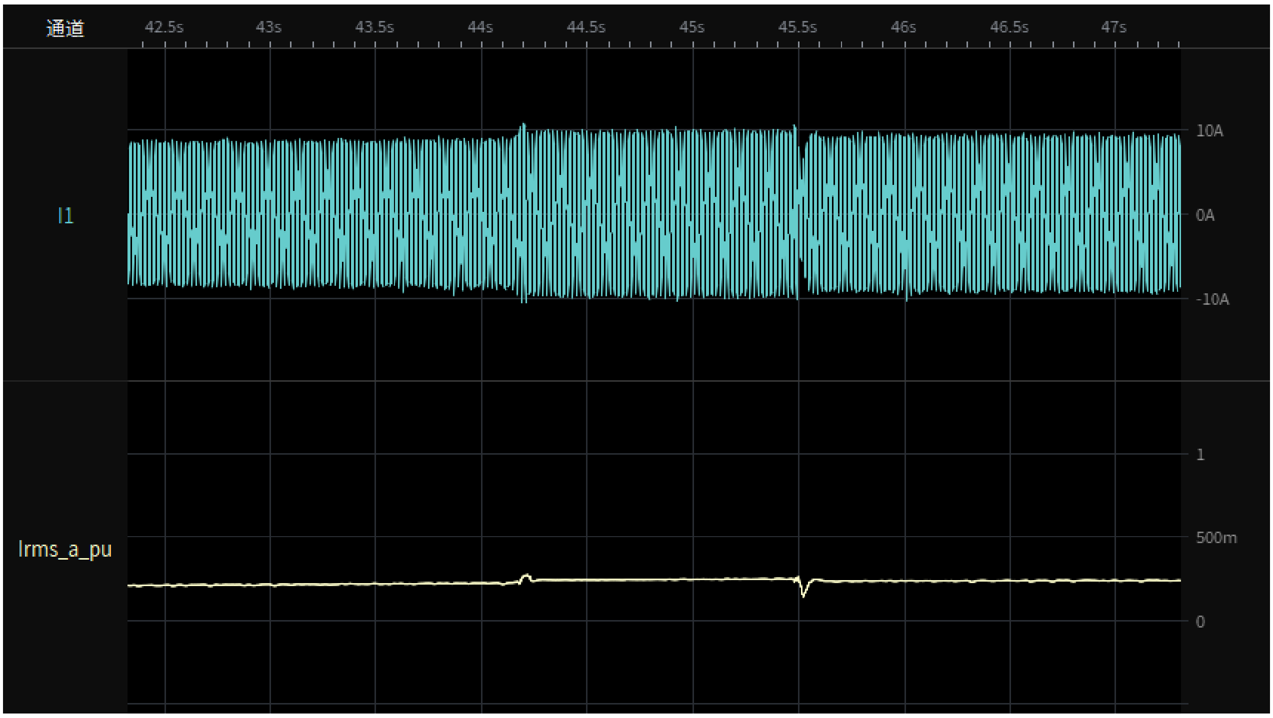


Test 4a-1.2 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

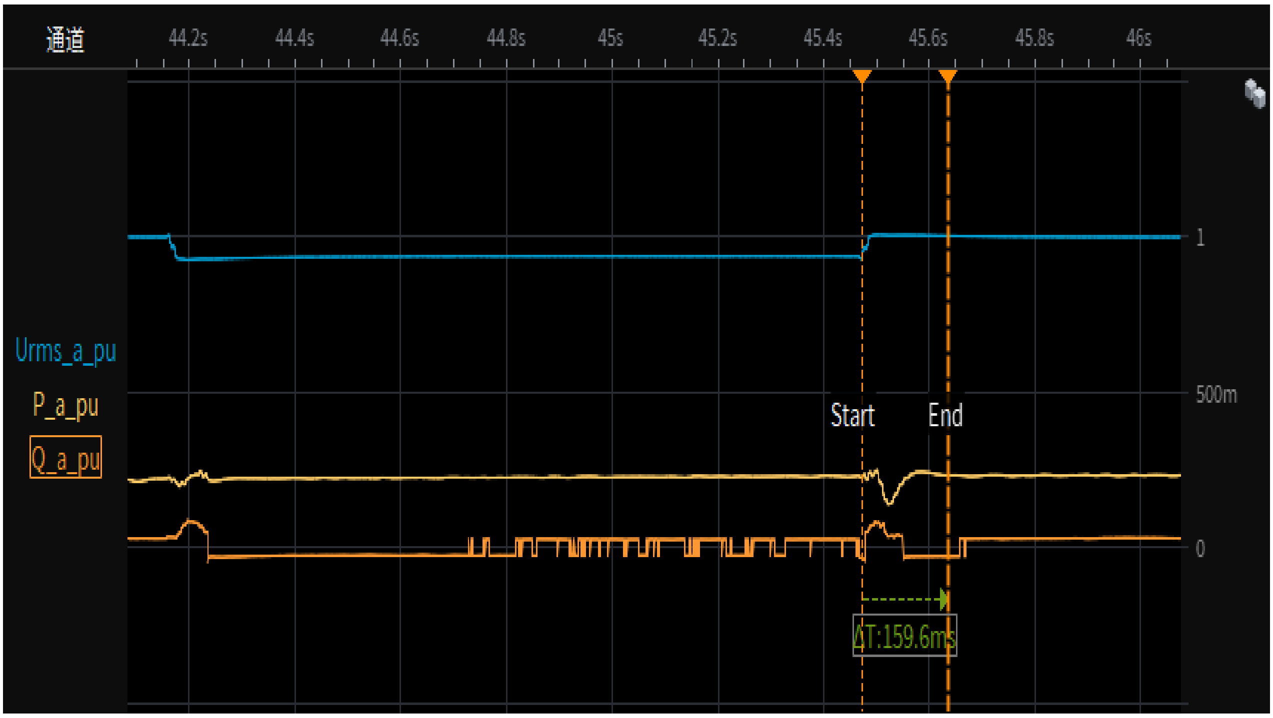


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

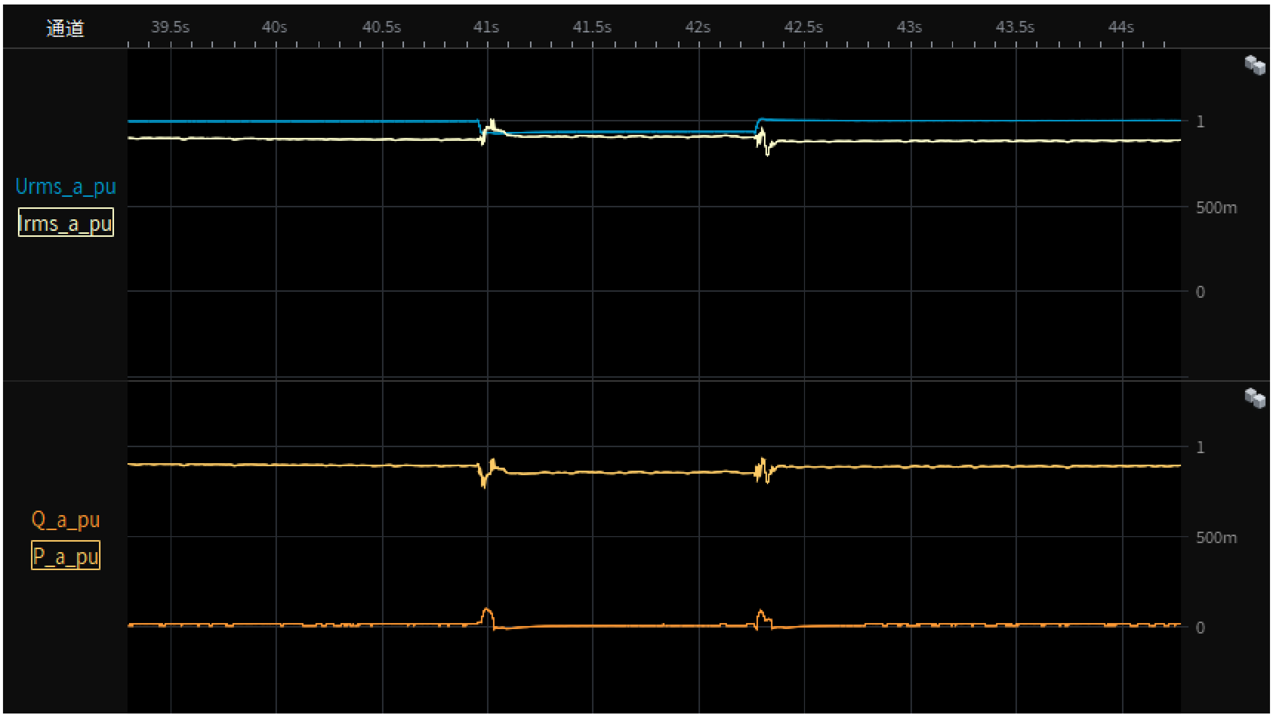


Test 4a-1.4 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),20% load
restoring time

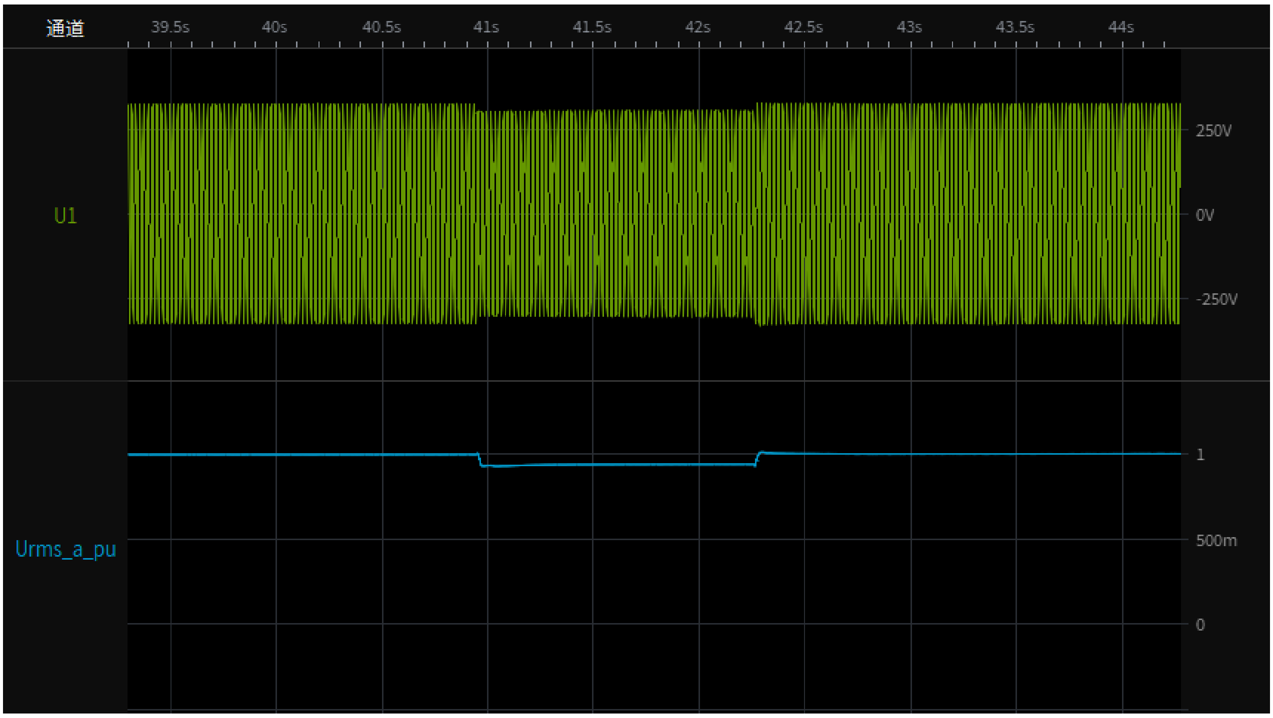


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

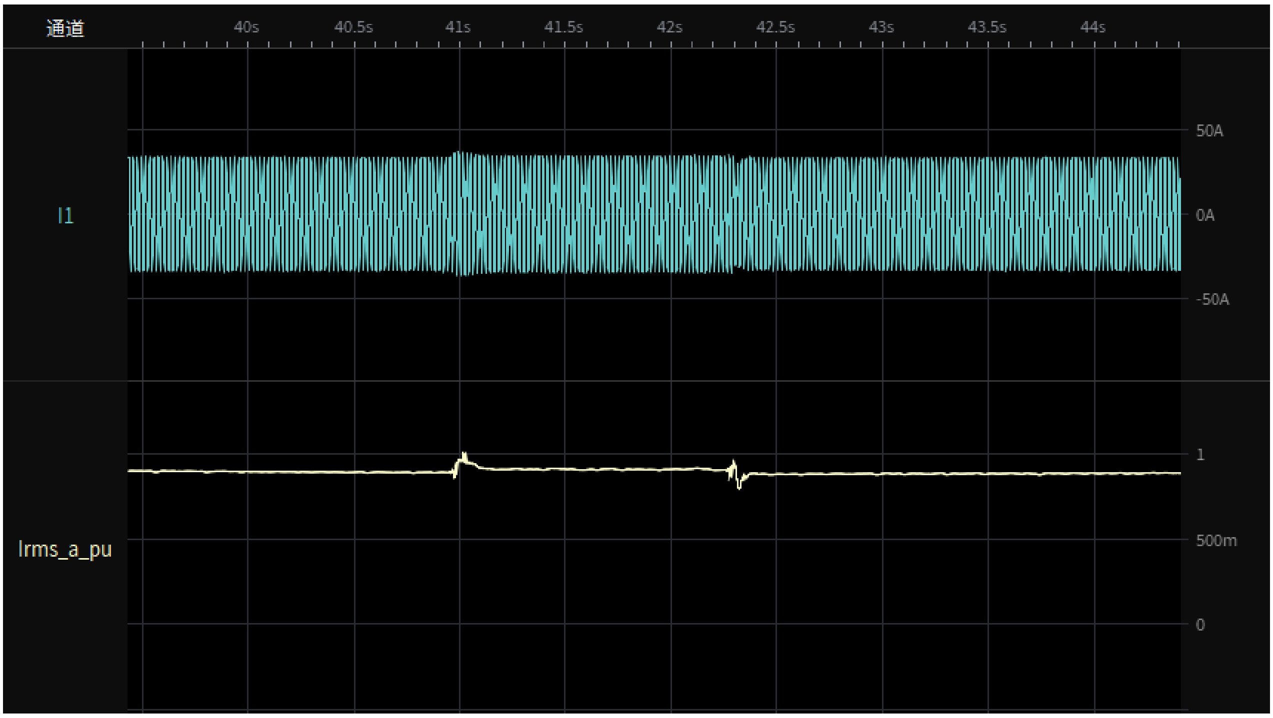
Test 4a-2.1 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),95% load
Test overview(voltage,current,active and reactive power)



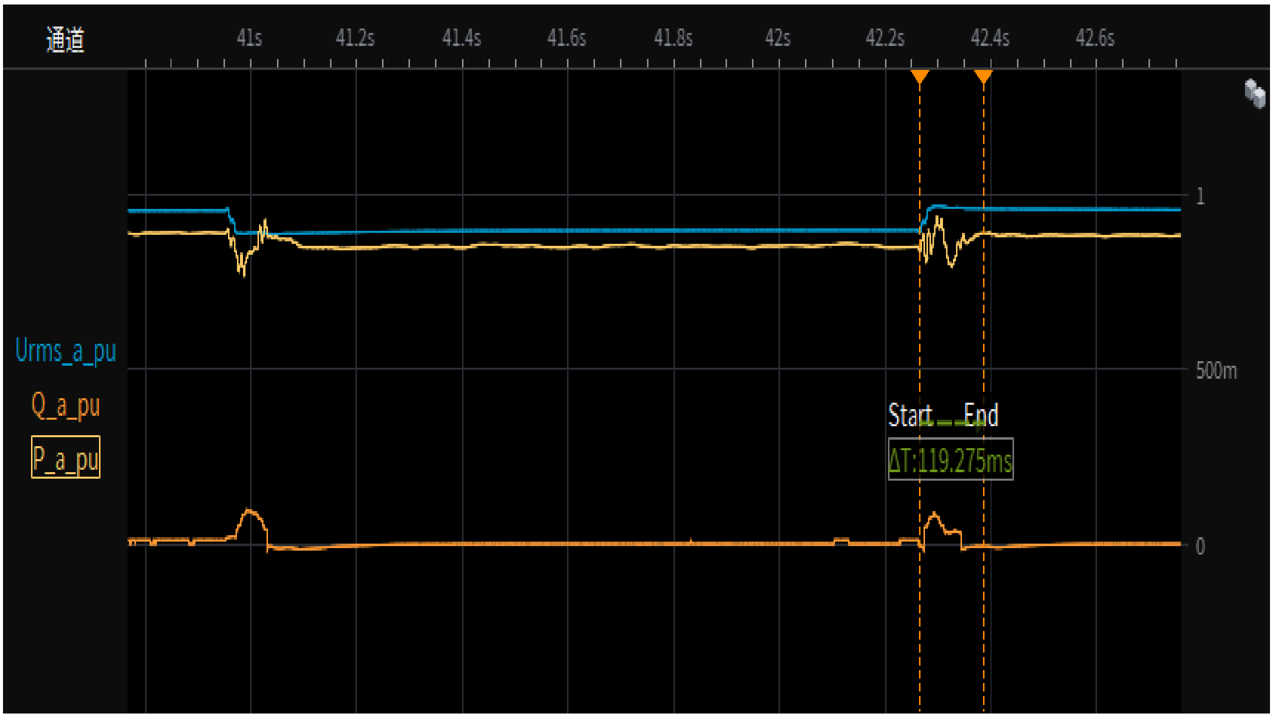
Test 4a-2.2 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages



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

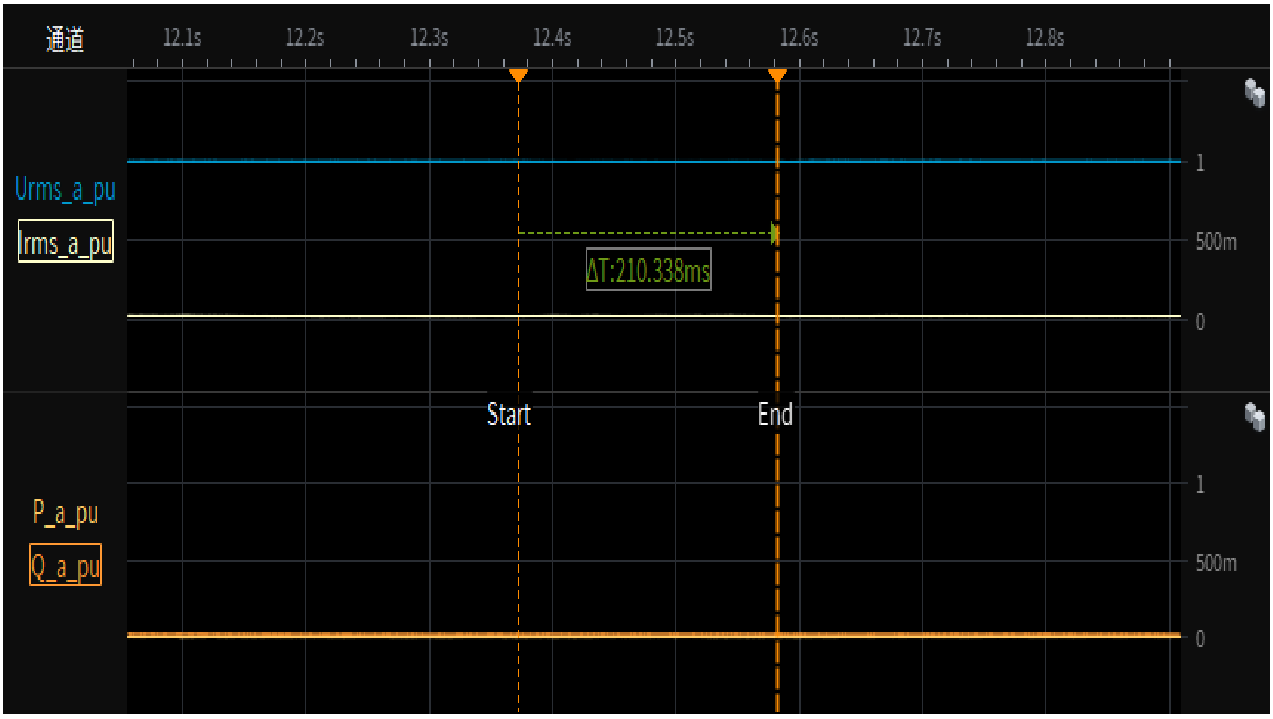


Test 4a-2.4 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D), 95% load
restoring time

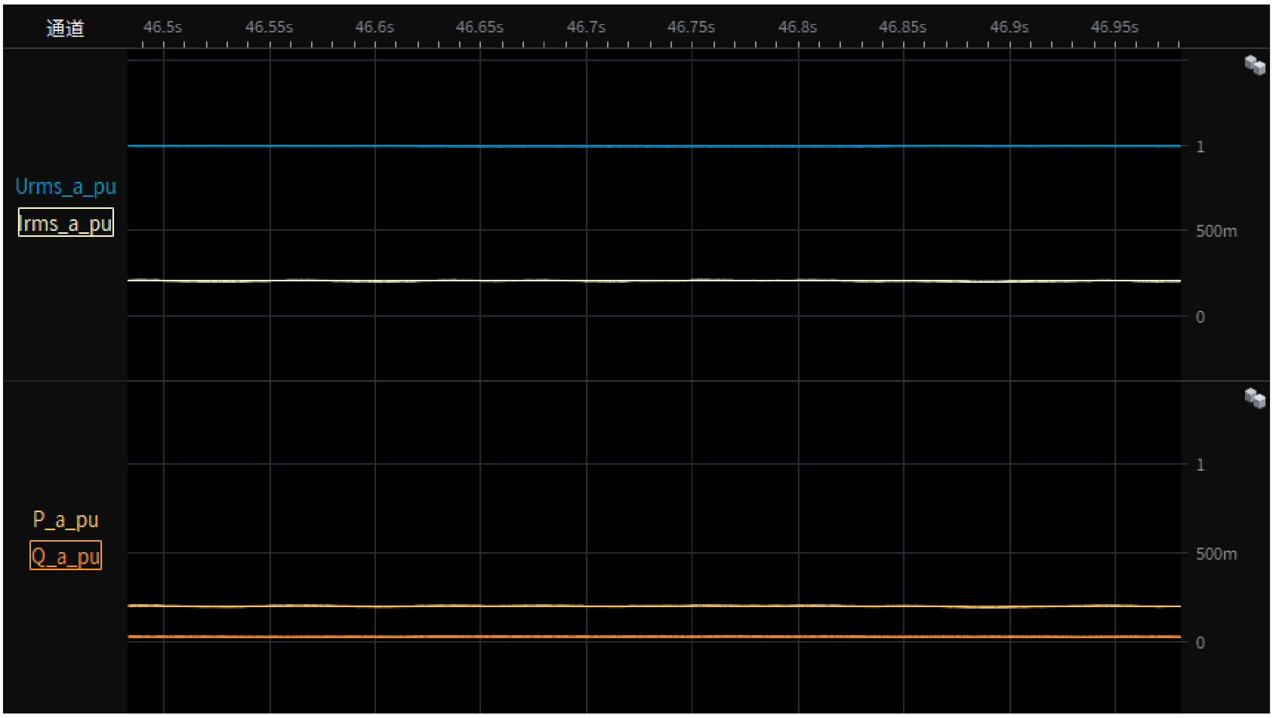


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

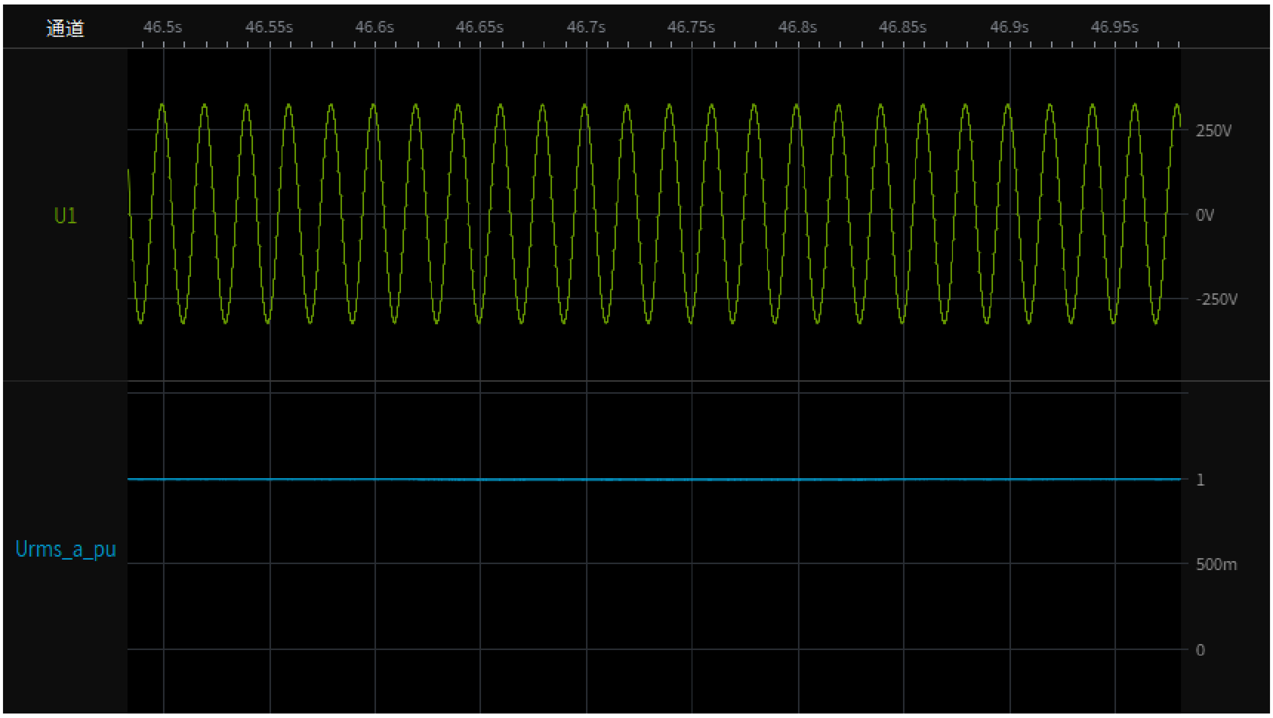


Test 5-1.1 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),20% load
Test overview(voltage,current,active and reactive power)

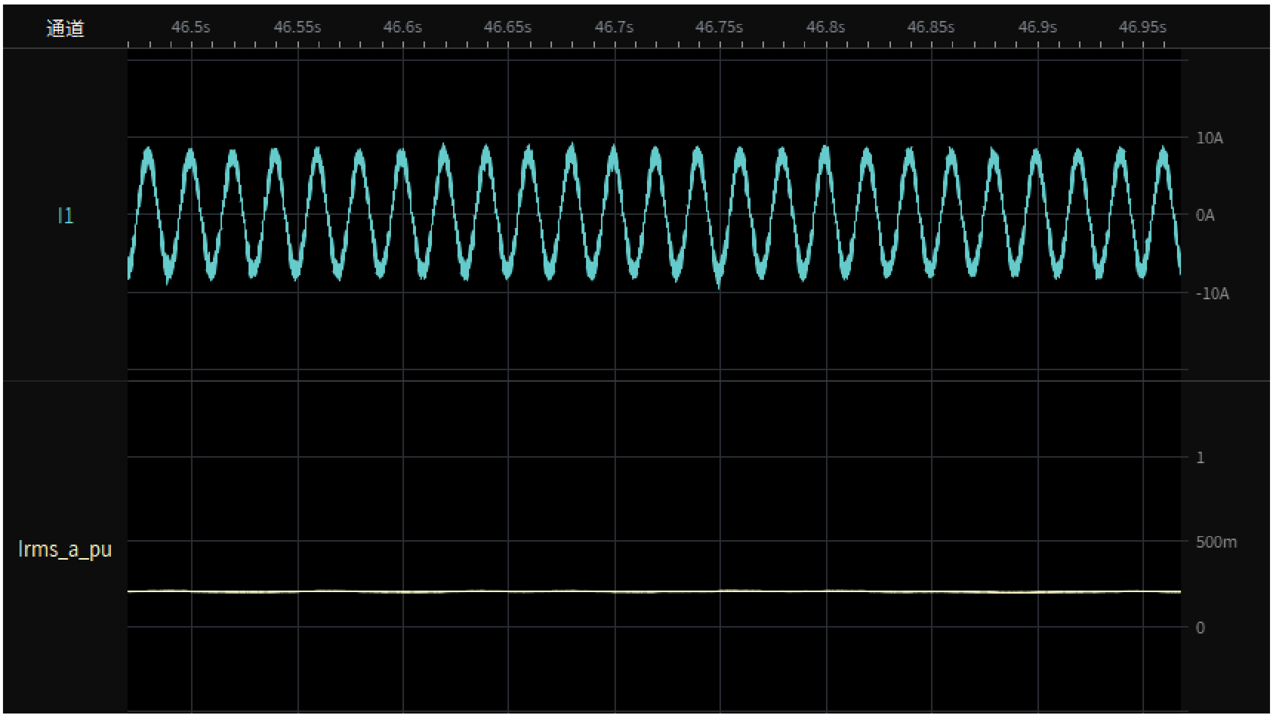


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

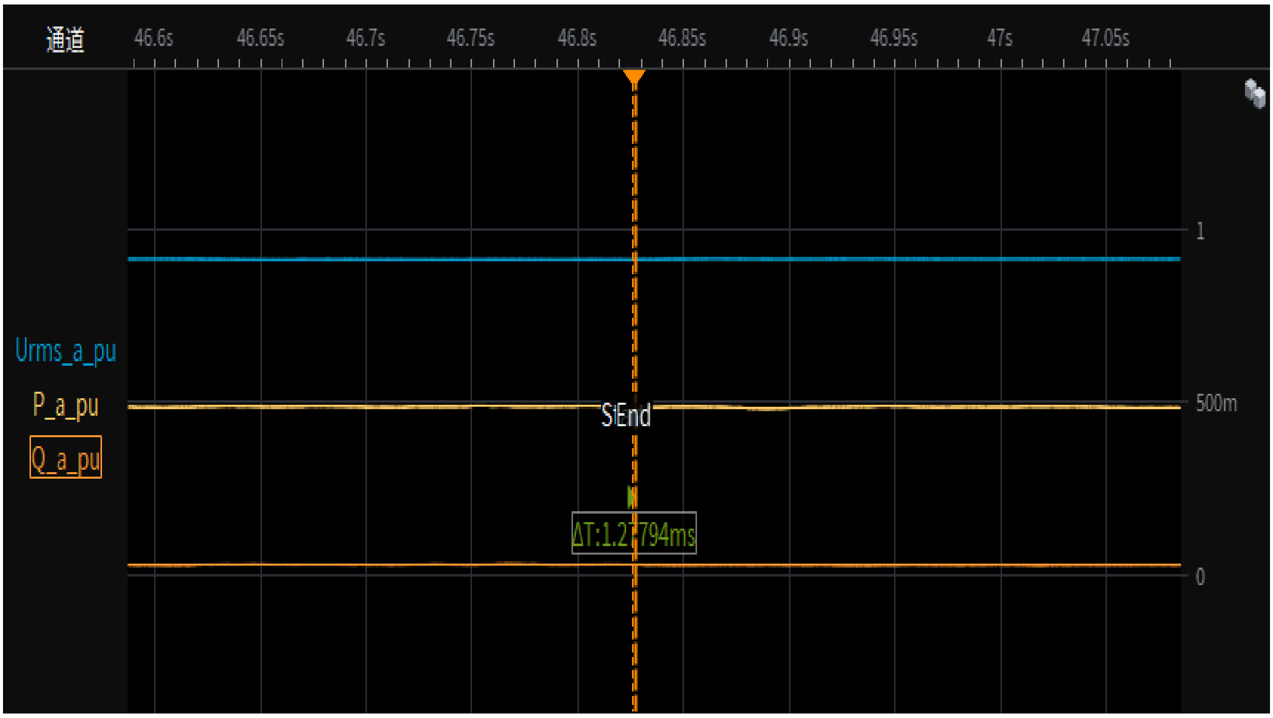


Test 5-1.3 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase currents

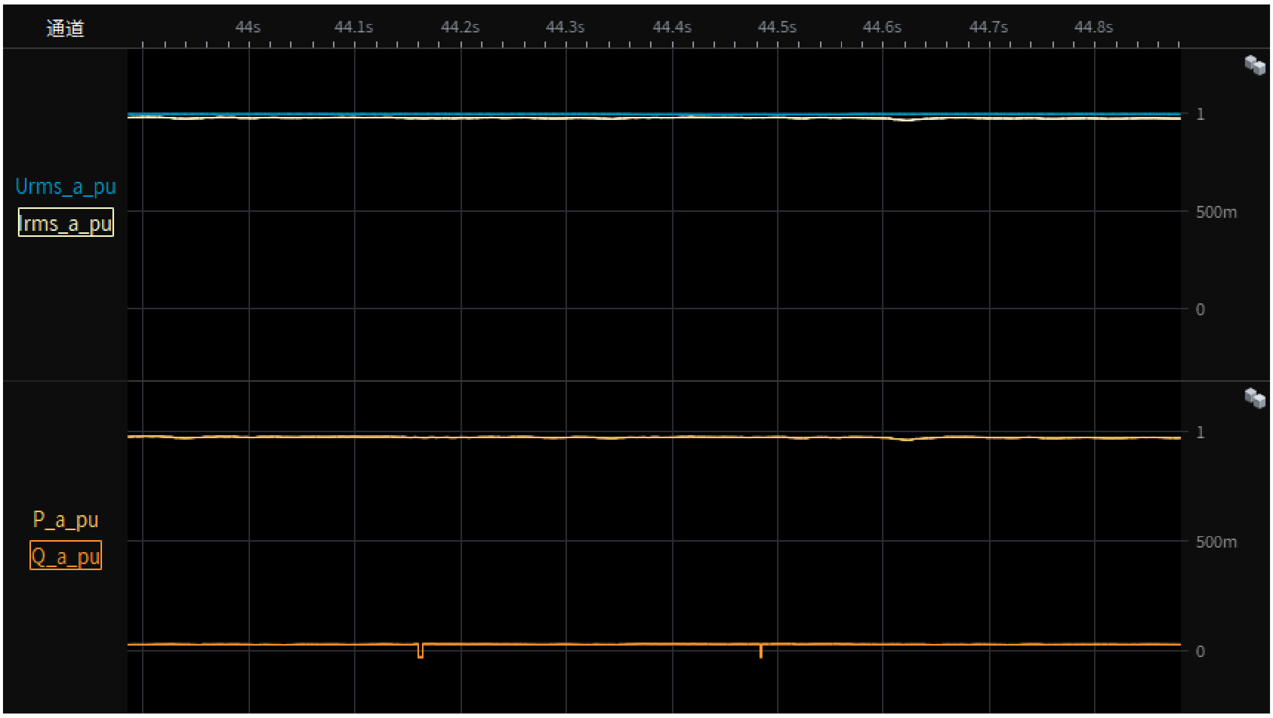


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

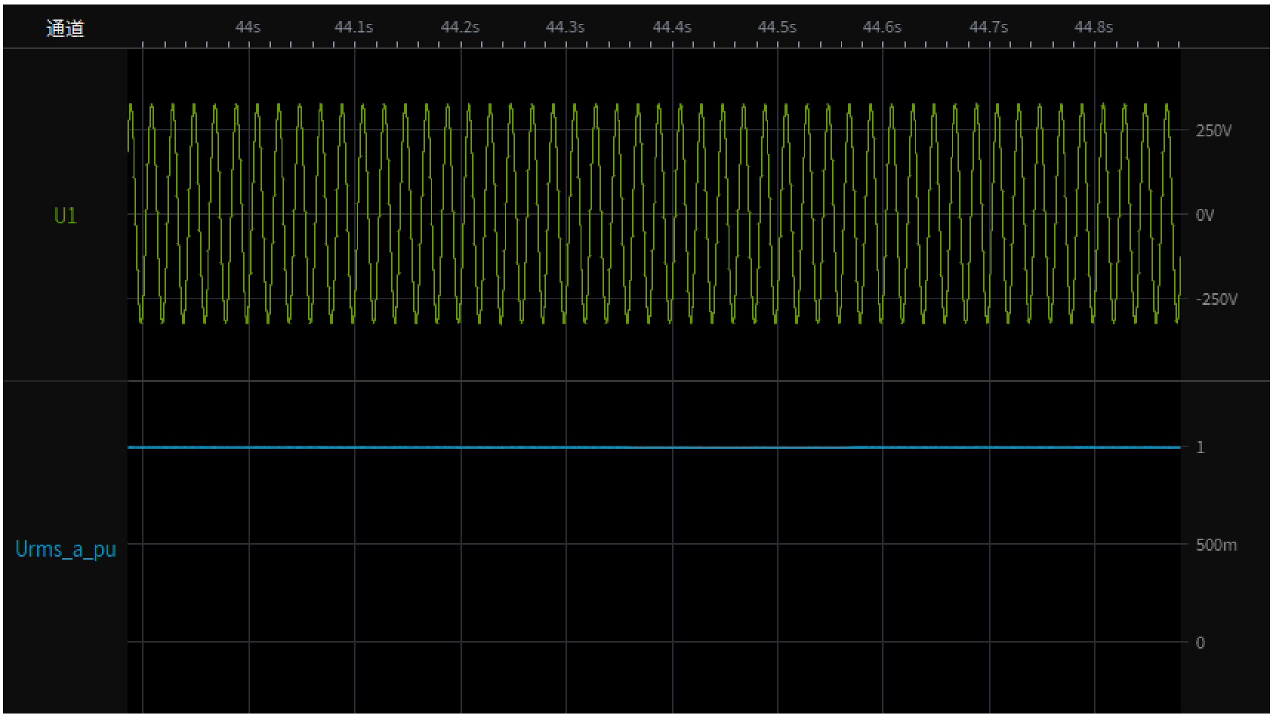


Test 5-2.1 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),95% load Test overview(voltage,current,active and reactive power)

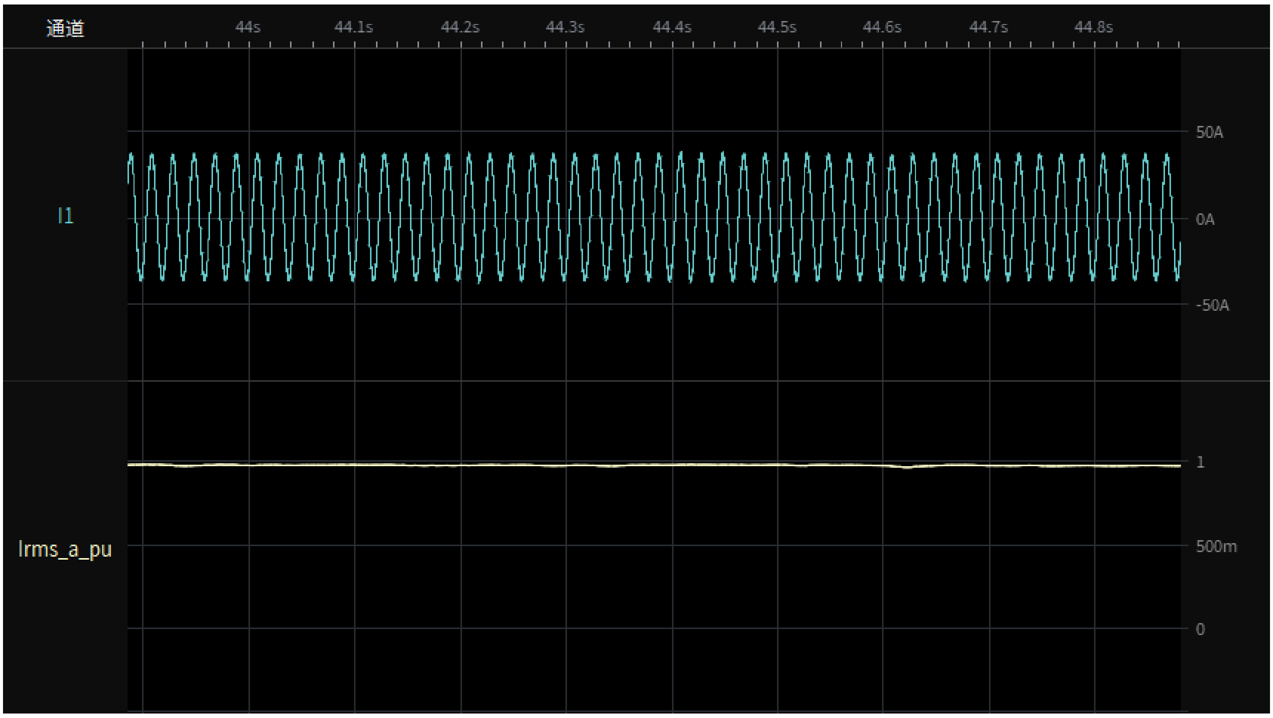


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

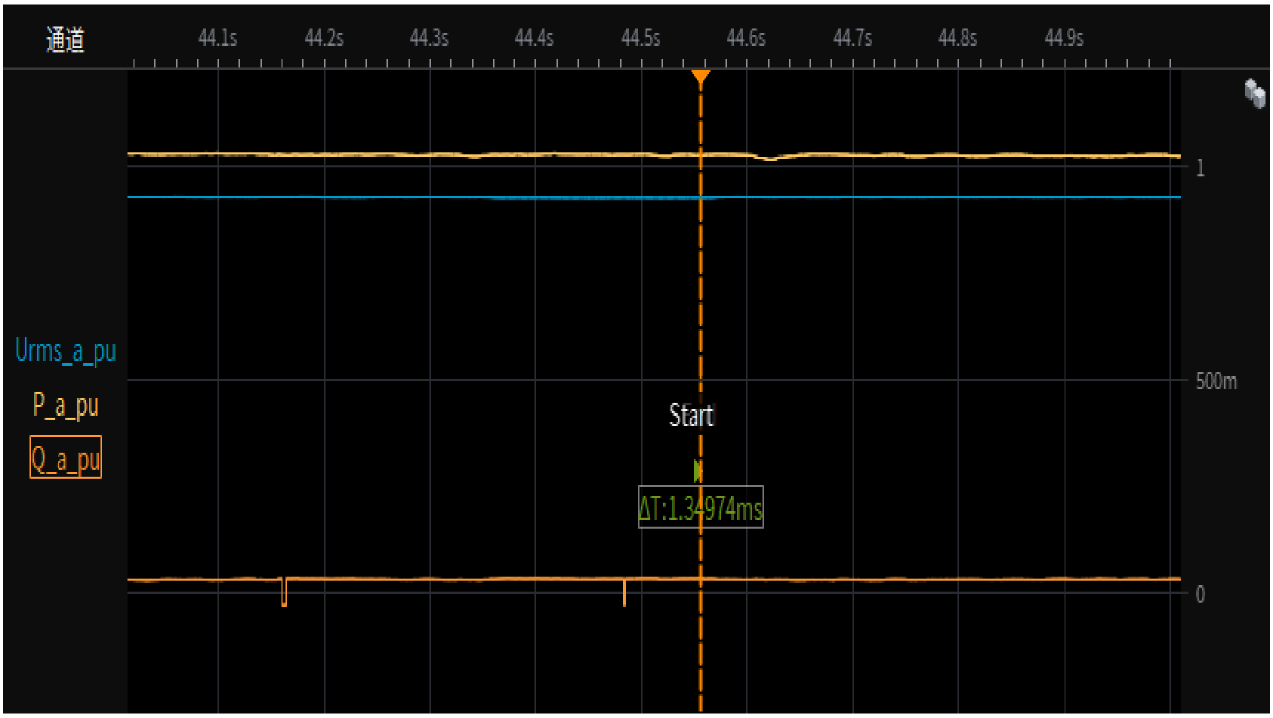


Test 5-2.3 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase currents

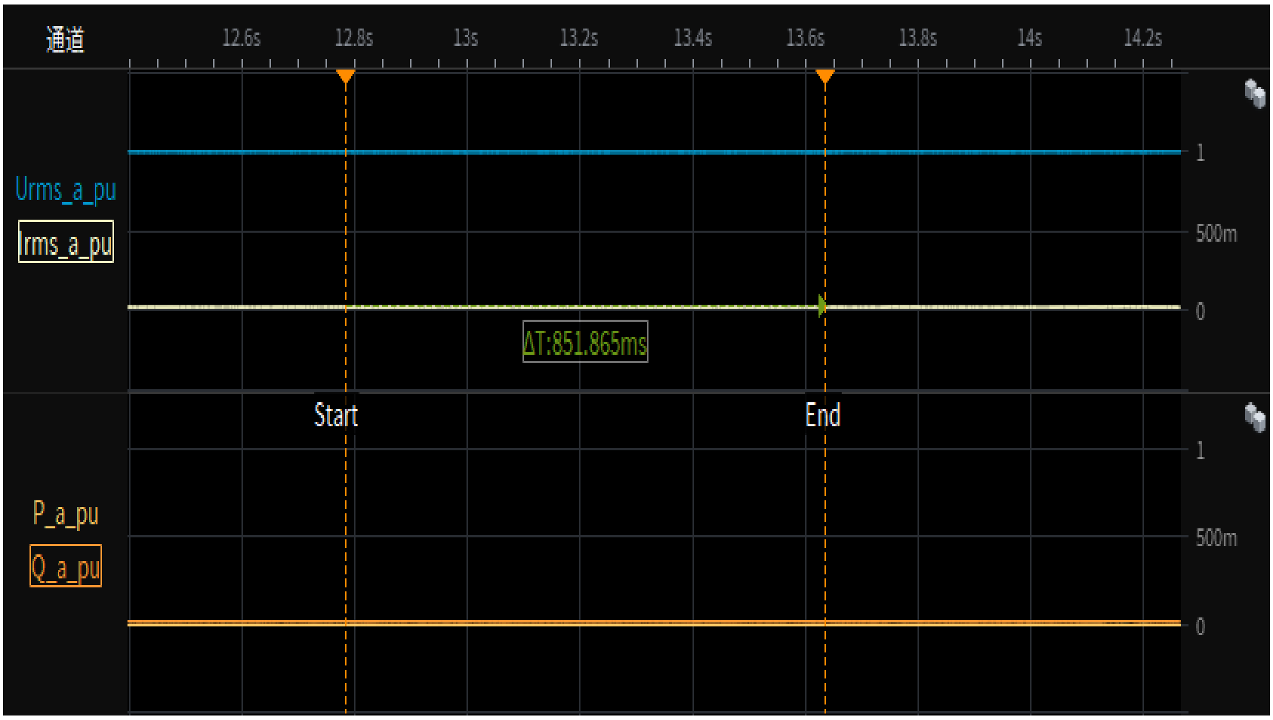


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

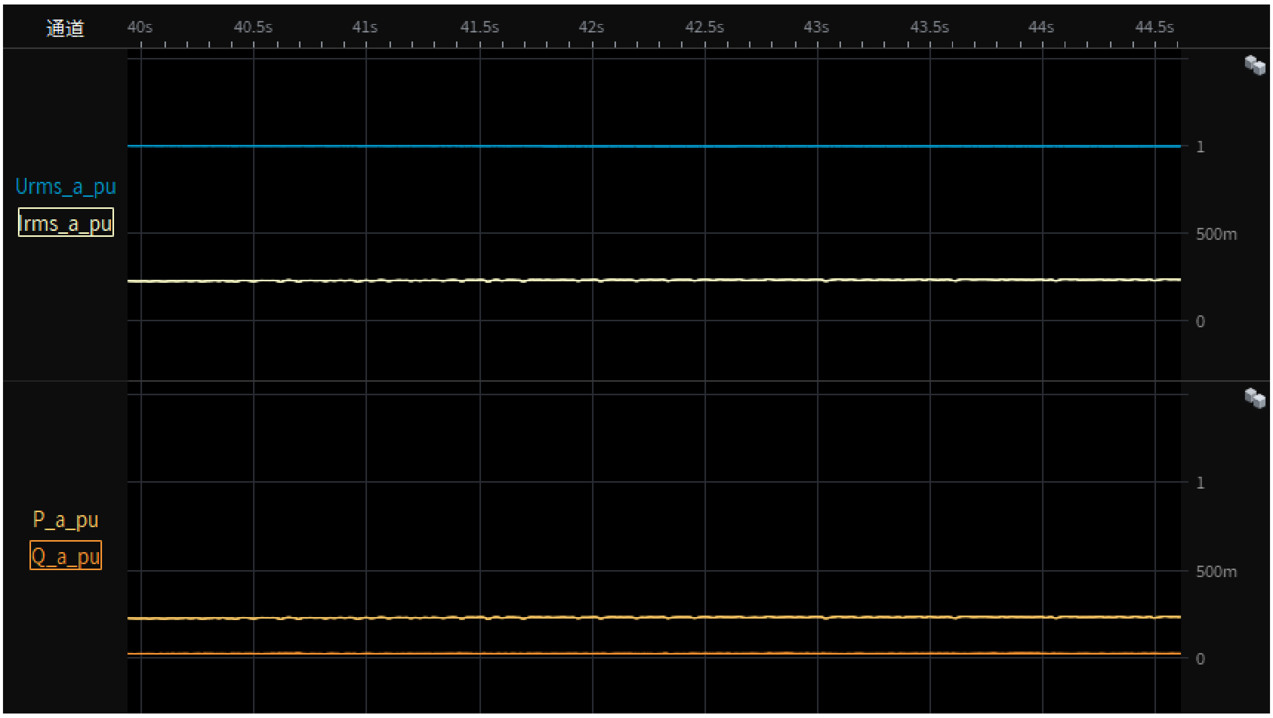


Test 6-Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D), 0% load Test overview(voltage,current,active and reactive power)

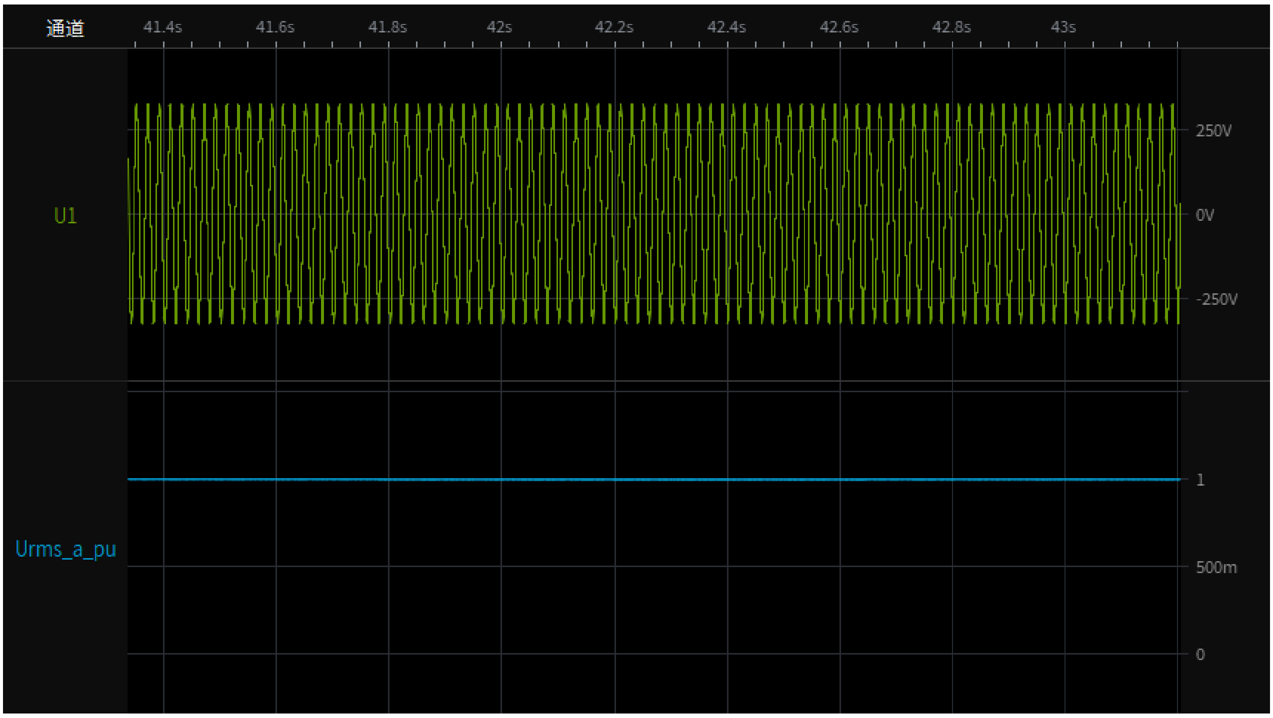


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

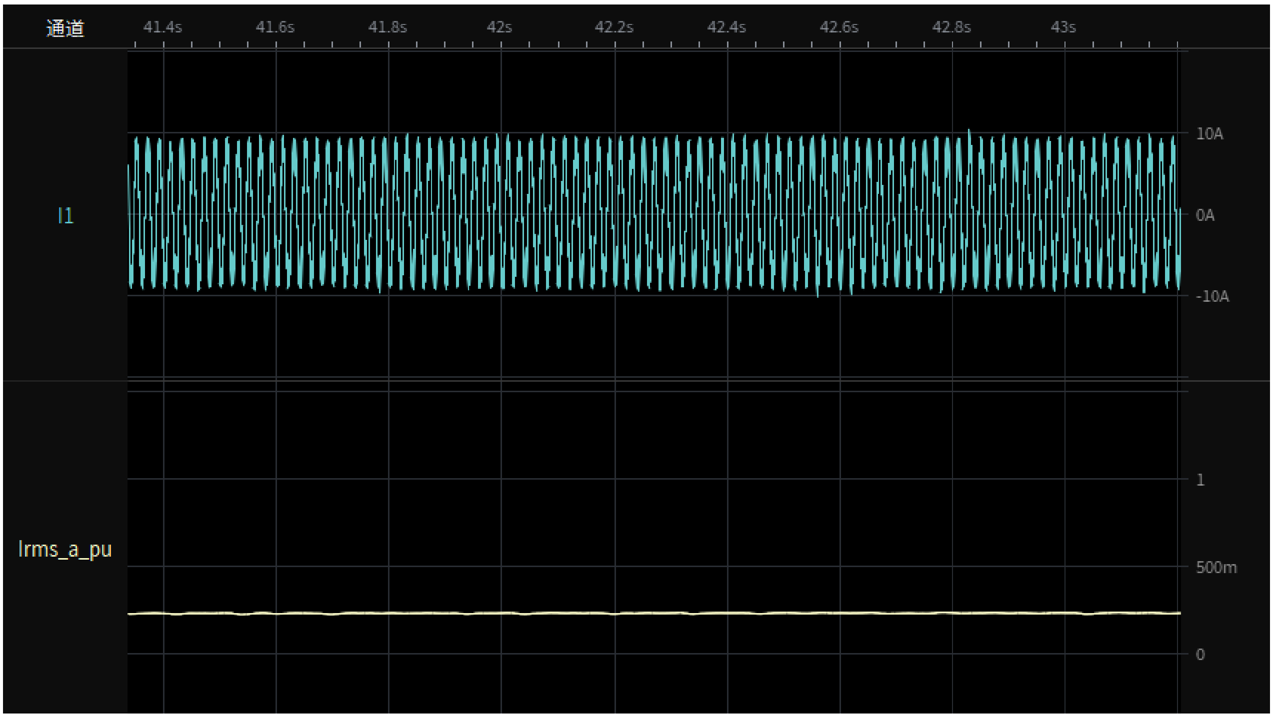


Test 6-1.2 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

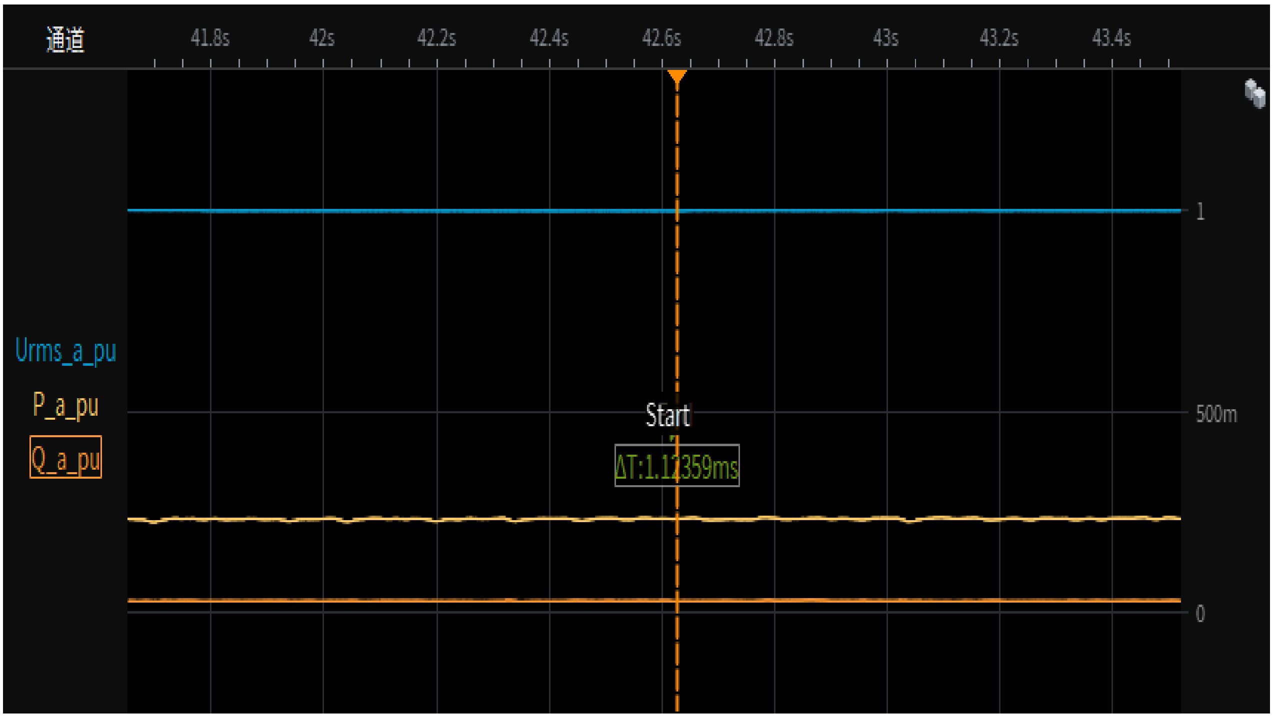


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

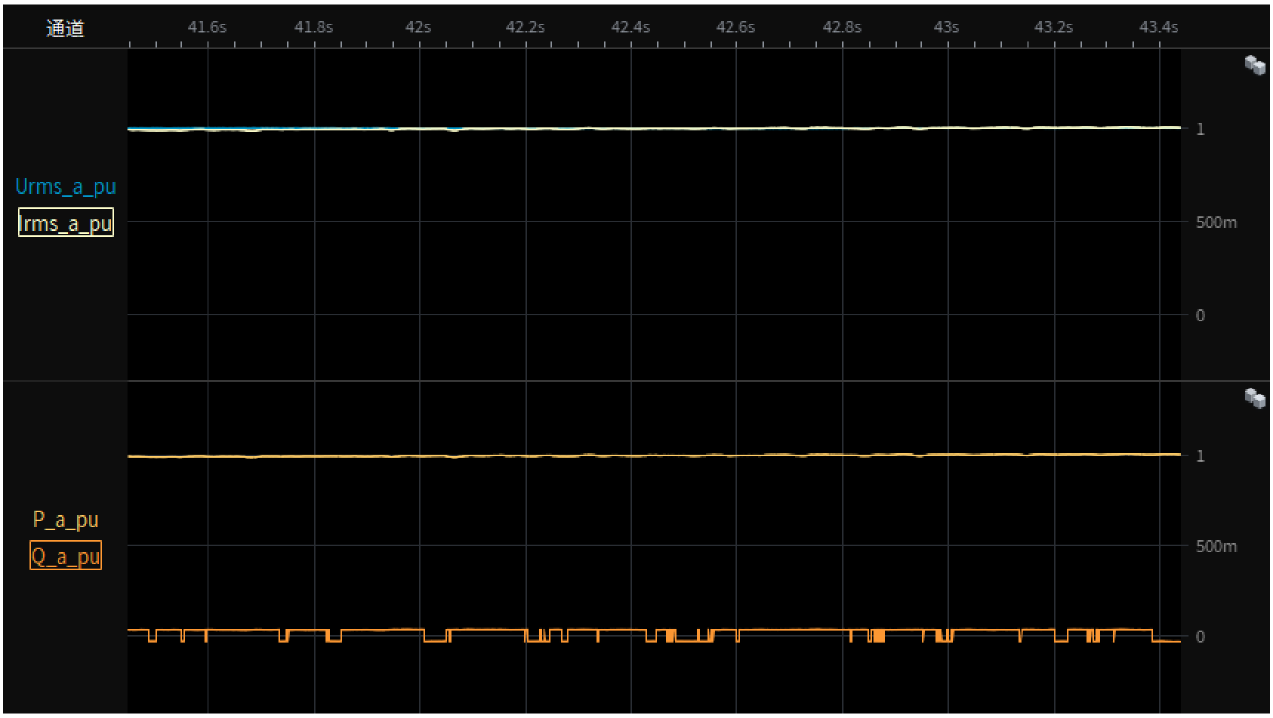


Test 6-1.4 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),20% load
restoring time

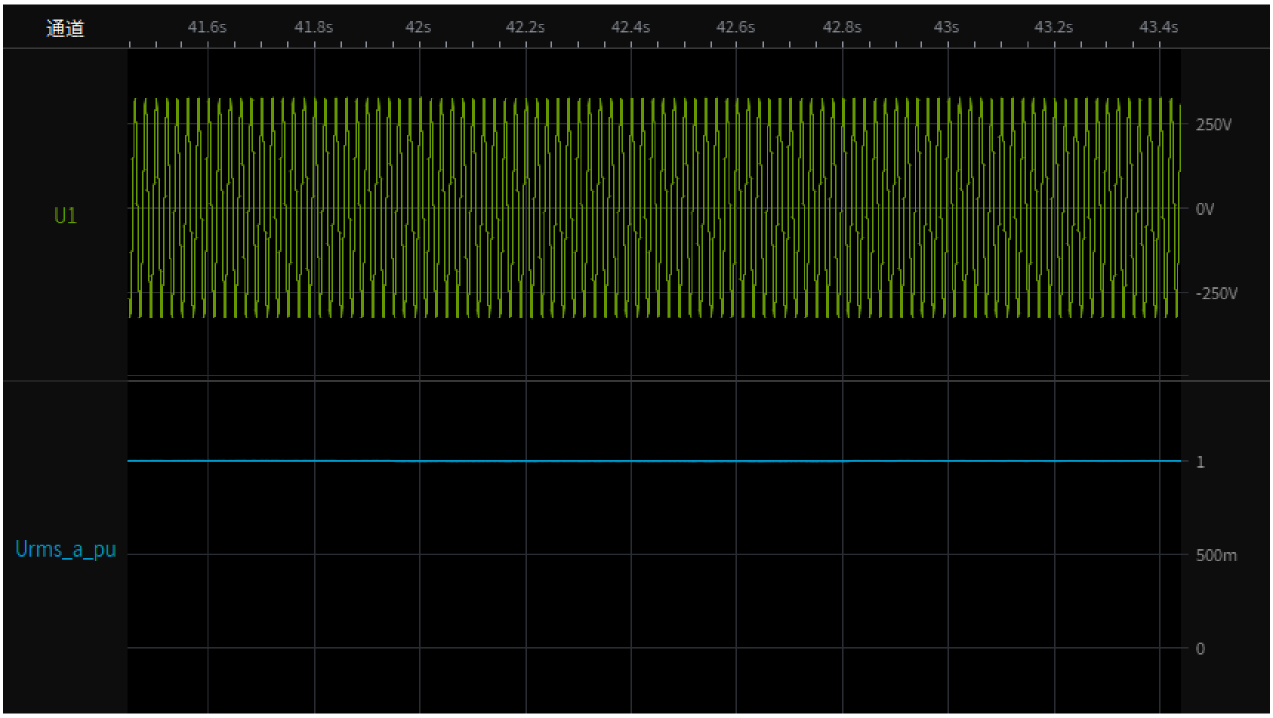


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

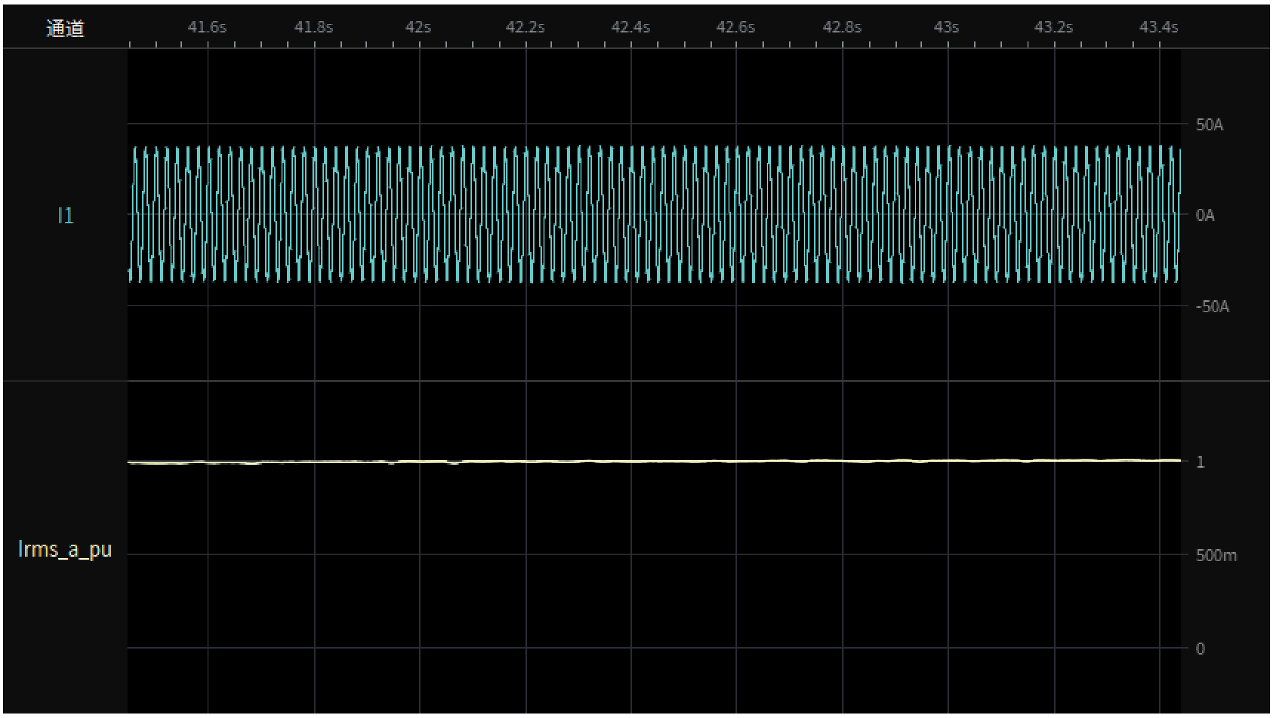


Test 6-2.2 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

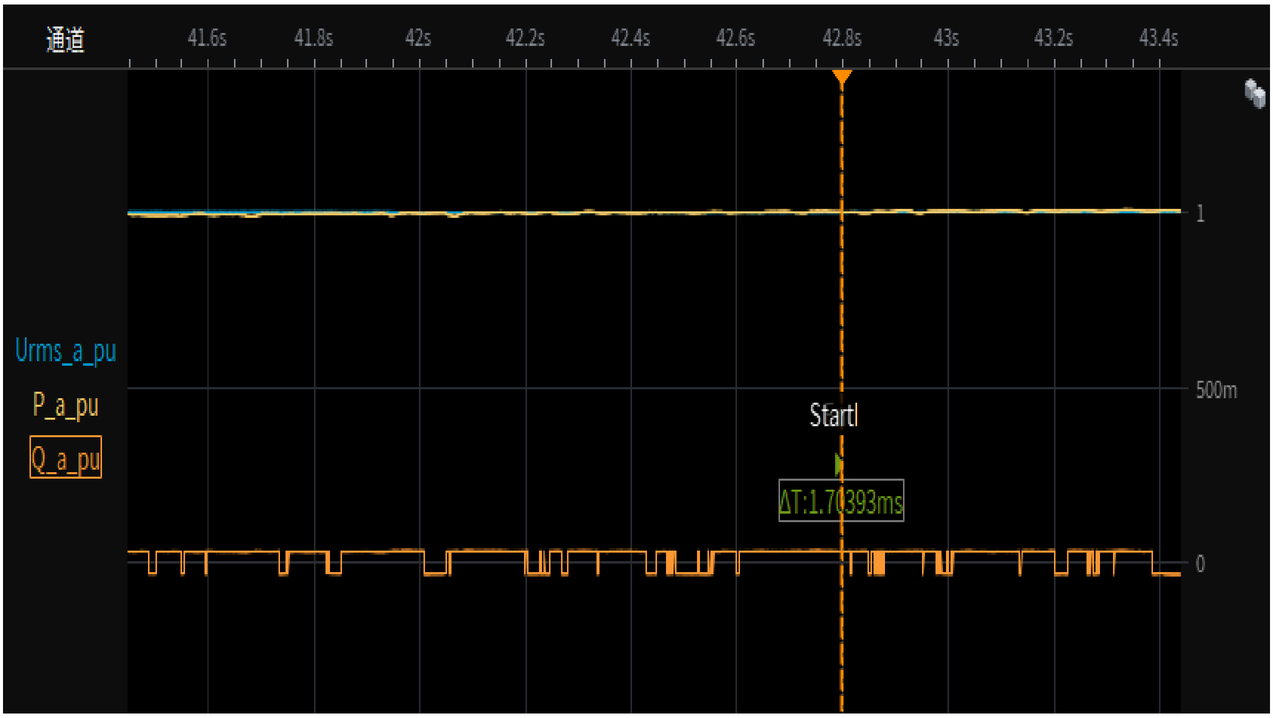


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

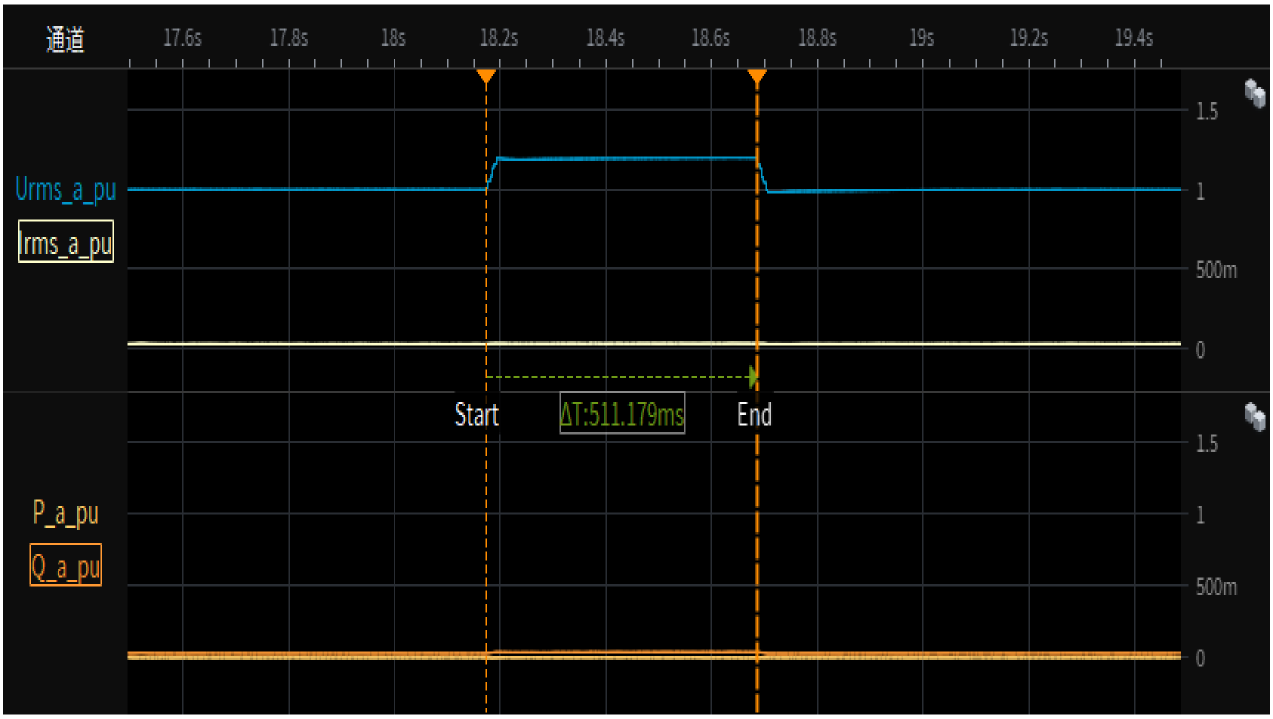


Test 6-2.4 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D), 95% load
restoring time

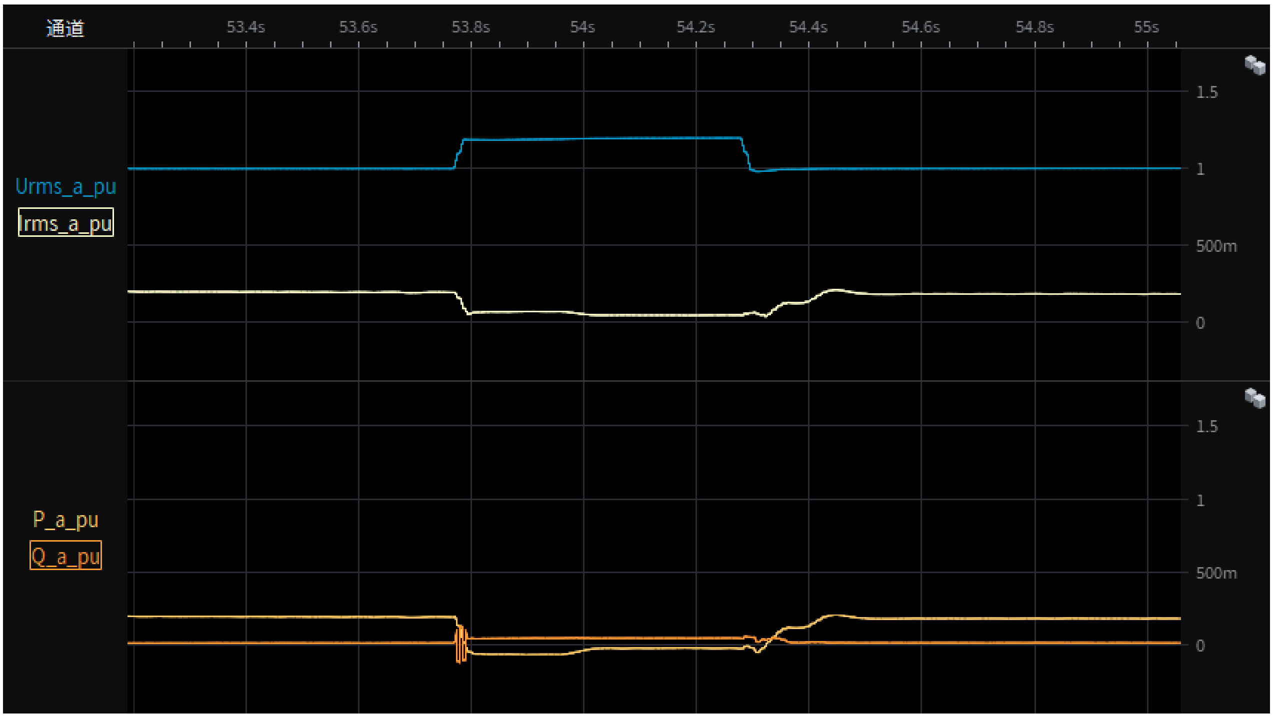


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

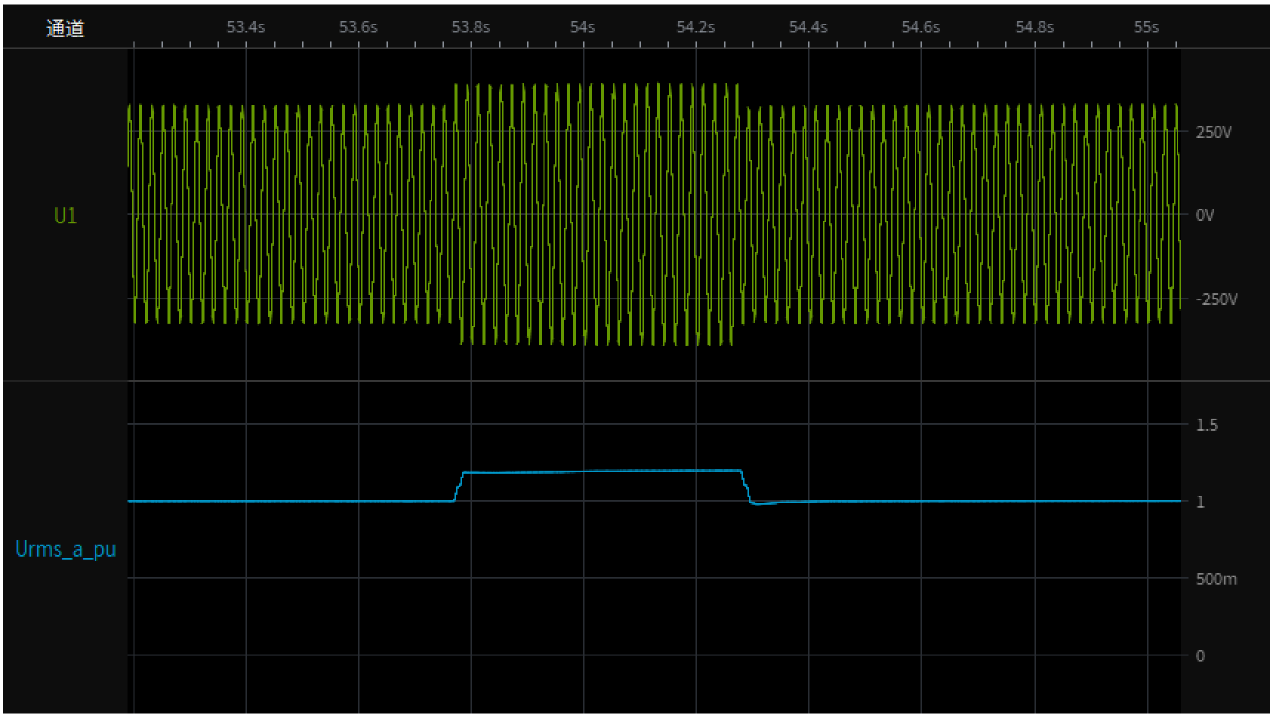


Test 7-1.1 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)

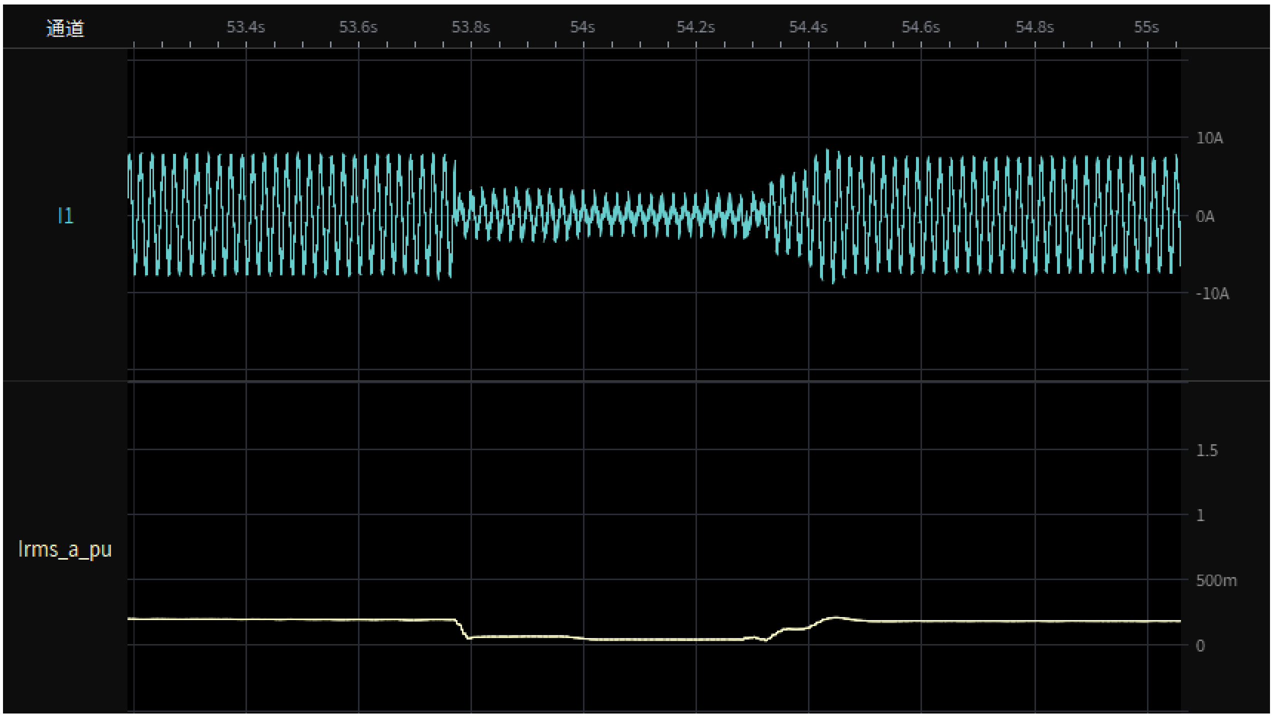


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

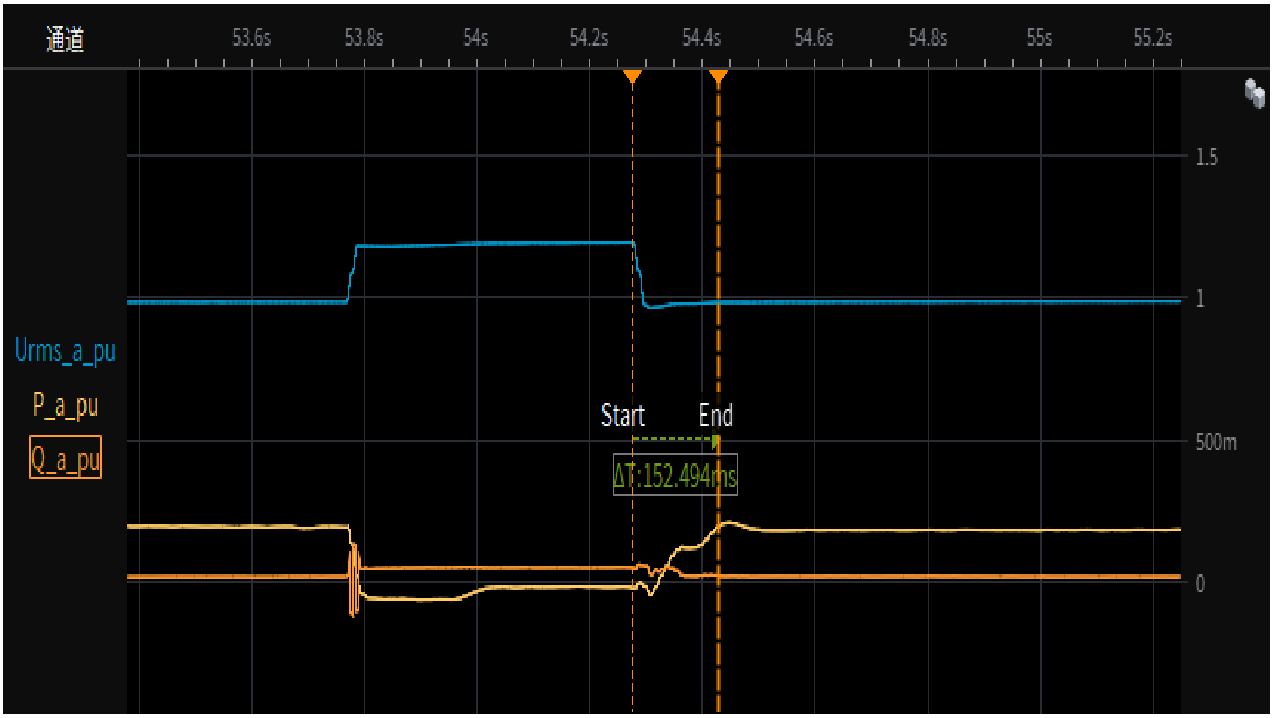


Test 7-1.3 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents

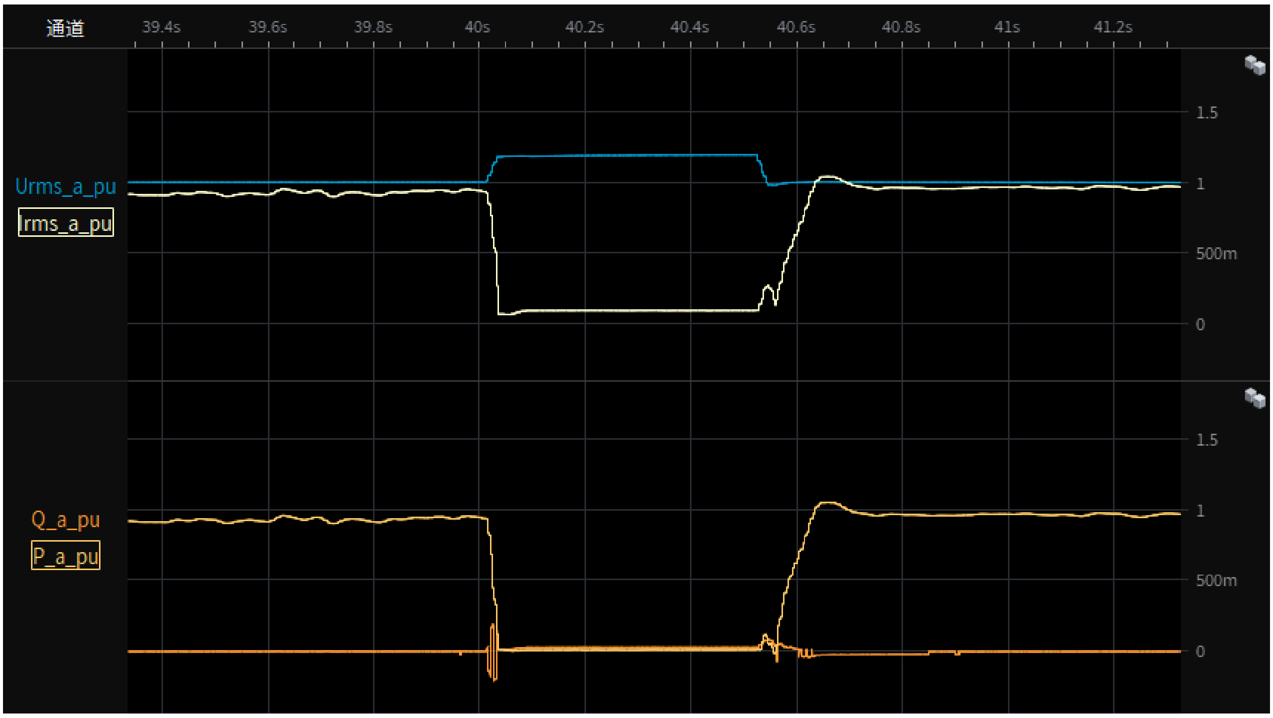


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

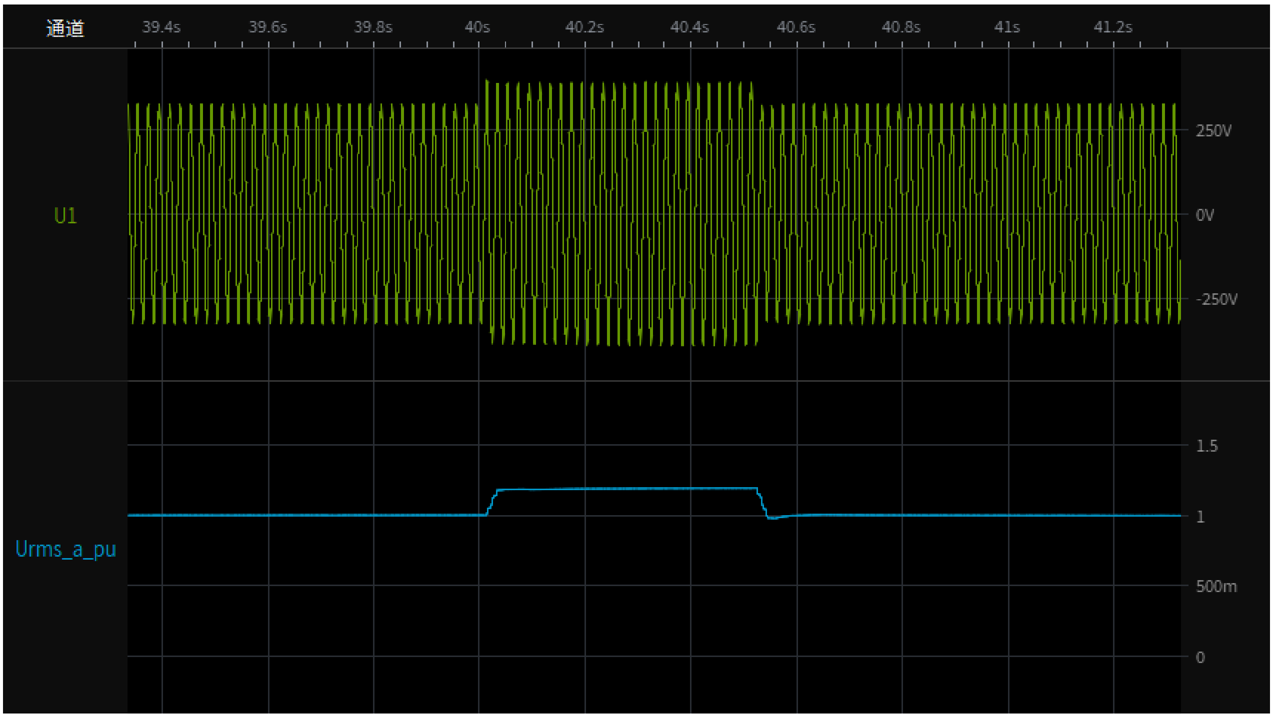


Test 7-2.1 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),95% load Test overview(voltage,current,active and reactive power)

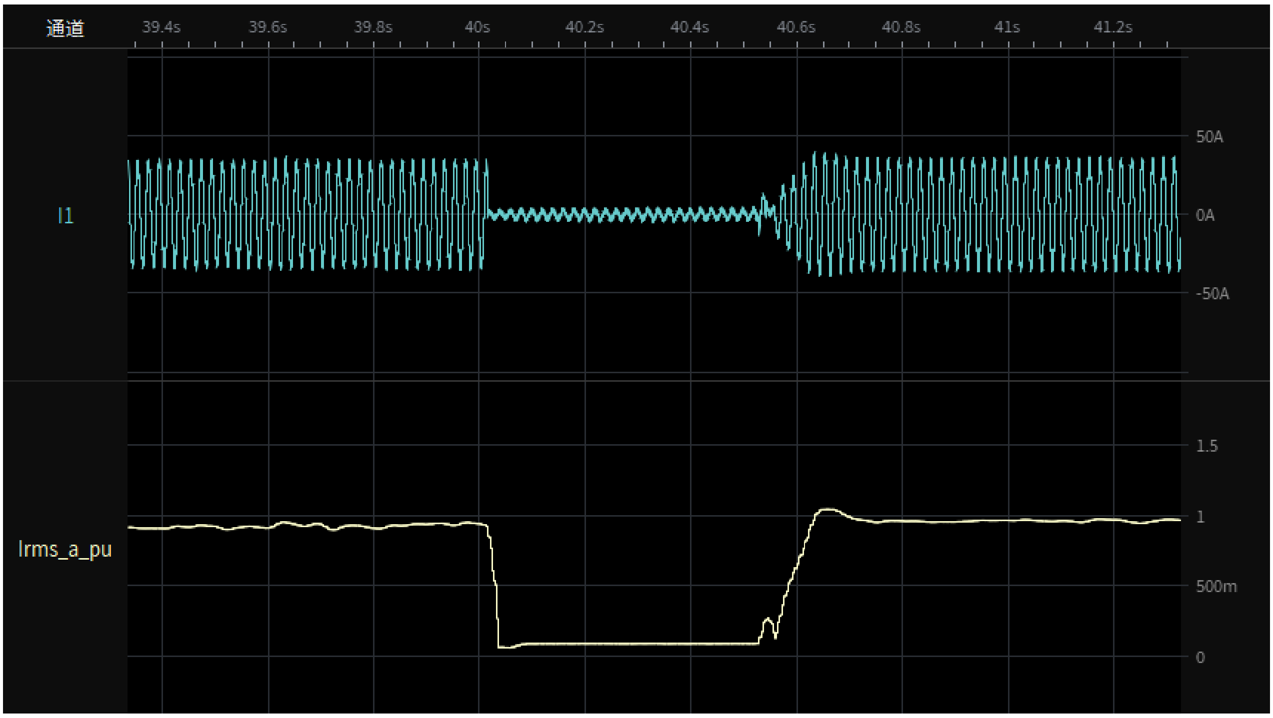


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

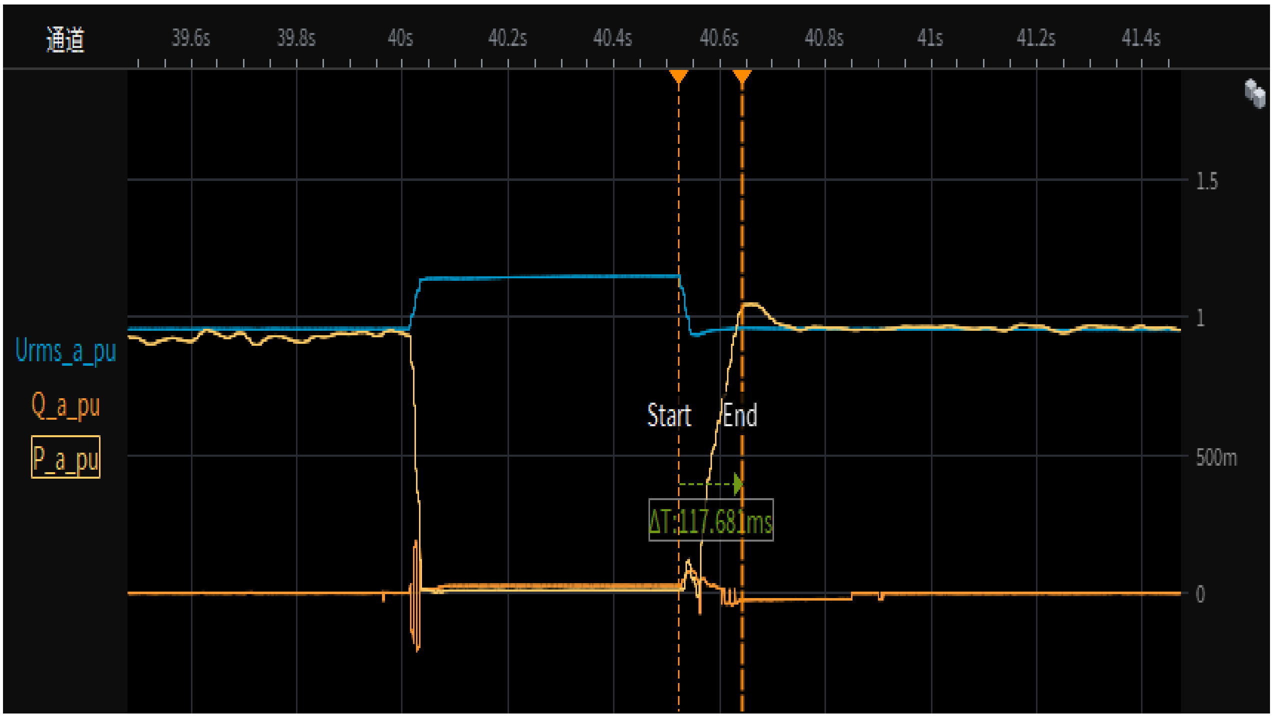


Test 7-2.3 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents

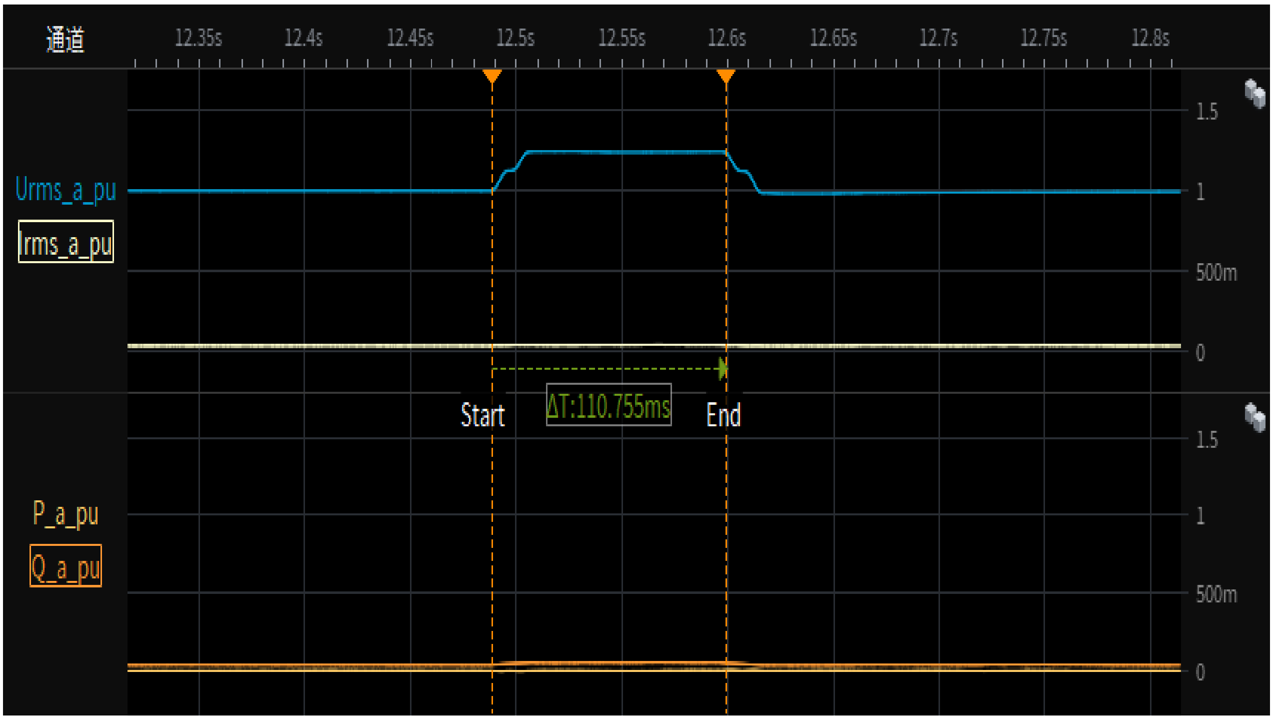


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

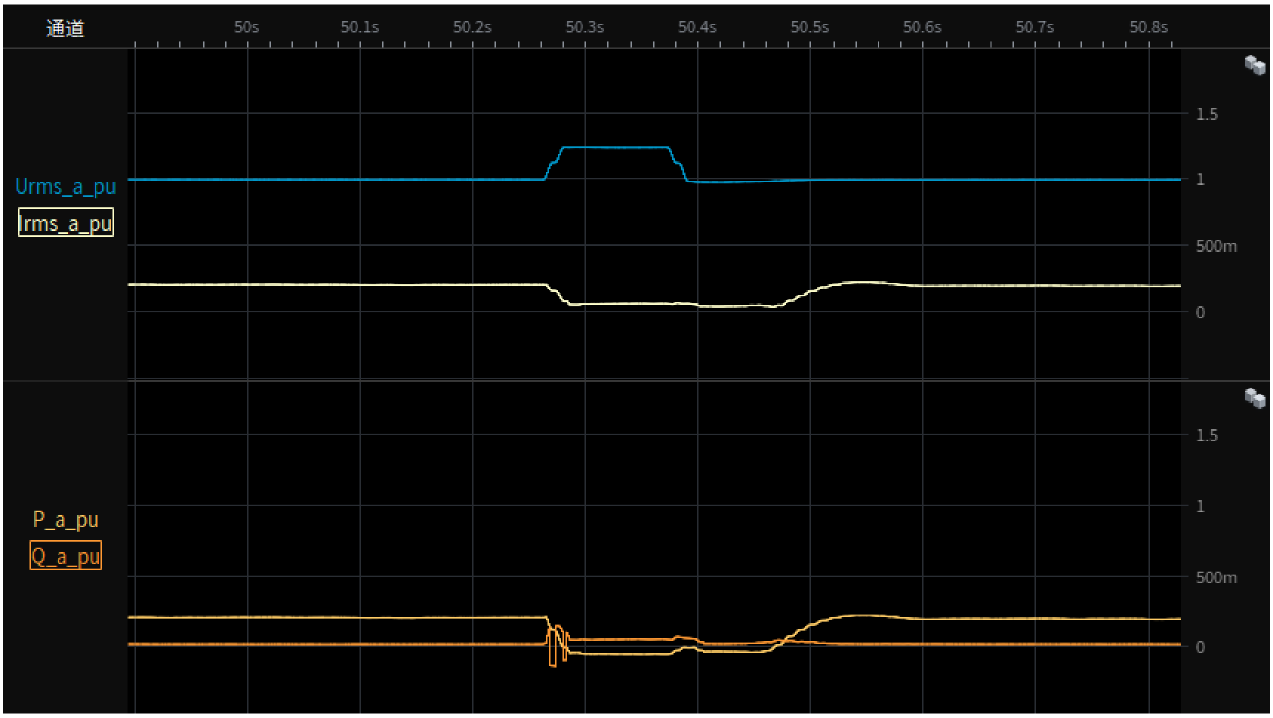


Test 8-Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A), 0% load
Test overview(voltage,current,active and reactive power)

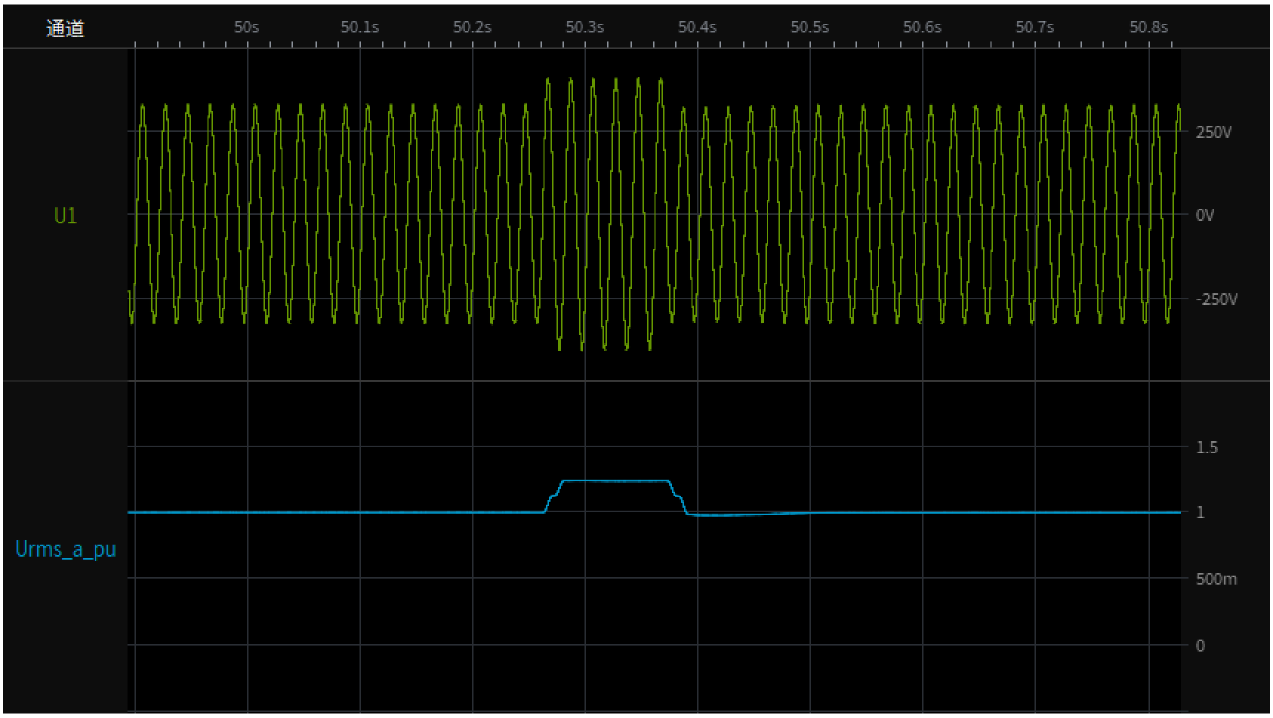


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

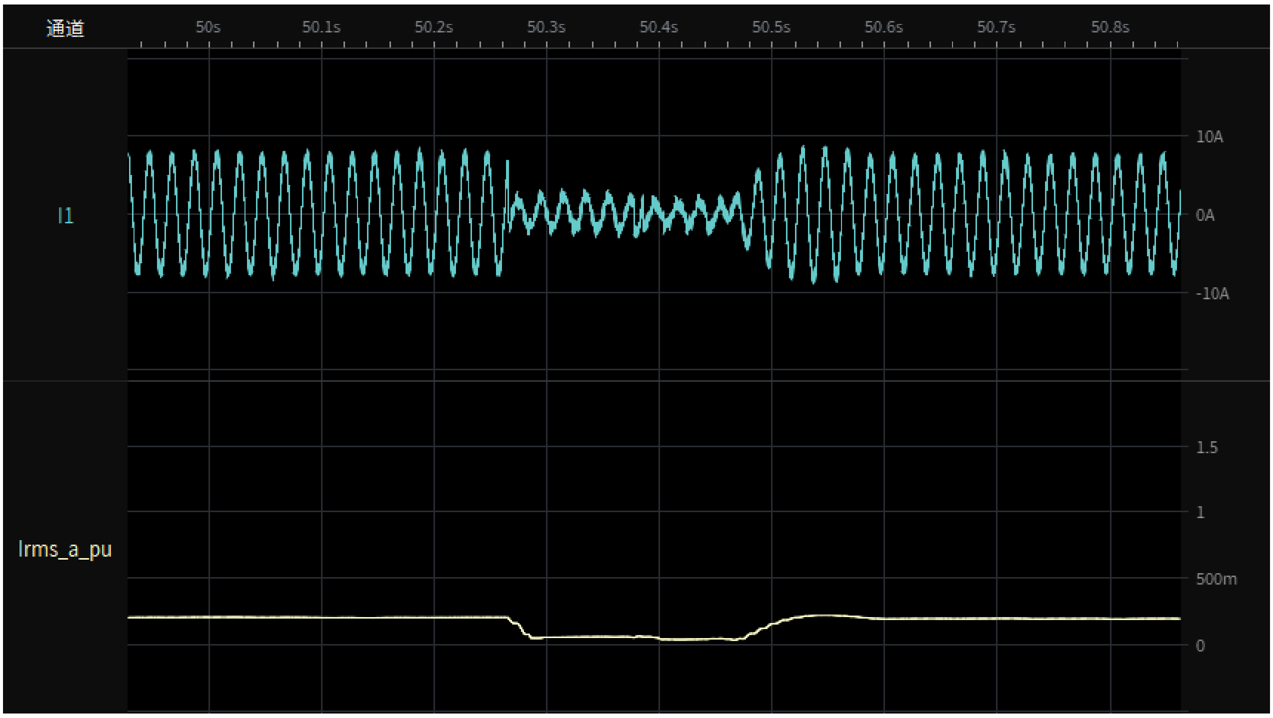


Test 8-1.2 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

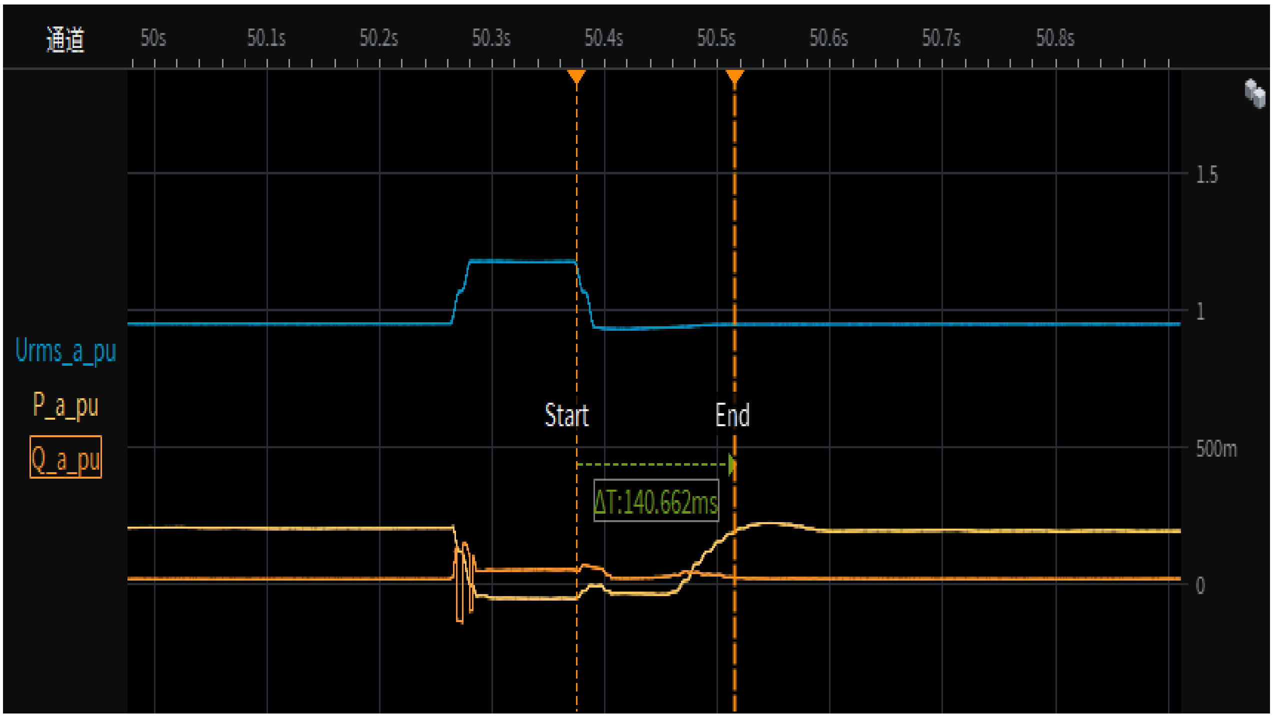


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

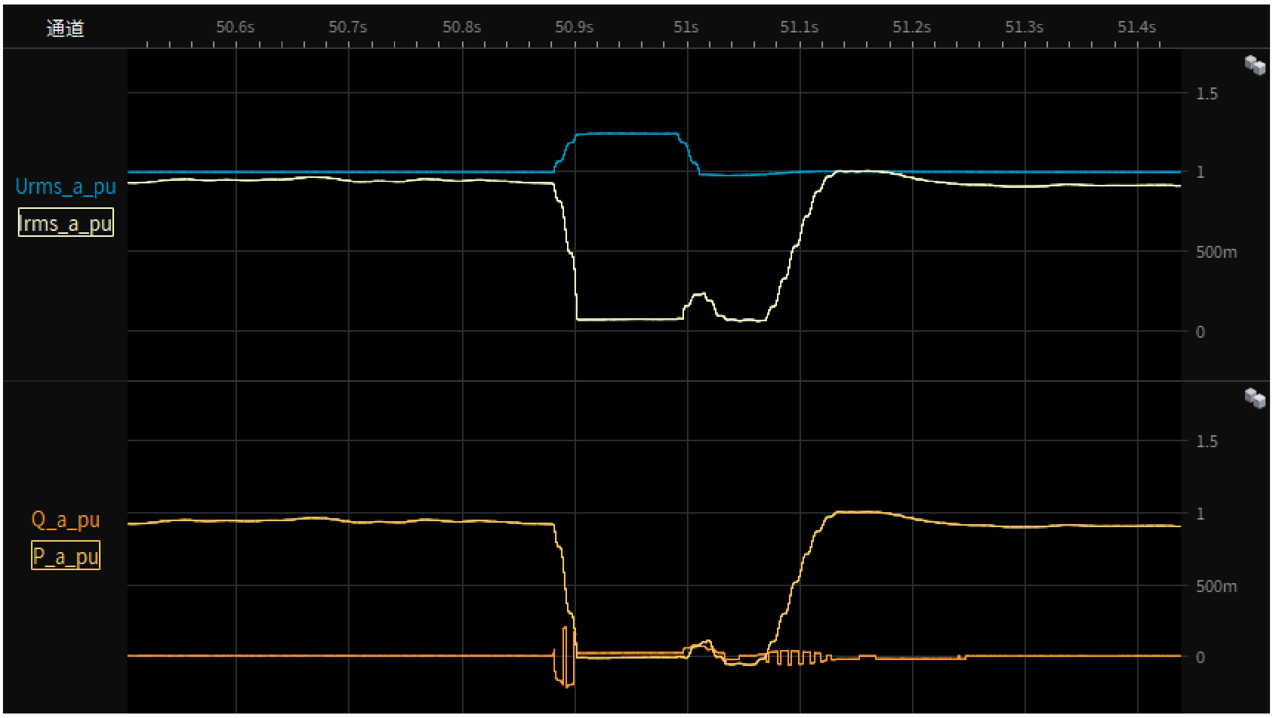


Test 8-1.4 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),20% load
restoring time

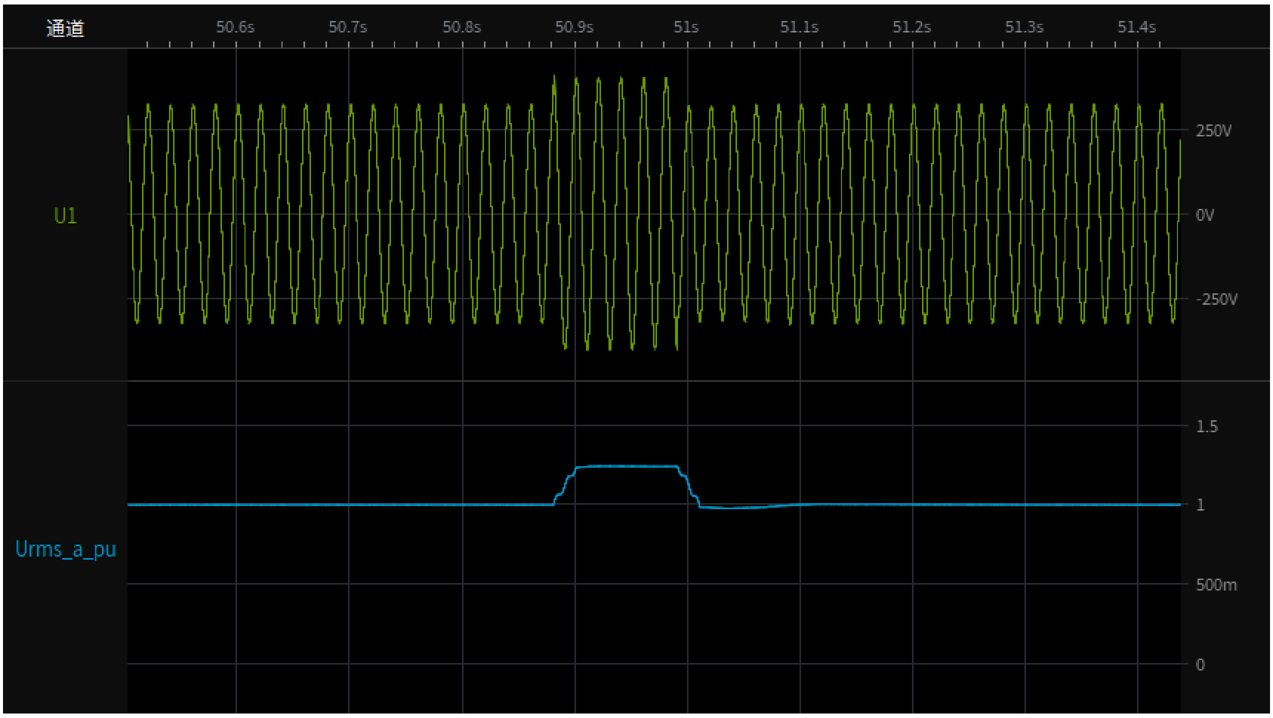


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

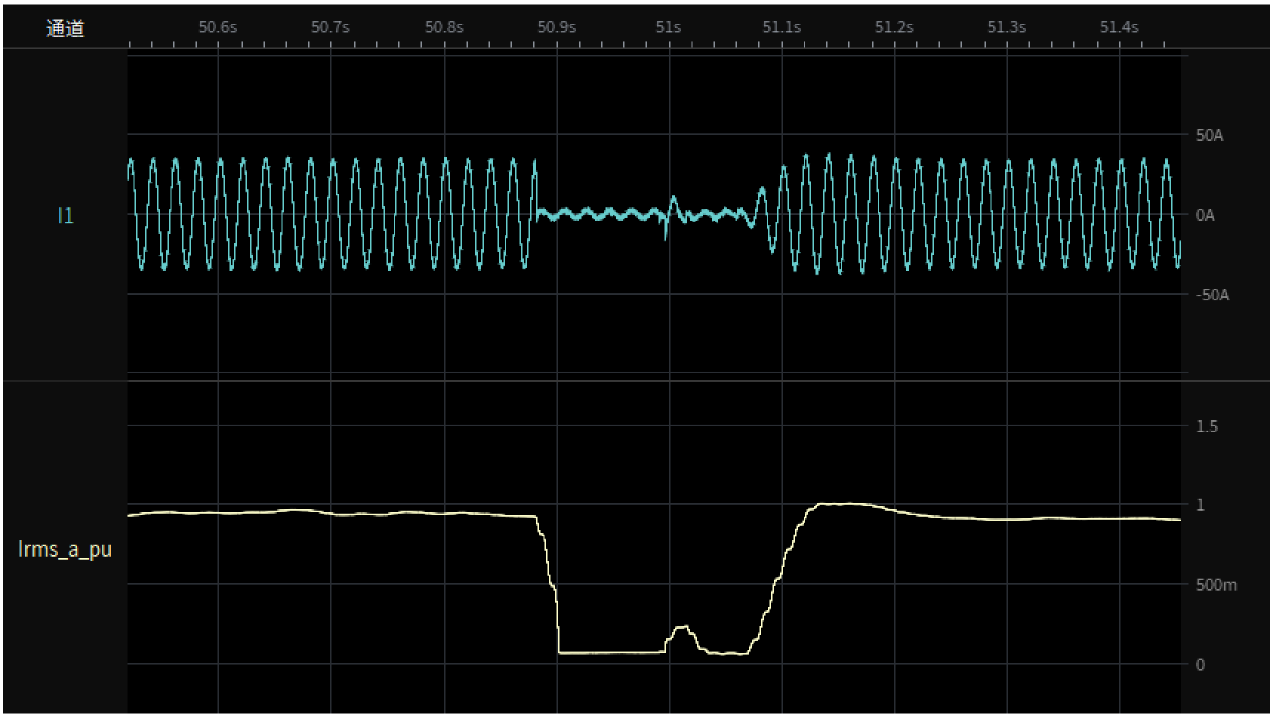


Test 8-2.2 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

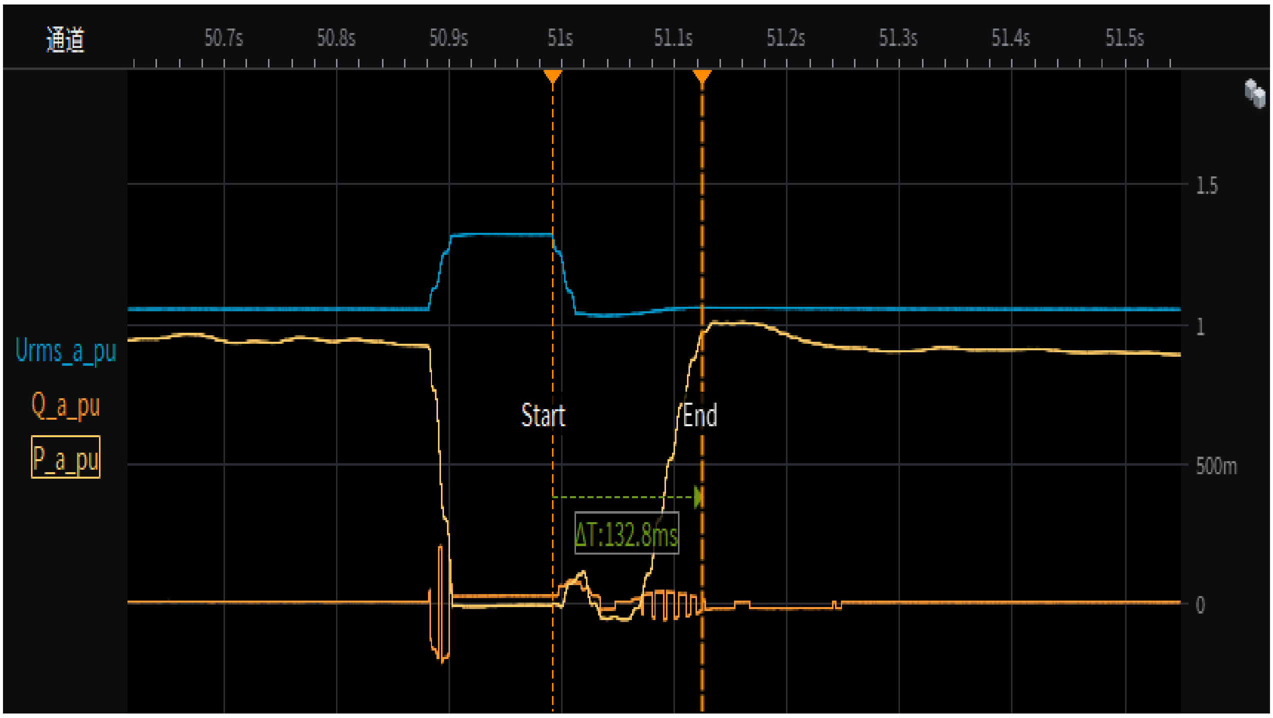


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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	AF6K-SL				
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%	0.999	90	25.68	26.00	The PV inverter continue to feed power to grid after phase angle shift has been performed. No damage, no hazard.
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%	0.999	180	25.82	26.92	The PV inverter continue to feed power to grid after phase angle shift has been performed. No damage, no hazard.

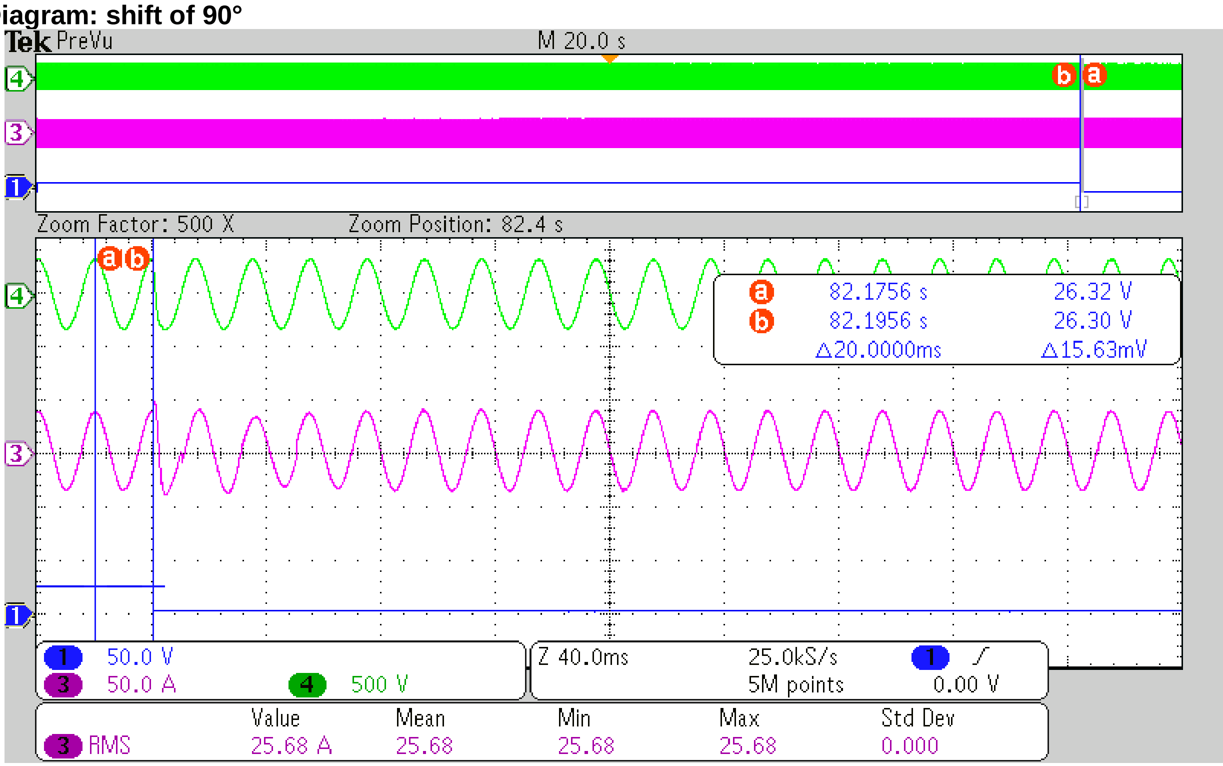
Note:

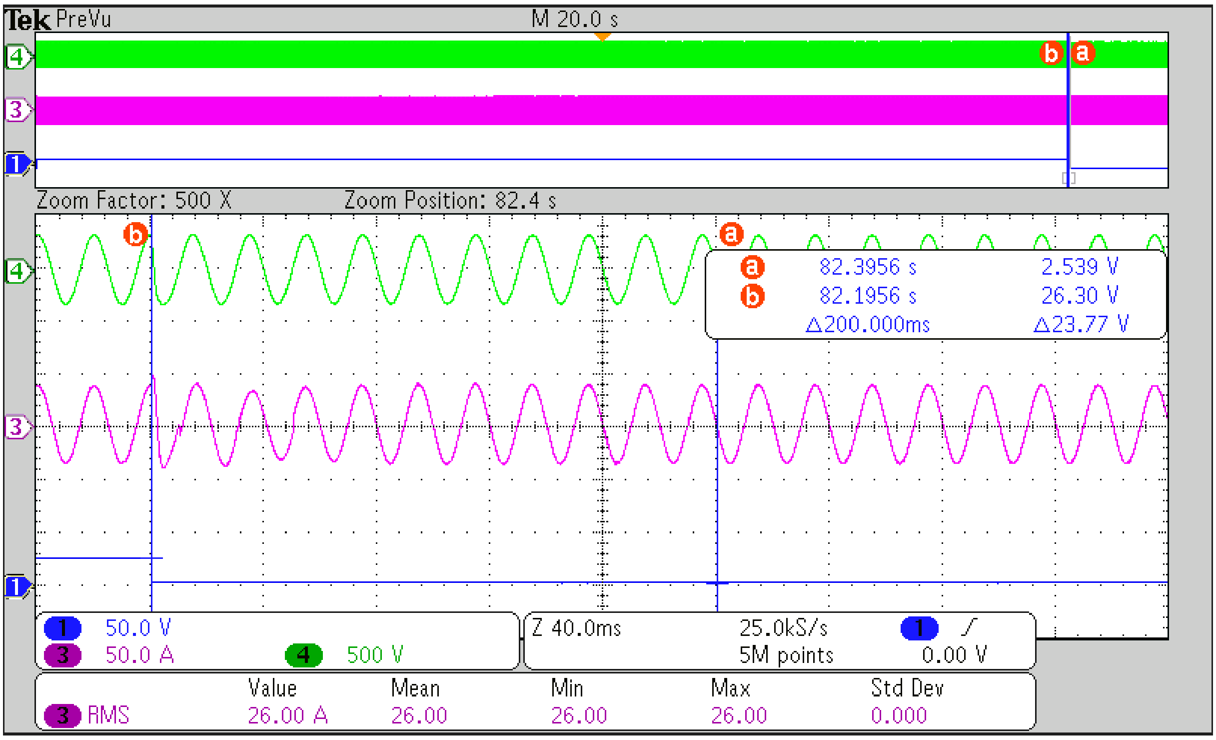
The generator must be brought into operation at rated power. Let the system operate under the set conditions for at least 5 min or the time necessary for the temperature inside the converter to stabilize.

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

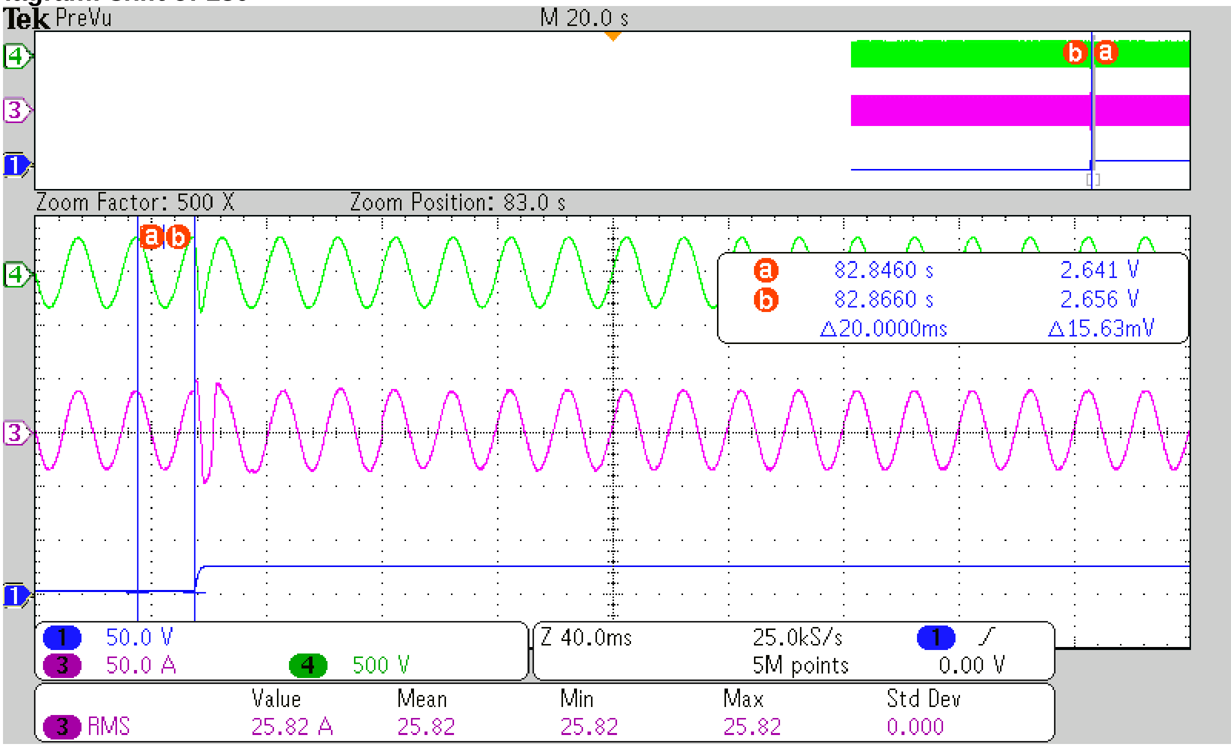
Diagram: shift of 90°

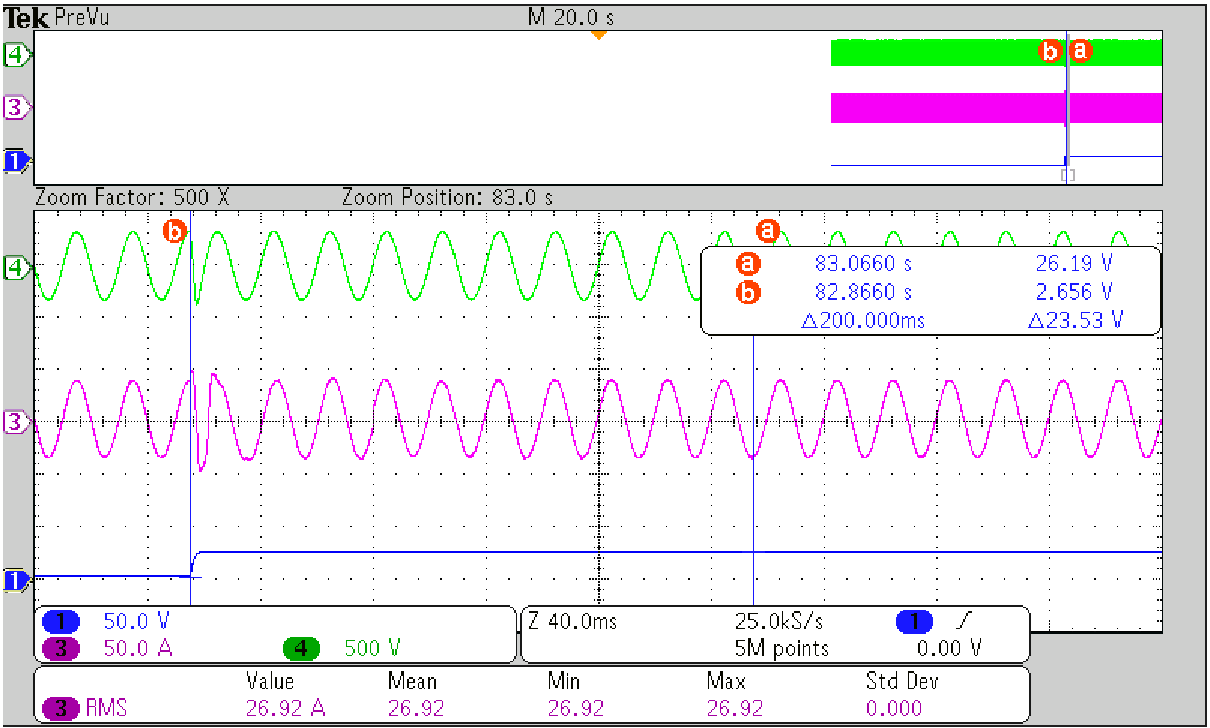




CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Diagram: shift of 180°





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

Bbis.3 a)/b)	**TABLE: Harmonics measurement**	**P**
Mode	AF6K-SL	
☒ 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	AF6K-SLP+15Battery			
Active power (W)	-6024.44 (60°C)			
Voltage (V)	228.55			
Current (A)	26.37			
Power Factor	-0.9995			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	26.367	--	Single phase	--
2nd	0.050	0.188	Single phase	8
3rd	0.428	1.623	Single phase	21,6
4th	0.013	0.048	Single phase	4
5th	0.217	0.822	Single phase	10,7
6th	0.010	0.039	Single phase	2,7
7th	0.136	0.516	Single phase	7,2
8th	0.008	0.031	Single phase	2
9th	0.103	0.391	Single phase	3,8
10th	0.008	0.030	Single phase	1,6
11th	0.073	0.278	Single phase	3,1
12th	0.007	0.027	Single phase	1,3
13th	0.061	0.230	Single phase	2
14th	0.007	0.027	Single phase	N/A
15th	0.044	0.167	Single phase	N/A
16th	0.006	0.024	Single phase	N/A
17th	0.040	0.152	Single phase	N/A
18th	0.006	0.022	Single phase	N/A
19th	0.024	0.091	Single phase	N/A
20th	0.006	0.022	Single phase	N/A
21st	0.020	0.076	Single phase	N/A
22nd	0.008	0.029	Single phase	N/A
23rd	0.012	0.046	Single phase	N/A
24th	0.006	0.021	Single phase	N/A
25th	0.011	0.040	Single phase	N/A
26th	0.005	0.020	Single phase	N/A
27th	0.010	0.036	Single phase	N/A
28th	0.006	0.022	Single phase	N/A
29th	0.008	0.029	Single phase	N/A
30th	0.005	0.020	Single phase	N/A
31st	0.009	0.034	Single phase	N/A
32nd	0.005	0.019	Single phase	N/A
33rd	0.006	0.022	Single phase	N/A
34th	0.004	0.017	Single phase	N/A
35th	0.006	0.024	Single phase	N/A
36th	0.006	0.022	Single phase	N/A
37th	0.008	0.031	Single phase	N/A
38th	0.004	0.017	Single phase	N/A
39th	0.007	0.028	Single phase	N/A
40th	0.004	0.016	Single phase	N/A
THD	--	2.183	Single phase	23
PWHD	--	1.241	Single phase	23

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	AF6K-SLP+15Battery	

Active power (W)	-6025.07 (-25°C)			
Voltage (V)	228.56			
Current (A)	26.37			
Power Factor	-0.9995			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	26.369	--	Single phase	--
2nd	0.049	0.186	Single phase	8
3rd	0.427	1.619	Single phase	21,6
4th	0.012	0.047	Single phase	4
5th	0.217	0.823	Single phase	10,7
6th	0.010	0.038	Single phase	2,7
7th	0.136	0.516	Single phase	7,2
8th	0.008	0.030	Single phase	2
9th	0.103	0.392	Single phase	3,8
10th	0.008	0.031	Single phase	1,6
11th	0.074	0.279	Single phase	3,1
12th	0.007	0.026	Single phase	1,3
13th	0.061	0.231	Single phase	2
14th	0.007	0.027	Single phase	N/A
15th	0.044	0.166	Single phase	N/A
16th	0.007	0.025	Single phase	N/A
17th	0.040	0.152	Single phase	N/A
18th	0.006	0.023	Single phase	N/A
19th	0.024	0.093	Single phase	N/A
20th	0.006	0.023	Single phase	N/A
21st	0.020	0.076	Single phase	N/A
22nd	0.008	0.030	Single phase	N/A
23rd	0.013	0.049	Single phase	N/A
24th	0.006	0.021	Single phase	N/A
25th	0.011	0.042	Single phase	N/A
26th	0.006	0.021	Single phase	N/A
27th	0.009	0.035	Single phase	N/A
28th	0.007	0.025	Single phase	N/A
29th	0.007	0.028	Single phase	N/A
30th	0.005	0.019	Single phase	N/A
31st	0.009	0.033	Single phase	N/A
32nd	0.005	0.019	Single phase	N/A
33rd	0.006	0.022	Single phase	N/A
34th	0.005	0.017	Single phase	N/A
35th	0.007	0.025	Single phase	N/A
36th	0.005	0.018	Single phase	N/A
37th	0.008	0.032	Single phase	N/A
38th	0.005	0.017	Single phase	N/A
39th	0.008	0.029	Single phase	N/A
40th	0.004	0.017	Single phase	N/A
THD	--	2.123	Single phase	23
PWHD	--	1.248	Single phase	23

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	AF6K-SLP+15Battery			
Active power (W)	-6024.17 (25°C)			
Voltage (V)	228.55			
Current (A)	26.37			
Power Factor	-0.9995			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	26.367	--	Single phase	--
2nd	0.049	0.188	Single phase	8
3rd	0.427	1.619	Single phase	21,6
4th	0.012	0.045	Single phase	4
5th	0.217	0.823	Single phase	10,7
6th	0.010	0.038	Single phase	2,7
7th	0.136	0.515	Single phase	7,2
8th	0.008	0.031	Single phase	2
9th	0.103	0.392	Single phase	3,8
10th	0.008	0.031	Single phase	1,6
11th	0.073	0.278	Single phase	3,1
12th	0.007	0.026	Single phase	1,3
13th	0.061	0.230	Single phase	2
14th	0.007	0.027	Single phase	N/A
15th	0.044	0.167	Single phase	N/A
16th	0.006	0.024	Single phase	N/A
17th	0.040	0.151	Single phase	N/A
18th	0.006	0.023	Single phase	N/A
19th	0.024	0.092	Single phase	N/A
20th	0.006	0.023	Single phase	N/A
21st	0.020	0.077	Single phase	N/A
22nd	0.008	0.029	Single phase	N/A
23rd	0.013	0.049	Single phase	N/A
24th	0.006	0.023	Single phase	N/A
25th	0.011	0.044	Single phase	N/A
26th	0.005	0.020	Single phase	N/A
27th	0.010	0.037	Single phase	N/A
28th	0.005	0.019	Single phase	N/A
29th	0.007	0.027	Single phase	N/A
30th	0.006	0.021	Single phase	N/A
31st	0.009	0.034	Single phase	N/A
32nd	0.005	0.020	Single phase	N/A
33rd	0.006	0.022	Single phase	N/A
34th	0.004	0.017	Single phase	N/A
35th	0.006	0.024	Single phase	N/A
36th	0.008	0.030	Single phase	N/A
37th	0.009	0.033	Single phase	N/A
38th	0.004	0.017	Single phase	N/A
39th	0.008	0.030	Single phase	N/A
40th	0.004	0.017	Single phase	N/A
THD	--	2.110	Single phase	23
PWHD	--	1.257	Single phase	23

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	AF6K-SLP+15Battery			
Active power (W)	-3982.46 (60°C)			
Voltage (V)	229.00			
Current (A)	17.41			
Power Factor	-0.9991			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	17.399	--	Single phase	--
2nd	0.024	0.140	Single phase	8
3rd	0.395	2.272	Single phase	21,6
4th	0.003	0.020	Single phase	4
5th	0.203	1.165	Single phase	10,7
6th	0.006	0.032	Single phase	2,7
7th	0.137	0.785	Single phase	7,2
8th	0.005	0.028	Single phase	2
9th	0.097	0.555	Single phase	3,8
10th	0.006	0.034	Single phase	1,6
11th	0.072	0.411	Single phase	3,1
12th	0.006	0.034	Single phase	1,3
13th	0.059	0.338	Single phase	2
14th	0.004	0.025	Single phase	N/A
15th	0.039	0.226	Single phase	N/A
16th	0.006	0.033	Single phase	N/A
17th	0.038	0.218	Single phase	N/A
18th	0.006	0.036	Single phase	N/A
19th	0.025	0.142	Single phase	N/A
20th	0.005	0.028	Single phase	N/A
21st	0.017	0.099	Single phase	N/A
22nd	0.006	0.032	Single phase	N/A
23rd	0.012	0.068	Single phase	N/A
24th	0.006	0.035	Single phase	N/A
25th	0.010	0.056	Single phase	N/A
26th	0.003	0.019	Single phase	N/A
27th	0.005	0.031	Single phase	N/A
28th	0.003	0.016	Single phase	N/A
29th	0.003	0.017	Single phase	N/A
30th	0.003	0.017	Single phase	N/A
31st	0.003	0.015	Single phase	N/A
32nd	0.003	0.018	Single phase	N/A
33rd	0.005	0.027	Single phase	N/A
34th	0.003	0.015	Single phase	N/A
35th	0.005	0.031	Single phase	N/A
36th	0.008	0.043	Single phase	N/A
37th	0.005	0.027	Single phase	N/A
38th	0.004	0.021	Single phase	N/A
39th	0.006	0.034	Single phase	N/A
40th	0.003	0.017	Single phase	N/A
THD	--	2.837	Single phase	23
PWHD	--	1.668	Single phase	23

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	AF6K-SLP+15Battery			
Active power (W)	-3982 (-25°C)			
Voltage (V)	228.97			
Current (A)	17.41			
Power Factor	-0.9991			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	17.401	--	Single phase	--
2nd	0.024	0.137	Single phase	8
3rd	0.396	2.276	Single phase	21,6
4th	0.003	0.019	Single phase	4
5th	0.203	1.168	Single phase	10,7
6th	0.005	0.032	Single phase	2,7
7th	0.137	0.787	Single phase	7,2
8th	0.005	0.028	Single phase	2
9th	0.097	0.557	Single phase	3,8
10th	0.006	0.035	Single phase	1,6
11th	0.072	0.412	Single phase	3,1
12th	0.006	0.034	Single phase	1,3
13th	0.059	0.339	Single phase	2
14th	0.004	0.025	Single phase	N/A
15th	0.039	0.226	Single phase	N/A
16th	0.006	0.033	Single phase	N/A
17th	0.038	0.218	Single phase	N/A
18th	0.006	0.036	Single phase	N/A
19th	0.024	0.140	Single phase	N/A
20th	0.005	0.027	Single phase	N/A
21st	0.017	0.098	Single phase	N/A
22nd	0.004	0.025	Single phase	N/A
23rd	0.011	0.064	Single phase	N/A
24th	0.006	0.036	Single phase	N/A
25th	0.009	0.053	Single phase	N/A
26th	0.004	0.022	Single phase	N/A
27th	0.005	0.028	Single phase	N/A
28th	0.003	0.017	Single phase	N/A
29th	0.003	0.017	Single phase	N/A
30th	0.003	0.017	Single phase	N/A
31st	0.003	0.017	Single phase	N/A
32nd	0.003	0.018	Single phase	N/A
33rd	0.005	0.029	Single phase	N/A
34th	0.003	0.015	Single phase	N/A
35th	0.006	0.032	Single phase	N/A
36th	0.006	0.032	Single phase	N/A
37th	0.005	0.029	Single phase	N/A
38th	0.004	0.021	Single phase	N/A
39th	0.006	0.037	Single phase	N/A
40th	0.003	0.017	Single phase	N/A
THD	--	2.850	Single phase	23
PWHD	--	1.650	Single phase	23

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	AF6K-SLP+15Battery			
Active power (W)	-3982 (25°C)			
Voltage (V)	228.98			
Current (A)	17.41			
Power Factor	-0.9991			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	17.398	--	Single phase	--
2nd	0.024	0.139	Single phase	8
3rd	0.397	2.278	Single phase	21,6
4th	0.003	0.019	Single phase	4
5th	0.204	1.169	Single phase	10,7
6th	0.006	0.032	Single phase	2,7
7th	0.137	0.788	Single phase	7,2
8th	0.005	0.028	Single phase	2
9th	0.097	0.557	Single phase	3,8
10th	0.006	0.035	Single phase	1,6
11th	0.072	0.412	Single phase	3,1
12th	0.006	0.033	Single phase	1,3
13th	0.059	0.339	Single phase	2
14th	0.004	0.025	Single phase	N/A
15th	0.039	0.226	Single phase	N/A
16th	0.005	0.031	Single phase	N/A
17th	0.038	0.220	Single phase	N/A
18th	0.006	0.036	Single phase	N/A
19th	0.024	0.140	Single phase	N/A
20th	0.005	0.027	Single phase	N/A
21st	0.017	0.099	Single phase	N/A
22nd	0.004	0.023	Single phase	N/A
23rd	0.011	0.064	Single phase	N/A
24th	0.006	0.035	Single phase	N/A
25th	0.009	0.053	Single phase	N/A
26th	0.004	0.022	Single phase	N/A
27th	0.005	0.028	Single phase	N/A
28th	0.003	0.019	Single phase	N/A
29th	0.004	0.021	Single phase	N/A
30th	0.003	0.017	Single phase	N/A
31st	0.003	0.020	Single phase	N/A
32nd	0.003	0.015	Single phase	N/A
33rd	0.005	0.029	Single phase	N/A
34th	0.003	0.016	Single phase	N/A
35th	0.006	0.033	Single phase	N/A
36th	0.004	0.025	Single phase	N/A
37th	0.005	0.027	Single phase	N/A
38th	0.003	0.020	Single phase	N/A
39th	0.007	0.038	Single phase	N/A
40th	0.003	0.016	Single phase	N/A
THD	--	2.852	Single phase	23
PWHD	--	1.651	Single phase	23

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	AF6K-SLP+15Battery			
Active power (W)	-1987 (60°C)			
Voltage (V)	229.42			
Current (A)	8.69			
Power Factor	-0.9974			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	8.675	--	Single phase	--
2nd	0.008	0.089	Single phase	8
3rd	0.361	4.160	Single phase	21,6
4th	0.005	0.052	Single phase	4
5th	0.174	2.000	Single phase	10,7
6th	0.008	0.097	Single phase	2,7
7th	0.096	1.109	Single phase	7,2
8th	0.006	0.071	Single phase	2
9th	0.056	0.644	Single phase	3,8
10th	0.007	0.080	Single phase	1,6
11th	0.025	0.286	Single phase	3,1
12th	0.006	0.066	Single phase	1,3
13th	0.015	0.171	Single phase	2
14th	0.004	0.046	Single phase	N/A
15th	0.014	0.158	Single phase	N/A
16th	0.005	0.053	Single phase	N/A
17th	0.011	0.124	Single phase	N/A
18th	0.006	0.069	Single phase	N/A
19th	0.024	0.273	Single phase	N/A
20th	0.005	0.063	Single phase	N/A
21st	0.022	0.252	Single phase	N/A
22nd	0.003	0.038	Single phase	N/A
23rd	0.017	0.195	Single phase	N/A
24th	0.008	0.095	Single phase	N/A
25th	0.015	0.168	Single phase	N/A
26th	0.005	0.052	Single phase	N/A
27th	0.007	0.079	Single phase	N/A
28th	0.005	0.061	Single phase	N/A
29th	0.007	0.082	Single phase	N/A
30th	0.006	0.068	Single phase	N/A
31st	0.006	0.074	Single phase	N/A
32nd	0.003	0.035	Single phase	N/A
33rd	0.008	0.094	Single phase	N/A
34th	0.003	0.037	Single phase	N/A
35th	0.010	0.110	Single phase	N/A
36th	0.004	0.047	Single phase	N/A
37th	0.010	0.111	Single phase	N/A
38th	0.002	0.025	Single phase	N/A
39th	0.011	0.131	Single phase	N/A
40th	0.002	0.026	Single phase	N/A
THD	--	4.915	Single phase	23
PWHD	--	2.895	Single phase	23

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	AF6K-SLP+15Battery			
Active power (W)	-1987 (-25°C)			
Voltage (V)	229.42			
Current (A)	8.69			
Power Factor	-0.9974			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	8.676	--	Single phase	--
2nd	0.007	0.083	Single phase	8
3rd	0.361	4.161	Single phase	21,6
4th	0.004	0.051	Single phase	4
5th	0.173	1.997	Single phase	10,7
6th	0.008	0.097	Single phase	2,7
7th	0.096	1.109	Single phase	7,2
8th	0.006	0.068	Single phase	2
9th	0.056	0.642	Single phase	3,8
10th	0.007	0.078	Single phase	1,6
11th	0.025	0.286	Single phase	3,1
12th	0.005	0.062	Single phase	1,3
13th	0.015	0.168	Single phase	2
14th	0.004	0.046	Single phase	N/A
15th	0.014	0.160	Single phase	N/A
16th	0.005	0.053	Single phase	N/A
17th	0.011	0.122	Single phase	N/A
18th	0.006	0.066	Single phase	N/A
19th	0.024	0.276	Single phase	N/A
20th	0.005	0.063	Single phase	N/A
21st	0.022	0.257	Single phase	N/A
22nd	0.003	0.038	Single phase	N/A
23rd	0.017	0.192	Single phase	N/A
24th	0.008	0.092	Single phase	N/A
25th	0.015	0.170	Single phase	N/A
26th	0.005	0.059	Single phase	N/A
27th	0.007	0.085	Single phase	N/A
28th	0.005	0.059	Single phase	N/A
29th	0.007	0.081	Single phase	N/A
30th	0.006	0.066	Single phase	N/A
31st	0.006	0.072	Single phase	N/A
32nd	0.003	0.040	Single phase	N/A
33rd	0.008	0.093	Single phase	N/A
34th	0.003	0.037	Single phase	N/A
35th	0.010	0.111	Single phase	N/A
36th	0.004	0.042	Single phase	N/A
37th	0.010	0.110	Single phase	N/A
38th	0.002	0.023	Single phase	N/A
39th	0.011	0.131	Single phase	N/A
40th	0.002	0.025	Single phase	N/A
THD	--	4.898	Single phase	23
PWHD	--	2.904	Single phase	23

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	AF6K-SLP+15Battery			
Active power (W)	-1987 (25°C)			
Voltage (V)	229.42			
Current (A)	8.69			
Power Factor	-0.9974			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	8.675	--	Single phase	--
2nd	0.007	0.084	Single phase	8
3rd	0.362	4.162	Single phase	21,6
4th	0.004	0.052	Single phase	4
5th	0.173	1.996	Single phase	10,7
6th	0.008	0.095	Single phase	2,7
7th	0.096	1.108	Single phase	7,2
8th	0.006	0.071	Single phase	2
9th	0.056	0.639	Single phase	3,8
10th	0.007	0.078	Single phase	1,6
11th	0.025	0.285	Single phase	3,1
12th	0.006	0.065	Single phase	1,3
13th	0.014	0.166	Single phase	2
14th	0.004	0.048	Single phase	N/A
15th	0.014	0.160	Single phase	N/A
16th	0.005	0.053	Single phase	N/A
17th	0.011	0.123	Single phase	N/A
18th	0.006	0.069	Single phase	N/A
19th	0.024	0.278	Single phase	N/A
20th	0.005	0.062	Single phase	N/A
21st	0.022	0.255	Single phase	N/A
22nd	0.004	0.043	Single phase	N/A
23rd	0.017	0.191	Single phase	N/A
24th	0.008	0.095	Single phase	N/A
25th	0.015	0.169	Single phase	N/A
26th	0.005	0.056	Single phase	N/A
27th	0.007	0.084	Single phase	N/A
28th	0.006	0.064	Single phase	N/A
29th	0.007	0.082	Single phase	N/A
30th	0.006	0.069	Single phase	N/A
31st	0.006	0.070	Single phase	N/A
32nd	0.003	0.036	Single phase	N/A
33rd	0.008	0.091	Single phase	N/A
34th	0.003	0.039	Single phase	N/A
35th	0.010	0.110	Single phase	N/A
36th	0.004	0.048	Single phase	N/A
37th	0.009	0.109	Single phase	N/A
38th	0.002	0.023	Single phase	N/A
39th	0.012	0.135	Single phase	N/A
40th	0.002	0.024	Single phase	N/A
THD	--	4.918	Single phase	23
PWHD	--	2.911	Single phase	23

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	AF6K-SLP+15Battery			
Active power (W)	5935 (60°C)			
Voltage (V)	230.92			
Current (A)	25.71			
Power Factor	0.9999			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	25.709	--	Single phase	--
2nd	0.037	0.145	Single phase	8
3rd	0.118	0.458	Single phase	21,6
4th	0.007	0.028	Single phase	4
5th	0.099	0.385	Single phase	10,7
6th	0.009	0.034	Single phase	2,7
7th	0.055	0.213	Single phase	7,2
8th	0.007	0.025	Single phase	2
9th	0.059	0.228	Single phase	3,8
10th	0.009	0.036	Single phase	1,6
11th	0.052	0.200	Single phase	3,1
12th	0.017	0.066	Single phase	1,3
13th	0.032	0.125	Single phase	2
14th	0.009	0.033	Single phase	N/A
15th	0.032	0.125	Single phase	N/A
16th	0.013	0.050	Single phase	N/A
17th	0.026	0.102	Single phase	N/A
18th	0.006	0.024	Single phase	N/A
19th	0.023	0.091	Single phase	N/A
20th	0.009	0.037	Single phase	N/A
21st	0.014	0.056	Single phase	N/A
22nd	0.012	0.046	Single phase	N/A
23rd	0.017	0.065	Single phase	N/A
24th	0.005	0.020	Single phase	N/A
25th	0.015	0.059	Single phase	N/A
26th	0.008	0.031	Single phase	N/A
27th	0.016	0.063	Single phase	N/A
28th	0.005	0.019	Single phase	N/A
29th	0.011	0.044	Single phase	N/A
30th	0.004	0.016	Single phase	N/A
31st	0.008	0.029	Single phase	N/A
32nd	0.006	0.023	Single phase	N/A
33rd	0.007	0.026	Single phase	N/A
34th	0.003	0.012	Single phase	N/A
35th	0.006	0.025	Single phase	N/A
36th	0.005	0.020	Single phase	N/A
37th	0.009	0.036	Single phase	N/A
38th	0.003	0.010	Single phase	N/A
39th	0.007	0.028	Single phase	N/A
40th	0.002	0.006	Single phase	N/A
THD	--	0.811	Single phase	23
PWHD	--	1.169	Single phase	23

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	AF6K-SLP+15Battery			
Active power (W)	5936 (-25°C)			
Voltage (V)	230.92			
Current (A)	25.71			
Power Factor	0.9999			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	25.712	--	Single phase	--
2nd	0.039	0.153	Single phase	8
3rd	0.118	0.458	Single phase	21,6
4th	0.007	0.028	Single phase	4
5th	0.099	0.384	Single phase	10,7
6th	0.009	0.034	Single phase	2,7
7th	0.055	0.213	Single phase	7,2
8th	0.007	0.026	Single phase	2
9th	0.059	0.228	Single phase	3,8
10th	0.009	0.036	Single phase	1,6
11th	0.051	0.198	Single phase	3,1
12th	0.017	0.066	Single phase	1,3
13th	0.032	0.125	Single phase	2
14th	0.009	0.034	Single phase	N/A
15th	0.032	0.125	Single phase	N/A
16th	0.013	0.051	Single phase	N/A
17th	0.026	0.100	Single phase	N/A
18th	0.006	0.024	Single phase	N/A
19th	0.024	0.093	Single phase	N/A
20th	0.009	0.036	Single phase	N/A
21st	0.014	0.055	Single phase	N/A
22nd	0.011	0.042	Single phase	N/A
23rd	0.017	0.065	Single phase	N/A
24th	0.005	0.019	Single phase	N/A
25th	0.016	0.062	Single phase	N/A
26th	0.008	0.031	Single phase	N/A
27th	0.016	0.061	Single phase	N/A
28th	0.005	0.019	Single phase	N/A
29th	0.012	0.046	Single phase	N/A
30th	0.004	0.016	Single phase	N/A
31st	0.008	0.030	Single phase	N/A
32nd	0.006	0.022	Single phase	N/A
33rd	0.007	0.029	Single phase	N/A
34th	0.003	0.013	Single phase	N/A
35th	0.006	0.024	Single phase	N/A
36th	0.005	0.018	Single phase	N/A
37th	0.009	0.036	Single phase	N/A
38th	0.003	0.011	Single phase	N/A
39th	0.007	0.027	Single phase	N/A
40th	0.002	0.006	Single phase	N/A
THD	--	0.813	Single phase	23
PWHD	--	1.167	Single phase	23

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	AF6K-SLP+15Battery			
Active power (W)	5935 (25°C)			
Voltage (V)	230.91			
Current (A)	25.71			
Power Factor	0.9999			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	25.708	--	Single phase	--
2nd	0.040	0.154	Single phase	8
3rd	0.118	0.459	Single phase	21,6
4th	0.007	0.029	Single phase	4
5th	0.099	0.384	Single phase	10,7
6th	0.009	0.034	Single phase	2,7
7th	0.055	0.212	Single phase	7,2
8th	0.007	0.025	Single phase	2
9th	0.059	0.228	Single phase	3,8
10th	0.009	0.036	Single phase	1,6
11th	0.051	0.199	Single phase	3,1
12th	0.017	0.065	Single phase	1,3
13th	0.032	0.125	Single phase	2
14th	0.009	0.034	Single phase	N/A
15th	0.032	0.125	Single phase	N/A
16th	0.013	0.050	Single phase	N/A
17th	0.026	0.102	Single phase	N/A
18th	0.006	0.024	Single phase	N/A
19th	0.024	0.092	Single phase	N/A
20th	0.010	0.038	Single phase	N/A
21st	0.014	0.055	Single phase	N/A
22nd	0.010	0.038	Single phase	N/A
23rd	0.017	0.066	Single phase	N/A
24th	0.004	0.017	Single phase	N/A
25th	0.016	0.063	Single phase	N/A
26th	0.009	0.035	Single phase	N/A
27th	0.015	0.059	Single phase	N/A
28th	0.005	0.020	Single phase	N/A
29th	0.011	0.045	Single phase	N/A
30th	0.004	0.015	Single phase	N/A
31st	0.008	0.031	Single phase	N/A
32nd	0.007	0.025	Single phase	N/A
33rd	0.007	0.029	Single phase	N/A
34th	0.003	0.011	Single phase	N/A
35th	0.006	0.023	Single phase	N/A
36th	0.003	0.011	Single phase	N/A
37th	0.009	0.036	Single phase	N/A
38th	0.003	0.010	Single phase	N/A
39th	0.007	0.026	Single phase	N/A
40th	0.002	0.006	Single phase	N/A
THD	--	0.814	Single phase	23
PWHD	--	1.163	Single phase	23

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	AF6K-SLP+15Battery			
Active power (W)	3928 (60°C)			
Voltage (V)	230.61			
Current (A)	17.04			
Power Factor	0.9998			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	17.039	--	Single phase	--
2nd	0.029	0.171	Single phase	8
3rd	0.075	0.440	Single phase	21,6
4th	0.004	0.021	Single phase	4
5th	0.071	0.416	Single phase	10,7
6th	0.005	0.029	Single phase	2,7
7th	0.059	0.348	Single phase	7,2
8th	0.004	0.022	Single phase	2
9th	0.044	0.260	Single phase	3,8
10th	0.005	0.028	Single phase	1,6
11th	0.042	0.244	Single phase	3,1
12th	0.005	0.028	Single phase	1,3
13th	0.033	0.196	Single phase	2
14th	0.004	0.024	Single phase	N/A
15th	0.024	0.138	Single phase	N/A
16th	0.002	0.014	Single phase	N/A
17th	0.027	0.161	Single phase	N/A
18th	0.011	0.066	Single phase	N/A
19th	0.024	0.144	Single phase	N/A
20th	0.006	0.036	Single phase	N/A
21st	0.014	0.082	Single phase	N/A
22nd	0.019	0.114	Single phase	N/A
23rd	0.015	0.087	Single phase	N/A
24th	0.009	0.052	Single phase	N/A
25th	0.013	0.075	Single phase	N/A
26th	0.009	0.054	Single phase	N/A
27th	0.013	0.076	Single phase	N/A
28th	0.004	0.025	Single phase	N/A
29th	0.009	0.054	Single phase	N/A
30th	0.005	0.027	Single phase	N/A
31st	0.010	0.056	Single phase	N/A
32nd	0.003	0.019	Single phase	N/A
33rd	0.008	0.049	Single phase	N/A
34th	0.002	0.009	Single phase	N/A
35th	0.005	0.032	Single phase	N/A
36th	0.005	0.028	Single phase	N/A
37th	0.007	0.041	Single phase	N/A
38th	0.003	0.016	Single phase	N/A
39th	0.007	0.041	Single phase	N/A
40th	0.002	0.013	Single phase	N/A
THD	--	0.974	Single phase	23
PWHD	--	1.672	Single phase	23

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	AF6K-SLP+15Battery			
Active power (W)	3929 (-25°C)			
Voltage (V)	230.62			
Current (A)	17.04			
Power Factor	0.9998			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	17.040	--	Single phase	--
2nd	0.027	0.160	Single phase	8
3rd	0.075	0.441	Single phase	21,6
4th	0.004	0.021	Single phase	4
5th	0.071	0.418	Single phase	10,7
6th	0.005	0.029	Single phase	2,7
7th	0.059	0.348	Single phase	7,2
8th	0.003	0.020	Single phase	2
9th	0.044	0.260	Single phase	3,8
10th	0.005	0.028	Single phase	1,6
11th	0.042	0.246	Single phase	3,1
12th	0.005	0.029	Single phase	1,3
13th	0.033	0.195	Single phase	2
14th	0.004	0.024	Single phase	N/A
15th	0.024	0.139	Single phase	N/A
16th	0.002	0.015	Single phase	N/A
17th	0.028	0.163	Single phase	N/A
18th	0.011	0.066	Single phase	N/A
19th	0.025	0.144	Single phase	N/A
20th	0.006	0.035	Single phase	N/A
21st	0.014	0.082	Single phase	N/A
22nd	0.019	0.113	Single phase	N/A
23rd	0.015	0.087	Single phase	N/A
24th	0.009	0.053	Single phase	N/A
25th	0.013	0.074	Single phase	N/A
26th	0.009	0.051	Single phase	N/A
27th	0.013	0.079	Single phase	N/A
28th	0.005	0.028	Single phase	N/A
29th	0.009	0.055	Single phase	N/A
30th	0.004	0.025	Single phase	N/A
31st	0.010	0.058	Single phase	N/A
32nd	0.003	0.016	Single phase	N/A
33rd	0.008	0.048	Single phase	N/A
34th	0.002	0.009	Single phase	N/A
35th	0.005	0.031	Single phase	N/A
36th	0.004	0.021	Single phase	N/A
37th	0.007	0.040	Single phase	N/A
38th	0.003	0.015	Single phase	N/A
39th	0.007	0.043	Single phase	N/A
40th	0.002	0.012	Single phase	N/A
THD	--	0.979	Single phase	23
PWHD	--	1.672	Single phase	23

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	AF6K-SLP+15Battery			
Active power (W)	3931 (25°C)			
Voltage (V)	230.62			
Current (A)	17.05			
Power Factor	0.9998			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	17.047	--	Single phase	--
2nd	0.027	0.160	Single phase	8
3rd	0.075	0.442	Single phase	21,6
4th	0.003	0.020	Single phase	4
5th	0.072	0.419	Single phase	10,7
6th	0.005	0.029	Single phase	2,7
7th	0.059	0.347	Single phase	7,2
8th	0.003	0.020	Single phase	2
9th	0.044	0.260	Single phase	3,8
10th	0.005	0.028	Single phase	1,6
11th	0.042	0.246	Single phase	3,1
12th	0.005	0.028	Single phase	1,3
13th	0.033	0.194	Single phase	2
14th	0.004	0.025	Single phase	N/A
15th	0.024	0.141	Single phase	N/A
16th	0.002	0.014	Single phase	N/A
17th	0.028	0.162	Single phase	N/A
18th	0.011	0.067	Single phase	N/A
19th	0.024	0.142	Single phase	N/A
20th	0.006	0.038	Single phase	N/A
21st	0.014	0.083	Single phase	N/A
22nd	0.019	0.111	Single phase	N/A
23rd	0.015	0.087	Single phase	N/A
24th	0.009	0.054	Single phase	N/A
25th	0.013	0.075	Single phase	N/A
26th	0.009	0.050	Single phase	N/A
27th	0.014	0.081	Single phase	N/A
28th	0.005	0.027	Single phase	N/A
29th	0.009	0.055	Single phase	N/A
30th	0.005	0.028	Single phase	N/A
31st	0.010	0.061	Single phase	N/A
32nd	0.002	0.014	Single phase	N/A
33rd	0.009	0.050	Single phase	N/A
34th	0.002	0.010	Single phase	N/A
35th	0.005	0.032	Single phase	N/A
36th	0.005	0.028	Single phase	N/A
37th	0.007	0.042	Single phase	N/A
38th	0.003	0.016	Single phase	N/A
39th	0.007	0.042	Single phase	N/A
40th	0.002	0.014	Single phase	N/A
THD	--	0.980	Single phase	23
PWHD	--	1.690	Single phase	23

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	AF6K-SLP+15Battery			
Active power (W)	1963 (60°C)			
Voltage (V)	230.22			
Current (A)	8.54			
Power Factor	0.9991			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	8.534	--	Single phase	--
2nd	0.018	0.212	Single phase	8
3rd	0.086	1.007	Single phase	21,6
4th	0.007	0.084	Single phase	4
5th	0.074	0.863	Single phase	10,7
6th	0.003	0.036	Single phase	2,7
7th	0.049	0.573	Single phase	7,2
8th	0.005	0.054	Single phase	2
9th	0.052	0.604	Single phase	3,8
10th	0.009	0.104	Single phase	1,6
11th	0.035	0.409	Single phase	3,1
12th	0.014	0.165	Single phase	1,3
13th	0.032	0.374	Single phase	2
14th	0.011	0.127	Single phase	N/A
15th	0.025	0.294	Single phase	N/A
16th	0.010	0.119	Single phase	N/A
17th	0.028	0.328	Single phase	N/A
18th	0.002	0.029	Single phase	N/A
19th	0.021	0.251	Single phase	N/A
20th	0.011	0.131	Single phase	N/A
21st	0.021	0.244	Single phase	N/A
22nd	0.011	0.126	Single phase	N/A
23rd	0.017	0.202	Single phase	N/A
24th	0.005	0.057	Single phase	N/A
25th	0.014	0.168	Single phase	N/A
26th	0.009	0.103	Single phase	N/A
27th	0.008	0.092	Single phase	N/A
28th	0.002	0.021	Single phase	N/A
29th	0.009	0.106	Single phase	N/A
30th	0.003	0.038	Single phase	N/A
31st	0.006	0.068	Single phase	N/A
32nd	0.003	0.034	Single phase	N/A
33rd	0.008	0.090	Single phase	N/A
34th	0.003	0.035	Single phase	N/A
35th	0.006	0.076	Single phase	N/A
36th	0.004	0.048	Single phase	N/A
37th	0.004	0.052	Single phase	N/A
38th	0.002	0.021	Single phase	N/A
39th	0.007	0.077	Single phase	N/A
40th	0.001	0.014	Single phase	N/A
THD	--	2.027	Single phase	23
PWHD	--	3.236	Single phase	23

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	AF6K-SLP+15Battery			
Active power (W)	1961 (-25°C)			
Voltage (V)	230.21			
Current (A)	8.53			
Power Factor	0.9991			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	8.528	--	Single phase	--
2nd	0.019	0.218	Single phase	8
3rd	0.086	1.008	Single phase	21,6
4th	0.007	0.084	Single phase	4
5th	0.074	0.866	Single phase	10,7
6th	0.003	0.035	Single phase	2,7
7th	0.049	0.575	Single phase	7,2
8th	0.005	0.057	Single phase	2
9th	0.052	0.606	Single phase	3,8
10th	0.009	0.103	Single phase	1,6
11th	0.035	0.407	Single phase	3,1
12th	0.014	0.164	Single phase	1,3
13th	0.032	0.375	Single phase	2
14th	0.011	0.125	Single phase	N/A
15th	0.025	0.291	Single phase	N/A
16th	0.010	0.121	Single phase	N/A
17th	0.028	0.328	Single phase	N/A
18th	0.003	0.031	Single phase	N/A
19th	0.022	0.255	Single phase	N/A
20th	0.011	0.128	Single phase	N/A
21st	0.021	0.243	Single phase	N/A
22nd	0.011	0.127	Single phase	N/A
23rd	0.017	0.201	Single phase	N/A
24th	0.004	0.051	Single phase	N/A
25th	0.015	0.171	Single phase	N/A
26th	0.009	0.103	Single phase	N/A
27th	0.008	0.099	Single phase	N/A
28th	0.002	0.028	Single phase	N/A
29th	0.009	0.107	Single phase	N/A
30th	0.003	0.040	Single phase	N/A
31st	0.006	0.070	Single phase	N/A
32nd	0.003	0.040	Single phase	N/A
33rd	0.008	0.094	Single phase	N/A
34th	0.003	0.036	Single phase	N/A
35th	0.006	0.072	Single phase	N/A
36th	0.003	0.038	Single phase	N/A
37th	0.005	0.054	Single phase	N/A
38th	0.002	0.020	Single phase	N/A
39th	0.006	0.071	Single phase	N/A
40th	0.001	0.014	Single phase	N/A
THD	--	2.024	Single phase	23
PWHD	--	3.240	Single phase	23

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	AF6K-SLP+15Battery			
Active power (W)	1960 (25°C)			
Voltage (V)	230.22			
Current (A)	8.52			
Power Factor	0.9991			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	8.519	--	Single phase	--
2nd	0.018	0.216	Single phase	8
3rd	0.086	1.005	Single phase	21,6
4th	0.007	0.083	Single phase	4
5th	0.074	0.864	Single phase	10,7
6th	0.003	0.038	Single phase	2,7
7th	0.049	0.574	Single phase	7,2
8th	0.005	0.058	Single phase	2
9th	0.052	0.606	Single phase	3,8
10th	0.009	0.106	Single phase	1,6
11th	0.035	0.407	Single phase	3,1
12th	0.014	0.167	Single phase	1,3
13th	0.032	0.376	Single phase	2
14th	0.010	0.123	Single phase	N/A
15th	0.025	0.291	Single phase	N/A
16th	0.010	0.120	Single phase	N/A
17th	0.028	0.327	Single phase	N/A
18th	0.003	0.031	Single phase	N/A
19th	0.022	0.255	Single phase	N/A
20th	0.011	0.128	Single phase	N/A
21st	0.021	0.245	Single phase	N/A
22nd	0.011	0.126	Single phase	N/A
23rd	0.017	0.204	Single phase	N/A
24th	0.005	0.053	Single phase	N/A
25th	0.014	0.164	Single phase	N/A
26th	0.009	0.100	Single phase	N/A
27th	0.009	0.100	Single phase	N/A
28th	0.002	0.022	Single phase	N/A
29th	0.009	0.103	Single phase	N/A
30th	0.003	0.037	Single phase	N/A
31st	0.006	0.071	Single phase	N/A
32nd	0.003	0.037	Single phase	N/A
33rd	0.008	0.091	Single phase	N/A
34th	0.003	0.035	Single phase	N/A
35th	0.006	0.072	Single phase	N/A
36th	0.005	0.058	Single phase	N/A
37th	0.004	0.051	Single phase	N/A
38th	0.002	0.020	Single phase	N/A
39th	0.006	0.072	Single phase	N/A
40th	0.001	0.014	Single phase	N/A
THD	--	2.022	Single phase	23
PWHD	--	3.234	Single phase	23

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	AF6K-SLP+1Battery			
Active power (W)	-6022 (60°C)			
Voltage (V)	228.56			
Current (A)	26.37			
Power Factor	-0.9995			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	26.360	--	Single phase	--
2nd	0.049	0.187	Single phase	8
3rd	0.427	1.620	Single phase	21,6
4th	0.012	0.047	Single phase	4
5th	0.217	0.824	Single phase	10,7
6th	0.010	0.039	Single phase	2,7
7th	0.136	0.517	Single phase	7,2
8th	0.008	0.030	Single phase	2
9th	0.104	0.395	Single phase	3,8
10th	0.008	0.031	Single phase	1,6
11th	0.074	0.280	Single phase	3,1
12th	0.007	0.025	Single phase	1,3
13th	0.061	0.233	Single phase	2
14th	0.007	0.026	Single phase	N/A
15th	0.044	0.166	Single phase	N/A
16th	0.006	0.024	Single phase	N/A
17th	0.040	0.151	Single phase	N/A
18th	0.006	0.022	Single phase	N/A
19th	0.025	0.093	Single phase	N/A
20th	0.006	0.023	Single phase	N/A
21st	0.020	0.076	Single phase	N/A
22nd	0.007	0.027	Single phase	N/A
23rd	0.013	0.051	Single phase	N/A
24th	0.005	0.021	Single phase	N/A
25th	0.012	0.044	Single phase	N/A
26th	0.005	0.020	Single phase	N/A
27th	0.010	0.037	Single phase	N/A
28th	0.005	0.020	Single phase	N/A
29th	0.008	0.029	Single phase	N/A
30th	0.005	0.019	Single phase	N/A
31st	0.008	0.031	Single phase	N/A
32nd	0.005	0.021	Single phase	N/A
33rd	0.006	0.024	Single phase	N/A
34th	0.004	0.016	Single phase	N/A
35th	0.007	0.025	Single phase	N/A
36th	0.005	0.019	Single phase	N/A
37th	0.009	0.032	Single phase	N/A
38th	0.004	0.016	Single phase	N/A
39th	0.008	0.030	Single phase	N/A
40th	0.004	0.016	Single phase	N/A
THD	--	2.128	Single phase	23
PWHD	--	1.246	Single phase	23

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	AF6K-SLP+1Battery			
Active power (W)	-3982 (60°C)			
Voltage (V)	228.99			
Current (A)	17.41			
Power Factor	-0.9991			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	17.398	--	Single phase	--
2nd	0.024	0.137	Single phase	8
3rd	0.397	2.281	Single phase	21,6
4th	0.003	0.019	Single phase	4
5th	0.204	1.171	Single phase	10,7
6th	0.006	0.032	Single phase	2,7
7th	0.137	0.789	Single phase	7,2
8th	0.005	0.028	Single phase	2
9th	0.097	0.559	Single phase	3,8
10th	0.006	0.036	Single phase	1,6
11th	0.072	0.413	Single phase	3,1
12th	0.006	0.034	Single phase	1,3
13th	0.059	0.340	Single phase	2
14th	0.005	0.026	Single phase	N/A
15th	0.040	0.228	Single phase	N/A
16th	0.006	0.032	Single phase	N/A
17th	0.039	0.221	Single phase	N/A
18th	0.006	0.035	Single phase	N/A
19th	0.024	0.140	Single phase	N/A
20th	0.005	0.028	Single phase	N/A
21st	0.018	0.101	Single phase	N/A
22nd	0.004	0.022	Single phase	N/A
23rd	0.011	0.061	Single phase	N/A
24th	0.006	0.035	Single phase	N/A
25th	0.009	0.051	Single phase	N/A
26th	0.004	0.023	Single phase	N/A
27th	0.005	0.031	Single phase	N/A
28th	0.003	0.017	Single phase	N/A
29th	0.004	0.021	Single phase	N/A
30th	0.003	0.016	Single phase	N/A
31st	0.003	0.018	Single phase	N/A
32nd	0.003	0.015	Single phase	N/A
33rd	0.005	0.030	Single phase	N/A
34th	0.003	0.017	Single phase	N/A
35th	0.006	0.033	Single phase	N/A
36th	0.004	0.022	Single phase	N/A
37th	0.005	0.027	Single phase	N/A
38th	0.003	0.018	Single phase	N/A
39th	0.007	0.039	Single phase	N/A
40th	0.003	0.017	Single phase	N/A
THD	--	2.857	Single phase	23
PWHD	--	1.657	Single phase	23

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	AF6K-SLP+1Battery			
Active power (W)	-1987 (60°C)			
Voltage (V)	229.44			
Current (A)	8.68			
Power Factor	-0.9974			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	8.674	--	Single phase	--
2nd	0.008	0.091	Single phase	8
3rd	0.362	4.166	Single phase	21,6
4th	0.005	0.059	Single phase	4
5th	0.173	1.996	Single phase	10,7
6th	0.009	0.100	Single phase	2,7
7th	0.096	1.111	Single phase	7,2
8th	0.007	0.077	Single phase	2
9th	0.056	0.641	Single phase	3,8
10th	0.007	0.083	Single phase	1,6
11th	0.025	0.286	Single phase	3,1
12th	0.006	0.070	Single phase	1,3
13th	0.015	0.168	Single phase	2
14th	0.005	0.052	Single phase	N/A
15th	0.014	0.162	Single phase	N/A
16th	0.005	0.058	Single phase	N/A
17th	0.011	0.121	Single phase	N/A
18th	0.006	0.074	Single phase	N/A
19th	0.024	0.274	Single phase	N/A
20th	0.006	0.065	Single phase	N/A
21st	0.022	0.256	Single phase	N/A
22nd	0.005	0.052	Single phase	N/A
23rd	0.017	0.191	Single phase	N/A
24th	0.008	0.097	Single phase	N/A
25th	0.014	0.161	Single phase	N/A
26th	0.005	0.061	Single phase	N/A
27th	0.008	0.089	Single phase	N/A
28th	0.006	0.063	Single phase	N/A
29th	0.007	0.082	Single phase	N/A
30th	0.007	0.079	Single phase	N/A
31st	0.006	0.069	Single phase	N/A
32nd	0.003	0.029	Single phase	N/A
33rd	0.008	0.096	Single phase	N/A
34th	0.003	0.040	Single phase	N/A
35th	0.010	0.111	Single phase	N/A
36th	0.006	0.074	Single phase	N/A
37th	0.010	0.113	Single phase	N/A
38th	0.002	0.025	Single phase	N/A
39th	0.012	0.139	Single phase	N/A
40th	0.002	0.024	Single phase	N/A
THD	--	4.915	Single phase	23
PWHD	--	2.958	Single phase	23

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	AF6K-SLP+1Battery			
Active power (W)	5939 (60°C)			
Voltage (V)	230.92			
Current (A)	25.72			
Power Factor	0.9999			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	25.724	--	Single phase	--
2nd	0.041	0.159	Single phase	8
3rd	0.118	0.459	Single phase	21,6
4th	0.007	0.028	Single phase	4
5th	0.099	0.383	Single phase	10,7
6th	0.009	0.033	Single phase	2,7
7th	0.055	0.212	Single phase	7,2
8th	0.007	0.026	Single phase	2
9th	0.059	0.228	Single phase	3,8
10th	0.009	0.036	Single phase	1,6
11th	0.051	0.198	Single phase	3,1
12th	0.017	0.064	Single phase	1,3
13th	0.032	0.126	Single phase	2
14th	0.009	0.034	Single phase	N/A
15th	0.032	0.126	Single phase	N/A
16th	0.013	0.050	Single phase	N/A
17th	0.026	0.100	Single phase	N/A
18th	0.006	0.025	Single phase	N/A
19th	0.024	0.092	Single phase	N/A
20th	0.009	0.036	Single phase	N/A
21st	0.014	0.054	Single phase	N/A
22nd	0.009	0.035	Single phase	N/A
23rd	0.017	0.066	Single phase	N/A
24th	0.004	0.016	Single phase	N/A
25th	0.016	0.062	Single phase	N/A
26th	0.009	0.034	Single phase	N/A
27th	0.015	0.057	Single phase	N/A
28th	0.005	0.018	Single phase	N/A
29th	0.012	0.045	Single phase	N/A
30th	0.004	0.016	Single phase	N/A
31st	0.008	0.030	Single phase	N/A
32nd	0.006	0.024	Single phase	N/A
33rd	0.008	0.029	Single phase	N/A
34th	0.003	0.013	Single phase	N/A
35th	0.006	0.023	Single phase	N/A
36th	0.004	0.015	Single phase	N/A
37th	0.009	0.036	Single phase	N/A
38th	0.003	0.011	Single phase	N/A
39th	0.006	0.024	Single phase	N/A
40th	0.002	0.006	Single phase	N/A
THD	--	0.812	Single phase	23
PWHD	--	1.155	Single phase	23

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	AF6K-SLP+1Battery			
Active power (W)	3932 (60°C)			
Voltage (V)	230.63			
Current (A)	17.05			
Power Factor	0.9998			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	17.052	--	Single phase	--
2nd	0.028	0.162	Single phase	8
3rd	0.075	0.441	Single phase	21,6
4th	0.003	0.019	Single phase	4
5th	0.071	0.419	Single phase	10,7
6th	0.005	0.029	Single phase	2,7
7th	0.059	0.348	Single phase	7,2
8th	0.003	0.020	Single phase	2
9th	0.044	0.261	Single phase	3,8
10th	0.005	0.027	Single phase	1,6
11th	0.042	0.246	Single phase	3,1
12th	0.005	0.029	Single phase	1,3
13th	0.033	0.196	Single phase	2
14th	0.004	0.024	Single phase	N/A
15th	0.024	0.142	Single phase	N/A
16th	0.002	0.013	Single phase	N/A
17th	0.028	0.163	Single phase	N/A
18th	0.011	0.067	Single phase	N/A
19th	0.025	0.144	Single phase	N/A
20th	0.006	0.036	Single phase	N/A
21st	0.014	0.083	Single phase	N/A
22nd	0.019	0.109	Single phase	N/A
23rd	0.015	0.087	Single phase	N/A
24th	0.009	0.055	Single phase	N/A
25th	0.013	0.075	Single phase	N/A
26th	0.008	0.049	Single phase	N/A
27th	0.014	0.080	Single phase	N/A
28th	0.004	0.025	Single phase	N/A
29th	0.009	0.053	Single phase	N/A
30th	0.005	0.028	Single phase	N/A
31st	0.010	0.061	Single phase	N/A
32nd	0.002	0.013	Single phase	N/A
33rd	0.008	0.049	Single phase	N/A
34th	0.002	0.010	Single phase	N/A
35th	0.005	0.029	Single phase	N/A
36th	0.005	0.030	Single phase	N/A
37th	0.007	0.040	Single phase	N/A
38th	0.003	0.016	Single phase	N/A
39th	0.007	0.044	Single phase	N/A
40th	0.002	0.012	Single phase	N/A
THD	--	0.977	Single phase	23
PWHD	--	1.683	Single phase	23

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	AF6K-SLP+1Battery			
Active power (W)	1962 (60°C)			
Voltage (V)	230.22			
Current (A)	8.53			
Power Factor	0.9991			
Frequency (Hz)	50.00			
Harmonics	Current Magnitude (A)	Current Percent of Fundamental (%)	Phase	Harmonic Current Limits (%)
1st	8.529	--	Single phase	--
2nd	0.017	0.199	Single phase	8
3rd	0.086	1.005	Single phase	21,6
4th	0.006	0.073	Single phase	4
5th	0.074	0.866	Single phase	10,7
6th	0.003	0.032	Single phase	2,7
7th	0.049	0.572	Single phase	7,2
8th	0.005	0.059	Single phase	2
9th	0.052	0.606	Single phase	3,8
10th	0.009	0.107	Single phase	1,6
11th	0.035	0.407	Single phase	3,1
12th	0.014	0.163	Single phase	1,3
13th	0.032	0.376	Single phase	2
14th	0.011	0.124	Single phase	N/A
15th	0.024	0.285	Single phase	N/A
16th	0.010	0.116	Single phase	N/A
17th	0.028	0.326	Single phase	N/A
18th	0.002	0.029	Single phase	N/A
19th	0.022	0.259	Single phase	N/A
20th	0.011	0.129	Single phase	N/A
21st	0.021	0.248	Single phase	N/A
22nd	0.009	0.106	Single phase	N/A
23rd	0.018	0.212	Single phase	N/A
24th	0.004	0.047	Single phase	N/A
25th	0.014	0.170	Single phase	N/A
26th	0.008	0.096	Single phase	N/A
27th	0.009	0.106	Single phase	N/A
28th	0.002	0.021	Single phase	N/A
29th	0.009	0.106	Single phase	N/A
30th	0.003	0.036	Single phase	N/A
31st	0.007	0.077	Single phase	N/A
32nd	0.004	0.041	Single phase	N/A
33rd	0.008	0.095	Single phase	N/A
34th	0.004	0.043	Single phase	N/A
35th	0.006	0.070	Single phase	N/A
36th	0.004	0.047	Single phase	N/A
37th	0.004	0.052	Single phase	N/A
38th	0.002	0.020	Single phase	N/A
39th	0.005	0.054	Single phase	N/A
40th	0.001	0.014	Single phase	N/A
THD	--	2.033	Single phase	23
PWHD	--	3.233	Single phase	23

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)				
60°C, 100% P_{CMAX} power condition: AF1K-SL-1+1Battery				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.012	--	--	1.080
3rd	0.352	--	--	2.300
4th	0.007	--	--	0.430
5th	0.178	--	--	1.140
6th	0.019	--	--	0.300
7th	0.073	--	--	0.770
8th	0.016	--	--	0.230
9th	0.009	--	--	0.400
10th	0.013	--	--	0.184
11th	0.015	--	--	0.330
12th	0.013	--	--	0.153
13th	0.025	--	--	0.210
14th	0.009	--	--	0.131
15th	0.027	--	--	0.150
16th	0.004	--	--	0.115
17th	0.021	--	--	0.132
18th	0.004	--	--	0.102
19th	0.016	--	--	0.118
20th	0.006	--	--	0.092
21th	0.010	--	--	0.107
22th	0.007	--	--	0.084
23th	0.004	--	--	0.098
24th	0.002	--	--	0.077
25th	0.007	--	--	0.090
26th	0.004	--	--	0.071
27th	0.010	--	--	0.083
28th	0.004	--	--	0.066
29th	0.006	--	--	0.078
30th	0.003	--	--	0.061
31th	0.006	--	--	0.073
32th	0.002	--	--	0.058
33th	0.004	--	--	0.068
34th	0.002	--	--	0.054
35th	0.004	--	--	0.064
36th	0.004	--	--	0.051
37th	0.003	--	--	0.061
38th	0.002	--	--	0.048
39th	0.006	--	--	0.058
40th	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)				
60°C, 66% P_{CMAX} power condition: AF1K-SL-1+1Battery				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.013	--	--	1.080
3rd	0.362	--	--	2.300
4th	0.011	--	--	0.430
5th	0.123	--	--	1.140
6th	0.021	--	--	0.300
7th	0.015	--	--	0.770
8th	0.019	--	--	0.230
9th	0.057	--	--	0.400
10th	0.009	--	--	0.184
11th	0.059	--	--	0.330
12th	0.006	--	--	0.153
13th	0.038	--	--	0.210
14th	0.007	--	--	0.131
15th	0.013	--	--	0.150
16th	0.005	--	--	0.115
17th	0.026	--	--	0.132
18th	0.003	--	--	0.102
19th	0.025	--	--	0.118
20th	0.009	--	--	0.092
21th	0.020	--	--	0.107
22th	0.003	--	--	0.084
23th	0.011	--	--	0.098
24th	0.003	--	--	0.077
25th	0.014	--	--	0.090
26th	0.003	--	--	0.071
27th	0.014	--	--	0.083
28th	0.003	--	--	0.066
29th	0.009	--	--	0.078
30th	0.003	--	--	0.061
31th	0.006	--	--	0.073
32th	0.002	--	--	0.058
33th	0.008	--	--	0.068
34th	0.003	--	--	0.054
35th	0.010	--	--	0.064
36th	0.007	--	--	0.051
37th	0.007	--	--	0.061
38th	0.002	--	--	0.048
39th	0.007	--	--	0.058
40th	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)				
60°C, 33% P_{CMAX} power condition: AF1K-SL-1+1Battery				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.024	--	--	1.080
3rd	0.383	--	--	2.300
4th	0.012	--	--	0.430
5th	0.110	--	--	1.140
6th	0.015	--	--	0.300
7th	0.179	--	--	0.770
8th	0.008	--	--	0.230
9th	0.074	--	--	0.400
10th	0.013	--	--	0.184
11th	0.086	--	--	0.330
12th	0.010	--	--	0.153
13th	0.064	--	--	0.210
14th	0.014	--	--	0.131
15th	0.059	--	--	0.150
16th	0.007	--	--	0.115
17th	0.050	--	--	0.132
18th	0.005	--	--	0.102
19th	0.039	--	--	0.118
20th	0.007	--	--	0.092
21th	0.037	--	--	0.107
22th	0.003	--	--	0.084
23th	0.023	--	--	0.098
24th	0.004	--	--	0.077
25th	0.023	--	--	0.090
26th	0.004	--	--	0.071
27th	0.015	--	--	0.083
28th	0.005	--	--	0.066
29th	0.014	--	--	0.078
30th	0.003	--	--	0.061
31th	0.011	--	--	0.073
32th	0.003	--	--	0.058
33th	0.011	--	--	0.068
34th	0.003	--	--	0.054
35th	0.012	--	--	0.064
36th	0.006	--	--	0.051
37th	0.008	--	--	0.061
38th	0.002	--	--	0.048
39th	0.010	--	--	0.058
40th	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)				
60°C, 100% P_{SMAX} power condition: AF1K-SL-1+1Battery				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.018	--	--	1.080
3rd	0.352	--	--	2.300
4th	0.008	--	--	0.430
5th	0.179	--	--	1.140
6th	0.010	--	--	0.300
7th	0.073	--	--	0.770
8th	0.014	--	--	0.230
9th	0.009	--	--	0.400
10th	0.012	--	--	0.184
11th	0.015	--	--	0.330
12th	0.013	--	--	0.153
13th	0.025	--	--	0.210
14th	0.008	--	--	0.131
15th	0.027	--	--	0.150
16th	0.004	--	--	0.115
17th	0.021	--	--	0.132
18th	0.004	--	--	0.102
19th	0.016	--	--	0.118
20th	0.006	--	--	0.092
21th	0.010	--	--	0.107
22th	0.006	--	--	0.084
23th	0.004	--	--	0.098
24th	0.003	--	--	0.077
25th	0.006	--	--	0.090
26th	0.003	--	--	0.071
27th	0.010	--	--	0.083
28th	0.005	--	--	0.066
29th	0.006	--	--	0.078
30th	0.003	--	--	0.061
31th	0.007	--	--	0.073
32th	0.002	--	--	0.058
33th	0.004	--	--	0.068
34th	0.003	--	--	0.054
35th	0.004	--	--	0.064
36th	0.007	--	--	0.051
37th	0.004	--	--	0.061
38th	0.002	--	--	0.048
39th	0.006	--	--	0.058
40th	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)				
60°C, 66% P_{SMAX} power condition: AF1K-SL-1+1Battery				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.014	--	--	1.080
3rd	0.362	--	--	2.300
4th	0.011	--	--	0.430
5th	0.123	--	--	1.140
6th	0.021	--	--	0.300
7th	0.015	--	--	0.770
8th	0.019	--	--	0.230
9th	0.057	--	--	0.400
10th	0.009	--	--	0.184
11th	0.059	--	--	0.330
12th	0.006	--	--	0.153
13th	0.038	--	--	0.210
14th	0.007	--	--	0.131
15th	0.013	--	--	0.150
16th	0.005	--	--	0.115
17th	0.026	--	--	0.132
18th	0.003	--	--	0.102
19th	0.025	--	--	0.118
20th	0.009	--	--	0.092
21th	0.020	--	--	0.107
22th	0.004	--	--	0.084
23th	0.011	--	--	0.098
24th	0.003	--	--	0.077
25th	0.014	--	--	0.090
26th	0.003	--	--	0.071
27th	0.015	--	--	0.083
28th	0.003	--	--	0.066
29th	0.010	--	--	0.078
30th	0.003	--	--	0.061
31th	0.006	--	--	0.073
32th	0.002	--	--	0.058
33th	0.008	--	--	0.068
34th	0.003	--	--	0.054
35th	0.010	--	--	0.064
36th	0.005	--	--	0.051
37th	0.007	--	--	0.061
38th	0.002	--	--	0.048
39th	0.007	--	--	0.058
40th	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)				
60°C, 33% P_{SMAX} power condition: AF1K-SL-1+1Battery				
Harmonic	L1 Phase (A)	L2 Phase (A)	L3 Phase (A)	Limit (A)
2nd	0.024	--	--	1.080
3rd	0.383	--	--	2.300
4th	0.011	--	--	0.430
5th	0.111	--	--	1.140
6th	0.015	--	--	0.300
7th	0.180	--	--	0.770
8th	0.007	--	--	0.230
9th	0.075	--	--	0.400
10th	0.013	--	--	0.184
11th	0.087	--	--	0.330
12th	0.010	--	--	0.153
13th	0.064	--	--	0.210
14th	0.014	--	--	0.131
15th	0.060	--	--	0.150
16th	0.007	--	--	0.115
17th	0.050	--	--	0.132
18th	0.005	--	--	0.102
19th	0.039	--	--	0.118
20th	0.007	--	--	0.092
21th	0.037	--	--	0.107
22th	0.004	--	--	0.084
23th	0.024	--	--	0.098
24th	0.003	--	--	0.077
25th	0.023	--	--	0.090
26th	0.005	--	--	0.071
27th	0.015	--	--	0.083
28th	0.006	--	--	0.066
29th	0.014	--	--	0.078
30th	0.003	--	--	0.061
31th	0.011	--	--	0.073
32th	0.003	--	--	0.058
33th	0.012	--	--	0.068
34th	0.003	--	--	0.054
35th	0.012	--	--	0.064
36th	0.004	--	--	0.051
37th	0.008	--	--	0.061
38th	0.002	--	--	0.048
39th	0.010	--	--	0.058
40th	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

Mode	AF6K-SLP+15Battery-Discharge			
Normal ambient				
Output power:	Flicker limits according to*:	Result:		
		Plt	Pst	dc%
33%	EN61000-3-3 / EN61000-3-11	0.102	0.114	0.042
66%	EN61000-3-3 / EN61000-3-11	0.105	0.114	0.043
100%	EN61000-3-3 / EN61000-3-11	0.101	0.112	0.047
Minimum ambient rating (-25°C) or -10°C				
Output power:	Flicker limits according to*:	Result:		
		Plt	Pst	dc%
33%	EN61000-3-3 / EN61000-3-11	0.103	0.115	0.044
66%	EN61000-3-3 / EN61000-3-11	0.102	0.112	0.046
100%	EN61000-3-3 / EN61000-3-11	0.099	0.110	0.045
Maximum ambient rating (+60°C) or +55°C				
Output power:	Flicker limits according to*:	Result:		
		Plt	Pst	dc%
33%	EN61000-3-3 / EN61000-3-11	0.100	0.110	0.046
66%	EN61000-3-3 / EN61000-3-11	0.100	0.109	0.047
100%	EN61000-3-3 / EN61000-3-11	0.100	0.108	0.046

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.

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.037	Pass	0.259	Pass	0.0	Pass	0.100	Pass		
2	0.045	Pass	0.263	Pass	0.0	Pass	0.102	Pass		
3	0.035	Pass	0.262	Pass	0.0	Pass	0.103	Pass		
4	0.047	Pass	0.273	Pass	0.0	Pass	0.105	Pass		
5	0.040	Pass	0.263	Pass	0.0	Pass	0.095	Pass		
6	0.046	Pass	0.267	Pass	0.0	Pass	0.094	Pass		
7	0.043	Pass	0.270	Pass	0.0	Pass	0.100	Pass		
8	0.041	Pass	0.259	Pass	0.0	Pass	0.095	Pass		
9	0.036	Pass	0.260	Pass	0.0	Pass	0.094	Pass		
10	0.039	Pass	0.283	Pass	0.0	Pass	0.111	Pass		
11	0.047	Pass	0.284	Pass	0.0	Pass	0.112	Pass		
12	0.041	Pass	0.277	Pass	0.0	Pass	0.100	Pass		
Result		Pass		Pass		Pass		Pass	0.101	Pass

Mode	AF6K-SLP+15Battery-Charge			
Normal ambient				
Output power:	Flicker limits according to*:	Result:		
		Plt	Pst	dc%
33%	EN61000-3-3 / EN61000-3-11	0.103	0.114	0.045
66%	EN61000-3-3 / EN61000-3-11	0.103	0.113	0.046
100%	EN61000-3-3 / EN61000-3-11	0.102	0.115	0.047
Minimum ambient rating (-25°C) or -10°C				
Output power:	Flicker limits according to*:	Result:		
		Plt	Pst	dc%
33%	EN61000-3-3 / EN61000-3-11	0.103	0.115	0.047
66%	EN61000-3-3 / EN61000-3-11	0.103	0.115	0.047
100%	EN61000-3-3 / EN61000-3-11	0.102	0.112	0.041
Maximum ambient rating (+60°C) or +55°C				
Output power:	Flicker limits according to*:	Result:		
		Plt	Pst	dc%
33%	EN61000-3-3 / EN61000-3-11	0.104	0.116	0.046
66%	EN61000-3-3 / EN61000-3-11	0.103	0.114	0.047
100%	EN61000-3-3 / EN61000-3-11	0.101	0.110	0.044

Note:
* Mains Impedance according EN61000-3-3 / EN61000-3-11: $\mathbf{R_{max}}$ **= Ω; j$\mathbf{X_{max}}$= Ω @50Hz (|$\mathbf{Z_{max}}$| = 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[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.038	Pass	0.257	Pass	0.0	Pass	0.095	Pass		
2	0.047	Pass	0.266	Pass	0.0	Pass	0.093	Pass		
3	0.036	Pass	0.254	Pass	0.0	Pass	0.093	Pass		
4	0.037	Pass	0.272	Pass	0.0	Pass	0.113	Pass		
5	0.037	Pass	0.259	Pass	0.0	Pass	0.100	Pass		
6	0.037	Pass	0.281	Pass	0.0	Pass	0.104	Pass		
7	0.039	Pass	0.262	Pass	0.0	Pass	0.103	Pass		
8	0.038	Pass	0.265	Pass	0.0	Pass	0.104	Pass		
9	0.037	Pass	0.254	Pass	0.0	Pass	0.115	Pass		
10	0.035	Pass	0.264	Pass	0.0	Pass	0.102	Pass		
11	0.043	Pass	0.255	Pass	0.0	Pass	0.095	Pass		
12	0.045	Pass	0.256	Pass	0.0	Pass	0.112	Pass		
Result		Pass		Pass		Pass		Pass	0.102	Pass

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

Mode	AF6K-SLP+1Battery-Discharge			
Abnormal ambient				
Output power:	Flicker limits according to*:	Result:		
		Plt	Pst	dc%
33%	EN61000-3-3 / EN61000-3-11	0.105	0.112	0.037
66%	EN61000-3-3 / EN61000-3-11	0.104	0.112	0.039
100%	EN61000-3-3 / EN61000-3-11	0.103	0.109	0.039

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).

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.031	Pass	0.300	Pass	0.0	Pass	0.099	Pass		
2	0.032	Pass	0.298	Pass	0.0	Pass	0.100	Pass		
3	0.031	Pass	0.295	Pass	0.0	Pass	0.101	Pass		
4	0.037	Pass	0.293	Pass	0.0	Pass	0.106	Pass		
5	0.031	Pass	0.291	Pass	0.0	Pass	0.109	Pass		
6	0.033	Pass	0.291	Pass	0.0	Pass	0.109	Pass		
7	0.034	Pass	0.294	Pass	0.0	Pass	0.101	Pass		
8	0.035	Pass	0.296	Pass	0.0	Pass	0.100	Pass		
9	0.033	Pass	0.300	Pass	0.0	Pass	0.108	Pass		
10	0.030	Pass	0.292	Pass	0.0	Pass	0.100	Pass		
11	0.031	Pass	0.305	Pass	0.0	Pass	0.100	Pass		
12	0.039	Pass	0.291	Pass	0.0	Pass	0.104	Pass		
Result		Pass		Pass		Pass		Pass	0.103	Pass

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

Mode	AF6K-SLP+1Battery-Charge			
Abnormal ambient				
Output power:	Flicker limits according to*:	Result:		
		Plt	Pst	dc%
33%	EN61000-3-3 / EN61000-3-11	0.104	0.112	0.038
66%	EN61000-3-3 / EN61000-3-11	0.104	0.112	0.038
100%	EN61000-3-3 / EN61000-3-11	0.103	0.109	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).

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.031	Pass	0.299	Pass	0.0	Pass	0.100	Pass		
2	0.034	Pass	0.304	Pass	0.0	Pass	0.101	Pass		
3	0.031	Pass	0.296	Pass	0.0	Pass	0.105	Pass		
4	0.037	Pass	0.301	Pass	0.0	Pass	0.099	Pass		
5	0.038	Pass	0.298	Pass	0.0	Pass	0.109	Pass		
6	0.031	Pass	0.298	Pass	0.0	Pass	0.106	Pass		
7	0.030	Pass	0.297	Pass	0.0	Pass	0.109	Pass		
8	0.035	Pass	0.293	Pass	0.0	Pass	0.099	Pass		
9	0.033	Pass	0.295	Pass	0.0	Pass	0.104	Pass		
10	0.030	Pass	0.292	Pass	0.0	Pass	0.103	Pass		
11	0.031	Pass	0.296	Pass	0.0	Pass	0.105	Pass		
12	0.031	Pass	0.298	Pass	0.0	Pass	0.100	Pass		
Result		Pass		Pass		Pass		Pass	0.103	Pass

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

Mode	AF1K-SL-1+1Battery-Discharge			
Abnormal ambient				
Output power:	Flicker limits according to*:	Result:		
		Plt	Pst	dc%
33%	EN61000-3-3 / EN61000-3-11	0.104	0.112	0.036
66%	EN61000-3-3 / EN61000-3-11	0.103	0.110	0.033
100%	EN61000-3-3 / EN61000-3-11	0.104	0.110	0.037

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).

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.037	Pass	0.301	Pass	0.0	Pass	0.106	Pass		
2	0.027	Pass	0.302	Pass	0.0	Pass	0.108	Pass		
3	0.031	Pass	0.308	Pass	0.0	Pass	0.104	Pass		
4	0.031	Pass	0.302	Pass	0.0	Pass	0.109	Pass		
5	0.034	Pass	0.298	Pass	0.0	Pass	0.100	Pass		
6	0.029	Pass	0.299	Pass	0.0	Pass	0.103	Pass		
7	0.028	Pass	0.299	Pass	0.0	Pass	0.109	Pass		
8	0.037	Pass	0.312	Pass	0.0	Pass	0.100	Pass		
9	0.028	Pass	0.301	Pass	0.0	Pass	0.102	Pass		
10	0.032	Pass	0.302	Pass	0.0	Pass	0.102	Pass		
11	0.031	Pass	0.297	Pass	0.0	Pass	0.100	Pass		
12	0.026	Pass	0.291	Pass	0.0	Pass	0.110	Pass		
Result		Pass		Pass		Pass		Pass	0.104	Pass

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

Mode	AF1K-SL-1+1Battery-Charge			
Abnormal ambient				
Output power:	Flicker limits according to*:	Result:		
		Plt	Pst	dc%
33%	EN61000-3-3 / EN61000-3-11	0.103	0.111	0.035
66%	EN61000-3-3 / EN61000-3-11	0.105	0.110	0.037
100%	EN61000-3-3 / EN61000-3-11	0.104	0.112	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).

	dc[%]		dmax[%]		d(t)[ms]		Pst		Plt	
Limit	3.30		4.00		500 3.30%		1.00		0.65 N:12	
No. 1	0.038	Pass	0.290	Pass	0.0	Pass	0.099	Pass		
2	0.037	Pass	0.312	Pass	0.0	Pass	0.107	Pass		
3	0.030	Pass	0.313	Pass	0.0	Pass	0.099	Pass		
4	0.030	Pass	0.299	Pass	0.0	Pass	0.106	Pass		
5	0.027	Pass	0.289	Pass	0.0	Pass	0.102	Pass		
6	0.027	Pass	0.289	Pass	0.0	Pass	0.112	Pass		
7	0.034	Pass	0.293	Pass	0.0	Pass	0.109	Pass		
8	0.034	Pass	0.289	Pass	0.0	Pass	0.101	Pass		
9	0.030	Pass	0.307	Pass	0.0	Pass	0.108	Pass		
10	0.028	Pass	0.295	Pass	0.0	Pass	0.105	Pass		
11	0.035	Pass	0.301	Pass	0.0	Pass	0.101	Pass		
12	0.034	Pass	0.293	Pass	0.0	Pass	0.105	Pass		
Result		Pass		Pass		Pass		Pass	0.104	Pass

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

Bbis.4	**TABLE: Check the operating range in voltage and frequency**					**P**
Model	AF6K-SLP+15Battery					
Supplementary information: P_{SMAX} =6kW P_{CMAX} =6kW						
Test Point	Voltage (%)	Frequency(Hz)	P (W) *	cos φ	Time (s)	Result
Test 1	85.03	47.50	5327	0.999	>5min	No disconnection
Test 2	109.99	51.50	5989	0.999	>5min	No disconnection
Test 3	85.03	47.50	-5327	-0.998	>5min	No disconnection
Test 4	109.92	51.50	-6050	-0.997	>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 *：Due to conversion efficiency, it is not possible to achieve 100%P_{SMAX} 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

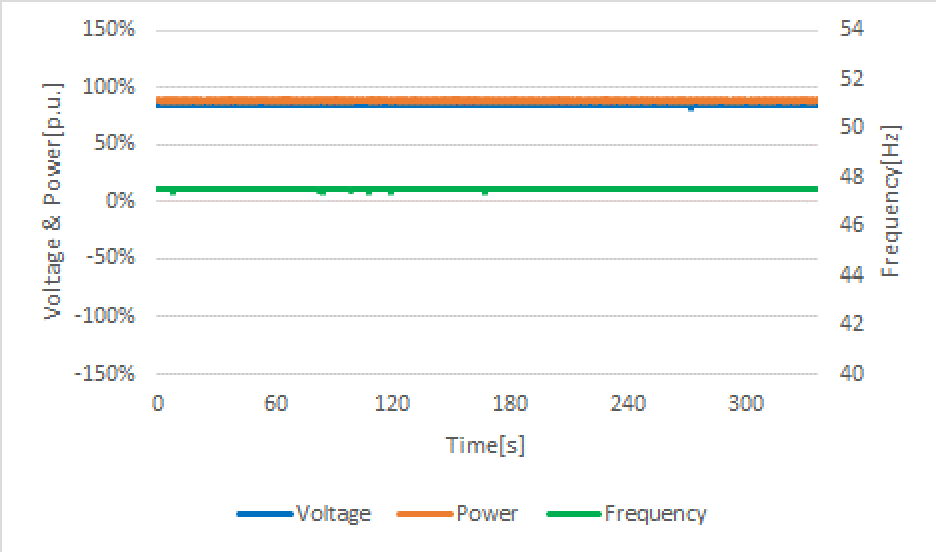
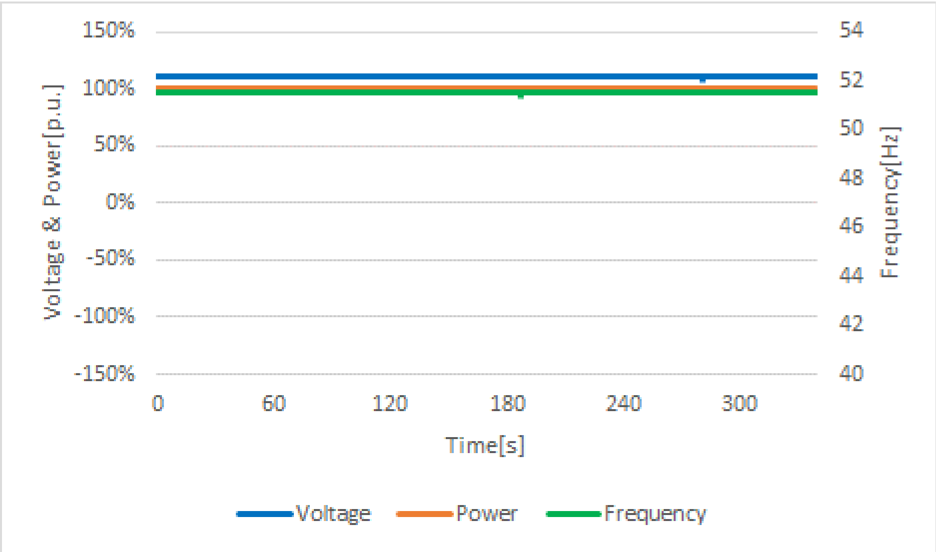


Diagram of Test 2



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

Diagram of Test 3

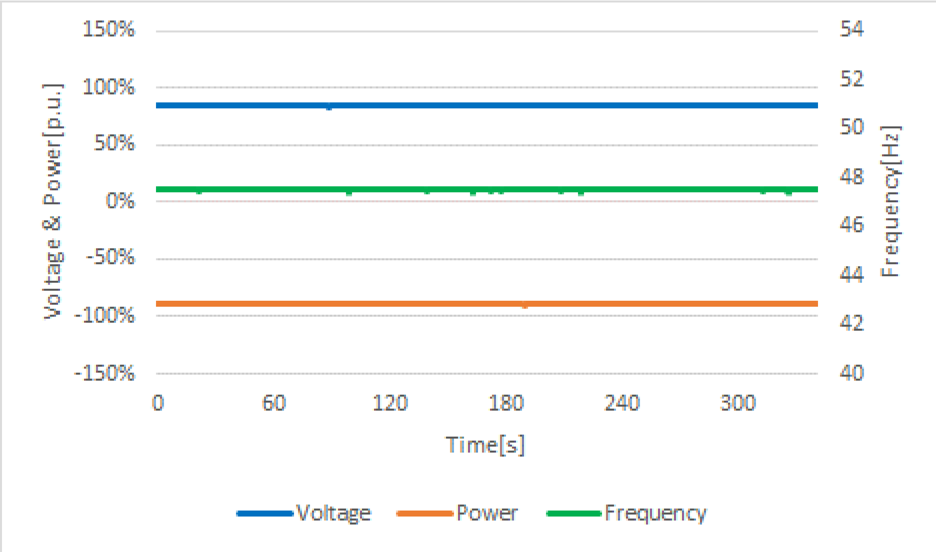
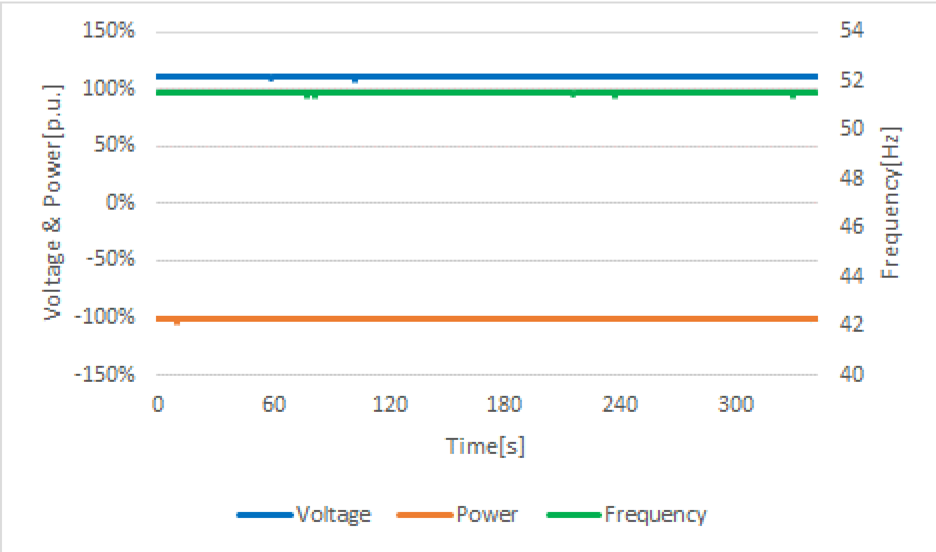


Diagram of Test 4

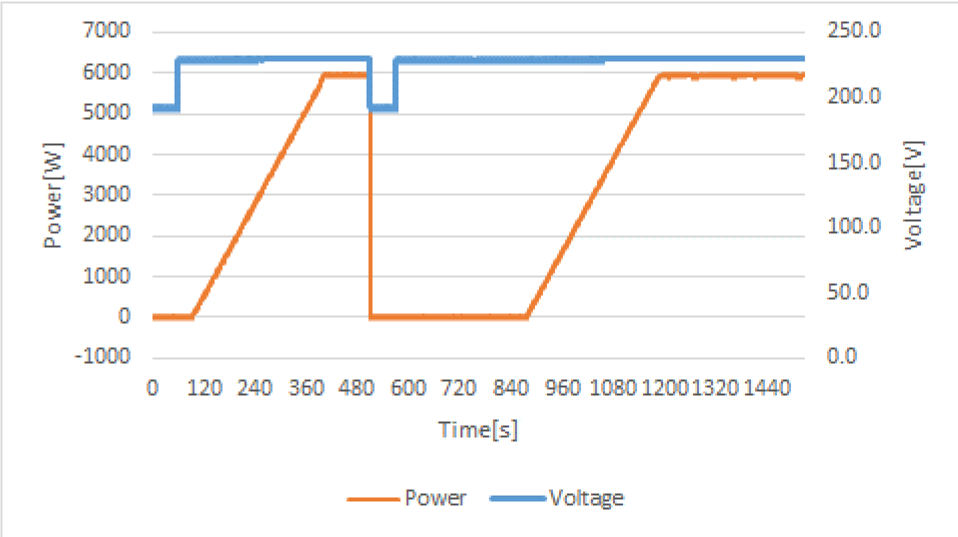


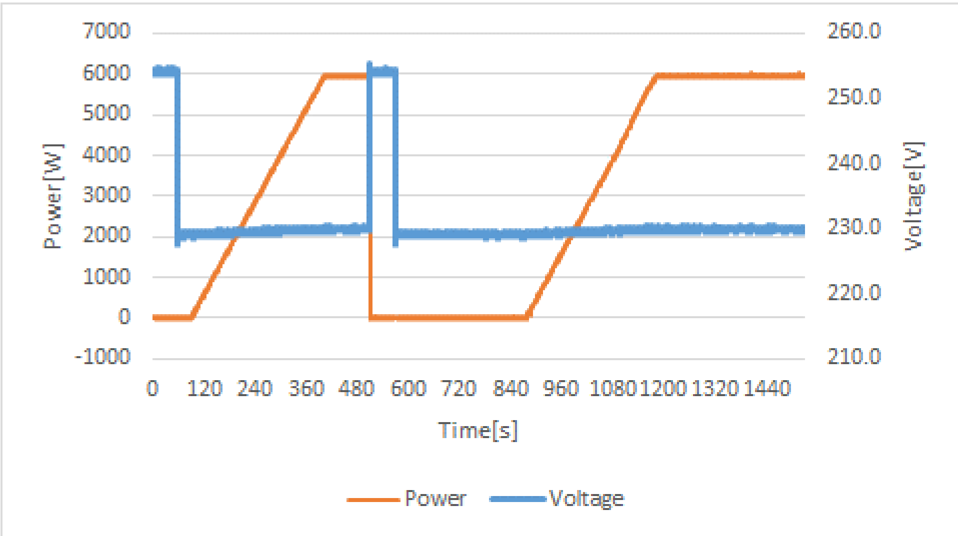
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.5	**TABLE: Conditions of connection, reconnection and gradual power supply**		**P**
Model	AF6K-SLP+15Battery		
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]	33.6	32.3	
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]	304.4	305.1	
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]	33.5	32.3	
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]	304.2	306.1	
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)		

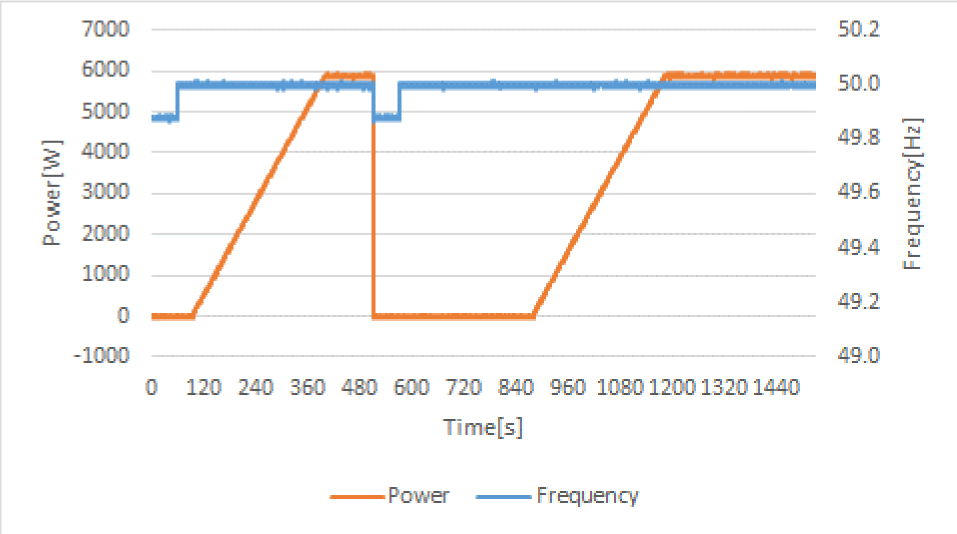
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

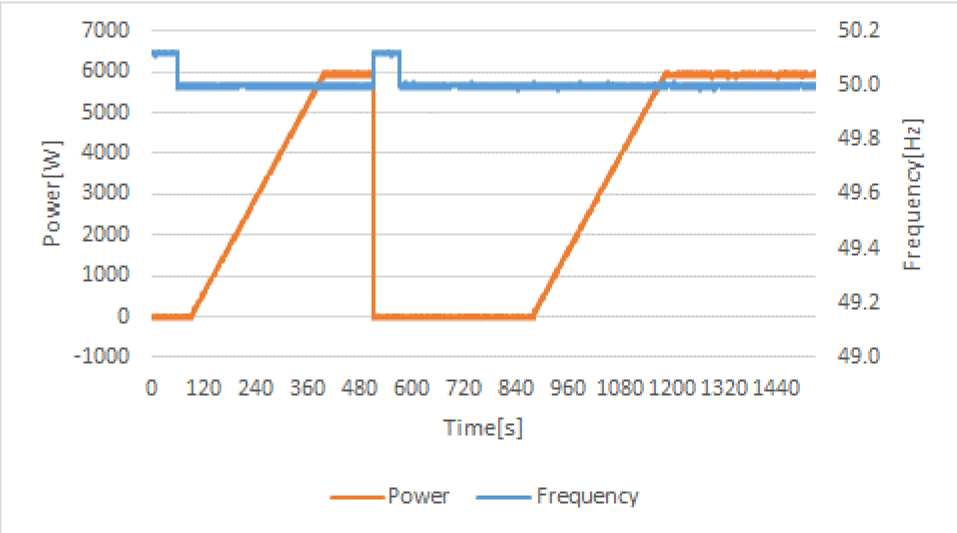
Test: Test condition b) and c): voltage within the limits of 85% to 110%U_n Test condition e) and f): frequency within the limits of 49,90Hz to 50,10Hz Max deviation of the gradient: +2,5%P_{SMAX} or P_{NINV}		Reconnection time range: 0-900s in steps of 5s (default value: 300s)





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



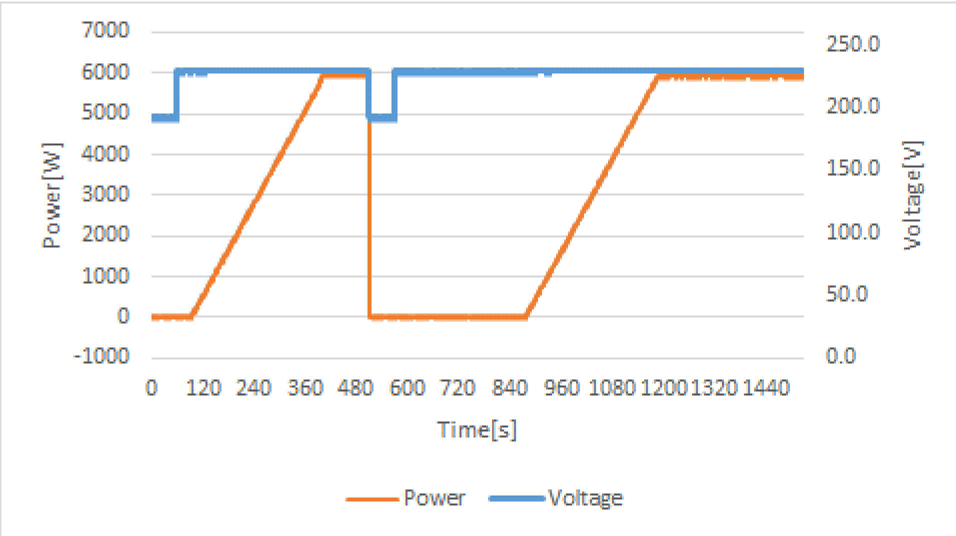


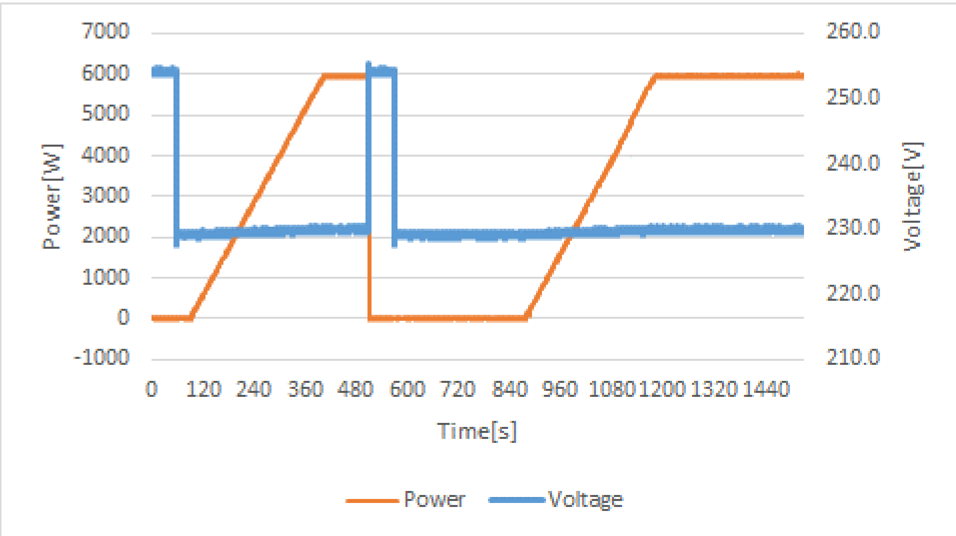
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.5	**TABLE: Conditions of connection, reconnection and gradual power supply**		**P**
Model	AF6K-SLP+1Battery		
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]	32.3	32.6	
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]	306.5	305.1	
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]	33.6	33.2	
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]	306.4	305.1	
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)		

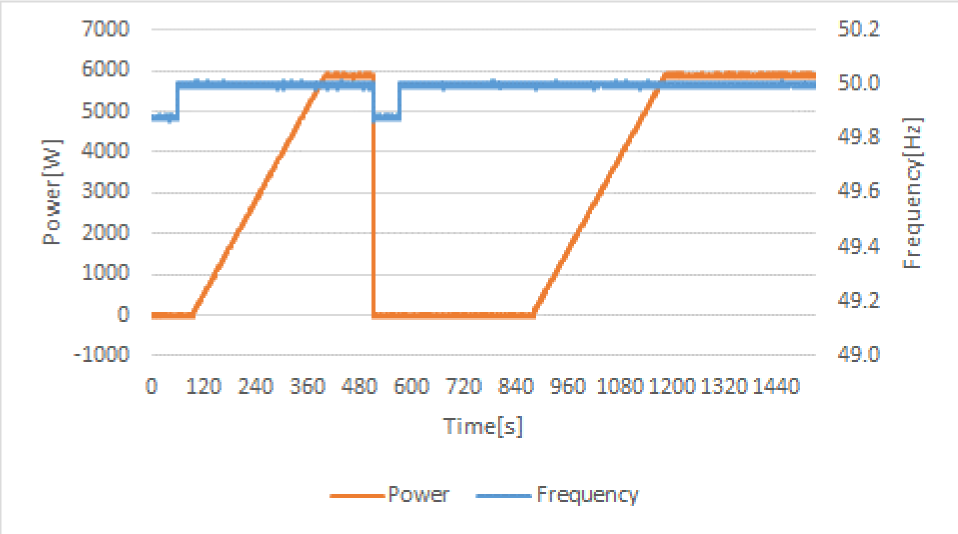
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

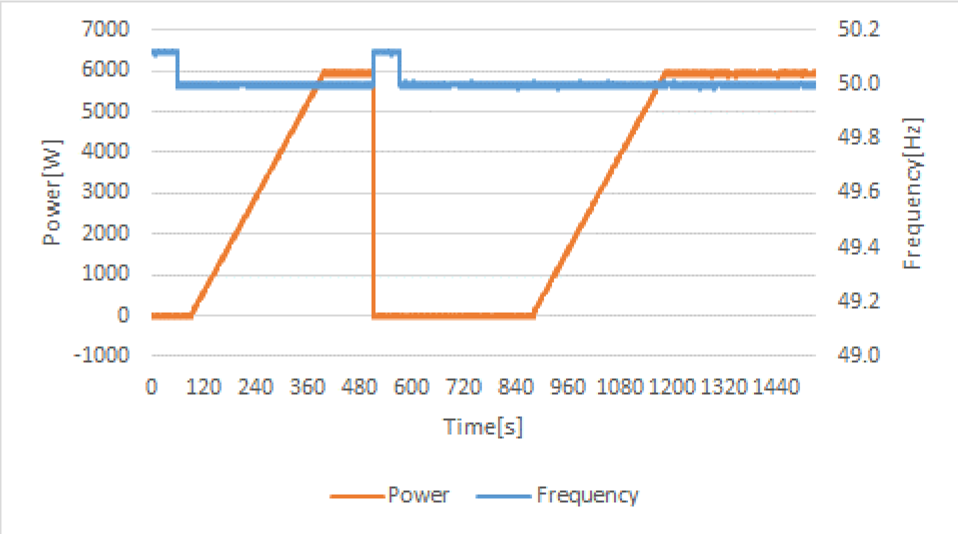
Test: Test condition b) and c): voltage within the limits of 85% to 110%U_n Test condition e) and f): frequency within the limits of 49,90Hz to 50,10Hz Max deviation of the gradient: +2,5%P_{SMAX} or P_{NINV}		Reconnection time range: 0-900s in steps of 5s (default value: 300s)





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



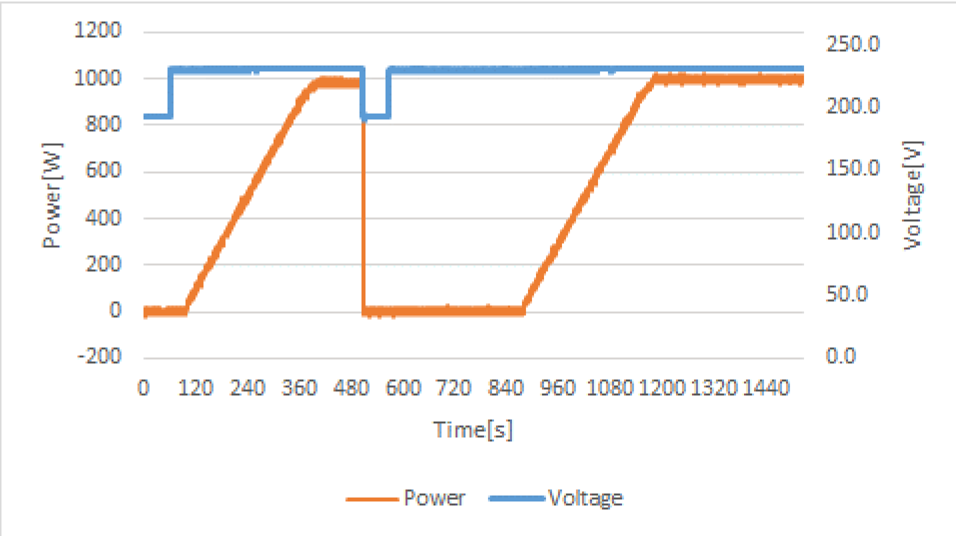


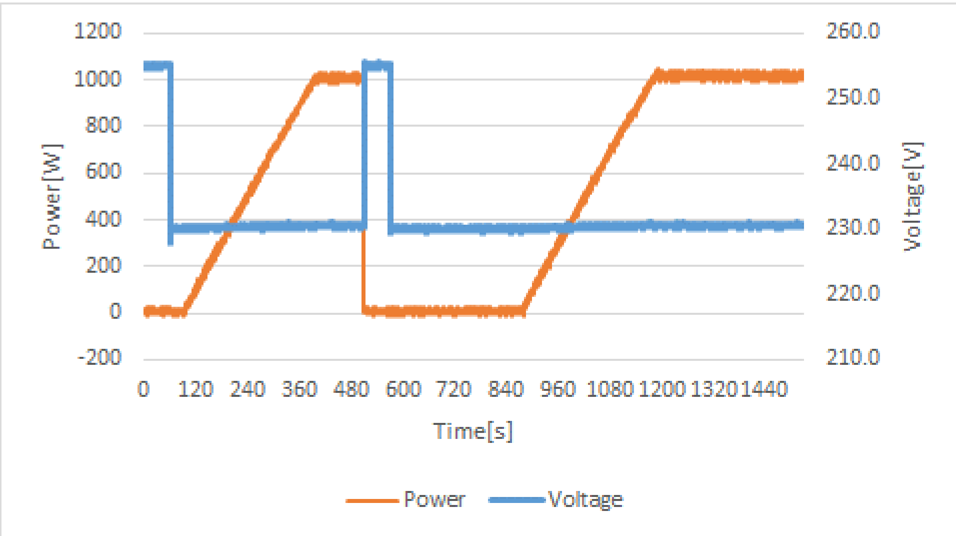
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.5	**TABLE: Conditions of connection, reconnection and gradual power supply**		**P**
Model	AF1K-SL-1+1Battery		
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]	34.5	36.2	
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]	304.4	304.9	
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]	35.2	32.7	
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]	306.4	304.6	
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)		

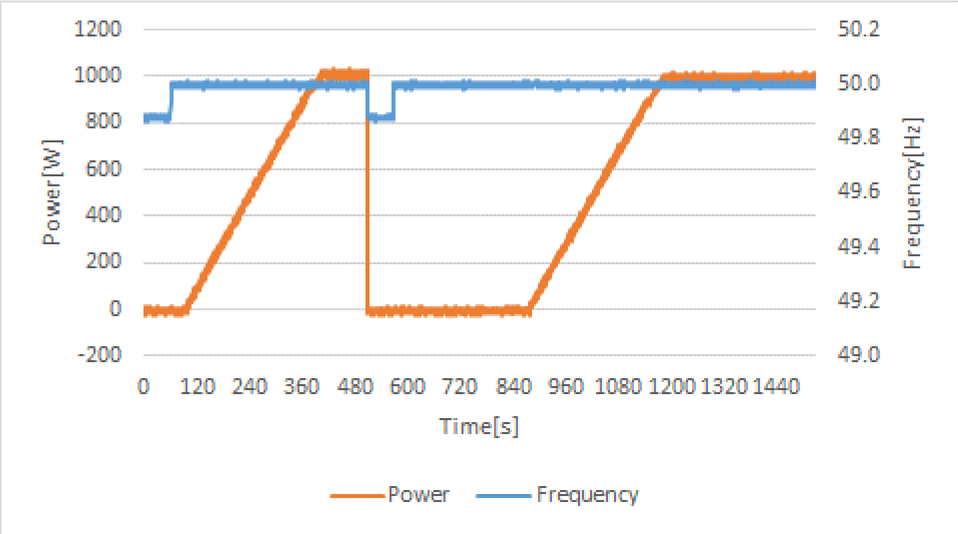
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

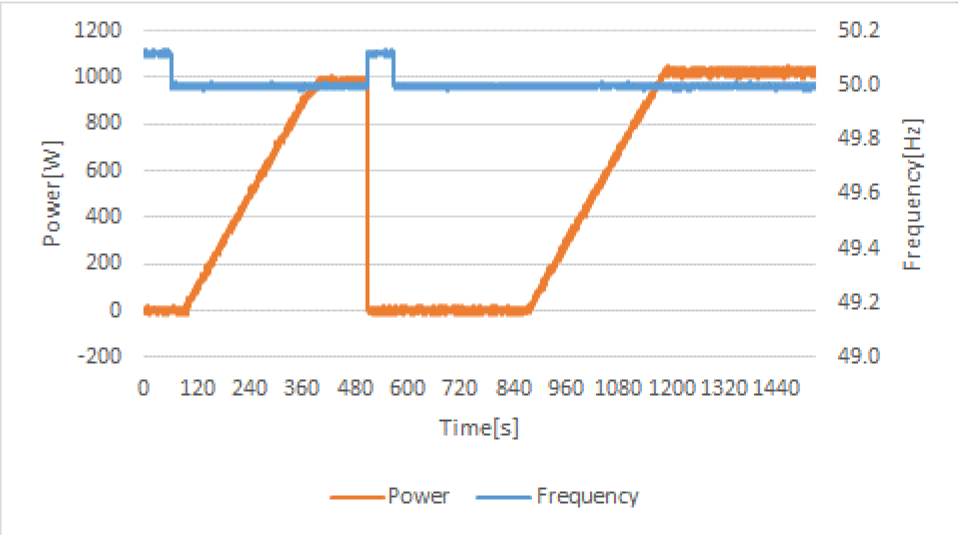
Test: Test condition b) and c): voltage within the limits of 85% to 110%U_n Test condition e) and f): frequency within the limits of 49,90Hz to 50,10Hz Max deviation of the gradient: +2,5%P_{SMAX} or P_{NINV}		Reconnection time range: 0-900s in steps of 5s (default value: 300s)





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





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%**	

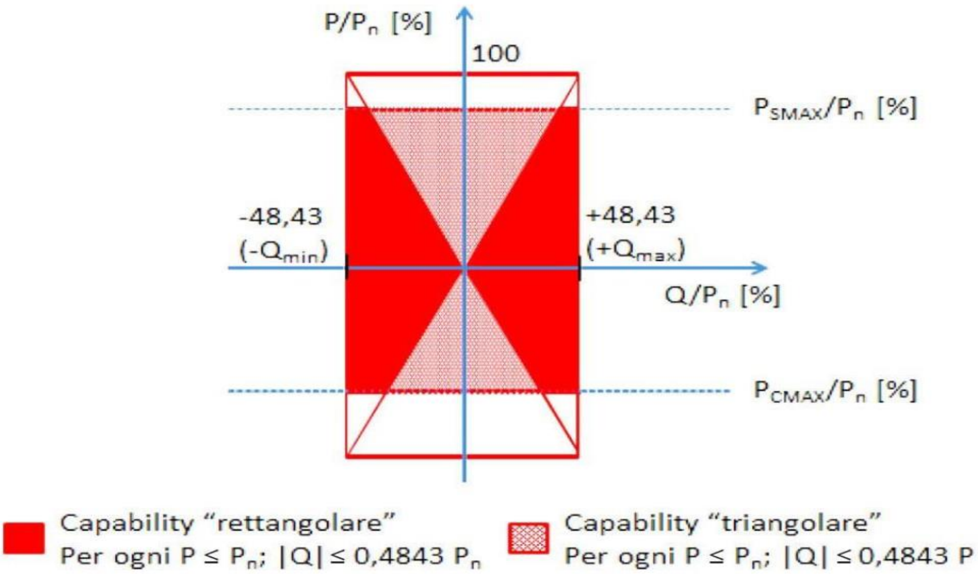


Figure 62 - Capability for a storage system with bidirectional inverter

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	AF6K-SLP+15Battery						
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}	-5982	-99.67%	-186	-3.10%	-5437	-90.61%	-0.9995
80% -90% P_{CMAX}	-5376	-89.59%	-182	-3.02%	-4886	-81.44%	-0.9994
70% -80% P_{CMAX}	-4772	-79.51%	-175	-2.93%	-4336	-72.27%	-0.9993
60% -70% P_{CMAX}	-4163	-69.40%	-168	-2.81%	-3784	-63.07%	-0.9992
50% -60% P_{CMAX}	-3562	-59.33%	-163	-2.70%	-3234	-53.90%	-0.9990
40% -50% P_{CMAX}	-2956	-49.24%	-155	-2.58%	-2684	-44.73%	-0.9986
30% -40% P_{CMAX}	-2352	-39.17%	-146	-2.45%	-2134	-35.56%	-0.9980
20% -30% P_{CMAX}	-1744	-29.09%	-136	-2.28%	-1583	-26.39%	-0.9969
10% -20% P_{CMAX}	-1144	-19.05%	-123	-2.05%	-1035	-17.25%	-0.9943
0% -10% P_{CMAX}	-541	-9.03%	-102	-1.69%	-488	-8.13%	-0.9830
0% -10% P_{SMAX}	497	8.32%	-100	-1.71%	553	9.22%	0.9796
10% -20% P_{SMAX}	1118	18.66%	-91	-1.53%	1235	20.59%	0.9966
20% -30% P_{SMAX}	1726	28.80%	-84	-1.41%	1904	31.73%	0.9988
30% -40% P_{SMAX}	2333	38.87%	-82	-1.34%	2568	42.80%	0.9994
40% -50% P_{SMAX}	2928	48.80%	-77	-1.28%	3223	53.71%	0.9997
50% -60% P_{SMAX}	3521	58.69%	-74	-1.24%	3875	64.58%	0.9998
60% -70% P_{SMAX}	4113	68.56%	-74	-1.23%	4525	75.42%	0.9998
70% -80% P_{SMAX}	4703	78.40%	-73	-1.19%	5174	86.23%	0.9999
80% -90% P_{SMAX}	5295	88.23%	-73	-1.19%	5822	97.03%	0.9999
90% -100% P_{SMAX}	5952	99.18%	-85	-1.41%	6544	109.07%	0.9999
TABLE: Reactive power production with set point Q = -Q_{max} (>11.08 kW) or cos φ = -0.9 (≤ 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}	-5383	-89.72%	-2907	-48.46%	-4894	-81.57%	-0.8799
80% -90% P_{CMAX}	-5169	-86.15%	-2907	-48.44%	-4699	-78.32%	-0.8717
70% -80% P_{CMAX}	-4778	-79.63%	-2908	-48.46%	-4343	-72.38%	-0.8547
60% -70% P_{CMAX}	-4172	-69.54%	-2908	-48.46%	-3792	-63.20%	-0.8210
50% -60% P_{CMAX}	-3568	-59.46%	-2907	-48.44%	-3242	-54.03%	-0.7763
40% -50% P_{CMAX}	-2961	-49.35%	-2908	-48.47%	-2690	-44.83%	-0.7135
30% -40% P_{CMAX}	-2358	-39.31%	-2909	-48.48%	-2141	-35.69%	-0.6304
20% -30% P_{CMAX}	-1755	-29.26%	-2909	-48.49%	-1592	-26.54%	-0.5172

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Clause	Requirement - Test	Result - Remark	Verdict

10% -20% P_{CMAX}	-1152	-19.21%	-2908	-48.47%	-1044	-17.39%	-0.3688
0% -10% P_{CMAX}	-550	-9.17%	-2907	-48.45%	-496	-8.27%	-0.1861
0% -10% P_{SMAX}	503	8.39%	-2906	-48.44%	558	9.30%	0.1707
10% -20% P_{SMAX}	1116	18.61%	-2911	-48.52%	1232	20.53%	0.3581
20% -30% P_{SMAX}	1728	28.80%	-2906	-48.44%	1903	31.72%	0.5110
30% -40% P_{SMAX}	2324	38.74%	-2907	-48.46%	2559	42.65%	0.6248
40% -50% P_{SMAX}	2924	48.73%	-2909	-48.49%	3218	53.63%	0.7088
50% -60% P_{SMAX}	3519	58.66%	-2907	-48.45%	3872	64.54%	0.7713
60% -70% P_{SMAX}	4115	68.58%	-2906	-48.44%	4527	75.45%	0.8171
70% -80% P_{SMAX}	4707	78.45%	-2908	-48.47%	5178	86.30%	0.8507
80% -90% P_{SMAX}	5141	85.68%	-2908	-48.47%	5654	94.24%	0.8707
90% -100% P_{SMAX}	5329	88.82%	-2906	-48.44%	5861	97.69%	0.8780

TABLE: Reactive power production with set point Q =+Q_{max} (>11.08 kW) or cos φ = +0.9 (≤ 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}	-5408	-90.15%	2907	48.44%	-4917	-81.95%	-0.8813
80% -90% P_{CMAX}	-5243	-87.39%	2911	48.51%	-4766	-79.44%	-0.8743
70% -80% P_{CMAX}	-4796	-79.94%	2906	48.44%	-4359	-72.66%	-0.8556
60% -70% P_{CMAX}	-4191	-69.85%	2907	48.45%	-3809	-63.49%	-0.8221
50% -60% P_{CMAX}	-3585	-59.75%	2907	48.45%	-3257	-54.29%	-0.7772
40% -50% P_{CMAX}	-2979	-49.66%	2908	48.46%	-2706	-45.10%	-0.7163
30% -40% P_{CMAX}	-2375	-39.59%	2907	48.45%	-2156	-35.94%	-0.6332
20% -30% P_{CMAX}	-1772	-29.53%	2906	48.44%	-1607	-26.79%	-0.5215
10% -20% P_{CMAX}	-1168	-19.47%	2906	48.44%	-1058	-17.64%	-0.3734
0% -10% P_{CMAX}	-566	-9.44%	2908	48.47%	-510	-8.51%	-0.1912
0% -10% P_{SMAX}	524	8.74%	2907	48.45%	581	9.68%	0.1794
10% -20% P_{SMAX}	1102	18.36%	2906	48.44%	1216	20.26%	0.3574
20% -30% P_{SMAX}	1708	28.46%	2909	48.49%	1881	31.36%	0.5094
30% -40% P_{SMAX}	2308	38.46%	2908	48.46%	2541	42.35%	0.6239
40% -50% P_{SMAX}	2910	48.50%	2907	48.45%	3203	53.38%	0.7089
50% -60% P_{SMAX}	3511	58.52%	2908	48.47%	3863	64.39%	0.7709
60% -70% P_{SMAX}	4104	68.40%	2906	48.44%	4515	75.25%	0.8161
70% -80% P_{SMAX}	4694	78.24%	2907	48.46%	5164	86.06%	0.8507
80% -90% P_{SMAX}	5287	88.12%	2907	48.45%	5815	96.92%	0.8764
90% -100% P_{SMAX}	5345	89.09%	2907	48.45%	5879	97.98%	0.8786

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Clause	Requirement - Test	Result - Remark	Verdict

Model	AF6K-SLP+1Battery						
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}	-5980	-99.67%	-186	-3.10%	-5437	-90.61%	-0.9995
80% -90% P_{CMAX}	-5375	-89.59%	-181	-3.02%	-4887	-81.44%	-0.9994
70% -80% P_{CMAX}	-4770	-79.51%	-176	-2.93%	-4336	-72.27%	-0.9993
60% -70% P_{CMAX}	-4164	-69.40%	-169	-2.81%	-3784	-63.07%	-0.9992
50% -60% P_{CMAX}	-3560	-59.33%	-162	-2.70%	-3234	-53.91%	-0.9990
40% -50% P_{CMAX}	-2955	-49.24%	-155	-2.58%	-2684	-44.73%	-0.9986
30% -40% P_{CMAX}	-2350	-39.17%	-147	-2.45%	-2134	-35.56%	-0.9980
20% -30% P_{CMAX}	-1745	-29.09%	-137	-2.28%	-1583	-26.39%	-0.9969
10% -20% P_{CMAX}	-1143	-19.05%	-123	-2.05%	-1035	-17.25%	-0.9943
0% -10% P_{CMAX}	-542	-9.03%	-101	-1.69%	-488	-8.13%	-0.9830
0% -10% P_{SMAX}	499	8.32%	-102	-1.71%	553	9.22%	0.9796
10% -20% P_{SMAX}	1119	18.66%	-92	-1.53%	1235	20.59%	0.9966
20% -30% P_{SMAX}	1728	28.80%	-85	-1.41%	1904	31.73%	0.9988
30% -40% P_{SMAX}	2332	38.87%	-80	-1.34%	2568	42.80%	0.9994
40% -50% P_{SMAX}	2928	48.80%	-77	-1.28%	3222	53.71%	0.9997
50% -60% P_{SMAX}	3521	58.69%	-74	-1.24%	3875	64.58%	0.9998
60% -70% P_{SMAX}	4114	68.56%	-74	-1.23%	4526	75.43%	0.9998
70% -80% P_{SMAX}	4704	78.40%	-72	-1.19%	5174	86.23%	0.9999
80% -90% P_{SMAX}	5294	88.23%	-72	-1.19%	5822	97.04%	0.9999
90% -100% P_{SMAX}	5356	89.27%	-72	-1.20%	5891	98.18%	0.9999
TABLE: Reactive power production with set point Q = -Q_{max} (>11.08 kW) or cos φ = -0.9 (≤ 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}	-5382	-89.69%	-2907	-48.46%	-4892	-81.54%	-0.8798
80% -90% P_{CMAX}	-5169	-86.15%	-2907	-48.44%	-4699	-78.32%	-0.8717
70% -80% P_{CMAX}	-4778	-79.63%	-2908	-48.46%	-4343	-72.38%	-0.8547
60% -70% P_{CMAX}	-4172	-69.54%	-2908	-48.46%	-3792	-63.19%	-0.8210
50% -60% P_{CMAX}	-3568	-59.46%	-2907	-48.44%	-3242	-54.03%	-0.7763
40% -50% P_{CMAX}	-2961	-49.35%	-2908	-48.47%	-2690	-44.83%	-0.7135
30% -40% P_{CMAX}	-2358	-39.31%	-2909	-48.48%	-2141	-35.69%	-0.6304
20% -30% P_{CMAX}	-1755	-29.26%	-2909	-48.49%	-1593	-26.54%	-0.5172

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Clause	Requirement - Test	Result - Remark	Verdict

10% -20% P_{CMAX}	-1152	-19.21%	-2908	-48.47%	-1044	-17.39%	-0.3688
0% -10% P_{CMAX}	-550	-9.17%	-2907	-48.45%	-496	-8.26%	-0.1861
0% -10% P_{SMAX}	503	8.39%	-2906	-48.44%	558	9.30%	0.1707
10% -20% P_{SMAX}	1116	18.61%	-2911	-48.52%	1232	20.53%	0.3581
20% -30% P_{SMAX}	1728	28.80%	-2906	-48.44%	1904	31.73%	0.5110
30% -40% P_{SMAX}	2324	38.74%	-2907	-48.46%	2559	42.65%	0.6248
40% -50% P_{SMAX}	2924	48.73%	-2909	-48.49%	3218	53.63%	0.7088
50% -60% P_{SMAX}	3519	58.66%	-2907	-48.45%	3872	64.54%	0.7713
60% -70% P_{SMAX}	4115	68.58%	-2906	-48.44%	4527	75.45%	0.8171
70% -80% P_{SMAX}	4707	78.45%	-2908	-48.47%	5178	86.30%	0.8507
80% -90% P_{SMAX}	5141	85.68%	-2908	-48.47%	5654	94.24%	0.8707
90% -100% P_{SMAX}	5327	88.79%	-2906	-48.44%	5859	97.65%	0.8779

TABLE: Reactive power production with set point Q =+Q_{max} (>11.08 kW) or cos φ = +0.9 (≤ 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}	-5409	-90.15%	2907	48.44%	-4917	-81.95%	-0.8813
80% -90% P_{CMAX}	-5247	-87.46%	2906	48.44%	-4770	-79.50%	-0.8748
70% -80% P_{CMAX}	-4796	-79.94%	2906	48.44%	-4360	-72.66%	-0.8556
60% -70% P_{CMAX}	-4191	-69.85%	2907	48.45%	-3809	-63.48%	-0.8221
50% -60% P_{CMAX}	-3585	-59.75%	2907	48.45%	-3258	-54.29%	-0.7772
40% -50% P_{CMAX}	-2979	-49.66%	2908	48.46%	-2706	-45.10%	-0.7163
30% -40% P_{CMAX}	-2375	-39.59%	2907	48.45%	-2157	-35.94%	-0.6332
20% -30% P_{CMAX}	-1772	-29.53%	2906	48.44%	-1607	-26.79%	-0.5215
10% -20% P_{CMAX}	-1168	-19.47%	2906	48.44%	-1058	-17.64%	-0.3734
0% -10% P_{CMAX}	-566	-9.44%	2908	48.47%	-510	-8.51%	-0.1912
0% -10% P_{SMAX}	524	8.74%	2907	48.45%	581	9.69%	0.1794
10% -20% P_{SMAX}	1102	18.36%	2906	48.44%	1216	20.26%	0.3574
20% -30% P_{SMAX}	1708	28.46%	2909	48.49%	1882	31.36%	0.5094
30% -40% P_{SMAX}	2308	38.46%	2908	48.46%	2541	42.35%	0.6239
40% -50% P_{SMAX}	2910	48.50%	2907	48.45%	3203	53.38%	0.7089
50% -60% P_{SMAX}	3511	58.52%	2908	48.47%	3863	64.38%	0.7709
60% -70% P_{SMAX}	4104	68.40%	2906	48.44%	4515	75.25%	0.8161
70% -80% P_{SMAX}	4694	78.24%	2907	48.46%	5164	86.06%	0.8507
80% -90% P_{SMAX}	5287	88.12%	2907	48.45%	5815	96.92%	0.8764
90% -100% P_{SMAX}	5345	89.09%	2907	48.45%	5879	97.98%	0.8786

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Clause	Requirement - Test	Result - Remark	Verdict

Model	AF1K-SL-1+1Battery						
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}	-959	-95.90%	28	2.80%	-862	-86.24%	-0.9996
80% -90% P_{CMAX}	-892	-89.20%	29	2.90%	-803	-80.31%	-0.9995
70% -80% P_{CMAX}	-797	-79.70%	27	2.70%	-716	-71.58%	-0.9994
60% -70% P_{CMAX}	-693	-69.30%	36	3.60%	-623	-62.27%	-0.9988
50% -60% P_{CMAX}	-591	-59.10%	35	3.50%	-531	-53.10%	-0.9984
40% -50% P_{CMAX}	-497	-49.70%	34	3.40%	-445	-44.53%	-0.9978
30% -40% P_{CMAX}	-393	-39.30%	37	3.70%	-353	-35.32%	-0.9960
20% -30% P_{CMAX}	-294	-29.40%	32	3.20%	-262	-26.16%	-0.9936
10% -20% P_{CMAX}	-196	-19.60%	32	3.20%	-173	-17.31%	-0.9852
0% -10% P_{CMAX}	-96	-9.60%	30	3.00%	-82	-8.19%	-0.9453
0% -10% P_{SMAX}	96	9.60%	23	2.30%	111	11.06%	0.9668
10% -20% P_{SMAX}	189	18.90%	26	2.60%	212	21.19%	0.9905
20% -30% P_{SMAX}	298	29.80%	27	2.70%	332	33.18%	0.9961
30% -40% P_{SMAX}	391	39.10%	24	2.40%	438	43.83%	0.9977
40% -50% P_{SMAX}	483	48.30%	23	2.30%	542	54.20%	0.9985
50% -60% P_{SMAX}	597	59.70%	26	2.60%	664	66.43%	0.9990
60% -70% P_{SMAX}	694	69.40%	27	2.70%	772	77.18%	0.9993
70% -80% P_{SMAX}	777	77.70%	26	2.60%	864	86.44%	0.9994
80% -90% P_{SMAX}	896	89.60%	26	2.60%	999	99.87%	0.9995
90% -100% P_{SMAX}	998	99.80%	26	2.60%	1114	111.37%	0.9996
TABLE: Reactive power production with set point Q = -Q_{max} (>11.08 kW) or cos φ = -0.9 (≤ 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}	-931	-93.10%	-516	-51.60%	-837	-83.71%	-0.8743
80% -90% P_{CMAX}	-879	-87.90%	-490	-49.00%	-792	-79.16%	-0.8711
70% -80% P_{CMAX}	-784	-78.40%	-491	-49.10%	-704	-70.37%	-0.8454
60% -70% P_{CMAX}	-675	-67.50%	-489	-48.90%	-607	-60.68%	-0.8076
50% -60% P_{CMAX}	-584	-58.40%	-488	-48.80%	-525	-52.46%	-0.7650
40% -50% P_{CMAX}	-479	-47.90%	-488	-48.80%	-429	-42.91%	-0.6982
30% -40% P_{CMAX}	-373	-37.30%	-486	-48.60%	-335	-33.49%	-0.6072
20% -30% P_{CMAX}	-289	-28.90%	-488	-48.80%	-256	-25.64%	-0.5065

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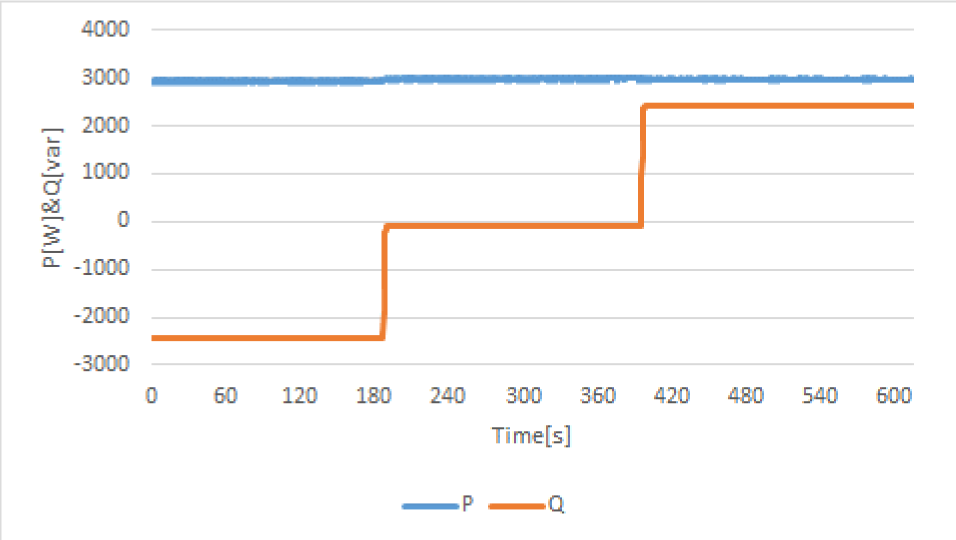
Clause	Requirement - Test	Result - Remark	Verdict

10% -20% P_{CMAX}	-195	-19.50%	-487	-48.70%	-172	-17.18%	-0.3698
0% -10% P_{CMAX}	-83	-8.30%	-487	-48.70%	-70	-7.03%	-0.1637
0% -10% P_{SMAX}	77	7.70%	-487	-48.70%	89	8.88%	0.1571
10% -20% P_{SMAX}	182	18.20%	-486	-48.60%	204	20.39%	0.3475
20% -30% P_{SMAX}	293	29.30%	-485	-48.50%	326	32.60%	0.5111
30% -40% P_{SMAX}	378	37.80%	-489	-48.90%	423	42.32%	0.6109
40% -50% P_{SMAX}	476	47.60%	-491	-49.10%	534	53.40%	0.6971
50% -60% P_{SMAX}	580	58.00%	-489	-48.90%	646	64.63%	0.7616
60% -70% P_{SMAX}	682	68.20%	-489	-48.90%	758	75.85%	0.8089
70% -80% P_{SMAX}	779	77.90%	-491	-49.10%	867	86.67%	0.8432
80% -90% P_{SMAX}	886	88.60%	-493	-49.30%	988	98.82%	0.8728
90% -100% P_{SMAX}	929	92.90%	-524	-52.40%	1037	103.67%	0.8723
TABLE: Reactive power production with set point Q =+Q_{max} (>11.08 kW) or cos φ = +0.9 (≤ 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}	-940	-94.00%	527	52.70%	-845	-84.52%	-0.8733
80% -90% P_{CMAX}	-879	-87.90%	495	49.50%	-791	-79.11%	-0.8715
70% -80% P_{CMAX}	-783	-78.30%	492	49.20%	-703	-70.33%	-0.8457
60% -70% P_{CMAX}	-681	-68.10%	492	49.20%	-612	-61.24%	-0.8107
50% -60% P_{CMAX}	-578	-57.80%	491	49.10%	-520	-52.00%	-0.7627
40% -50% P_{CMAX}	-483	-48.30%	490	49.00%	-433	-43.28%	-0.7011
30% -40% P_{CMAX}	-387	-38.70%	490	49.00%	-348	-34.79%	-0.6215
20% -30% P_{CMAX}	-291	-29.10%	486	48.60%	-259	-25.85%	-0.5097
10% -20% P_{CMAX}	-189	-18.90%	485	48.50%	-166	-16.64%	-0.3586
0% -10% P_{CMAX}	-81	-8.10%	483	48.30%	-68	-6.84%	-0.1595
0% -10% P_{SMAX}	81	8.10%	484	48.40%	93	9.31%	0.1650
10% -20% P_{SMAX}	189	18.90%	487	48.70%	211	21.14%	0.3593
20% -30% P_{SMAX}	287	28.70%	488	48.80%	319	31.86%	0.5032
30% -40% P_{SMAX}	390	39.00%	485	48.50%	436	43.64%	0.6242
40% -50% P_{SMAX}	486	48.60%	485	48.50%	545	54.46%	0.7057
50% -60% P_{SMAX}	593	59.30%	489	48.90%	660	65.98%	0.7693
60% -70% P_{SMAX}	682	68.20%	491	49.10%	758	75.81%	0.8101
70% -80% P_{SMAX}	788	78.80%	491	49.10%	877	87.70%	0.8471
80% -90% P_{SMAX}	872	87.20%	489	48.90%	973	97.26%	0.8703
90% -100% P_{SMAX}	943	94.30%	518	51.80%	1052	105.24%	0.8762

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	AF6K-SLP+15Battery			
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% $\mathbf{P_{SMAX}}$				
50% P_n	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%	-40.38%	-0.38%	$\Delta Q \leq \pm 5\%\ S_n$
0	0.00%	-1.36%	-1.36%	$\Delta Q \leq \pm 5\%\ S_n$
$+Q_{max}$ (=40%S_n)	40.00%	40.38%	0.38%	$\Delta Q \leq \pm 5\%\ S_n$



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);

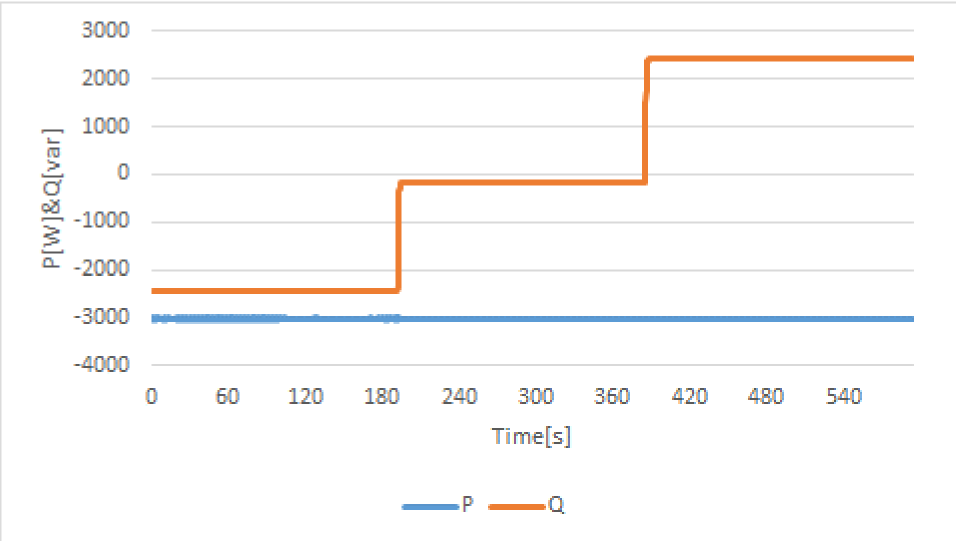
–Δcos φ ≤ ±0,01 (setting via power factor).

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	AF6K-SLP+15Battery			
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/S_n [%]	Reactive power measured Q/S_n [%]	Deviation from set point $\Delta Q/S_n$ [%]	Limit [%]
$-Q_{min}$ (=40%S_n)	-40.00%	-40.18%	-0.18%	$\Delta Q \leq \pm 5\%\ S_n$
0	0.00%	-2.60%	-2.60%	$\Delta Q \leq \pm 5\%\ S_n$
$+Q_{max}$ (=40%S_n)	40.00%	40.37%	0.37%	$\Delta Q \leq \pm 5\%\ S_n$



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.6.5	**TABLE: Response time to a step change of the assigned level (Required for inverter used in plant > 11.08 kW)**		**P**
Model	AF6K-SLP+15Battery		
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.

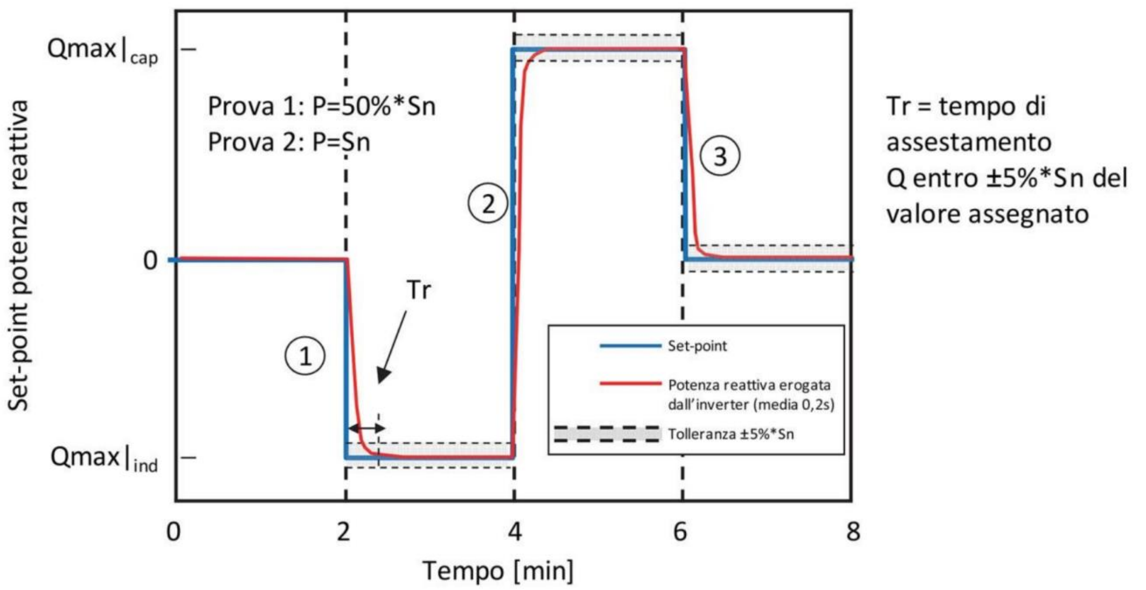
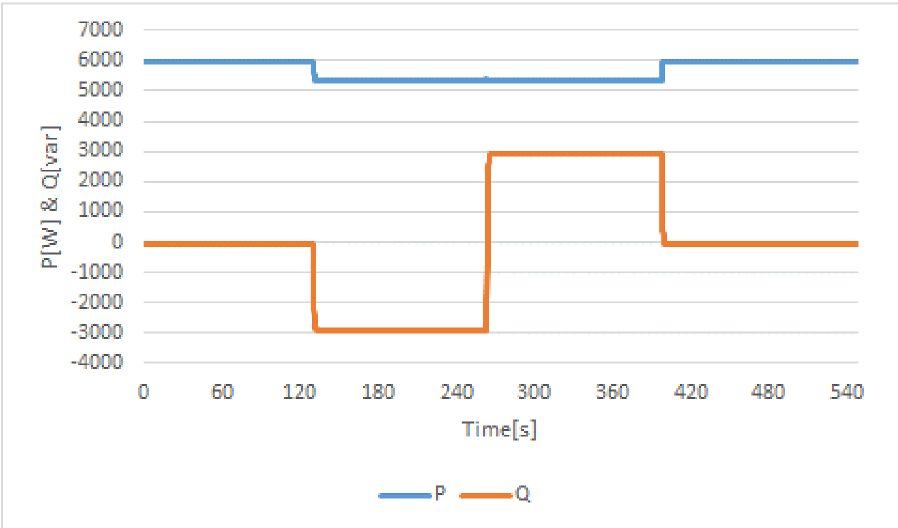


Figure 65 - Measurement of the response time to step changes of the set-point assigned for the reactive power

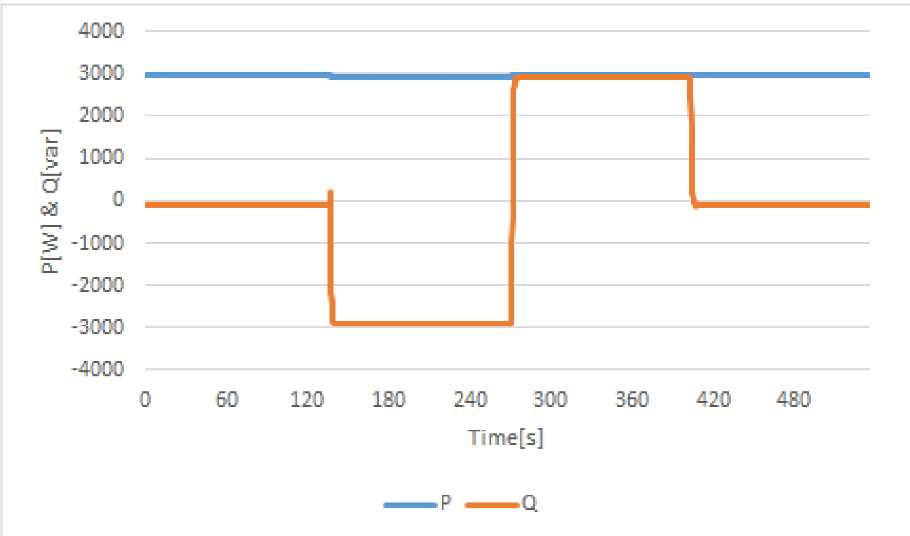
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1 (see Graph 1): 100%P_{SMAX}						
Point	Output power [W]	transient	Vac [V]	Q [VAr]	Tr [s]	Limit [s]
1	5316	0 ® $Q_{max\|ind}$	230.45	-2903	1.3	10
2	5324	$Q_{max\|ind}$ ® $Q_{max\|cap}$	230.79	2886	1.5	10
3	5944	$Q_{max\|cap}$ ® 0	230.62	-72	1.1	10
Test 2 (see Graph 2): 50%P_{SMAX}						
Point	Output power [W]	transient	Vac [V]	Q [VAr]	Tr [s]	Limit [s]
1	2925	0 ® $Q_{max\|ind}$	229.94	-2896	1.2	10
2	2968	$Q_{max\|ind}$ ® $Q_{max\|cap}$	230.24	2893	1.6	10
3	2978	$Q_{max\|cap}$ ® 0	230.10	-76	1.2	10

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



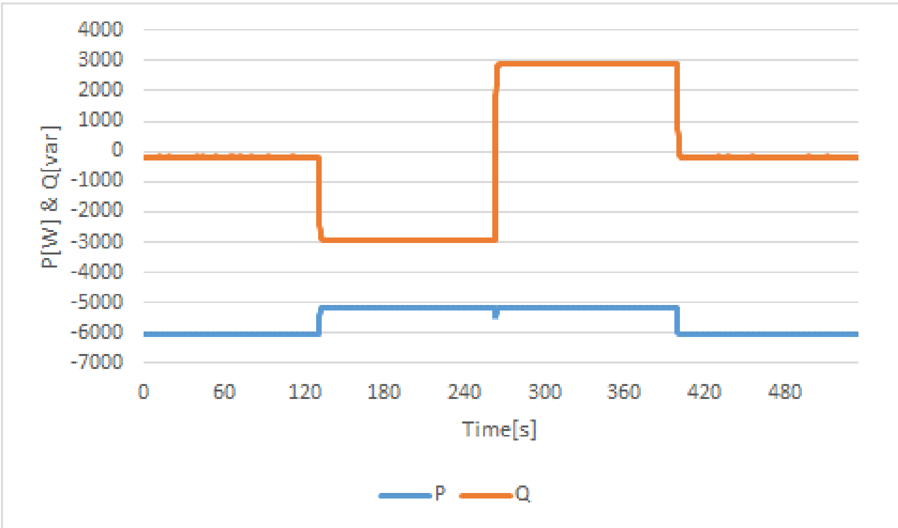
Graph 2 of the reaction time after a step variation of the assigned level (50%-Test 2)



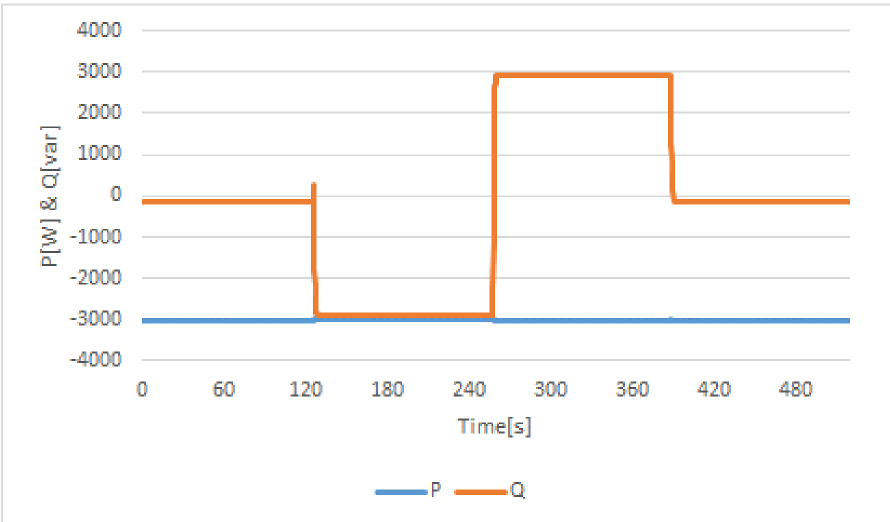
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Test 1 (see Graph 1): 100%P_{CMAX}						
Point	Output power [W]	transient	Vac [V]	Q [VAr]	Tr [s]	Limit [s]
1	-5166	0 ® $Q_{max\|ind}$	228.06	-2896	1.2	10
2	-5162	$Q_{max\|ind}$ ® $Q_{max\|cap}$	228.33	2885	1.6	10
3	-6034	$Q_{max\|cap}$ ® 0	228.00	-181	1.0	10
Test 2 (see Graph 2): 50%P_{Cmax}						
Point	Output power [W]	transient	Vac [V]	Q [VAr]	Tr [s]	Limit [s]
1	-2992	0 ® $Q_{max\|ind}$	228.53	-2891	1.2	10
2	-3039	$Q_{max\|ind}$ ® $Q_{max\|cap}$	228.85	2910	1.4	10
3	-3014	$Q_{max\|cap}$ ® 0	228.67	-152	1.2	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)	

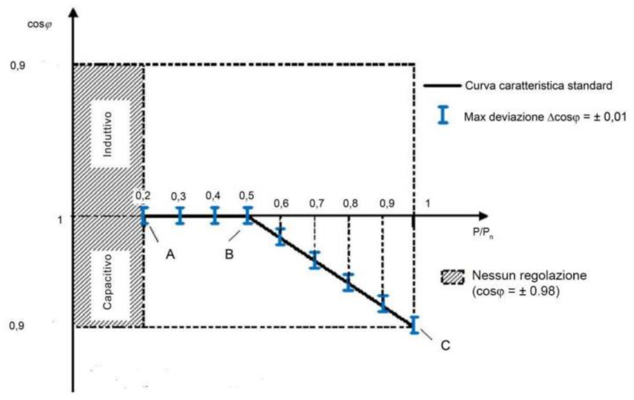
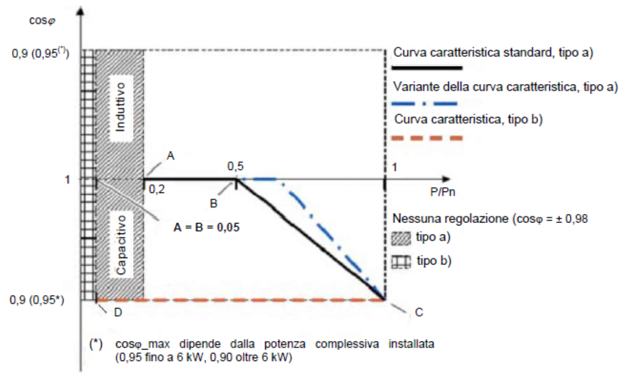


Figure 66 - Standard characteristic curve cosφ = f(P)



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.

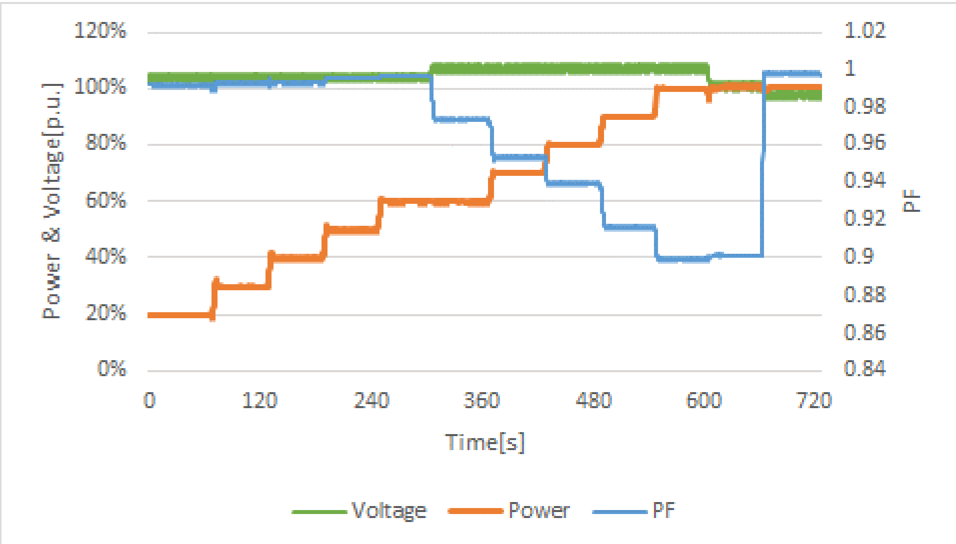
– .... Each value must be reach in < 10s.

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

Model:	AF6K-SLP+15Battery							
P/P_{SMAX}[%]	P[W]	Vout[V]	Q[Var]	Cosφ Setpoint	Cosφ measured	ΔCosφ	Limit Δcosφ_max	Result
20	1191	238.66	154	1.00	0.992	-0.008	≤ ± 0.01	P
30	1795	238.79	212	1.00	0.993	-0.007	≤ ± 0.01	P
40	2398	238.94	282	1.00	0.993	-0.007	≤ ± 0.01	P
50	2995	238.90	288	1.00	0.995	-0.005	≤ ± 0.01	P
60	3590	238.91	300	1.00	0.997	-0.003	≤ ± 0.01	P
60	3597	245.49	751	0.98	0.978	-0.002	≤ ± 0.01	P
70	4195	246.32	1320	0.96	0.954	-0.006	≤ ± 0.01	P
80	4793	246.33	1746	0.94	0.940	0.000	≤ ± 0.01	P
90	5393	246.63	2354	0.92	0.917	-0.003	≤ ± 0.01	P
100*	6000	246.59	2918	0.90	0.899	-0.001	≤ ± 0.01	P
100*	6035	232.81	2905	0.90	0.901	0.001	≤ ± 0.01	P
100	6029	225.06	383	1.00	0.998	-0.002	≤ ± 0.01	P

Due to conversion efficiency, it is not possible to achieve 100% P_{SMAX}

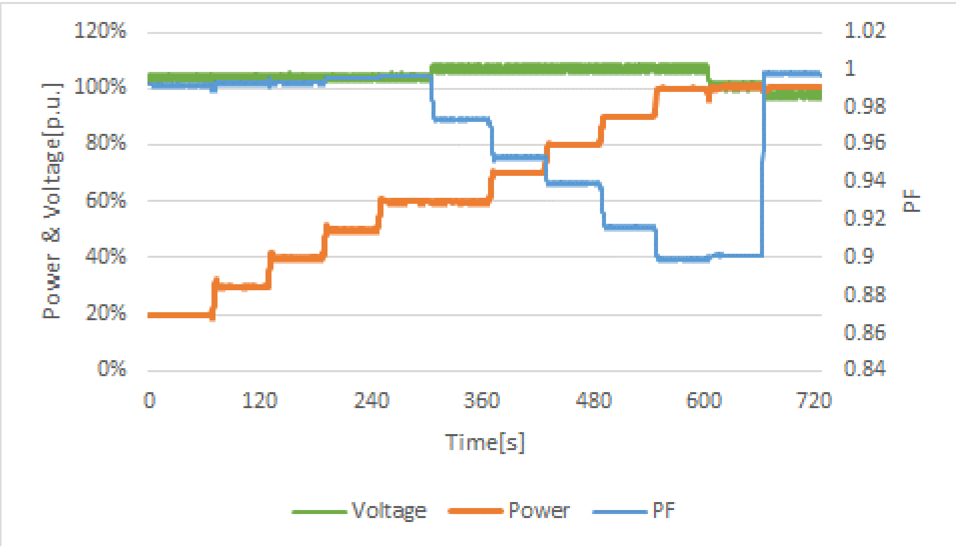
Graph reactive power production according to a characteristic curve cos(phi) = f(P)



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

Model:	AF6K-SLP+1Battery							
P/PSMAX[%]	P[W]	Vout[V]	Q[Var]	Cos Setpoint	Cosφ measured	ΔCosφ	Limit Δcosφ_max	Result
20	1197	238.66	155	1.00	0.992	-0.008	≤ ± 0.01	P
30	1799	238.80	214	1.00	0.993	-0.007	≤ ± 0.01	P
40	2397	238.90	281	1.00	0.993	-0.007	≤ ± 0.01	P
50	2996	238.88	286	1.00	0.995	-0.005	≤ ± 0.01	P
60	3593	238.88	301	1.00	0.997	-0.003	≤ ± 0.01	P
60	3594	245.47	746	0.98	0.978	-0.002	≤ ± 0.01	P
70	4197	246.34	1322	0.96	0.954	-0.006	≤ ± 0.01	P
80	4796	246.35	1745	0.94	0.940	0.000	≤ ± 0.01	P
90	5395	246.66	2358	0.92	0.917	-0.003	≤ ± 0.01	P
100	6002	246.60	2919	0.90	0.899	-0.001	≤ ± 0.01	P
100	6037	232.83	2915	0.90	0.901	0.001	≤ ± 0.01	P
100	6027	225.07	380	1.00	0.998	-0.002	≤ ± 0.01	P

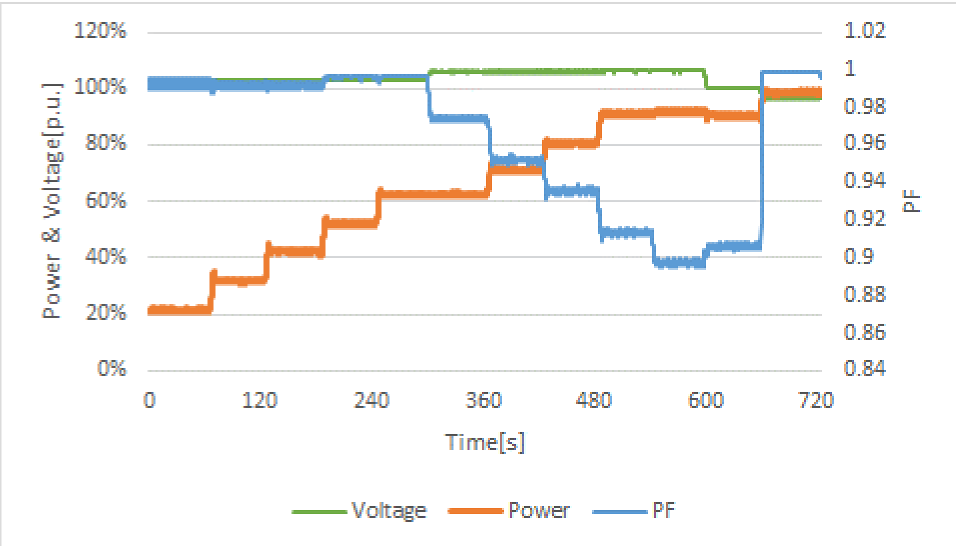
Graph reactive power production according to a characteristic curve cos(phi) = f(P)



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

Model:	AF1K-SL-1+1Battery							
P/P_{SMAX}[%]	P[W]	Vout[V]	Q[Var]	Cos φSetpoint	Cos φmeasured	ΔCosφ	Limit Δcosφ_max	Result
20	217	236.69	27	1.00	0.992	-0.008	≤ ± 0.01	P
30	321	236.78	38	1.00	0.993	-0.007	≤ ± 0.01	P
40	425	236.85	53	1.00	0.992	-0.008	≤ ± 0.01	P
50	523	236.93	48	1.00	0.996	-0.004	≤ ± 0.01	P
60	626	237.10	53	1.00	0.997	-0.003	≤ ± 0.01	P
60	627	244.11	144	0.98	0.975	-0.005	≤ ± 0.01	P
70	714	244.22	227	0.96	0.953	-0.007	≤ ± 0.01	P
80	808	244.32	304	0.94	0.936	-0.004	≤ ± 0.01	P
90	912	244.41	405	0.92	0.914	-0.006	≤ ± 0.01	P
100	920	244.41	451	0.90	0.898	-0.002	≤ ± 0.01	P
100	907	230.67	423	0.90	0.906	0.006	≤ ± 0.01	P
100	987	223.11	50	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

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

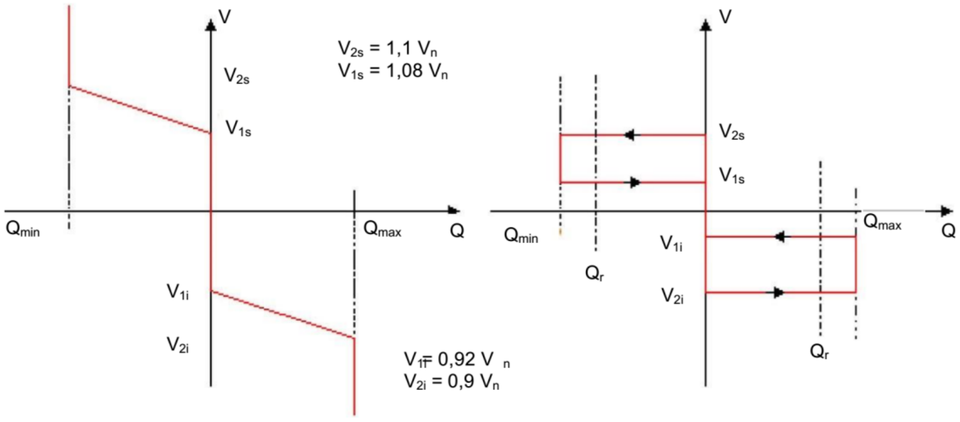


Fig. a Fig. b

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

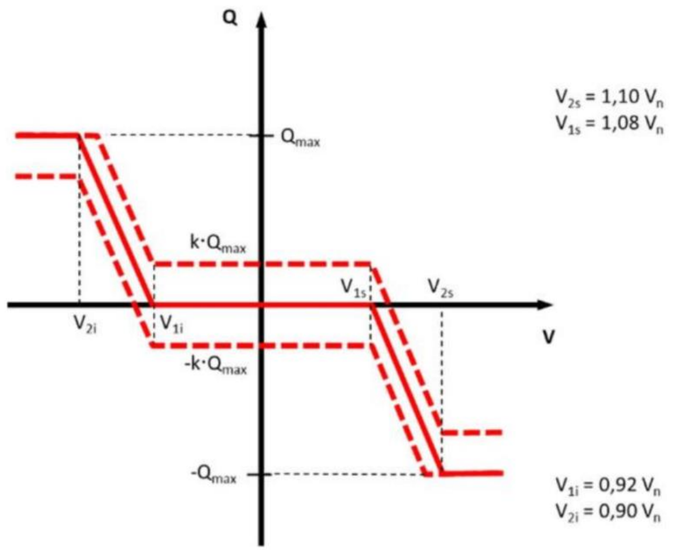


Figure 67 - Standard characteristic curve Q = f (V)

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	1068.23	246.05	299.82	k*Qmax	≤5%Sn
<20%P_{SMAX}	1.09Vn	1066.39	250.62	304.87	k*Qmax	≤5%Sn
30%P_{SMAX}	1.09Vn	1777.00	250.41	-1079.86	-0.4*Qmax (lock-in) *within 10sec*	≤5%Sn
40%P_{SMAX}	1.09Vn	2381.21	250.41	-1083.75	-0.4*Qmax	≤5%Sn
50%P_{SMAX}	1.09Vn	2984.17	250.52	-1111.14	-0.4*Qmax	≤5%Sn
60%P_{SMAX}	1.09Vn	3582.00	250.53	-1103.19	-0.4*Qmax	≤5%Sn
70%P_{SMAX}	1.09Vn	4176.45	250.53	-1088.44	-0.4*Qmax	≤5%Sn
80%P_{SMAX}	1.09Vn	4768.21	250.55	-1083.76	-0.4*Qmax	≤5%Sn
90%P_{SMAX}	1.09Vn	5361.56	250.67	-1108.37	-0.4*Qmax	≤5%Sn
100%P_{SMAX}	1.09Vn	5923.53	250.66	-1109.65	-0.4*Qmax	≤5%Sn
100%P_{SMAX}	1.1Vn	5433.35	252.88	-2584.48	-0.9*Qmax	≤5%Sn
10%P_{SMAX}	1.1Vn	525.55	252.60	-2553.29	-0.9*Qmax	≤5%Sn
≤5%P_{SMAX}	1.1Vn	177.21	252.66	203.93	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	1059.52	213.80	290.38	k*Qmax	≤5%Sn
<20%P_{SMAX}	0.91Vn	1058.09	209.21	282.78	k*Qmax	≤5%Sn
30%P_{SMAX}	0.91Vn	1773.56	208.86	1770.69	0.6*Qmax(lock-in)*within 10sec*	≤5%Sn
40%P_{SMAX}	0.91Vn	2375.00	208.91	1802.93	0.6*Qmax	≤5%Sn
50%P_{SMAX}	0.91Vn	2972.94	208.93	1787.30	0.6*Qmax	≤5%Sn
60%P_{SMAX}	0.91Vn	3562.08	208.96	1784.30	0.6*Qmax	≤5%Sn
70%P_{SMAX}	0.91Vn	4150.24	209.09	1766.44	0.6*Qmax	≤5%Sn
80%P_{SMAX}	0.91Vn	4737.55	209.11	1761.97	0.6*Qmax	≤5%Sn
90%P_{SMAX}	0.91Vn	5325.47	209.15	1772.99	0.6*Qmax	≤5%Sn
100%P_{SMAX}	0.91Vn	5788.35	209.14	1781.01	0.6*Qmax	≤5%Sn
100%P_{SMAX}	0.90Vn	5314.96	207.05	2900.14	Qmax	≤5%Sn
10%P_{SMAX}	0.90Vn	535.04	206.95	2868.77	Qmax	≤5%Sn
≤5%P_{SMAX}	0.90Vn	169.93	206.89	363.20	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	1070.01	246.11	291.34	-k*Qmax	≤5%Sn
<20%P_{SMAX}	1.09Vn	1070.30	250.69	285.94	-k*Qmax	≤5%Sn
30%P_{SMAX}	1.09Vn	1767.83	250.62	-1699.32	-0.6*Qmax (lock-in)*within 10sec*	≤5%Sn
40%P_{SMAX}	1.09Vn	2372.46	250.65	-1727.83	-0.6*Qmax	≤5%Sn
50%P_{SMAX}	1.09Vn	2974.35	250.66	-1726.46	-0.6*Qmax	≤5%Sn
60%P_{SMAX}	1.09Vn	3574.20	250.75	-1793.09	-0.6*Qmax	≤5%Sn
70%P_{SMAX}	1.09Vn	4167.66	250.75	-1770.84	-0.6*Qmax	≤5%Sn
80%P_{SMAX}	1.09Vn	4760.29	250.76	-1766.45	-0.6*Qmax	≤5%Sn
90%P_{SMAX}	1.09Vn	5353.17	250.77	-1732.58	-0.6*Qmax	≤5%Sn
100%P_{SMAX}	1.09Vn	5798.87	250.77	-1732.57	-0.6*Qmax	≤5%Sn
100%P_{SMAX}	1.1Vn	5292.71	253.18	-2878.78	-Qmax	≤5%Sn
10%P_{SMAX}	1.1Vn	514.07	253.02	-2913.19	-Qmax	≤5%Sn
≤5%P_{SMAX}	1.1Vn	181.41	253.09	-371.15	-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	1057.44	213.69	284.27	-k*Qmax	≤5%Sn
<20%P_{SMAX}	0.91Vn	1057.95	209.10	290.94	-k*Qmax	≤5%Sn
30%P_{SMAX}	0.91Vn	1779.82	208.94	1178.83	0.4*Qmax (lock-in) *within 10sec*	≤5%Sn
40%P_{SMAX}	0.91Vn	2378.96	208.97	1191.10	0.4*Qmax	≤5%Sn
50%P_{SMAX}	0.91Vn	2975.61	208.99	1158.02	0.4*Qmax	≤5%Sn
60%P_{SMAX}	0.91Vn	3568.23	209.02	1152.75	0.4*Qmax	≤5%Sn
70%P_{SMAX}	0.91Vn	4155.57	209.15	1148.29	0.4*Qmax	≤5%Sn
80%P_{SMAX}	0.91Vn	4744.82	209.18	1125.11	0.4*Qmax	≤5%Sn
90%P_{SMAX}	0.91Vn	5327.01	209.20	1162.12	0.4*Qmax	≤5%Sn
100%P_{SMAX}	0.91Vn	5920.48	209.21	1163.20	0.4*Qmax	≤5%Sn
100%P_{SMAX}	0.90Vn	5361.25	206.93	2593.32	0.9*Qmax	≤5%Sn
10%P_{SMAX}	0.90Vn	540.80	206.84	2569.82	0.9*Qmax	≤5%Sn
≤5%P_{SMAX}	0.90Vn	167.07	206.70	-197.92	-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	-1080.35	246.23	97.73	k*Qmax	≤5%Sn
<20%P_{CMAX}	1.09Vn	-1080.99	250.81	93.90	k*Qmax	≤5%Sn
30%P_{CMAX}	1.09Vn	-1796.23	250.65	-1129.25	-0.4*Qmax (lock-in)*within 10sec*	≤5%Sn
40%P_{CMAX}	1.09Vn	-2399.49	250.61	-1169.97	-0.4*Qmax	≤5%Sn
50%P_{CMAX}	1.09Vn	-3002.62	250.61	-1173.75	-0.4*Qmax	≤5%Sn
60%P_{CMAX}	1.09Vn	-3606.38	250.69	-1198.74	-0.4*Qmax	≤5%Sn
70%P_{CMAX}	1.09Vn	-4208.40	250.68	-1203.56	-0.4*Qmax	≤5%Sn
80%P_{CMAX}	1.09Vn	-4816.80	250.73	-1206.59	-0.4*Qmax	≤5%Sn
90%P_{CMAX}	1.09Vn	-5423.95	250.65	-1130.31	-0.4*Qmax	≤5%Sn
100%P_{CMAX}	1.09Vn	-5868.35	250.76	-1180.39	-0.4*Qmax	≤5%Sn
100%P_{CMAX}	1.1Vn	-5290.96	253.10	-2646.57	-0.9*Qmax	≤5%Sn
10%P_{CMAX}	1.1Vn	-582.24	253.08	-2643.79	-0.9*Qmax	≤5%Sn
≤5%P_{CMAX}	1.1Vn	-180.98	253.27	75.32	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	-1076.99	213.94	134.89	k*Qmax	≤5%Sn
<20%P_{CMAX}	0.91Vn	-1076.20	209.43	140.25	k*Qmax	≤5%Sn
30%P_{CMAX}	0.91Vn	-1812.87	209.01	1693.23	0.6*Qmax(lock-in)*within 10sec*	≤5%Sn
40%P_{CMAX}	0.91Vn	-2416.99	208.97	1765.47	0.6*Qmax	≤5%Sn
50%P_{CMAX}	0.91Vn	-3021.07	208.94	1808.76	0.6*Qmax	≤5%Sn
60%P_{CMAX}	0.91Vn	-3624.59	208.80	1807.39	0.6*Qmax	≤5%Sn
70%P_{CMAX}	0.91Vn	-4227.09	208.87	1828.50	0.6*Qmax	≤5%Sn
80%P_{CMAX}	0.91Vn	-4832.50	208.92	1789.80	0.6*Qmax	≤5%Sn
90%P_{CMAX}	0.91Vn	-5438.05	208.98	1802.31	0.6*Qmax	≤5%Sn
100%P_{CMAX}	0.91Vn	-5761.18	209.02	1784.52	0.6*Qmax	≤5%Sn
100%P_{CMAX}	0.90Vn	-5375.63	206.97	2887.02	Qmax	≤5%Sn
10%P_{CMAX}	0.90Vn	-619.91	207.23	2937.80	Qmax	≤5%Sn
≤5%P_{CMAX}	0.90Vn	-176.13	207.17	206.34	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	-1087.87	246.16	100.95	-k*Qmax	≤5%Sn
<20%P_{CMAX}	1.09Vn	-1088.70	250.74	96.54	-k*Qmax	≤5%Sn
30%P_{CMAX}	1.09Vn	-1799.38	250.63	-1714.89	-0.9*Qmax (lock-in)*within 10sec*	≤5%Sn
40%P_{CMAX}	1.09Vn	-2402.20	250.51	-1716.93	-0.6*Qmax	≤5%Sn
50%P_{CMAX}	1.09Vn	-3006.53	250.51	-1712.05	-0.6*Qmax	≤5%Sn
60%P_{CMAX}	1.09Vn	-3610.17	250.59	-1739.28	-0.6*Qmax	≤5%Sn
70%P_{CMAX}	1.09Vn	-4212.88	250.58	-1732.17	-0.6*Qmax	≤5%Sn
80%P_{CMAX}	1.09Vn	-4820.25	250.55	-1680.42	-0.6*Qmax	≤5%Sn
90%P_{CMAX}	1.09Vn	-5426.42	250.69	-1751.83	-0.6*Qmax	≤5%Sn
100%P_{CMAX}	1.09Vn	-5699.15	250.71	-1766.56	-0.6*Qmax	≤5%Sn
100%P_{CMAX}	1.1Vn	-5151.04	253.02	-2897.73	-Qmax	≤5%Sn
10%P_{CMAX}	1.1Vn	-587.95	253.09	-2924.40	-Qmax	≤5%Sn
≤5%P_{CMAX}	1.1Vn	-187.94	253.29	60.39	-k*Qmax (lock-out)	≤5%Sn

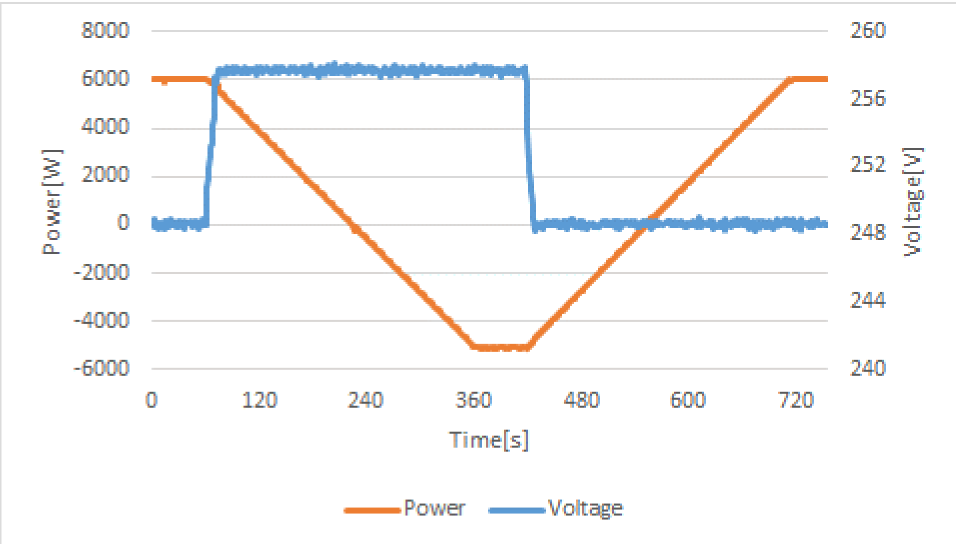
Curve B.2 - Test for bidirectional EESS in CHARGE with k = -0.1

Setting Power [%]	Setting Volatge [V]	Output Power [W]	Voltage [V]	Reactive Power [Var]	Reactive Power expected [Var]	ΔQ
<20%P_{CMAX}	0.93Vn	-1075.64	213.90	141.59	-k*Qmax	≤5%Sn
<20%P_{CMAX}	0.91Vn	-1075.20	209.31	146.50	-k*Qmax	≤5%Sn
30%P_{CMAX}	0.91Vn	-1806.26	209.03	1112.29	0.4*Qmax (lock-in)*within 10sec*	≤5%Sn
40%P_{CMAX}	0.91Vn	-2410.16	209.11	1146.67	0.4*Qmax	≤5%Sn
50%P_{CMAX}	0.91Vn	-3014.18	208.96	1193.93	0.4*Qmax	≤5%Sn
60%P_{CMAX}	0.91Vn	-3618.31	208.92	1186.71	0.4*Qmax	≤5%Sn
70%P_{CMAX}	0.91Vn	-4217.49	209.00	1159.29	0.4*Qmax	≤5%Sn
80%P_{CMAX}	0.91Vn	-4826.49	209.07	1151.83	0.4*Qmax	≤5%Sn
90%P_{CMAX}	0.91Vn	-5429.97	209.02	1209.09	0.4*Qmax	≤5%Sn
100%P_{CMAX}	0.91Vn	-5804.65	209.06	1181.30	0.4*Qmax	≤5%Sn
100%P_{CMAX}	0.90Vn	-5511.43	206.96	2600.85	0.9*Qmax	≤5%Sn
10%P_{CMAX}	0.90Vn	-616.31	207.08	2624.19	0.9*Qmax	≤5%Sn
≤5%P_{CMAX}	0.90Vn	-175.26	207.02	208.21	-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	AF6K-SLP+15Battery					
P_{SMAX} =6000 W P_{CMAX} =6000 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	248.81	6012.27	100.20%	100%	P
2	1,12	257.63	-5151.00	-85.85%	One-way: P <20%P_{SMAX} Biaxially: >80%P_{CMAX}	P
3	1,08	248.67	6050.00	100.83%	100%	P

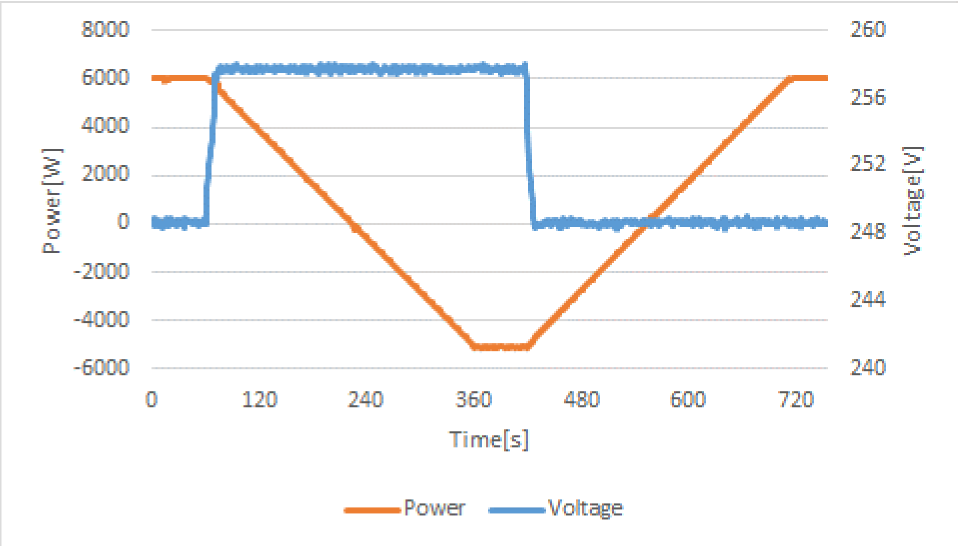
Graph curve P=f(V):



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	AF6K-SLP+1Battery					
P_{SMAX} =6000 W P_{CMAX} =6000 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	248.83	6008.23	100.14%	100%	P
2	1,12	257.65	-5153.00	-85.88%	One-way: P <20%P_{SMAX} Biaxially: >80%P_{CMAX}	P
3	1,08	248.69	6046.00	100.77%	100%	P

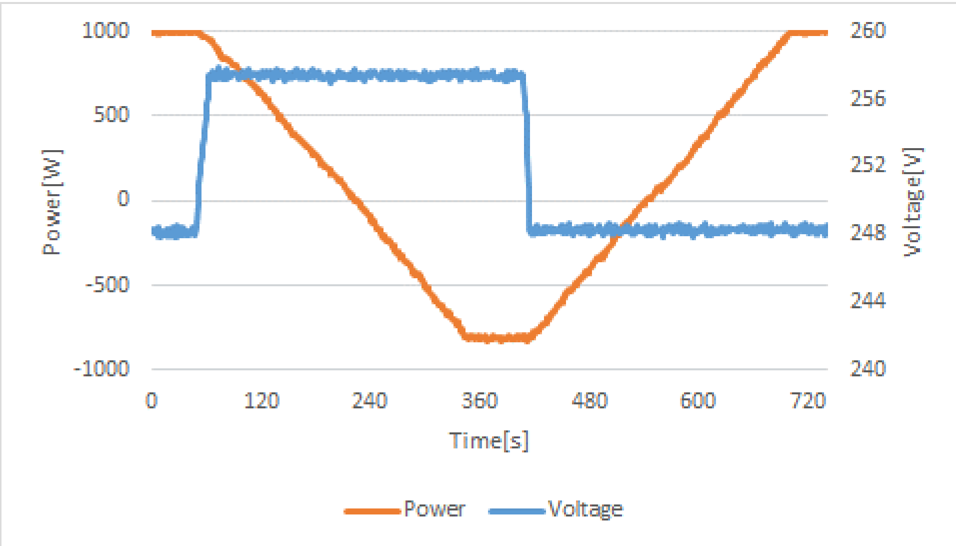
Graph curve P=f(V):



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	AF1K-SL-1+1Battery					
P_{SMAX} =1000W P_{CMAX} =1000W						
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	248.52	995.77	99.58%	100%	P
2	1,12	257.34	-832.00	-83.20%	One-way: P <20%P_{SMAX} Biaxially: >80%P_{CMAX}	P
3	1,08	248.32	1008.00	100.80%	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	AF6K-SLP+15Battery		
Activation settings.. :		Settable delay from 0s to 1s with step of 50ms (default value: no intentional delay)	

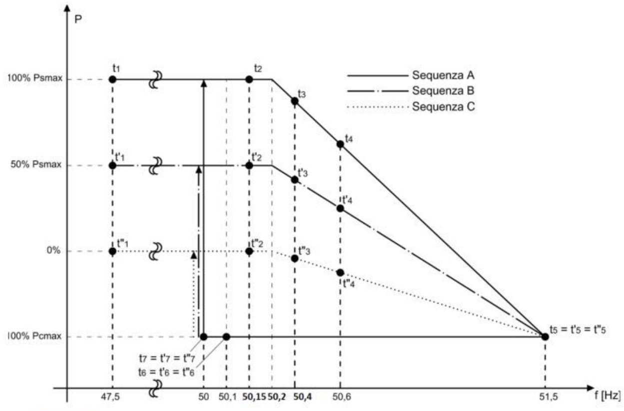


Figure 68 - Active power limitation curves for bidirectional converters

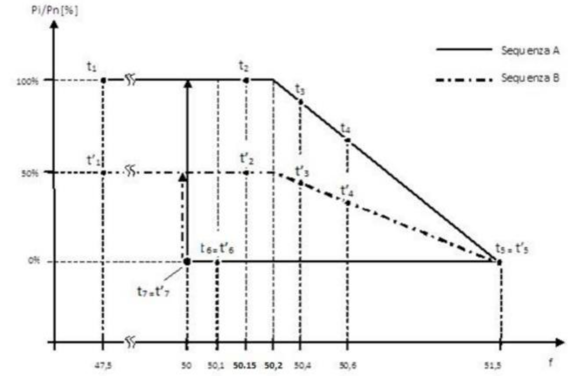


Figure 69 - Active power limitation curves for unidirectional converters

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).

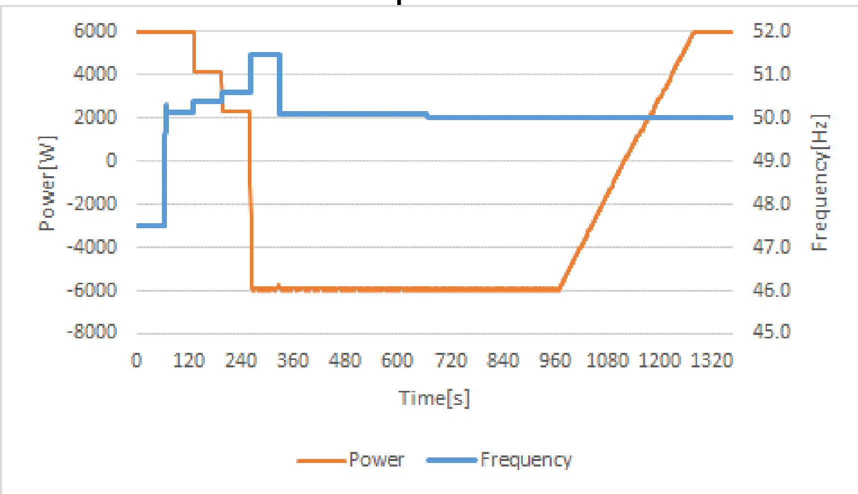
* The sequence C is applicable only for bi-directional converters.

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

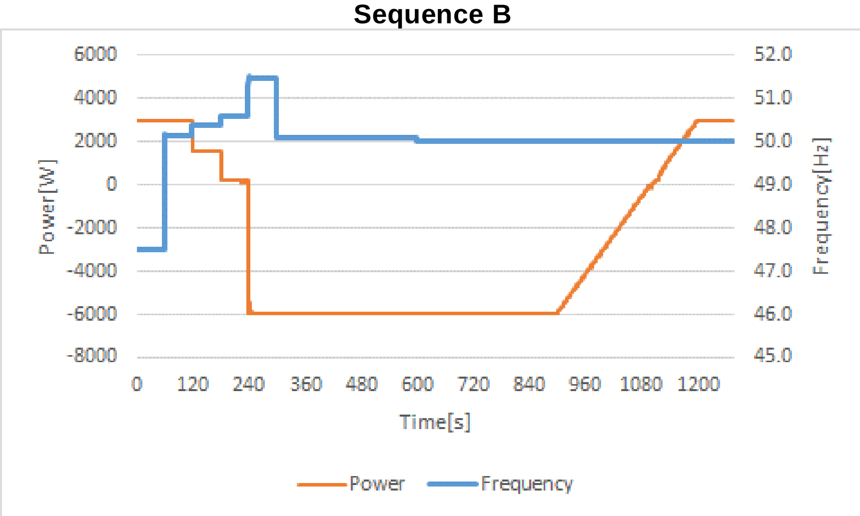
Model	AF6K-SLP+15Battery					
Sequence A						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	100	47.51	6000	6011	± 2.5% Pn	t_1
2	100	50.15	6000	6012	± 2.5% Pn	t_2
3	100	50.40	4154	4089	± 2.5% Pn	t_3
4	100	50.60	2308	2301	± 2.5% Pn	t_4
5	100	51.49	-5908	-5807	± 2.5% Pn	t_5
6	100	50.10	-5908	-5906	± 2.5% Pn	t_6
7	100	50.00	6000	6031	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	3000	2980	± 2.5% Pn	t'_1
2	50	50.15	3000	2982	± 2.5% Pn	t'_2
3	50	50.40	1615	1589	± 2.5% Pn	t'_3
4	50	50.60	231	233	± 2.5% Pn	t'_4
5	50	51.49	-5931	-5902	± 2.5% Pn	t'_5
6	50	50.10	-5931	-5940	± 2.5% Pn	t'_6
7	50	50.00	3000	2996	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	-32	± 2.5% Pn	t''_1
2	0	50.15	0	-31	± 2.5% Pn	t''_2
3	0	50.40	-923	-894	± 2.5% Pn	t''_3
4	0	50.60	-1846	-1858	± 2.5% Pn	t''_4
5	0	51.49	-5954	-5900	± 2.5% Pn	t''_5
6	0	50.10	-5954	-5962	± 2.5% Pn	t''_6
7	0	50.00	0	-43	0% Pn	t''_7

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

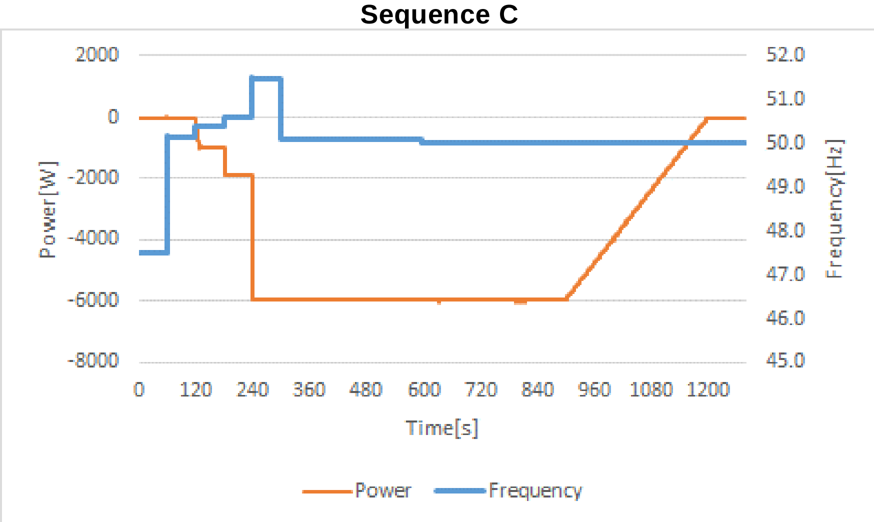
Sequence A



Sequence B



Sequence C

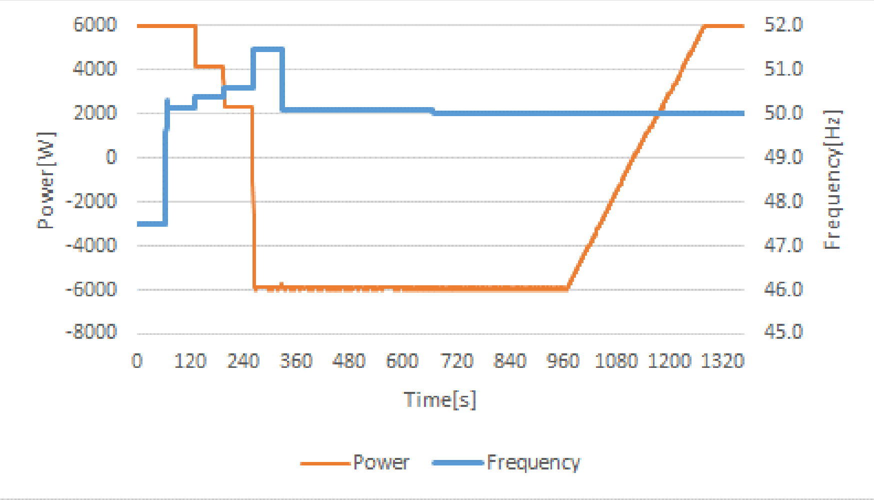


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

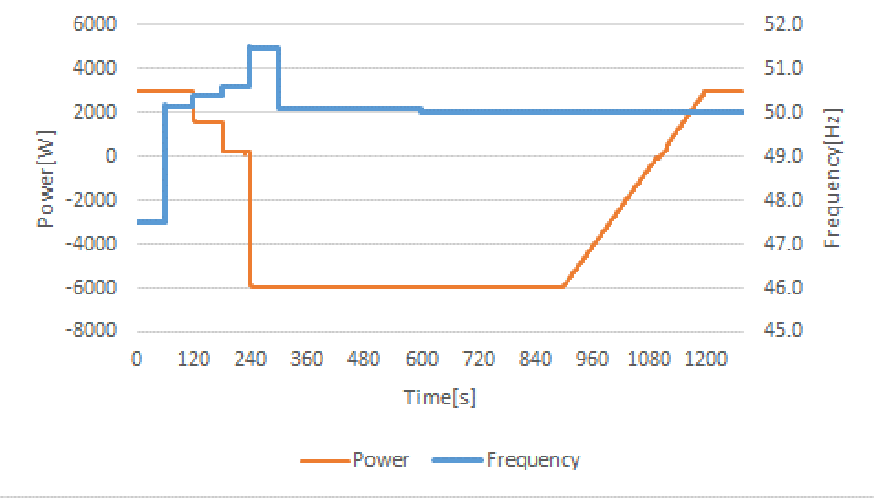
Model	**AF6K-SLP+1Battery**					
Sequence A						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	100	47.51	6000	6013	± 2.5% Pn	t_1
2	100	50.15	6000	6014	± 2.5% Pn	t_2
3	100	50.40	4154	4091	± 2.5% Pn	t_3
4	100	50.60	2308	2303	± 2.5% Pn	t_4
5	100	51.49	-5908	-5805	± 2.5% Pn	t_5
6	100	50.10	-5908	-5904	± 2.5% Pn	t_6
7	100	50.00	6000	6035	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	3000	2984	± 2.5% Pn	t'_1
2	50	50.15	3000	2986	± 2.5% Pn	t'_2
3	50	50.40	1615	1596	± 2.5% Pn	t'_3
4	50	50.60	231	245	± 2.5% Pn	t'_4
5	50	51.49	-5931	-5900	± 2.5% Pn	t'_5
6	50	50.10	-5931	-5952	± 2.5% Pn	t'_6
7	50	50.00	3000	2998	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	-42	± 2.5% Pn	t''_1
2	0	50.15	0	-38	± 2.5% Pn	t''_2
3	0	50.40	-923	-945	± 2.5% Pn	t''_3
4	0	50.60	-1846	-1861	± 2.5% Pn	t''_4
5	0	51.49	-5954	-5846	± 2.5% Pn	t''_5
6	0	50.10	-5954	-5966	± 2.5% Pn	t''_6
7	0	50.00	0	-43	0% Pn	t''_7

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

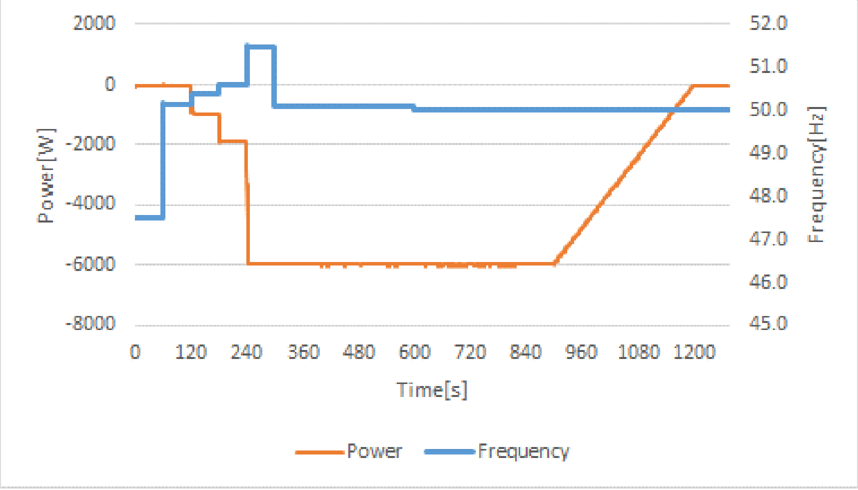
Sequence A



Sequence B



Sequence C

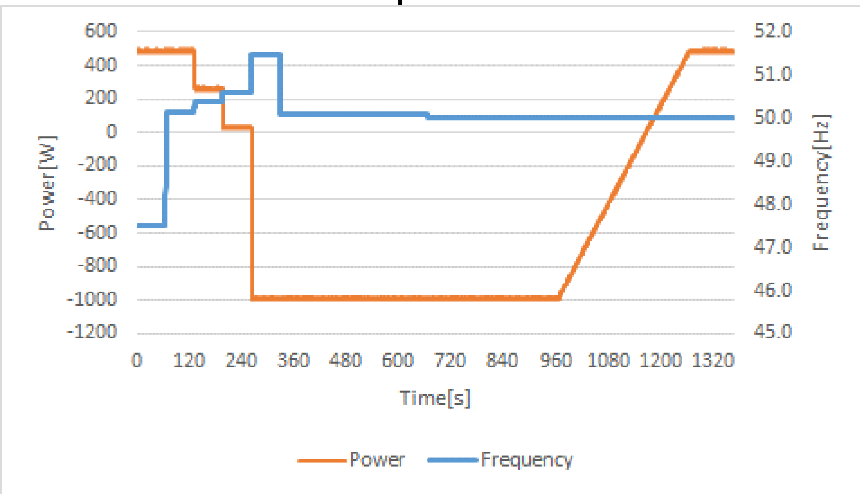


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

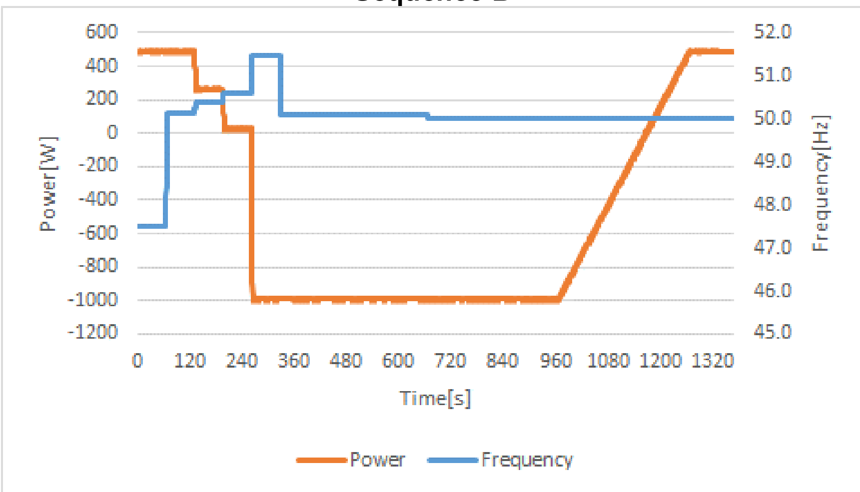
Model	**AF1K-SL-1+1Battery**					
Sequence A						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	100	47.51	1000	997	± 2.5% Pn	t_1
2	100	50.15	1000	998	± 2.5% Pn	t_2
3	100	50.40	692	695	± 2.5% Pn	t_3
4	100	50.60	385	386	± 2.5% Pn	t_4
5	100	51.49	-985	-956	± 2.5% Pn	t_5
6	100	50.10	-985	-982	± 2.5% Pn	t_6
7	100	50.00	1000	1011	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	500	496	± 2.5% Pn	t'_1
2	50	50.15	500	494	± 2.5% Pn	t'_2
3	50	50.40	269	267	± 2.5% Pn	t'_3
4	50	50.60	38	35	± 2.5% Pn	t'_4
5	50	51.49	-988	-968	± 2.5% Pn	t'_5
6	50	50.10	-988	-982	± 2.5% Pn	t'_6
7	50	50.00	500	503	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	3	± 2.5% Pn	t''_1
2	0	50.15	0	12	± 2.5% Pn	t''_2
3	0	50.40	-154	-136	± 2.5% Pn	t''_3
4	0	50.60	-308	-297	± 2.5% Pn	t''_4
5	0	51.49	-992	-966	± 2.5% Pn	t''_5
6	0	50.10	-992	-978	± 2.5% Pn	t''_6
7	0	50.00	0	22	0% Pn	t''_7

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

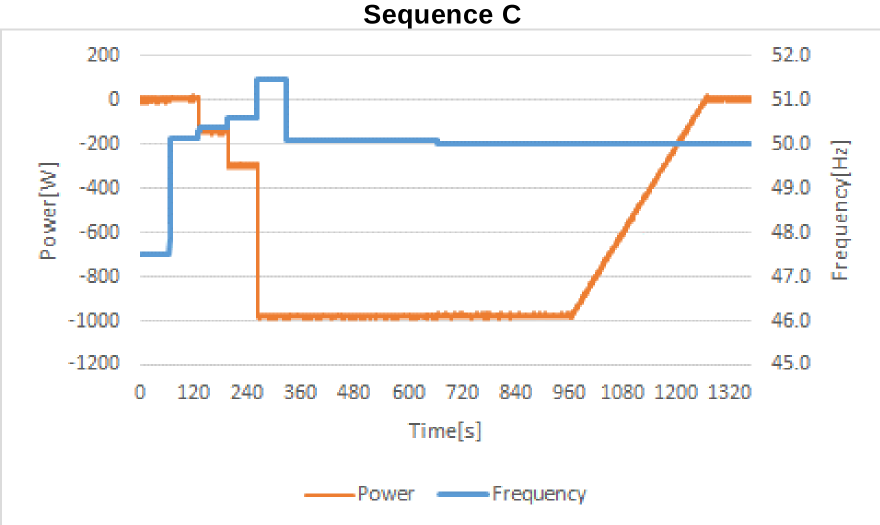
Sequence A



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)	

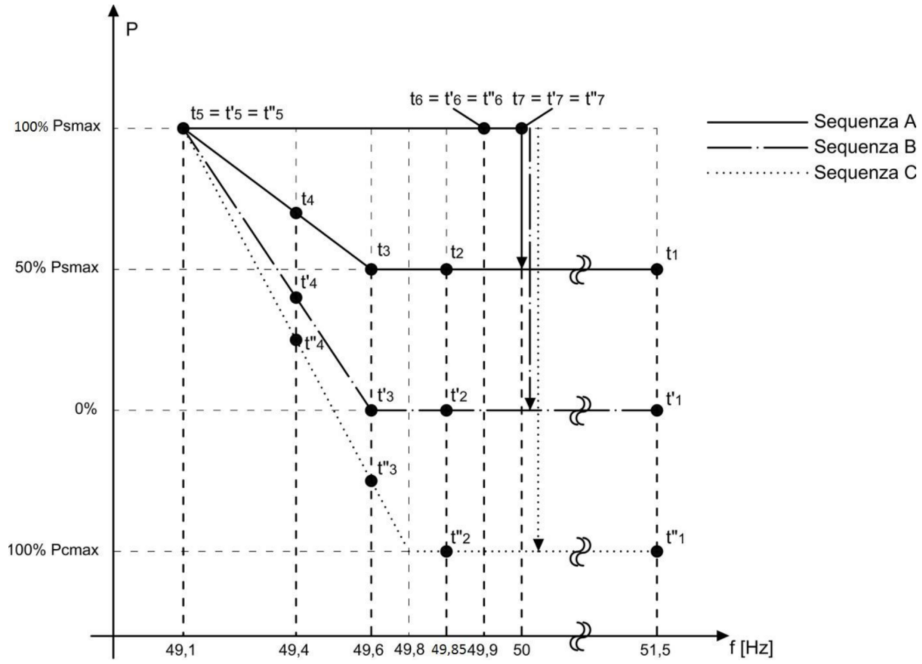


Figure 70 - Active power limitation curves

Bbis.7.4 Verification of the regulation of the active power on an external command from the DSO

Supplementary information:

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

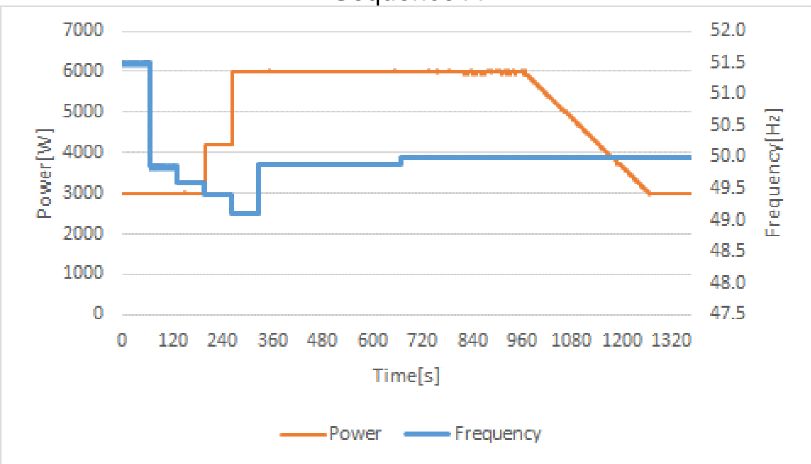
- bring all the parameters of the storage system under test to their respective normal operating values, such that the AC power delivered at the output is respectively equal, for sequences A and B, to 50% and 0% of P_{SMAX} (or P_{NINV} for integrated storage systems) and, for sequence C, 100% of the 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

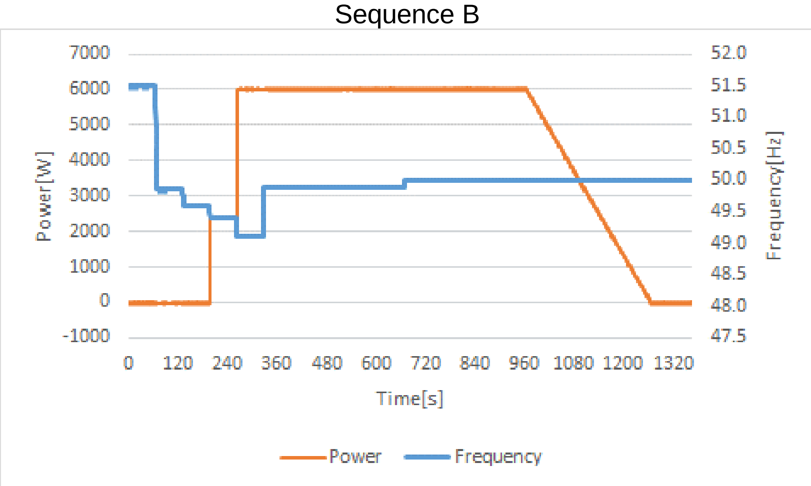
Model	AF6K-SLP+15Battery					
Sequence A						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	50	51.49	3000	2989	± 2.5% Sn	t_1
2	50	49.85	3000	2989	± 2.5% Sn	t_2
3	50	49.60	3000	3000	± 2.5% Sn	t_3
4	50	49.40	4200	4193	± 2.5% Sn	t_4
5	50	49.10	6000	5980	± 2.5% Sn	t_5
6	50	49.89	6000	5996	± 2.5% Sn	t_6
7	50	50.00	3000	2973	± 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	-2	± 2.5% Sn	t'_1
2	0	49.85	0	-11	± 2.5% Sn	t'_2
3	0	49.60	0	14	± 2.5% Sn	t'_3
4	0	49.40	2400	2426	± 2.5% Sn	t'_4
5	0	49.10	6000	5978	± 2.5% Sn	t'_5
6	0	49.89	6000	6003	± 2.5% Sn	t'_6
7	0	50.00	0	-21	± 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	-6000	-6007	± 2.5% Sn	t''_1
2	100% P_{CMAX}	49.85	-6000	-6000	± 2.5% Sn	t''_2
3	100% P_{CMAX}	49.60	-2571	-2562	± 2.5% Sn	t''_3
4	100% P_{CMAX}	49.40	857	864	± 2.5% Sn	t''_4
5	100% P_{CMAX}	49.10	6000	5966	± 2.5% Sn	t''_5
6	100% P_{CMAX}	49.89	6000	6009	± 2.5% Sn	t''_6
7	100% P_{CMAX}	50.00	-6000	-6029	± 2.5% Sn	t''_7

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

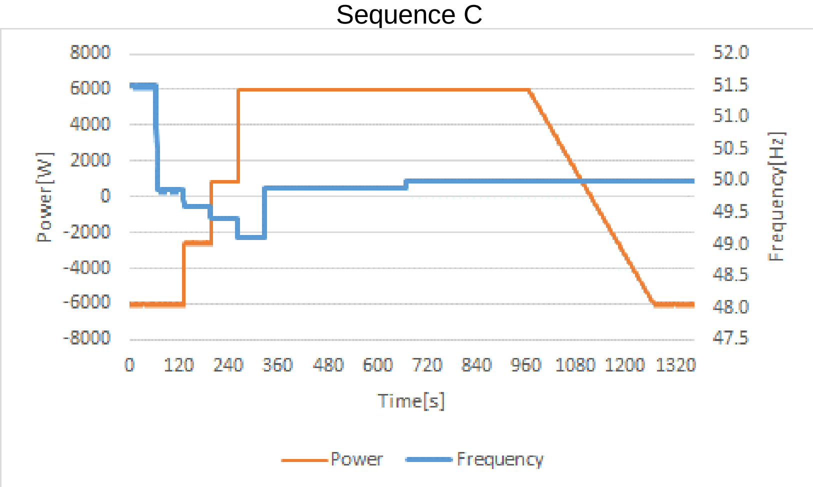
Graph Active power regulation in coincidence with transitory on the transmission grid
Sequence A



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

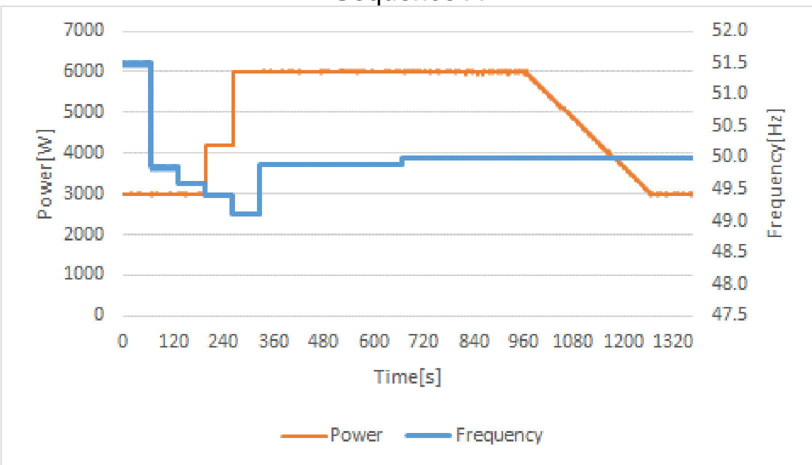


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

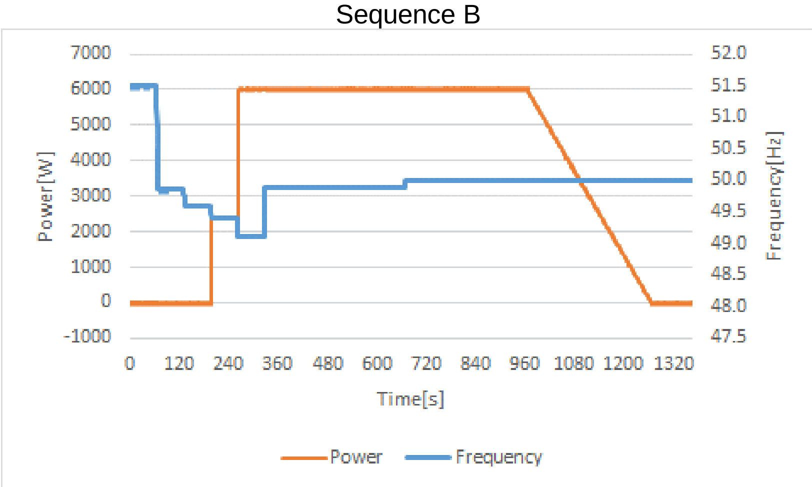
Model	**AF6K-SLP+1Battery**					
Sequence A						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	50	51.49	3000	2992	± 2.5% Sn	t_1
2	50	49.85	3000	2992	± 2.5% Sn	t_2
3	50	49.60	3000	3003	± 2.5% Sn	t_3
4	50	49.40	4200	4196	± 2.5% Sn	t_4
5	50	49.10	6000	5983	± 2.5% Sn	t_5
6	50	49.89	6000	5999	± 2.5% Sn	t_6
7	50	50.00	3000	2978	± 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	1	± 2.5% Sn	t'_1
2	0	49.85	0	-9	± 2.5% Sn	t'_2
3	0	49.60	0	19	± 2.5% Sn	t'_3
4	0	49.40	2400	2432	± 2.5% Sn	t'_4
5	0	49.10	6000	5980	± 2.5% Sn	t'_5
6	0	49.89	6000	6012	± 2.5% Sn	t'_6
7	0	50.00	0	-18	± 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	-6000	-6001	± 2.5% Sn	t''_1
2	100% P_{CMAX}	49.85	-6000	-5994	± 2.5% Sn	t''_2
3	100% P_{CMAX}	49.60	-2571	-2556	± 2.5% Sn	t''_3
4	100% P_{CMAX}	49.40	857	870	± 2.5% Sn	t''_4
5	100% P_{CMAX}	49.10	6000	5972	± 2.5% Sn	t''_5
6	100% P_{CMAX}	49.89	6000	6015	± 2.5% Sn	t''_6
7	100% P_{CMAX}	50.00	-6000	-6024	± 2.5% Sn	t''_7

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

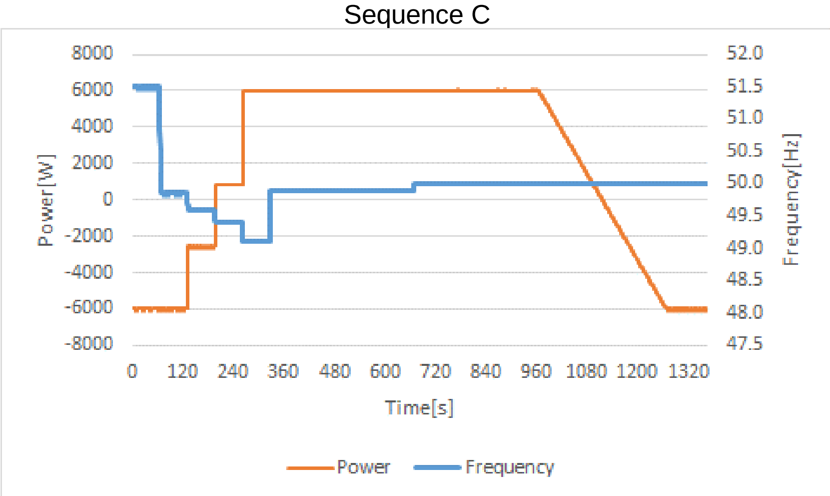
Graph Active power regulation in coincidence with transitory on the transmission grid
Sequence A



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

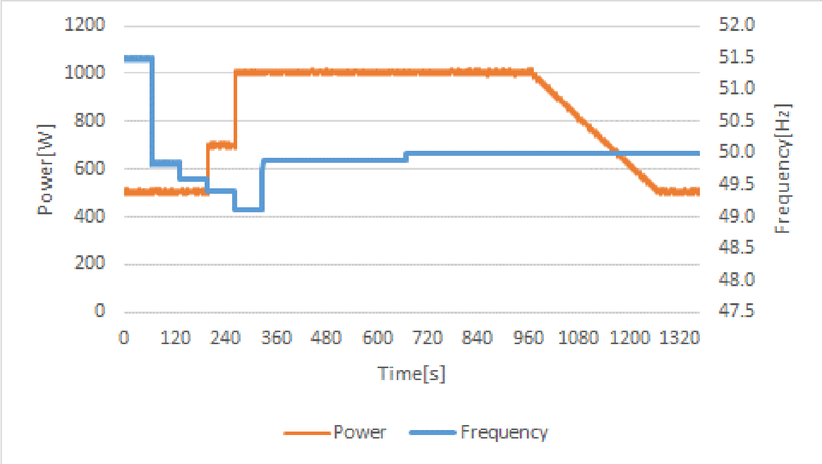


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

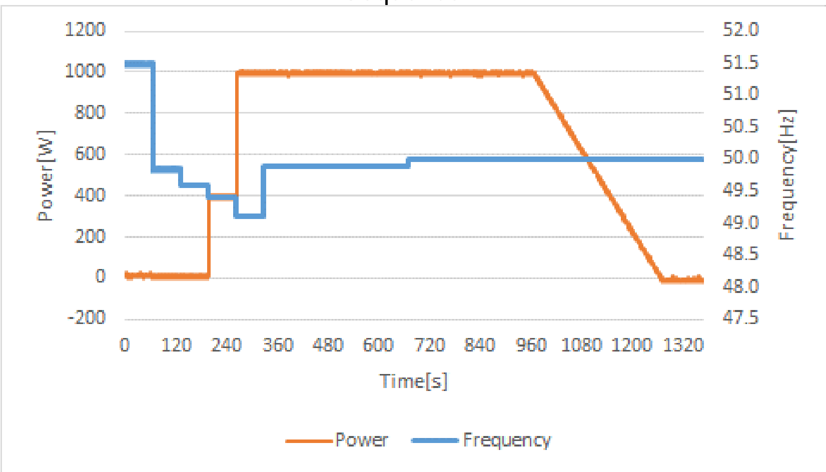
Model	**AF1K-SL-1+1Battery**					
Sequence A						
Step No.	Set output power [%]	Frequency [Hz]	Expected power value [W]	Actual power values [W]	Limits	Graph point
1	50	51.49	500	506	± 2.5% Sn	t_1
2	50	49.85	500	503	± 2.5% Sn	t_2
3	50	49.60	500	504	± 2.5% Sn	t_3
4	50	49.40	700	707	± 2.5% Sn	t_4
5	50	49.10	1000	1002	± 2.5% Sn	t_5
6	50	49.89	1000	1003	± 2.5% Sn	t_6
7	50	50.00	500	499	± 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	14	± 2.5% Sn	t'_1
2	0	49.85	0	12	± 2.5% Sn	t'_2
3	0	49.60	0	13	± 2.5% Sn	t'_3
4	0	49.40	400	395	± 2.5% Sn	t'_4
5	0	49.10	1000	996	± 2.5% Sn	t'_5
6	0	49.89	1000	994	± 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	-1000	-1003	± 2.5% Sn	t''_1
2	100% P_{CMAX}	49.85	-1000	-1002	± 2.5% Sn	t''_2
3	100% P_{CMAX}	49.60	-429	-433	± 2.5% Sn	t''_3
4	100% P_{CMAX}	49.40	143	134	± 2.5% Sn	t''_4
5	100% P_{CMAX}	49.10	1000	982	± 2.5% Sn	t''_5
6	100% P_{CMAX}	49.89	1000	989	± 2.5% Sn	t''_6
7	100% P_{CMAX}	50.00	-1000	-1012	± 2.5% Sn	t''_7

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

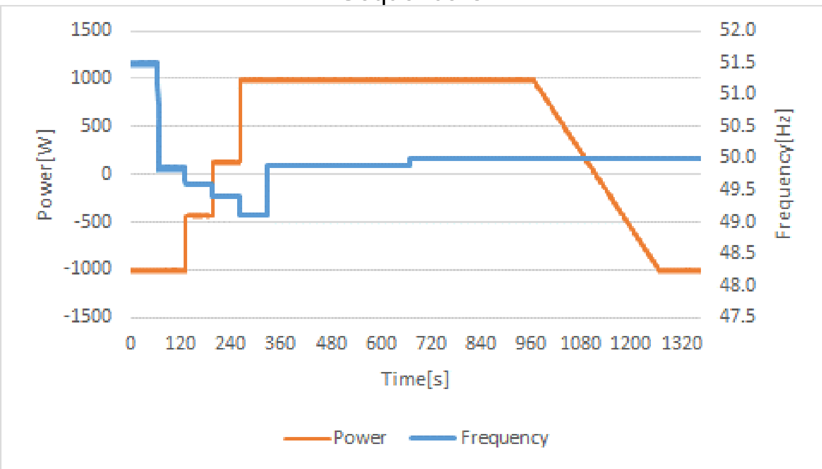
Graph Active power regulation in coincidence with transitory on the transmission grid
Sequence A



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	AF6K-SLP+15Battery				
Set Point	P [W]	Actual power [W]	ΔP/Pn%	Limit [%]	Result
50% P_{SMAX}	3000	2988	-0.20	--	P
30% P_{SMAX}	1800	1786	-0.23	± 2.5 % P_{SMAX}	P
30% P_{CMAX}	-1800	-1779	0.35	± 2.5 % P_{SMAX}	P

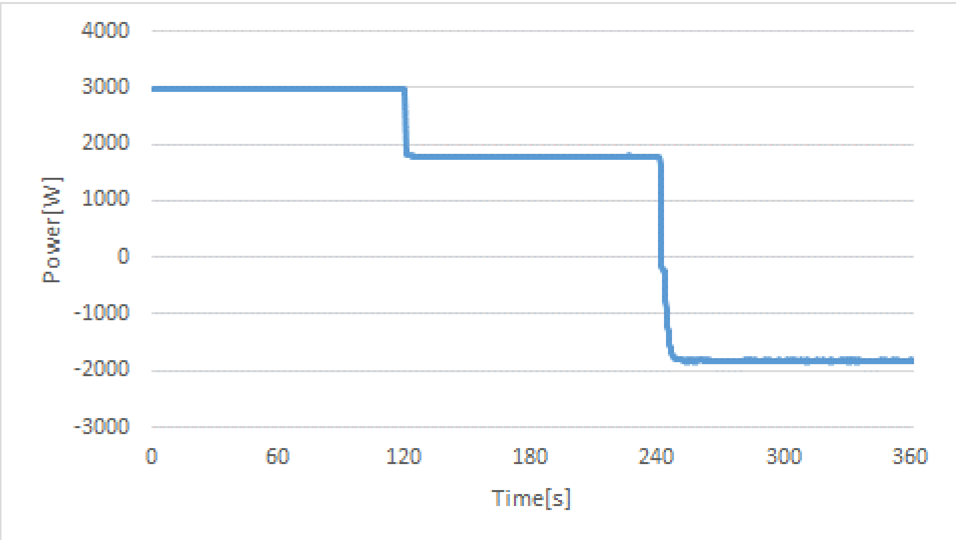
The test must be performed according to the following steps:

–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:



Bbis.7.4	**TABLE: Active power limitation in coincidence with external command coming from the Electricity Distributor**				**P**
Model	AF6K-SLP+1Battery				
Set Point	P [W]	Actual power [W]	ΔP/Pn%	Limit [%]	Result
50% P_{SMAX}	3000	2984	-0.27	--	P
30% P_{SMAX}	1800	1780	-0.33	± 2.5 % P_{SMAX}	P
30% P_{CMAX}	-1800	-1780	0.33	± 2.5 % P_{SMAX}	P

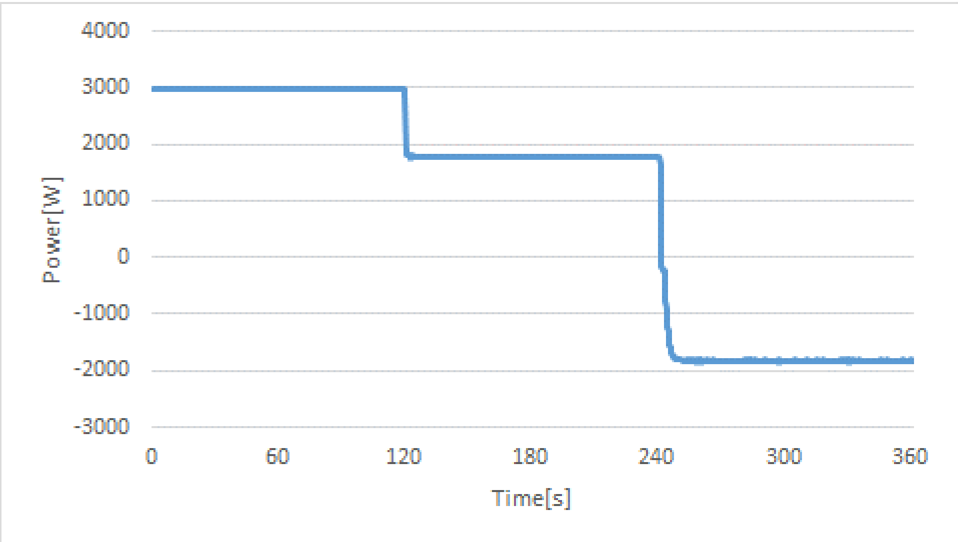
The test must be performed according to the following steps:

–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	AF1K-SL-1+1Battery				
Set Point	P [W]	Actual power [W]	ΔP /Pn%	Limit [%]	Result
50% P_{SMAX}	500	510	1.00	--	P
30% P_{SMAX}	300	304	0.07	± 2.5 % P_{SMAX}	P
30% P_{CMAX}	-300	-302	-0.03	± 2.5 % P_{SMAX}	P

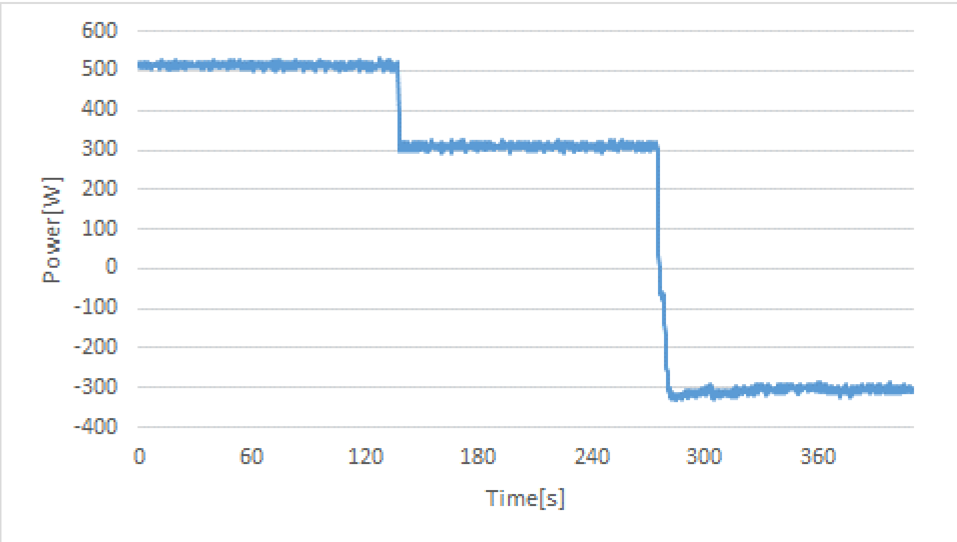
The test must be performed according to the following steps:

–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	AF6K-SLP+15Battery					
Set Point	P [W]	Actual power [W]	Setting time (s)	ΔP /Pn (%)	Deviation Limit	Setting time
Bidirectional converters						
100% P_{SMAX} 30% P_{CMAX}	-1800	-1812	21.4	-0.20	± 2.5 % Pn	≤ 50 s
100% P_{CMAX} 50% P_{SMAX}	3000	2985	16.8	-0.25	± 2.5 % Pn	≤ 50 s
Unidirectional converters						
100% P_{SMAX} 30% P_{SMAX}	--	--	--	--	± 2.5 % Pn	≤ 50 s
0% P_{SMAX} 50% P_{SMAX}	--	--	--	--	± 2.5 % Pn	≤ 50 s

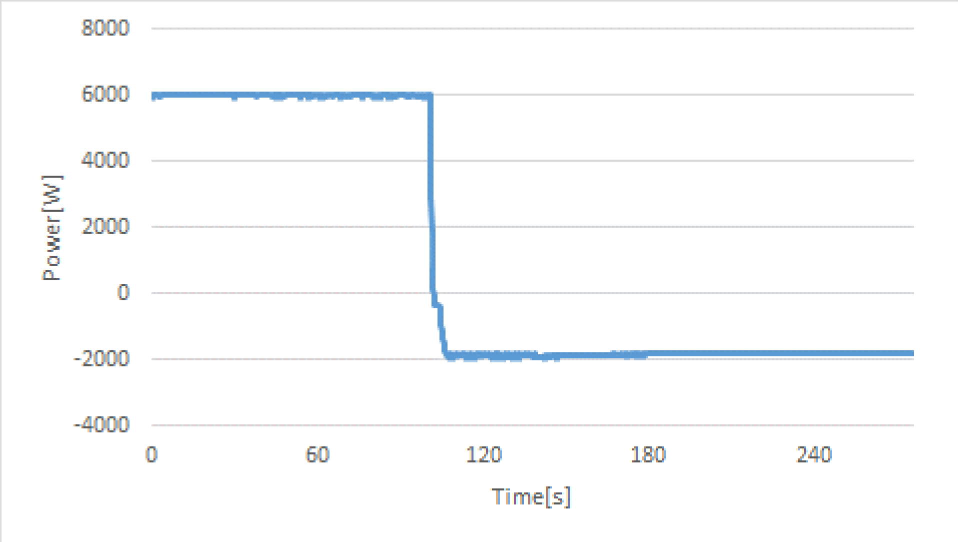
To check the settling time at a command to reduce the active power delivered, or increase the active power absorbed, the test is carried out:
–for storage systems connected to bidirectional converters, by adjusting the regulation parameter from 100%P_{SMAX} to 30% P_{CMAX} at time t_0;
–for storage systems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

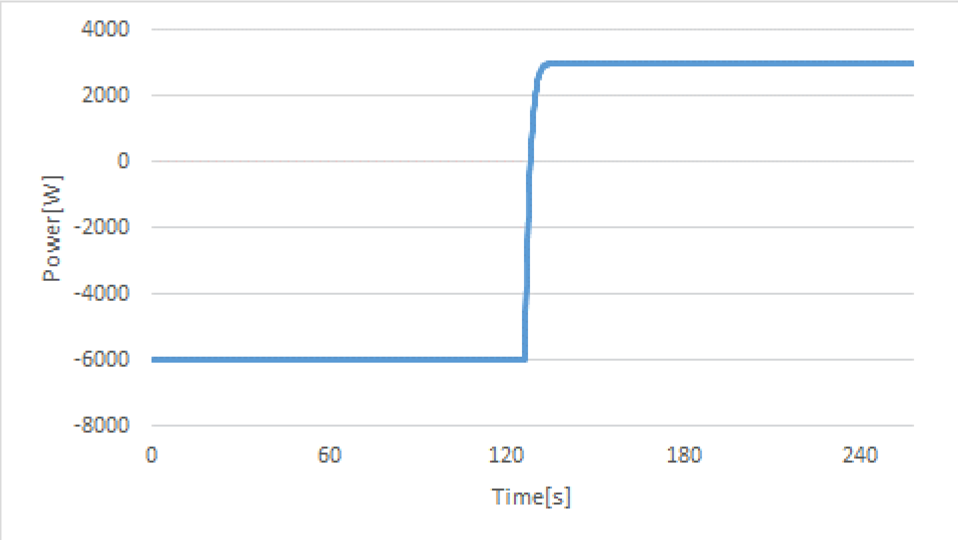
The settling time is the time interval from the instant t_0 of application of the step of increasing / limiting the active power (e.g. 100%P_{SMAX} ->30%P_{SMAX}) to the instant in which the power is stably within a tolerance band of ± 2.5%S_n with respect to the new set value.
The maximum measured settling 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	AF6K-SLP+1Battery					
Set Point	P [W]	Actual power [W]	Setting time (s)	ΔP/Pn (%)	Deviation Limit	Setting time
Bidirectional converters						
100% P_{SMAX} 30% P_{CMAX}	-1500	-1818	20.8	-0.30	± 2.5 % Pn	≤ 50 s
100% P_{CMAX} 50% P_{SMAX}	2500	2986	16.8	-0.23	± 2.5 % Pn	≤ 50 s
Unidirectional converters						
100% P_{SMAX} 30% P_{SMAX}	--	--	--	--	± 2.5 % Pn	≤ 50 s
0% P_{SMAX} 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:

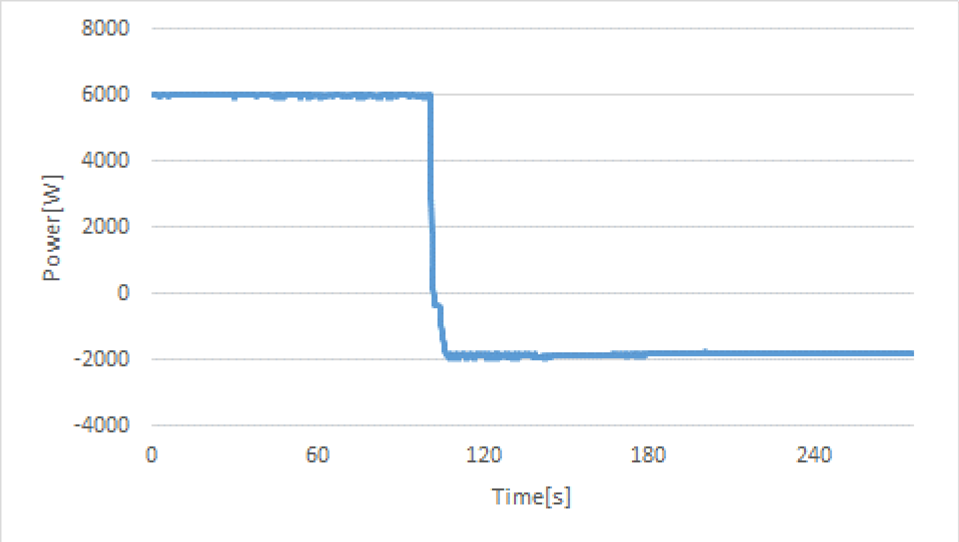
–for storage systems connected to bidirectional converters, by adjusting the regulation parameter from 100%P_{CMAX} to 50% P_{SMAX} at time t_0;

–for storage systems connected to unidirectional converters, by adjusting the regulation parameter from 0%P_{SMAX} to 50%P_{SMAX} at time t_0.

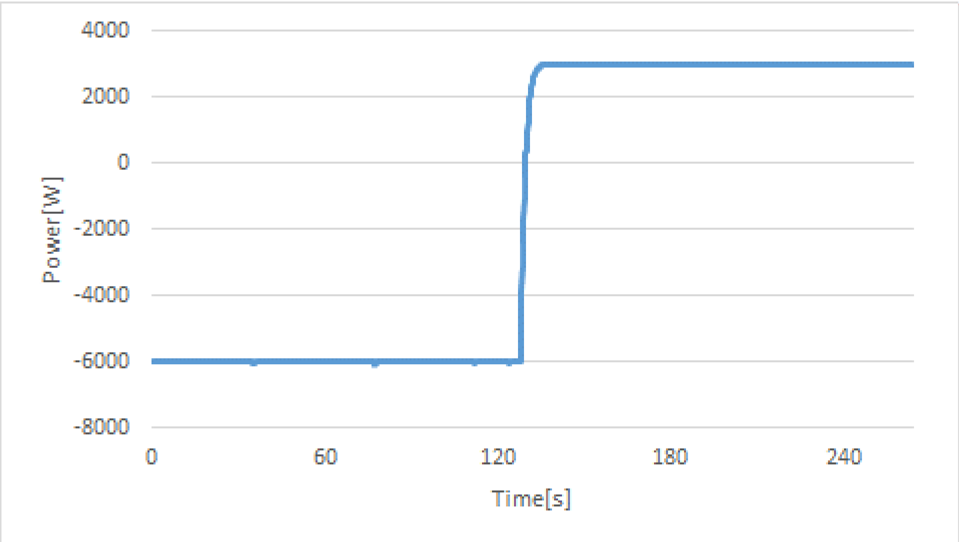
The settling time is the time interval from the instant t_0 of application of the step of increasing / limiting the active power (e.g. 100%P_{SMAX} ->30%P_{SMAX}) to the instant in which the power is stably within a tolerance band of ± 2.5%S_n with respect to the new set value.
The maximum measured settling 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	AF1K-SL-1+1Battery					
Set Point	P [W]	Actual power [W]	Setting time (s)	ΔP/Pn (%)	Deviation Limit	Setting time
Bidirectional converters						
100% P_{SMAX} 30% P_{CMAX}	-300	-305	29.4	-0.50	± 2.5 % Pn	≤ 50 s
100% P_{CMAX} 50% P_{SMAX}	500	496	24.8	-0.40	± 2.5 % Pn	≤ 50 s
Unidirectional converters						
100% P_{SMAX} 30% P_{SMAX}	--	--	--	--	± 2.5 % Pn	≤ 50 s
0% P_{SMAX} 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:

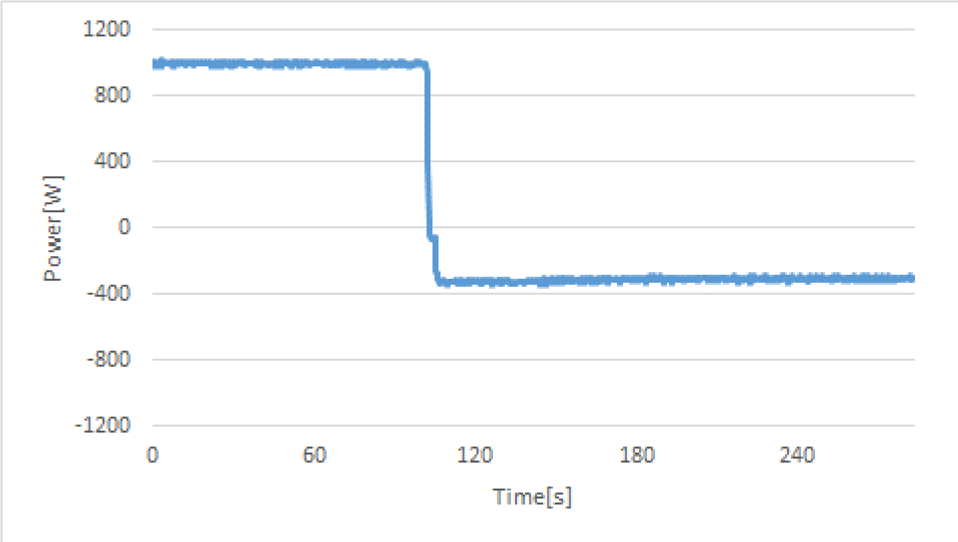
–for storage systems connected to bidirectional converters, by adjusting the regulation parameter from 100%P_{CMAX} to 50% P_{SMAX} at time t_0;

–for storage systems connected to unidirectional converters, by adjusting the regulation parameter from 0%P_{SMAX} to 50%P_{SMAX} at time t_0.

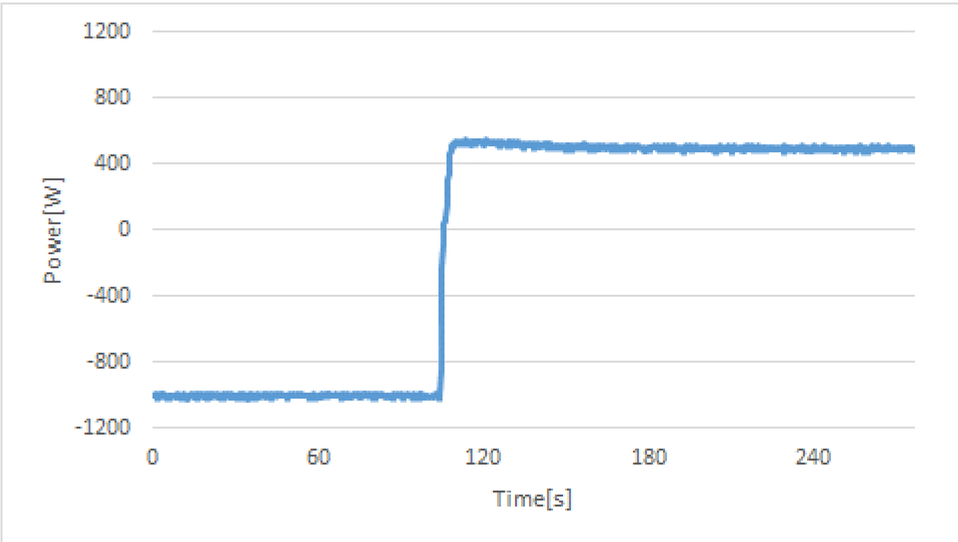
The settling time is the time interval from the instant t_0 of application of the step of increasing / limiting the active power (e.g. 100%P_{SMAX} ->30%P_{SMAX}) to the instant in which the power is stably within a tolerance band of ± 2.5%S_n with respect to the new set value.
The maximum measured settling 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}:

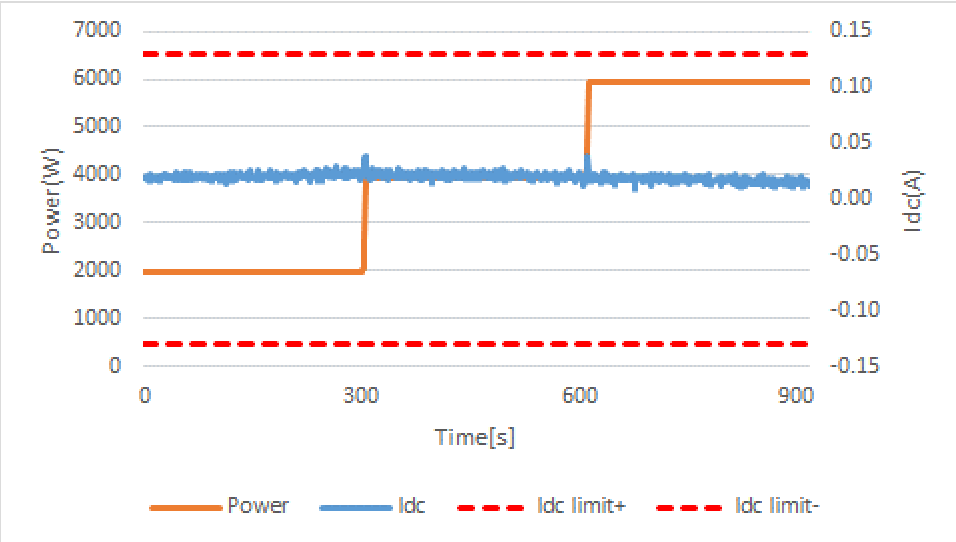


Graph: 100% P_{CMAX} to 50% P_{SMAX}:



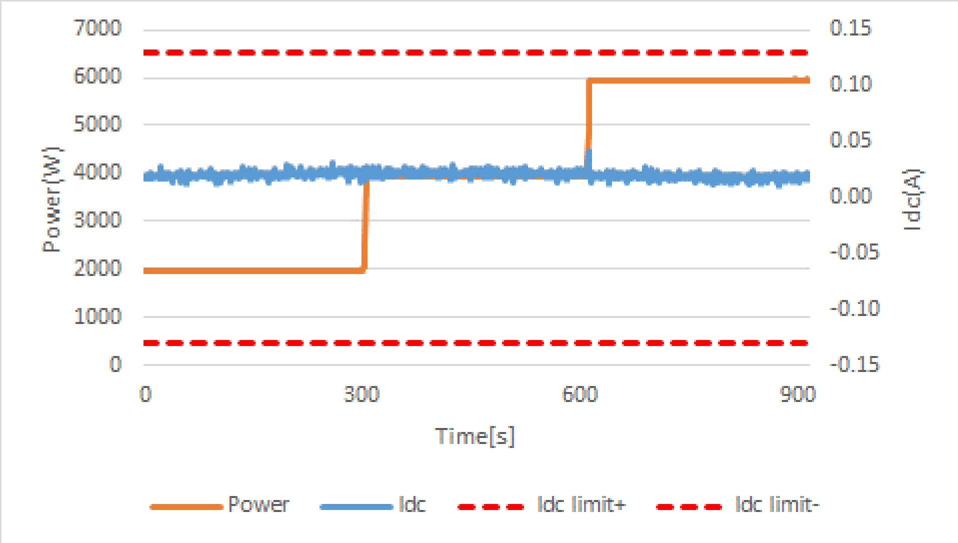
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.8.1	**TABLE: Verification of continuous component emission**		**P**
Model	AF6K-SLP+15Battery		
Completed test			
Power Level [%P_{SMAX}]	**(33 ± 5)%**	**(66 ± 5)%**	**(100 ± 5)%**
Ambient			
Total output Power (W)	1974	3942	5952
Output Vrms	230.22	230.62	230.91
Output Arms	8.57	17.09	25.78
Cos φ	0.9991	0.9998	0.9999
L1 DC Component (A)	0.021	0.021	0.017
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.079%	0.081%	0.066%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-



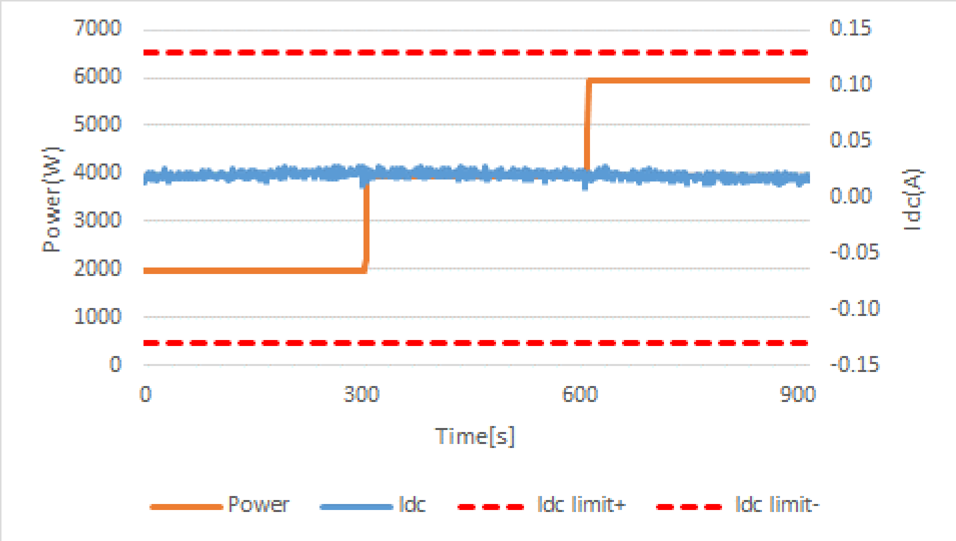
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Minimum ambient rating (-25°C) or -10°C			
Total output Power (W)	1972	3941	5949
Output Vrms	230.21	230.63	230.92
Output Arms	8.57	17.09	25.76
Cos φ	0.9991	0.9998	0.9999
L1 DC Component (A)	0.021	0.022	0.019
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.079%	0.084%	0.071%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-



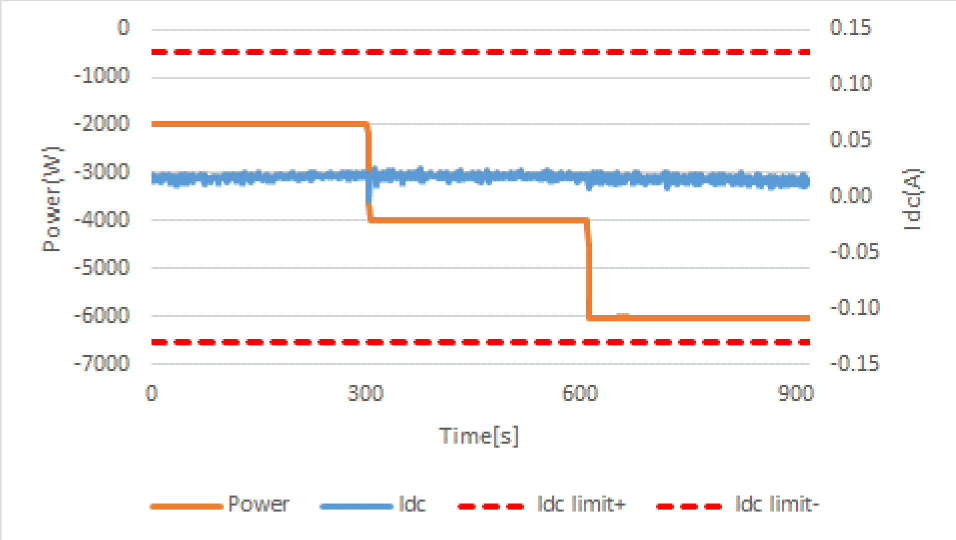
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Maximum ambient rating (+60°C) or +55°C			
Total output Power (W)	1970	3937	5947
Output Vrms	230.22	230.63	230.91
Output Arms	8.56	17.07	25.75
Cos φ	0.9991	0.9998	0.9999
L1 DC Component (A)	0.021	0.021	0.018
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.079%	0.081%	0.071%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-



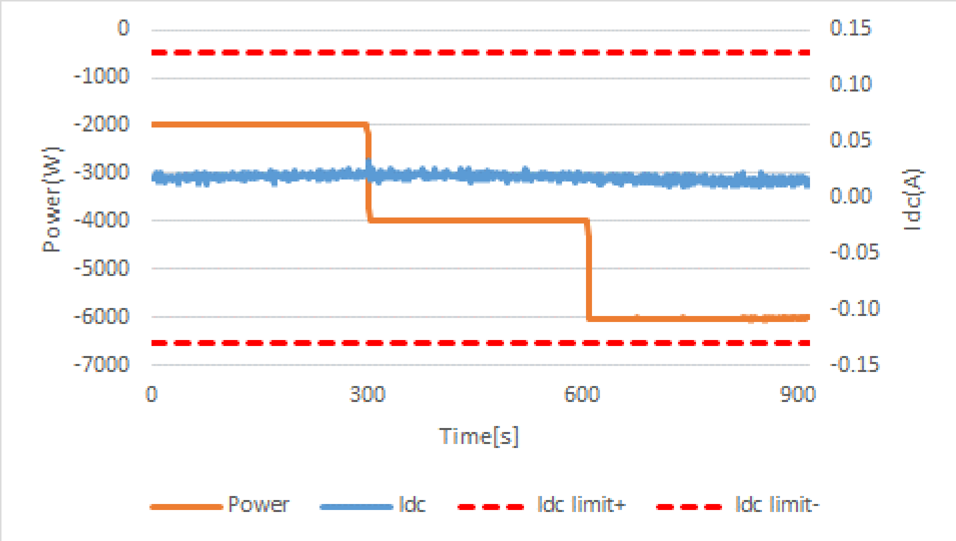
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Power Level [%P_{CMAX}]	**(33 ± 5)%**	**(66 ± 5)%**	**(100 ± 5)%**
Ambient			
Total output Power (W)	-1990	-3982	-6019
Output Vrms	229.41	228.99	228.55
Output Arms	8.70	17.41	26.35
Cos φ	-0.9974	-0.9991	-0.9995
L1 DC Component (A)	0.018	0.019	0.016
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.069%	0.072%	0.062%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-



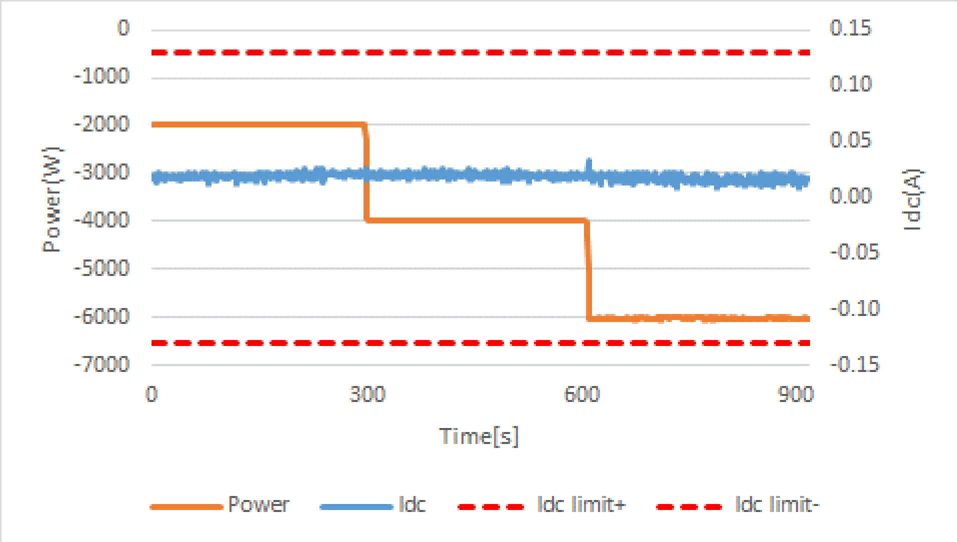
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Minimum ambient rating (-25°C) or -10°C			
Total output Power (W)	-1990	-3982	-6015
Output Vrms	229.41	229.00	228.58
Output Arms	8.70	17.41	26.33
Cos φ	-0.9974	-0.9991	-0.9995
L1 DC Component (A)	0.019	0.020	0.016
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.074%	0.075%	0.061%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-



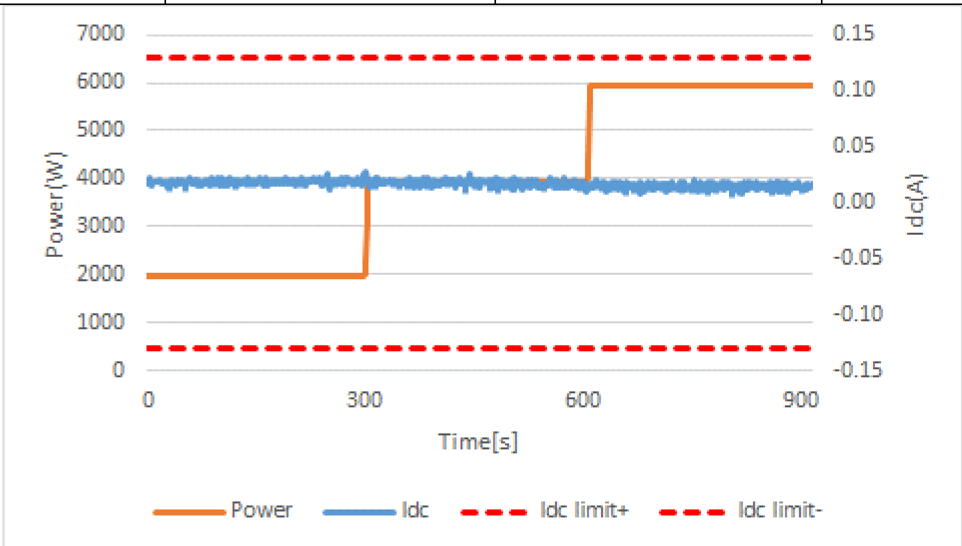
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Maximum ambient rating (+60°C) or +55°C			
Total output Power (W)	-1989	-3980	-6011
Output Vrms	229.40	228.99	228.57
Output Arms	8.69	17.40	26.31
Cos φ	-0.9974	-0.9991	-0.9995
L1 DC Component (A)	0.020	0.020	0.017
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.075%	0.077%	0.065%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-



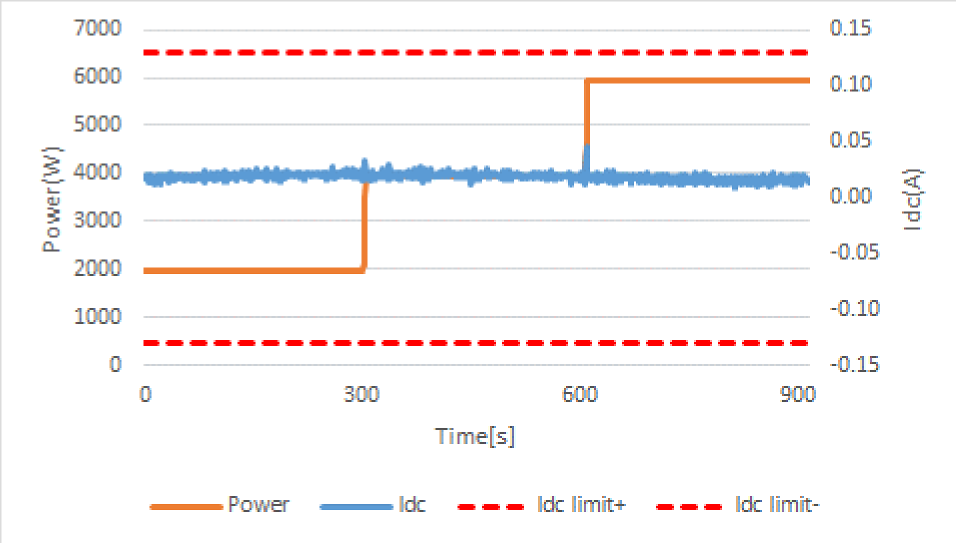
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.8.1	**TABLE: Verification of continuous component emission**		**P**
Model	AF6K-SLP+1Battery		
Completed test-			
Power Level [%P_{SMAX}]	**(33 ± 5)%**	**(66 ± 5)%**	**(100 ± 5)%**
Ambient			
Total output Power (W)	1962	3930	5944
Output Vrms	230.22	230.62	230.93
Output Arms	8.52	17.04	25.74
Cos φ	0.9991	0.9998	0.9999
L1 DC Component (A)	0.019	0.017	0.015
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.071%	0.067%	0.056%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-



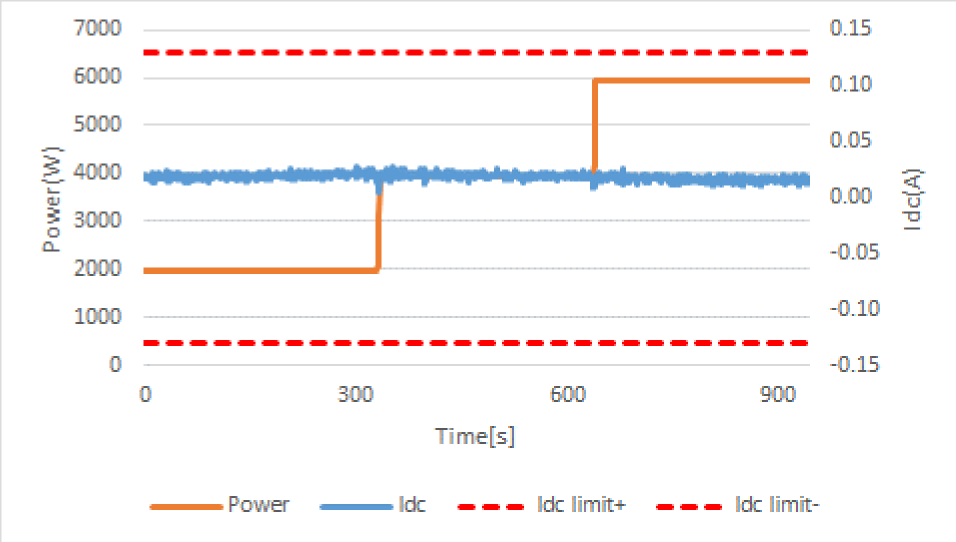
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Minimum ambient rating (-25°C) or -10°C			
Total output Power (W)	1963	3932	5943
Output Vrms	230.21	230.61	230.91
Output Arms	8.53	17.05	25.74
Cos φ	0.9991	0.9998	0.9999
L1 DC Component (A)	0.020	0.020	0.016
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.075%	0.077%	0.063%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-



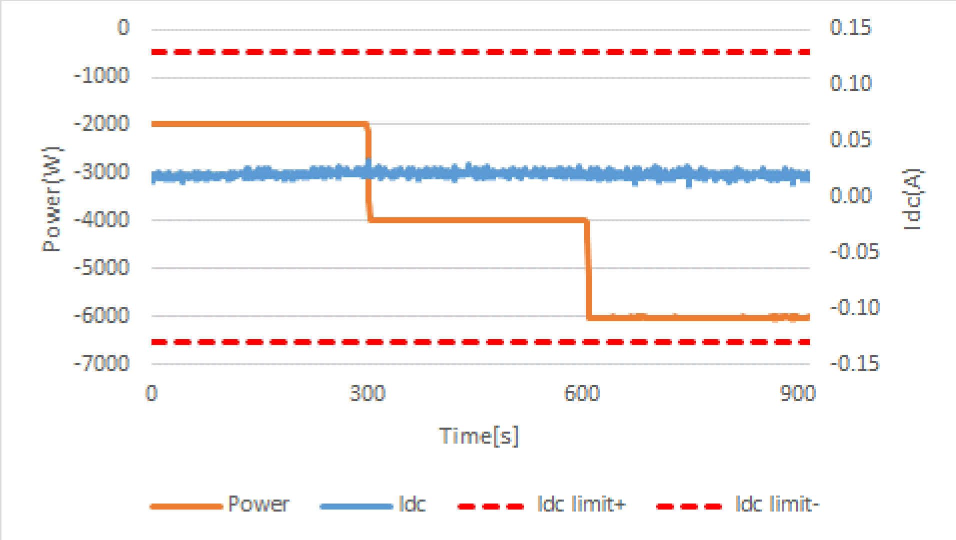
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Maximum ambient rating (+60°C) or +55°C			
Total output Power (W)	1962	3932	5943
Output Vrms	230.20	230.61	230.91
Output Arms	8.52	17.05	25.74
Cos φ	0.9991	0.9998	0.9999
L1 DC Component (A)	0.020	0.020	0.017
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.075%	0.076%	0.064%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-



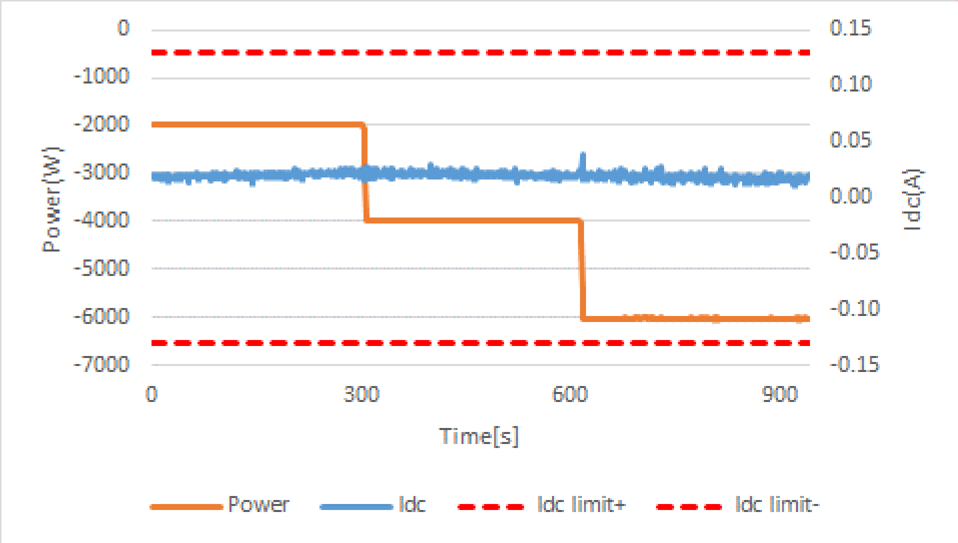
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Power Level [%P_{CMAX}]	(33 ± 5)%	(66 ± 5)%	(100 ± 5)%
Ambient			
Total output Power (W)	-1990	-3983	-6015
Output Vrms	229.40	228.97	228.57
Output Arms	8.70	17.41	26.33
Cos φ	-0.9974	-0.9991	-0.9995
L1 DC Component (A)	0.020	0.022	0.020
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.078%	0.083%	0.078%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-



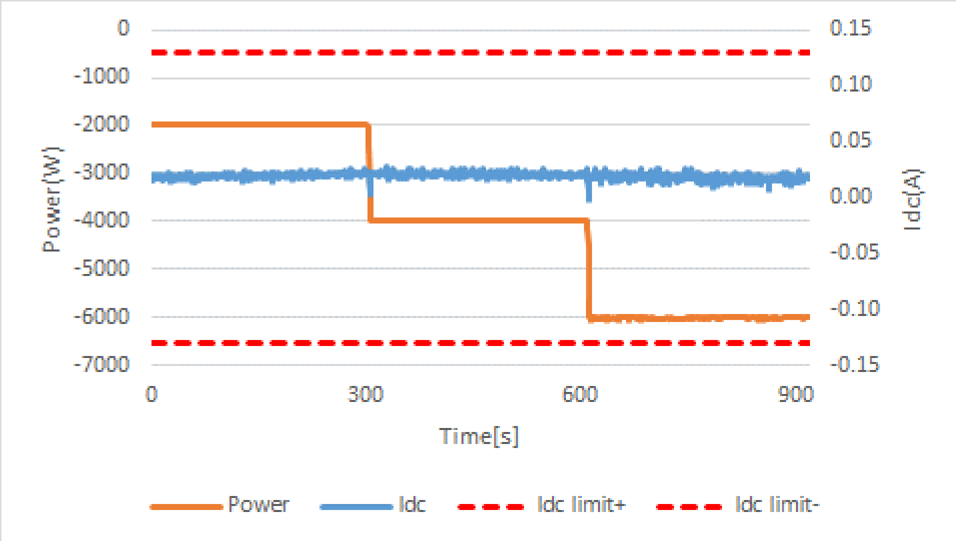
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Minimum ambient rating (-25°C) or -10°C			
Total output Power (W)	-1992	-3984	-6016
Output Vrms	229.42	229.01	228.59
Output Arms	8.71	17.41	26.33
Cos φ	-0.9974	-0.9991	-0.9995
L1 DC Component (A)	0.020	0.021	0.018
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.078%	0.080%	0.069%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-



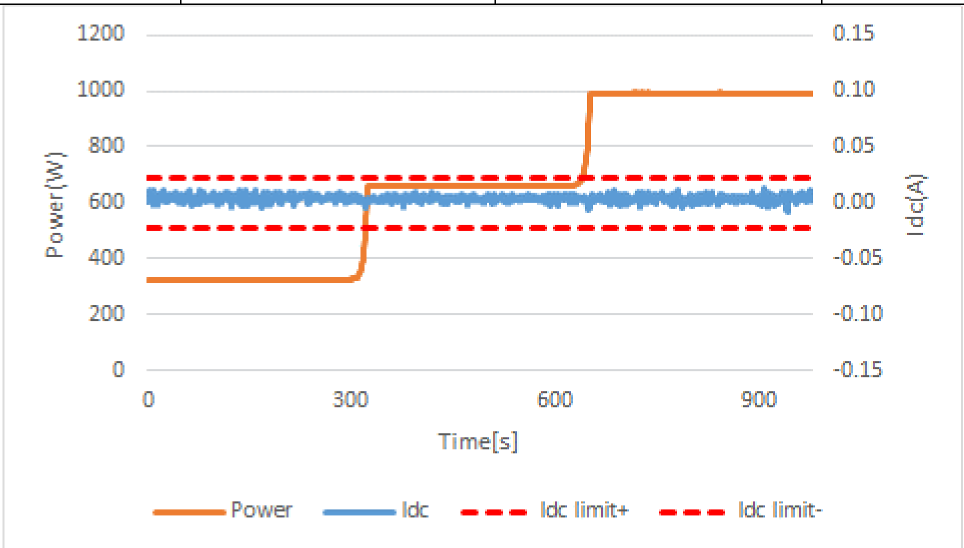
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Maximum ambient rating (+60°C) or +55°C			
Total output Power (W)	-1990	-3983	-6010
Output Vrms	229.42	229.02	228.58
Output Arms	8.70	17.41	26.31
Cos φ	-0.9974	-0.9991	-0.9995
L1 DC Component (A)	0.020	0.021	0.018
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.075%	0.079%	0.069%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-



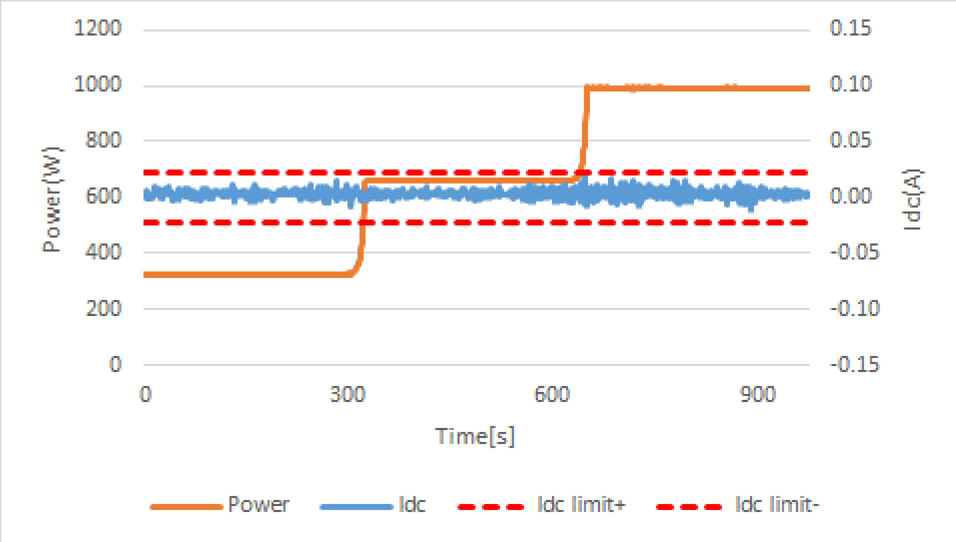
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Bbis.8.1	**TABLE: Verification of continuous component emission**		P
Model	AF1K-SL-1+1Battery		
Completed test			
Power Level [%P_{SMAX}]	**(33 ± 5)%**	**(66 ± 5)%**	**(100 ± 5)%**
Ambient			
Total output Power (W)	323	661	996
Output Vrms	229.36	229.41	229.44
Output Arms	1.91	3.16	4.52
Cos φ	0.7465	0.9132	0.9569
L1 DC Component (A)	0.005	0.004	0.004
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.108%	0.093%	0.100%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-

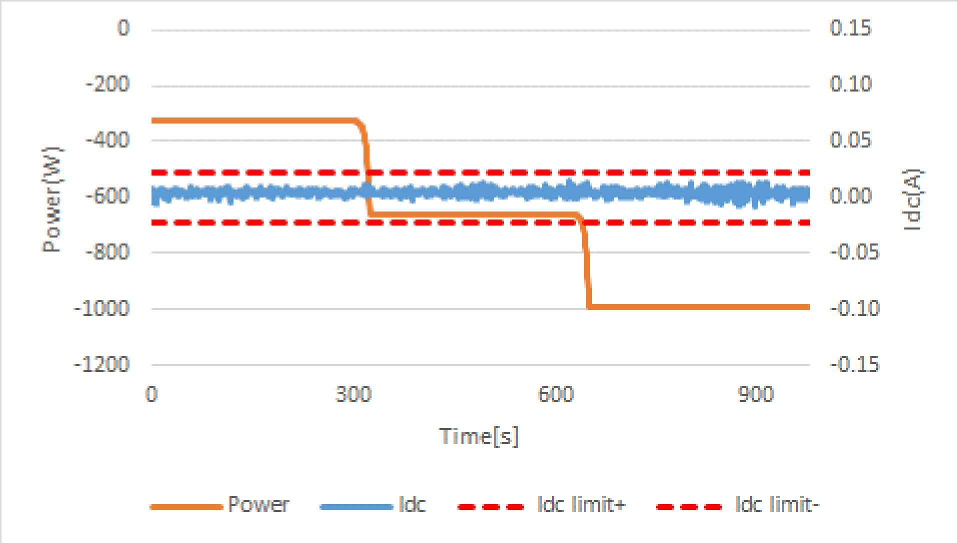


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Minimum ambient rating (-25°C) or -10°C			
Total output Power (W)	324	665	996
Output Vrms	229.39	229.40	229.43
Output Arms	1.91	3.16	4.52
Cos φ	0.7464	0.9133	0.9569
L1 DC Component (A)	0.004	0.004	0.004
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.089%	0.090%	0.099%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-

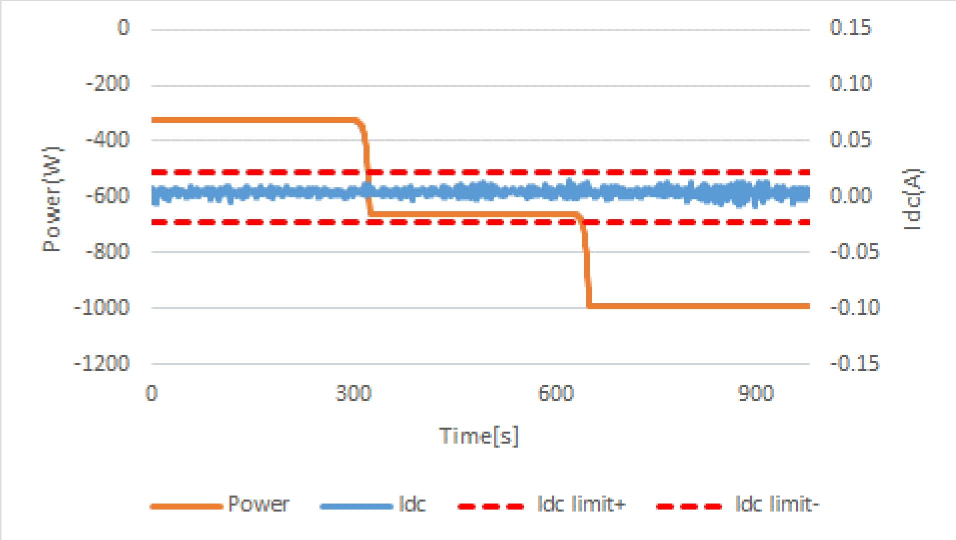


Maximum ambient rating (+60°C) or +55°C			
Total output Power (W)	-324	-665	-997
Output Vrms	229.39	229.41	229.46
Output Arms	1.91	3.16	4.52
Cos φ	-0.7464	-0.9132	-0.9569
L1 DC Component (A)	0.005	0.005	0.005
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.104%	0.116%	0.110%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-



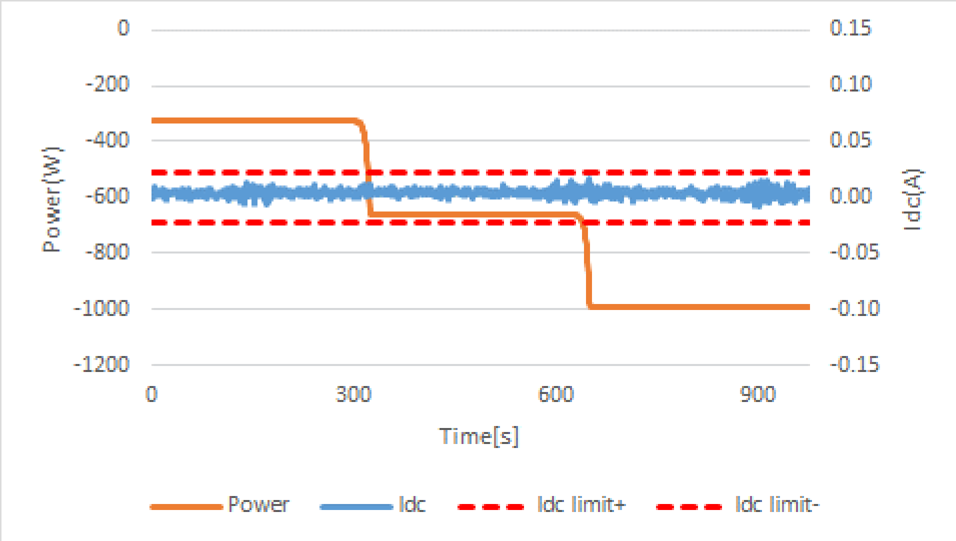
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Power Level [%P_{CMAX}]	**(33 ± 5)%**	**(66 ± 5)%**	**(100 ± 5)%**
Ambient			
Total output Power (W)	-326	-663	-994
Output Vrms	229.38	229.42	229.46
Output Arms	1.91	3.16	4.52
Cos φ	-0.7464	-0.9133	-0.9569
L1 DC Component (A)	0.004	0.004	0.004
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.100%	0.102%	0.103%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-



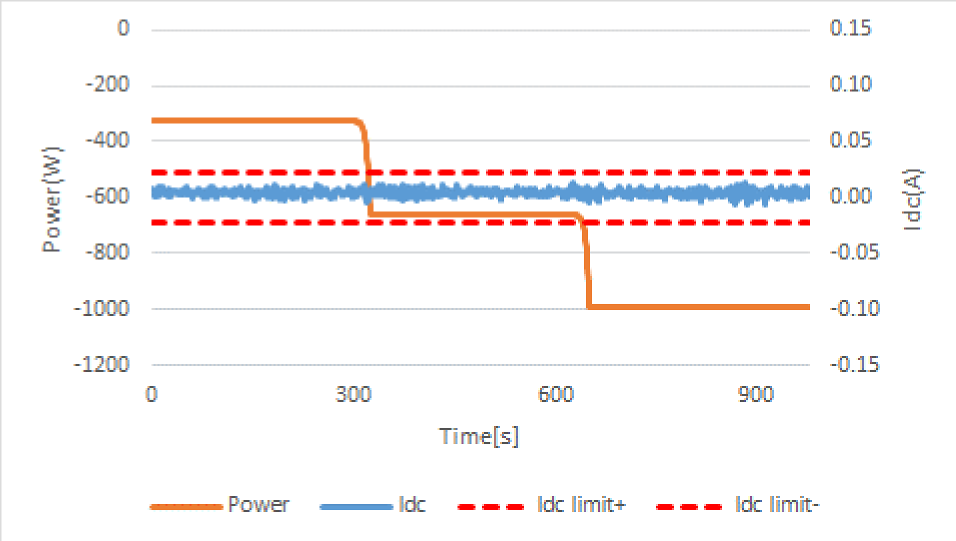
CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Minimum ambient rating (-25°C) or -10°C			
Total output Power (W)	-325	-664	-993
Output Vrms	229.38	229.42	229.46
Output Arms	1.91	3.16	4.52
Cos φ	-0.7464	-0.9133	-0.9569
L1 DC Component (A)	0.004	0.004	0.004
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.100%	0.102%	0.103%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-



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

Maximum ambient rating (+60°C) or +55°C			
Total output Power (W)	-326	-663	-993
Output Vrms	229.37	229.42	229.45
Output Arms	1.91	3.16	4.52
Cos φ	-0.7467	-0.9132	-0.9568
L1 DC Component (A)	0.005	0.005	0.004
L2 DC Component (A)	-	-	-
L3 DC Component (A)	-	-	-
L1 DC Component (% I_r)	0.105%	0.111%	0.096%
L2 DC Component (% I_r)	-	-	-
L3 DC Component (% I_r)	-	-	-



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

Bbis.8.2	**TABLE: Verification of protections against the continuous DC injection**			P
Model	AF6K-SLP+15Battery			
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	136.2	130.43	997.0
66%	+0,5%I_{nom} /1s	135.3	130.43	998.0
100%	+0,5%I_{nom} /1s	136.1	130.43	998.0
Minimum ambient rating (-25°C) or -10°C, I_{dc} = 0,5% of I_{nom}				
33%	+0,5%I_{nom} /1s	134.9	130.43	995.0
66%	+0,5%I_{nom} /1s	135.6	130.43	994.0
100%	+0,5%I_{nom} /1s	135.8	130.43	996.0
Maximum ambient rating (+60°C) or +55°C, I_{dc} = 0,5% of I_{nom}				
33%	+0,5%I_{nom} /1s	135.6	130.43	997.0
66%	+0,5%I_{nom} /1s	135.9	130.43	992.0
100%	+0,5%I_{nom} /1s	134.7	130.43	992.0
Ambient 25°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1016	1000	198.4
66%	+1A Idc/200ms	1023	1000	196.4
100%	+1A Idc/200ms	1023	1000	195.6
Minimum ambient rating (-25°C) or -10°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1018	1000	197.2
66%	+1A Idc/200ms	1022	1000	198.4
100%	+1A Idc/200ms	1019	1000	196.8
Maximum ambient rating (+60°C) or +55°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1021	1000	196.0
66%	+1A Idc/200ms	1023	1000	197.2
100%	+1A Idc/200ms	1024	1000	198.4
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	133.3	130.43	996.0
66%	+0,5%I_{nom} /1s	132.8	130.43	994.0
100%	+0,5%I_{nom} /1s	133.6	130.43	995.0
Minimum ambient rating (-25°C) or -10°C, I_{dc} = 0,5% of I_{nom}				
33%	+0,5%I_{nom} /1s	133.0	130.43	994.0
66%	+0,5%I_{nom} /1s	132.8	130.43	996.0

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

100%	+0,5%I_{nom} /1s	133.2	130.43	993.0
Maximum ambient rating (+60°C) or +55°C, I_{dc} = 0,5% of I_{nom}				
33%	+0,5%I_{nom} /1s	133.1	130.43	996.0
66%	+0,5%I_{nom} /1s	133.0	130.43	994.0
100%	+0,5%I_{nom} /1s	133.0	130.43	997.0
Ambient 25°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1017	1000	192.4
66%	+1A Idc/200ms	1030	1000	195.6
100%	+1A Idc/200ms	1035	1000	197.6
Minimum ambient rating (-25°C) or -10°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1018	1000	193.6
66%	+1A Idc/200ms	1028	1000	194.4
100%	+1A Idc/200ms	1028	1000	196.4
Maximum ambient rating (+60°C) or +55°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1022	1000	196.4
66%	+1A Idc/200ms	1028	1000	196.8
100%	+1A Idc/200ms	1035	1000	194.8
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	AF6K-SLP+1Battery			
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	135.4	130.43	991.0
66%	+0,5%I_{nom} /1s	137.0	130.43	993.0
100%	+0,5%I_{nom} /1s	134.6	130.43	995.0
Minimum ambient rating (-25°C) or -10°C, I_{dc} = 0,5% of I_{nom}				
33%	+0,5%I_{nom} /1s	135.0	130.43	995.0
66%	+0,5%I_{nom} /1s	135.9	130.43	997.0
100%	+0,5%I_{nom} /1s	135.0	130.43	997.0
Maximum ambient rating (+60°C) or +55°C, I_{dc} = 0,5% of I_{nom}				
33%	+0,5%I_{nom} /1s	135.2	130.43	997.0
66%	+0,5%I_{nom} /1s	136.6	130.43	995.0
100%	+0,5%I_{nom} /1s	134.9	130.43	991.0
Ambient 25°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1019	1000	197.6
66%	+1A Idc/200ms	1027	1000	196.8
100%	+1A Idc/200ms	1021	1000	195.6
Minimum ambient rating (-25°C) or -10°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1021	1000	195.2
66%	+1A Idc/200ms	1023	1000	193.6
100%	+1A Idc/200ms	1020	1000	195.6
Maximum ambient rating (+60°C) or +55°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1016	1000	194.0
66%	+1A Idc/200ms	1027	1000	196.8
100%	+1A Idc/200ms	1018	1000	197.2
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	133.1	130.43	996.0
66%	+0,5%I_{nom} /1s	133.7	130.43	998.0
100%	+0,5%I_{nom} /1s	133.9	130.43	995.0
Minimum ambient rating (-25°C) or -10°C, I_{dc} = 0,5% of I_{nom}				
33%	+0,5%I_{nom} /1s	133.3	130.43	996.0
66%	+0,5%I_{nom} /1s	132.6	130.43	992.0

100%	+0,5%I_{nom} /1s	133.9	130.43	993.0
Maximum ambient rating (+60°C) or +55°C, I_{dc} = 0,5% of I_{nom}				
33%	+0,5%I_{nom} /1s	132.9	130.43	994.0
66%	+0,5%I_{nom} /1s	133.0	130.43	994.0
100%	+0,5%I_{nom} /1s	134.3	130.43	995.0
Ambient 25°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1032	1000	193.6
66%	+1A Idc/200ms	1031	1000	192.4
100%	+1A Idc/200ms	1027	1000	195.6
Minimum ambient rating (-25°C) or -10°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1034	1000	194.0
66%	+1A Idc/200ms	1030	1000	194.8
100%	+1A Idc/200ms	1025	1000	196.4
Maximum ambient rating (+60°C) or +55°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1032	1000	196.0
66%	+1A Idc/200ms	1029	1000	196.8
100%	+1A Idc/200ms	1030	1000	196.4
Note: The internal temperature of the EUT must be stabilized.				

Bbis.8.2	**TABLE: Verification of protections against the continuous DC injection**			P
Model	AF1K-SL-1+1Battery			
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	22.63	21.74	991.0
66%	+0,5%I_{nom} /1s	22.39	21.74	994.0
100%	+0,5%I_{nom} /1s	22.31	21.74	991.7
Minimum ambient rating (-25°C) or -10°C, I_{dc} = 0,5% of I_{nom}				
33%	+0,5%I_{nom} /1s	22.21	21.74	992.7
66%	+0,5%I_{nom} /1s	22.55	21.74	992.0
100%	+0,5%I_{nom} /1s	22.39	21.74	990.7
Maximum ambient rating (+60°C) or +55°C, I_{dc} = 0,5% of I_{nom}				
33%	+0,5%I_{nom} /1s	22.55	21.74	991.4
66%	+0,5%I_{nom} /1s	22.41	21.74	998.0
100%	+0,5%I_{nom} /1s	22.23	21.74	990.1
Ambient 25°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1049	1000	190.2

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

66%	+1A Idc/200ms	1048	1000	190.5
100%	+1A Idc/200ms	1050	1000	192.0
Minimum ambient rating (-25°C) or -10°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1052	1000	193.0
66%	+1A Idc/200ms	1047	1000	194.0
100%	+1A Idc/200ms	1055	1000	193.0
Maximum ambient rating (+60°C) or +55°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1050	1000	193.0
66%	+1A Idc/200ms	1051	1000	193.0
100%	+1A Idc/200ms	1052	1000	192.0
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	22.28	21.74	994.0
66%	+0,5%I_{nom} /1s	21.99	21.74	990.0
100%	+0,5%I_{nom} /1s	22.04	21.74	992.0
Minimum ambient rating (-25°C) or -10°C, I_{dc} = 0,5% of I_{nom}				
33%	+0,5%I_{nom} /1s	22.18	21.74	990.0
66%	+0,5%I_{nom} /1s	22.30	21.74	993.0
100%	+0,5%I_{nom} /1s	22.17	21.74	991.0
Maximum ambient rating (+60°C) or +55°C, I_{dc} = 0,5% of I_{nom}				
33%	+0,5%I_{nom} /1s	22.15	21.74	995.5
66%	+0,5%I_{nom} /1s	21.98	21.74	993.0
100%	+0,5%I_{nom} /1s	22.19	21.74	990.0
Ambient 25°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1039	1000	191.0
66%	+1A Idc/200ms	1070	1000	195.0
100%	+1A Idc/200ms	1053	1000	193.0
Minimum ambient rating (-25°C) or -10°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1038	1000	194.0
66%	+1A Idc/200ms	1036	1000	198.0
100%	+1A Idc/200ms	1073	1000	197.0
Maximum ambient rating (+60°C) or +55°C, I_{dc} = 1A				
33%	+1A Idc/200ms	1042	1000	193.0
66%	+1A Idc/200ms	1070	1000	194.0
100%	+1A Idc/200ms	1043	1000	195.0
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	AF6K-SL	

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}).

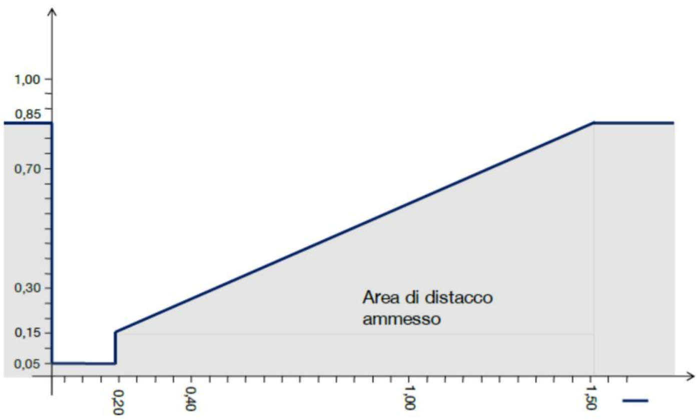
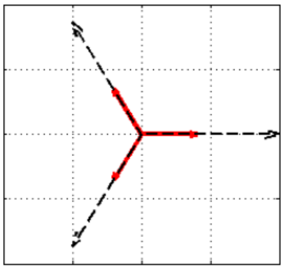


Figure 71 - Requirements for UVRT

Bbis.9.2.2 Alternative test methods - network simulator:

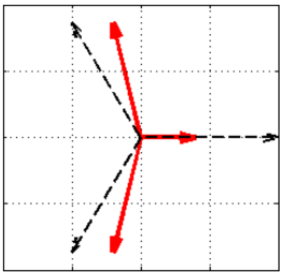
With reference to the list of tests shown in Table 39, the voltage drops that are the subject of these tests are caused by faults produced on the low, medium or high voltage distribution line. The types of faults considered are three:

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).

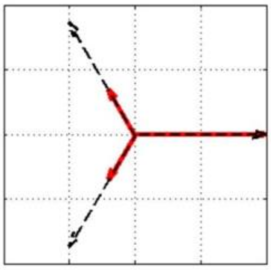


During the two-phase asymmetric fault, the residual amplitude of the 3 voltages and the phase shifts between the phases must comply with the values shown in the following table.

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)



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.

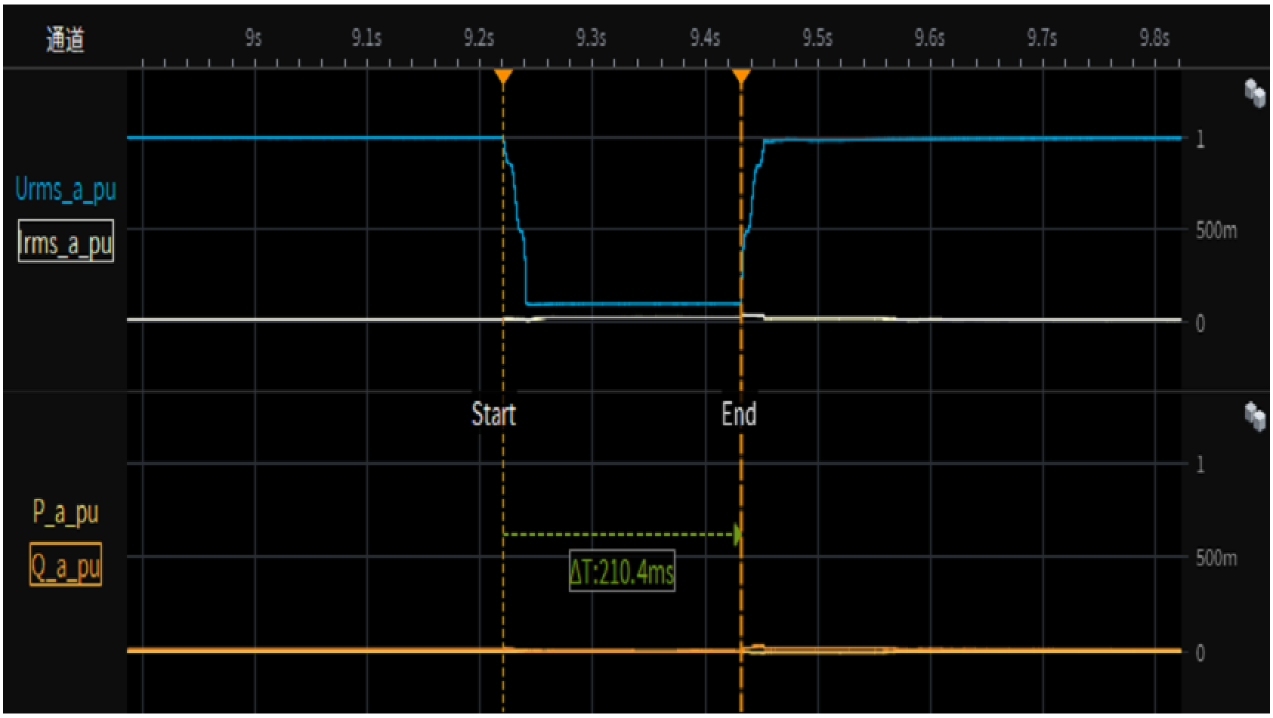
Graph of LVRT and OVRT test:				
Model	AF6K-SLP+15Battery			
List of tests	**Residual amplitude of phase-to-phase voltage V/V_{nom}**	**Drop duration limit [ms]**	**Measured drop duration [ms]**	**Duration of restoring network [ms]**
1s – three-phase symmetrical fault (P = 0,1 - 0,3)	0,10 ± 0,05 (V_1/Vn)	200 +20	210	98
1s – three-phase symmetrical fault (P > 0,9)	0,10 ± 0,05 (V_1/Vn)	200 +20	210	153
1a – two-phase asymmetrical fault (P = 0,1 - 0,3)	0,10 ± 0,05 (V_1/Vn)	200 +20	210	167
1a – two-phase asymmetrical fault (P > 0,9)	0,10 ± 0,05 (V_1/Vn)	200 +20	210	184
2s – three-phase symmetrical fault (P = 0,1 - 0,3)	0,25 ± 0,05 (V_2/Vn)	400 +20	410	107
2s – three-phase symmetrical fault (P > 0,9)	0,25 ± 0,05 (V_2/Vn)	400 +20	410	126
2a – three-phase symmetrical fault (P = 0,1 - 0,3)	0,25 ± 0,05 (V_2/Vn)	400 +20	410	155
2a – three-phase symmetrical fault (P > 0,9)	0,25 ± 0,05 (V_2/Vn)	400 +20	410	172
3s – three-phase symmetrical fault (P = 0,1 - 0,3)	0,50 ± 0,05 (V_3/Vn)	850 ± 20	860	102
3s – three-phase symmetrical fault (P > 0,9)	0,50 ± 0,05 (V_3/Vn)	850 ± 20	860	143
3a – two-phase asymmetrical fault (P = 0,1 - 0,3)	0,50 ± 0,05 (V_3/Vn)	850 ± 20	860	117
3a – two-phase asymmetrical fault (P > 0,9)	0,50 ± 0,05 (V_3/Vn)	850 ± 20	860	171
4s – three-phase symmetrical fault (P = 0,1 - 0,3)	0,75 ± 0,05 (V_4/Vn)	1300 ± 20	1313	105
4s – three-phase symmetrical fault (P > 0,9)	0,75 ± 0,05 (V_4/Vn)	1300 ± 20	1313	132
4a – two-phase asymmetrical fault (P = 0,1 - 0,3)	0,75 ± 0,05 (V_4/Vn)	1300 ± 20	1306	126
4a – two-phase asymmetrical fault (P > 0,9)	0,75 ± 0,05 (V_4/Vn)	1300 ± 20	1306	189
5 – LV two-phase asymmetrical fault (P = 0,1 - 0,3)	0,10 ± 0,05 (V_5/Vn)	200 +20	209	0
5 – LV two-phase asymmetrical fault (P > 0,9)	0,10 ± 0,05 (V_5/Vn)	200 +20	209	0
6 – LV two-phase asymmetrical fault (P = 0,1 - 0,3)	0,50 ± 0,05 (V_6/Vn)	850 +20	860	0
6 – LV two-phase asymmetrical fault (P > 0,9)	0,50 ± 0,05 (V_6/Vn)	850 +20	860	0

7– HV three-phase symmetrical fault (P = 0,1 - 0,3)	1,20 ± 0,05 (V_7/Vn)	500 +20	508	95
7– HV three-phase symmetrical fault (P > 0,9)	1,20 ± 0,05 (V_7/Vn)	500 +20	508	127
8– HV three-phase symmetrical fault (P = 0,1 - 0,3)	1,25 ± 0,05 (V_8/Vn)	100 +20	108	107
8– HV three-phase symmetrical fault (P > 0,9)	1,25 ± 0,05 (V_8/Vn)	100 +20	108	145

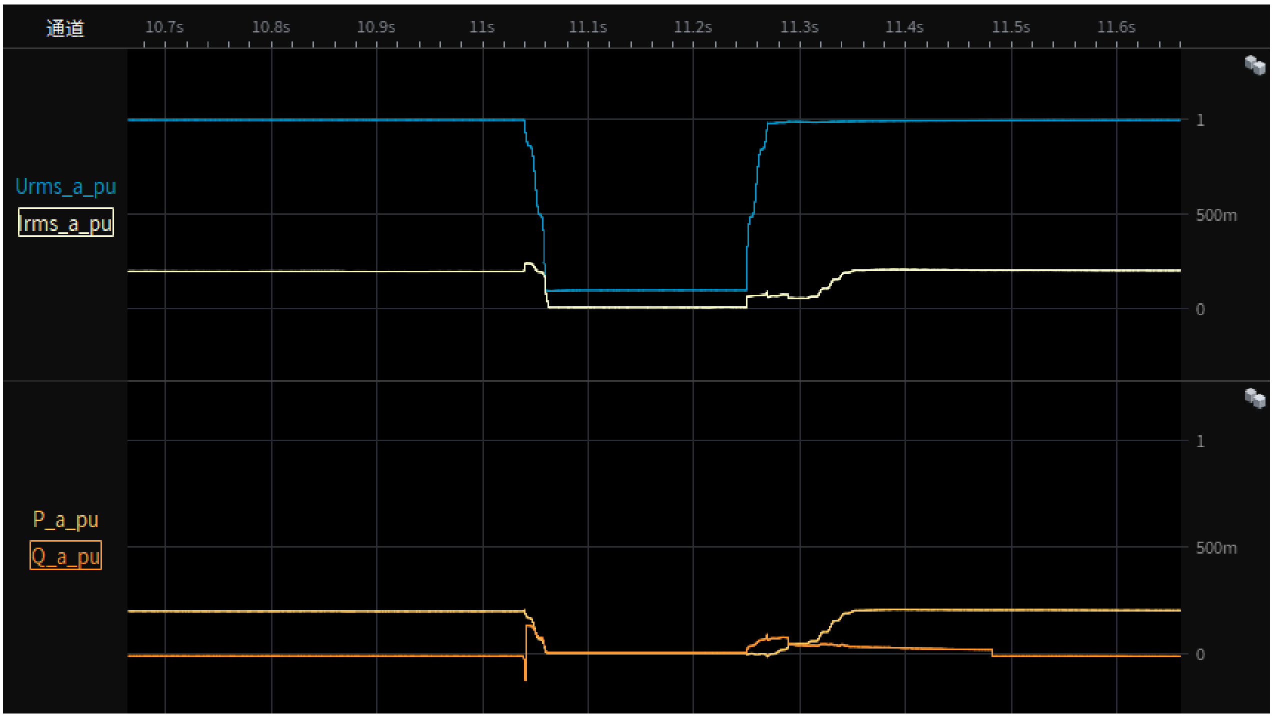
Note:
The interface protection shall be disabled or adjusted to avoid spurious tripping during testing.
The test conditions are performed as worst case conditions. The inverter feeds maximal active and reactive power during the complete test.

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)

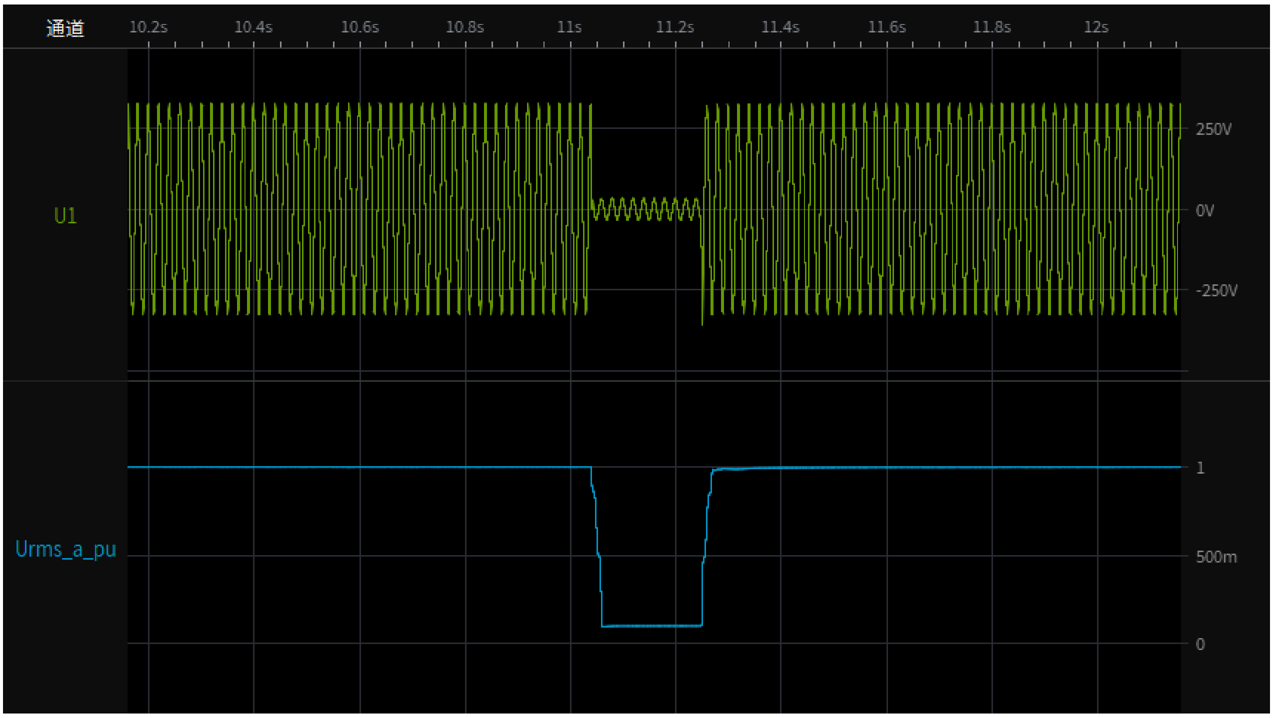


Test 1s-1.1 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)

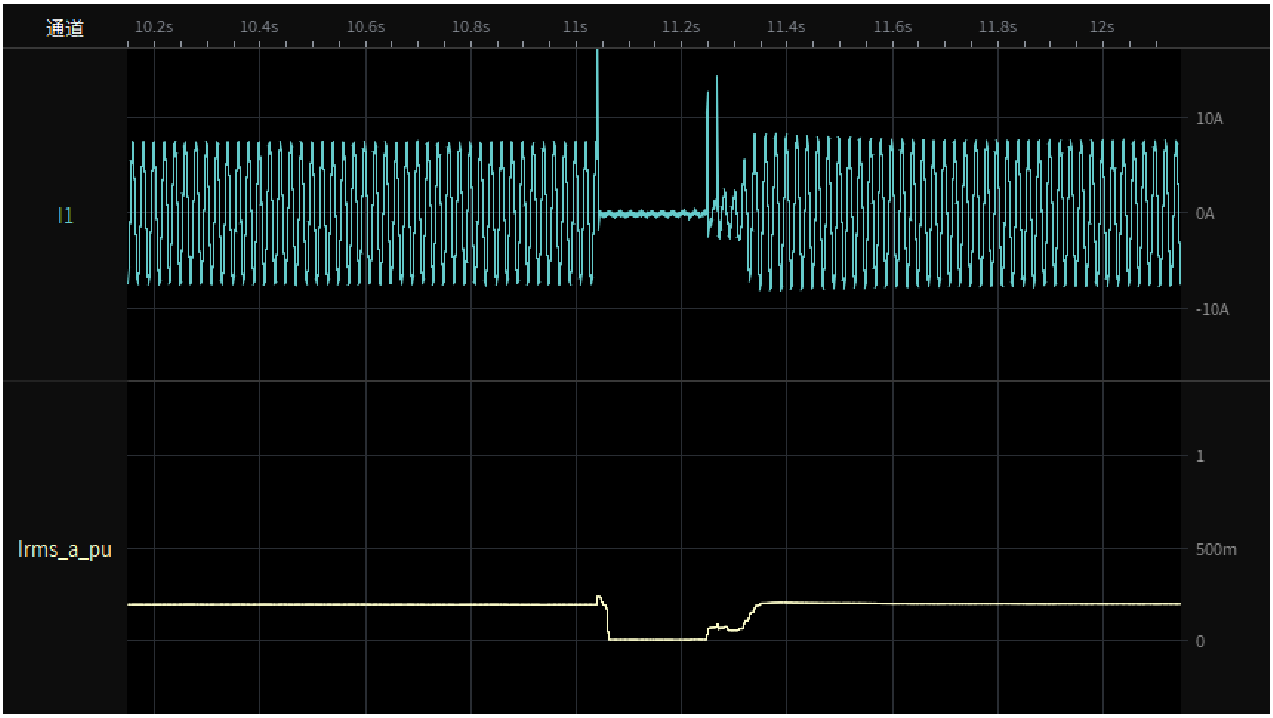


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

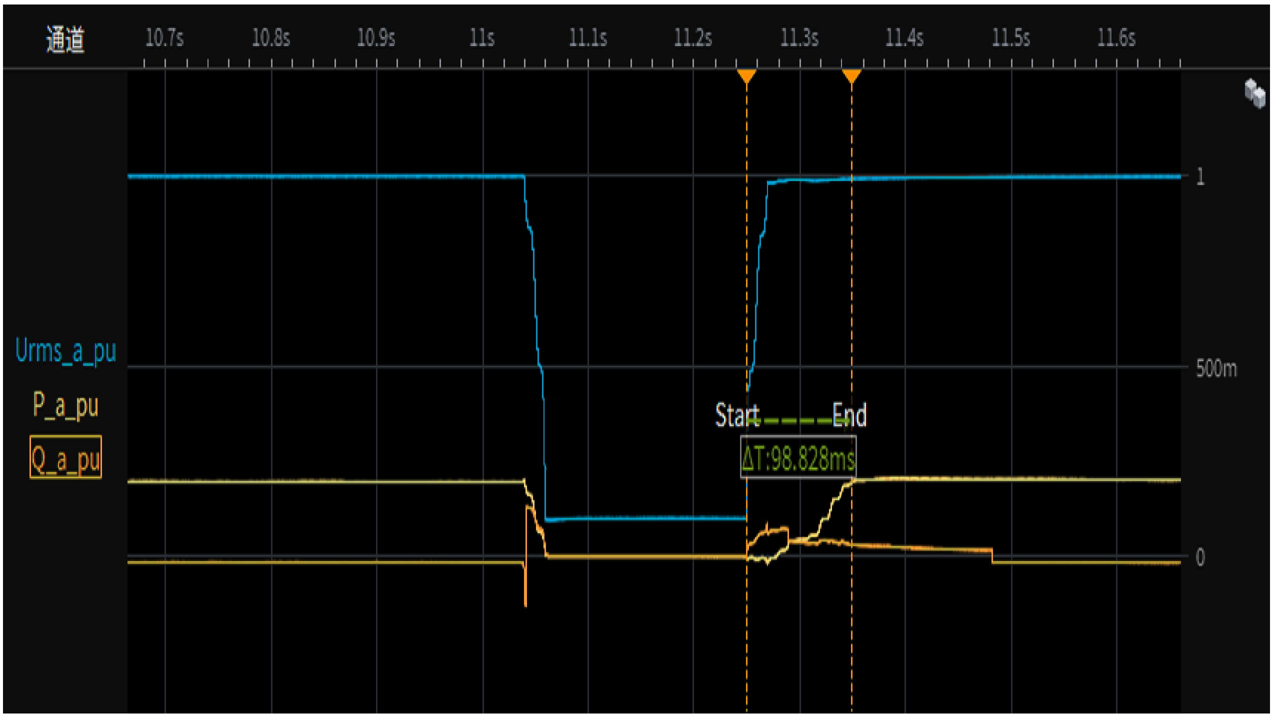


Test 1s-1.3 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents

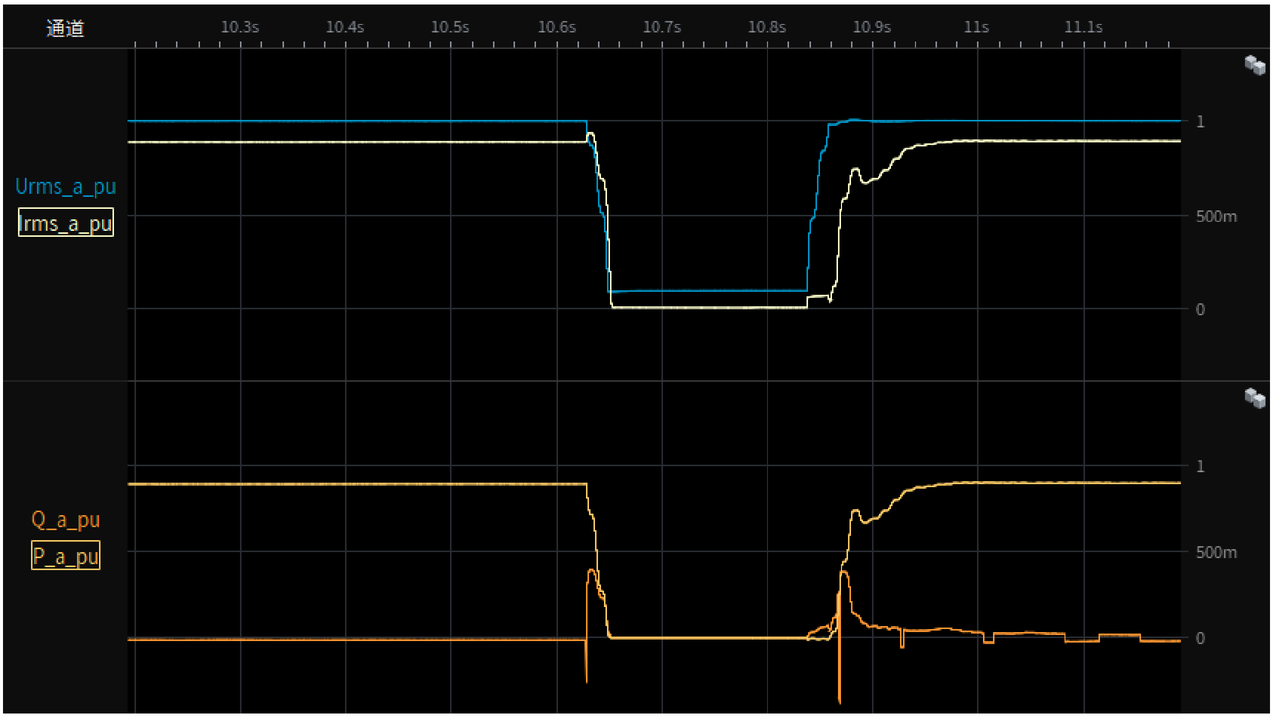


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

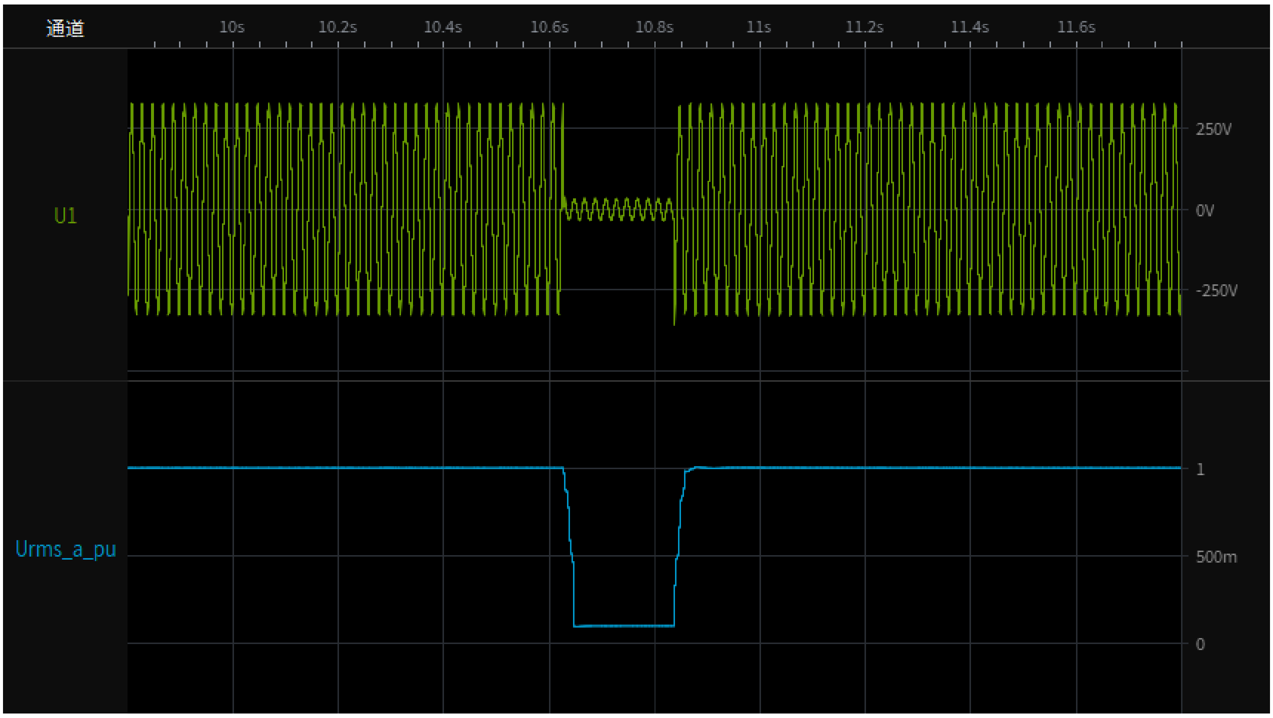


Test 1s-2.1 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),95% load
Test overview(voltage,current,active and reactive power)

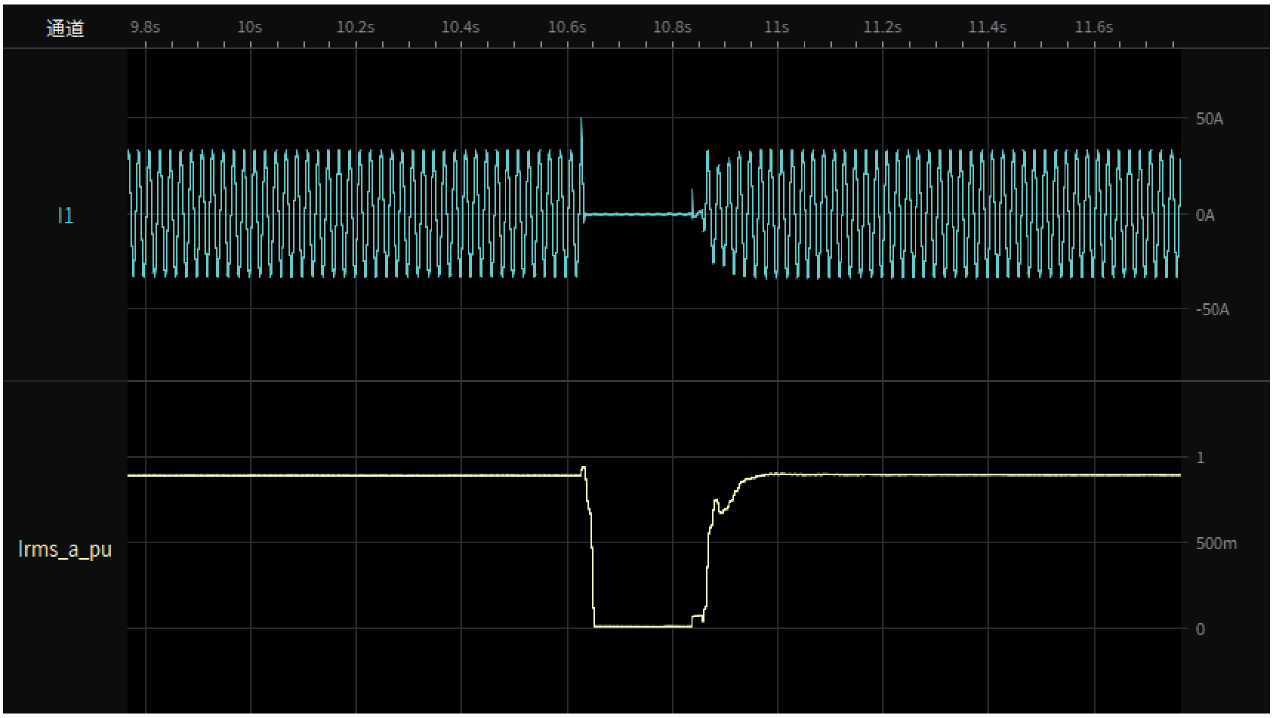


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

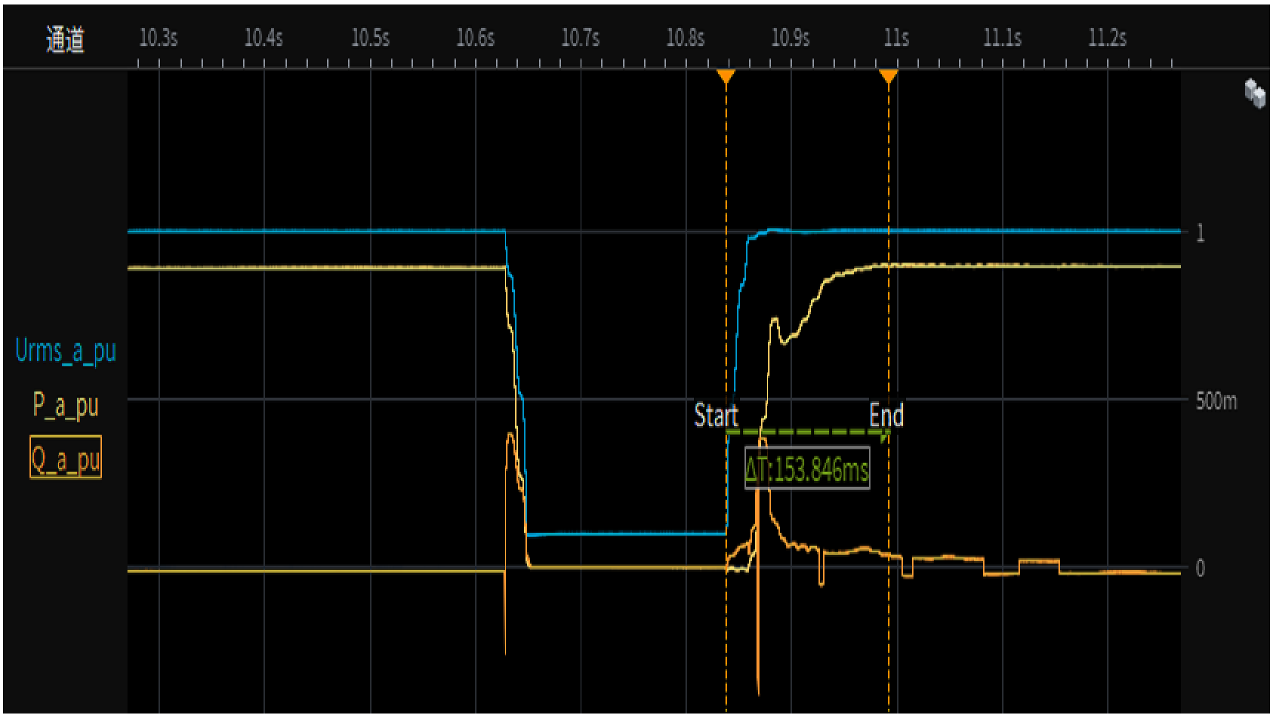


Test 1s-2.3 Depth of fault phase: 0.1p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents

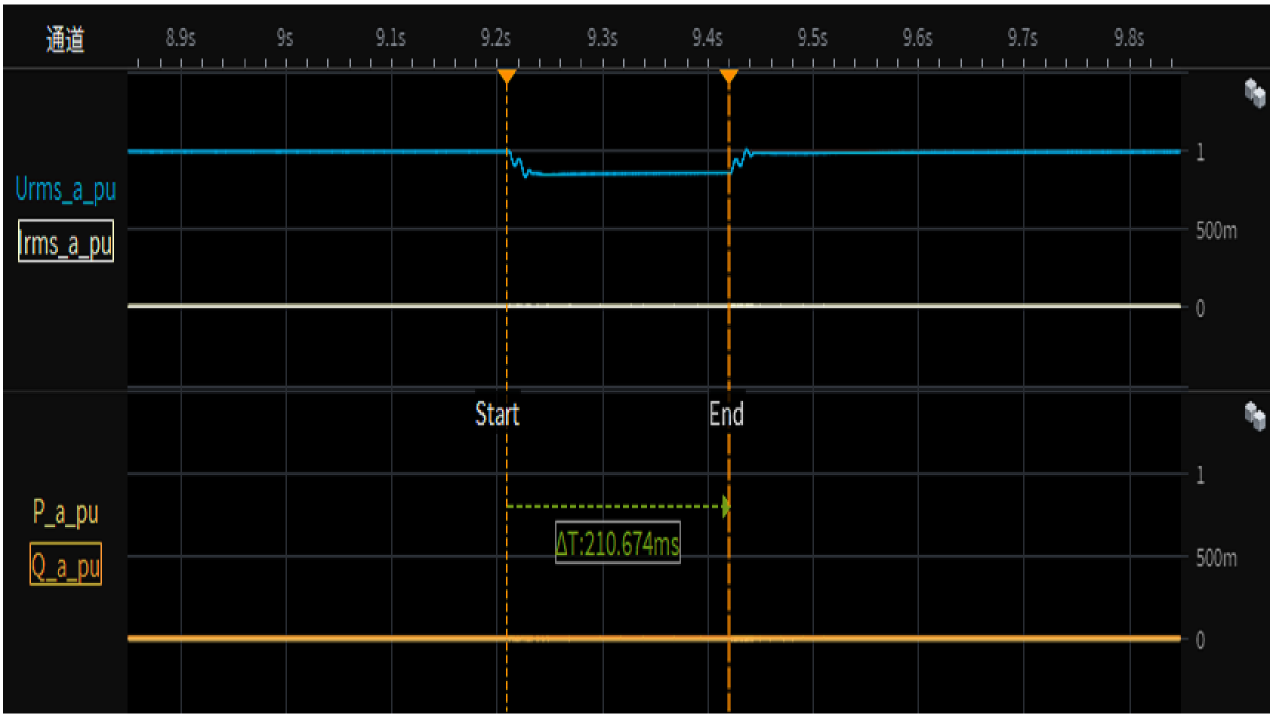


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

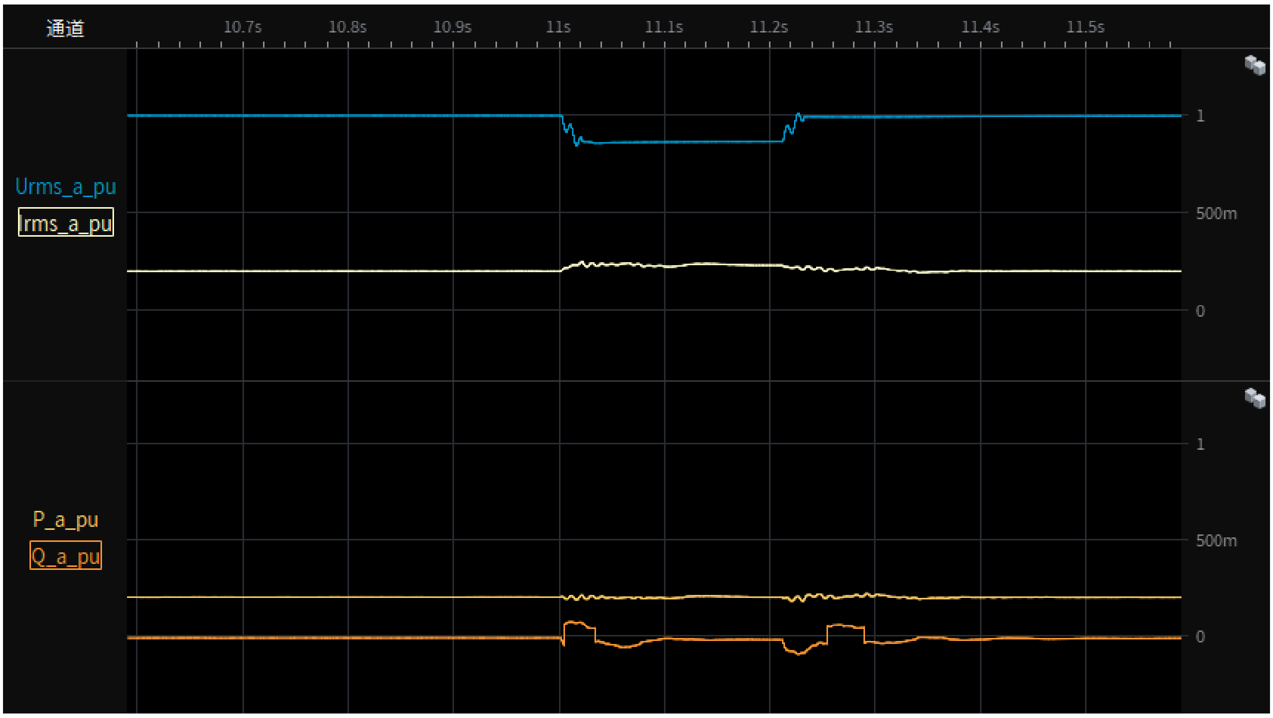


Test 1a-Depth of fault phase: 0.1p.u.,two-phase-asymmetrical (type D), 0% load Test overview(voltage,current,active and reactive power)

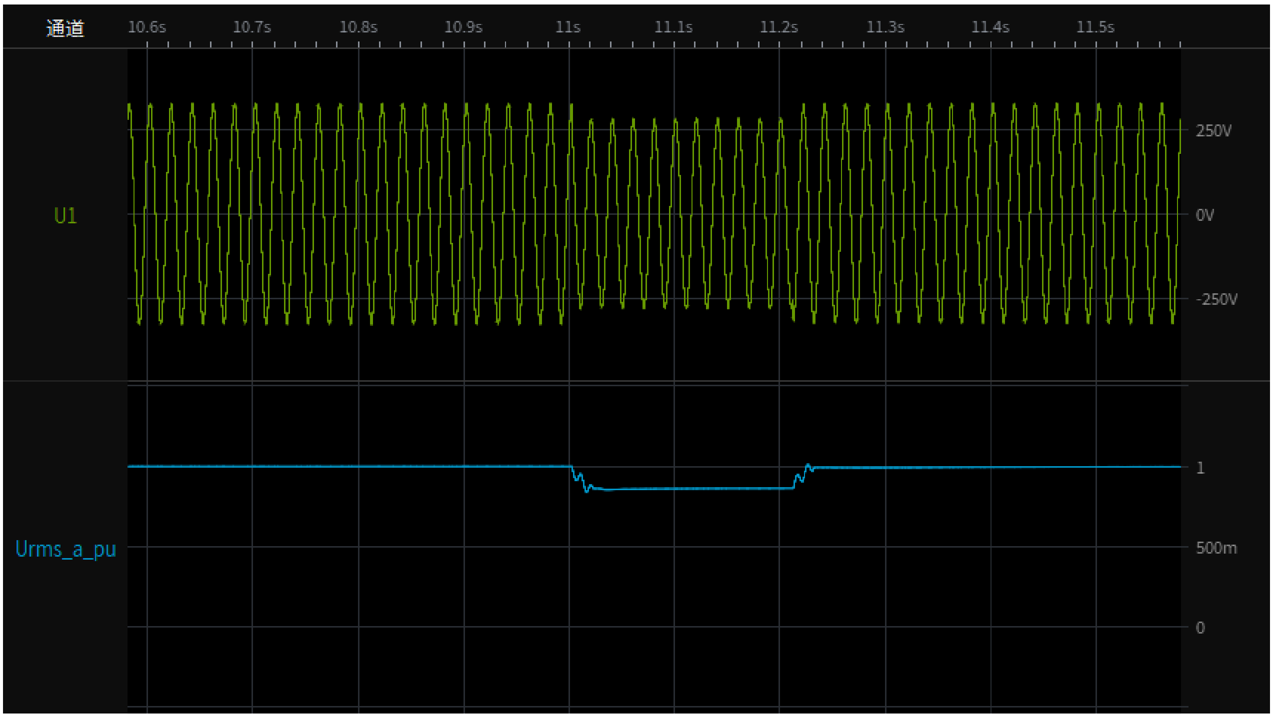


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

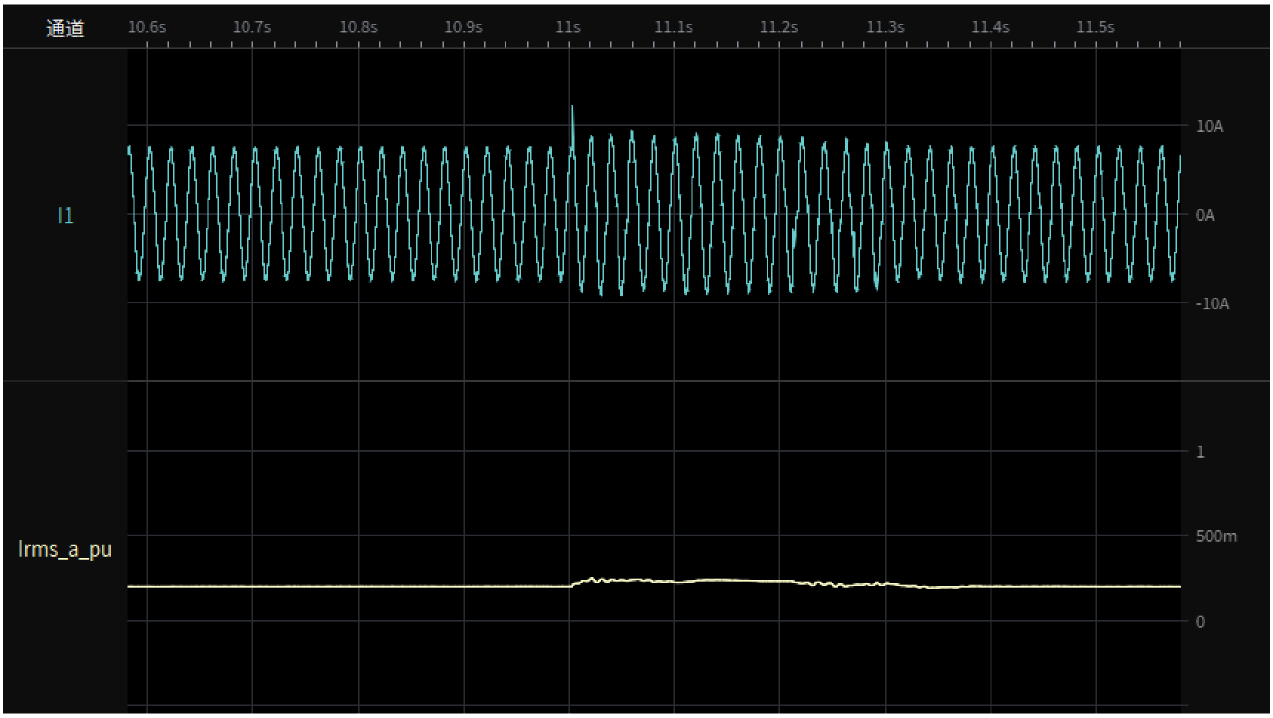


Test 1a-1.2 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

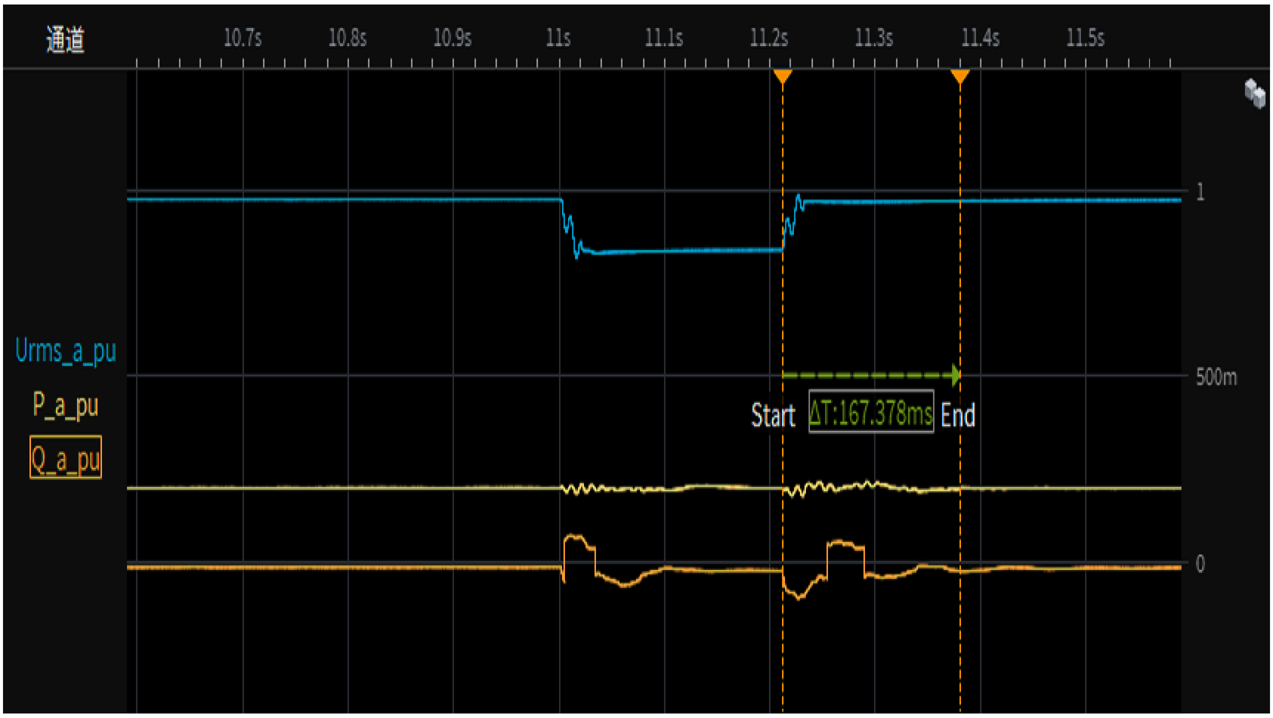


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

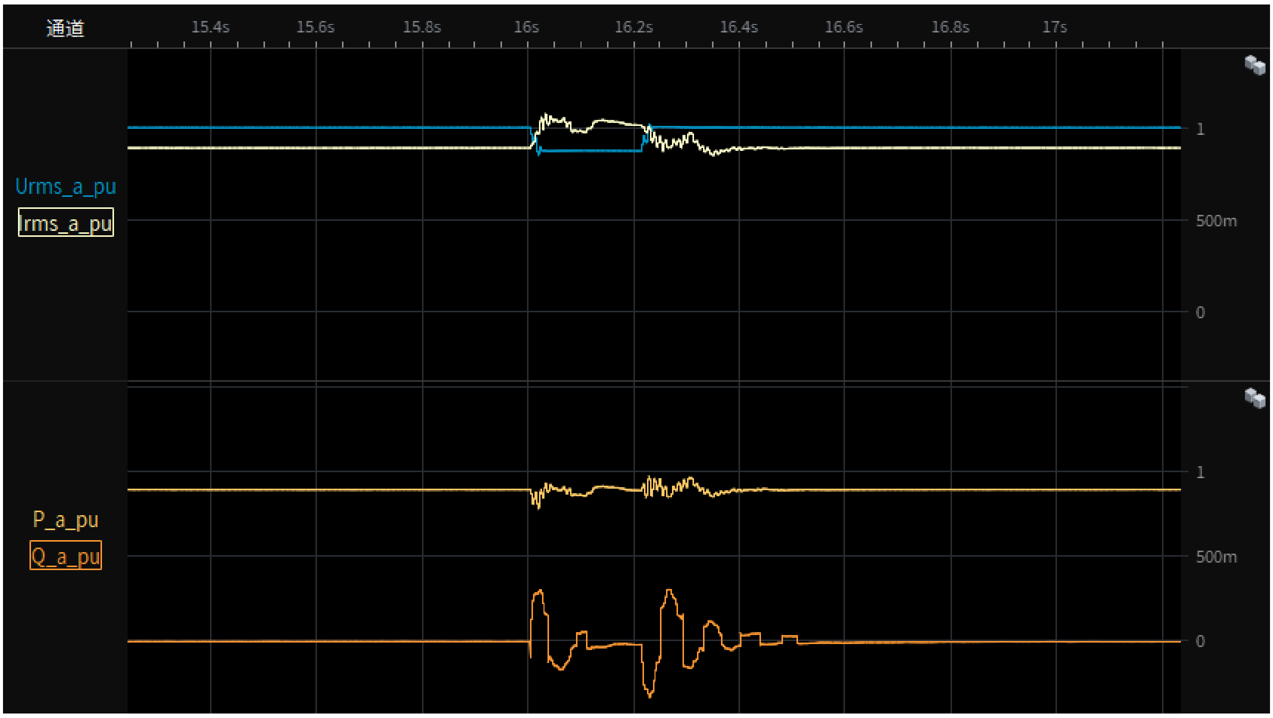


Test 1a-1.4 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),20% load
restoring time

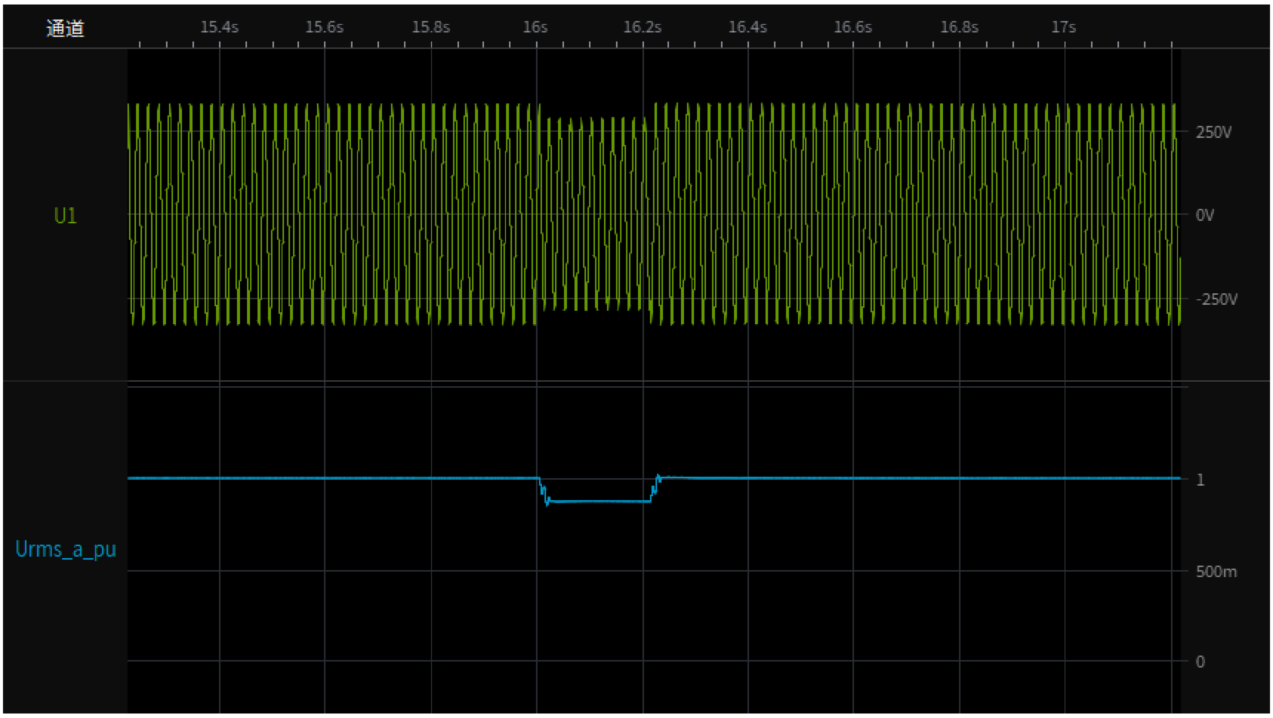


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

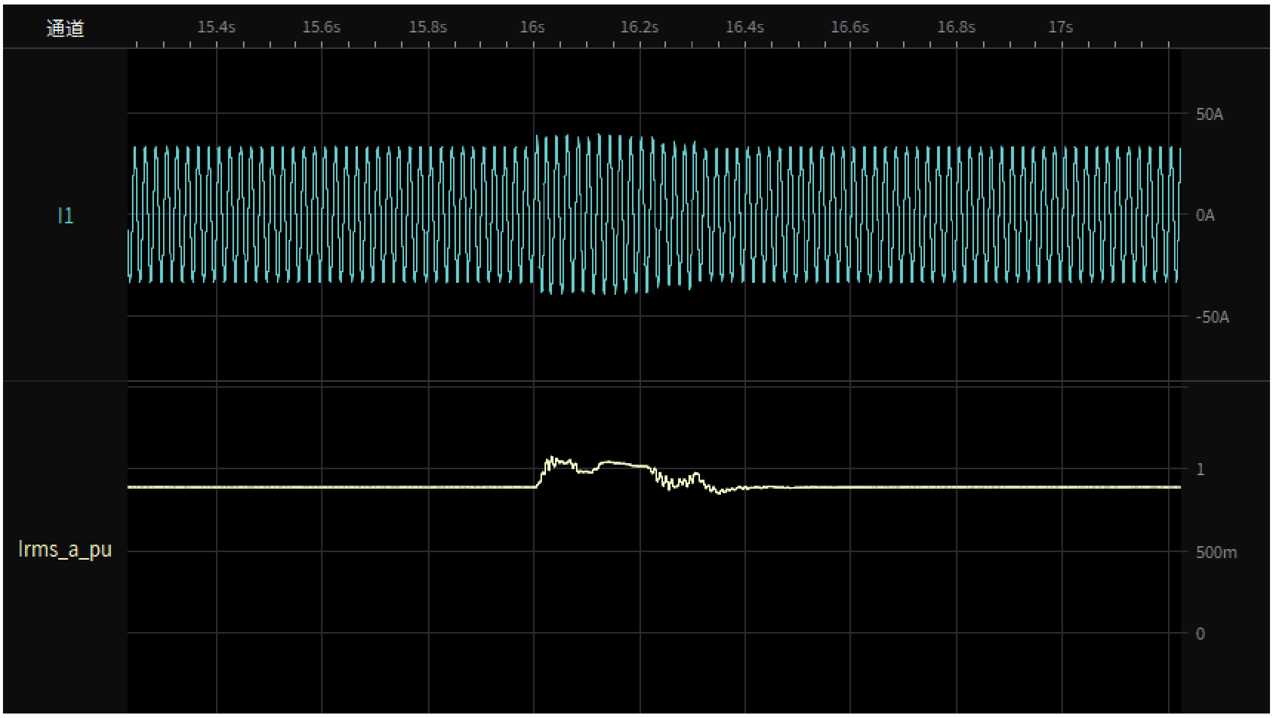


Test 1a-2.2 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages



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

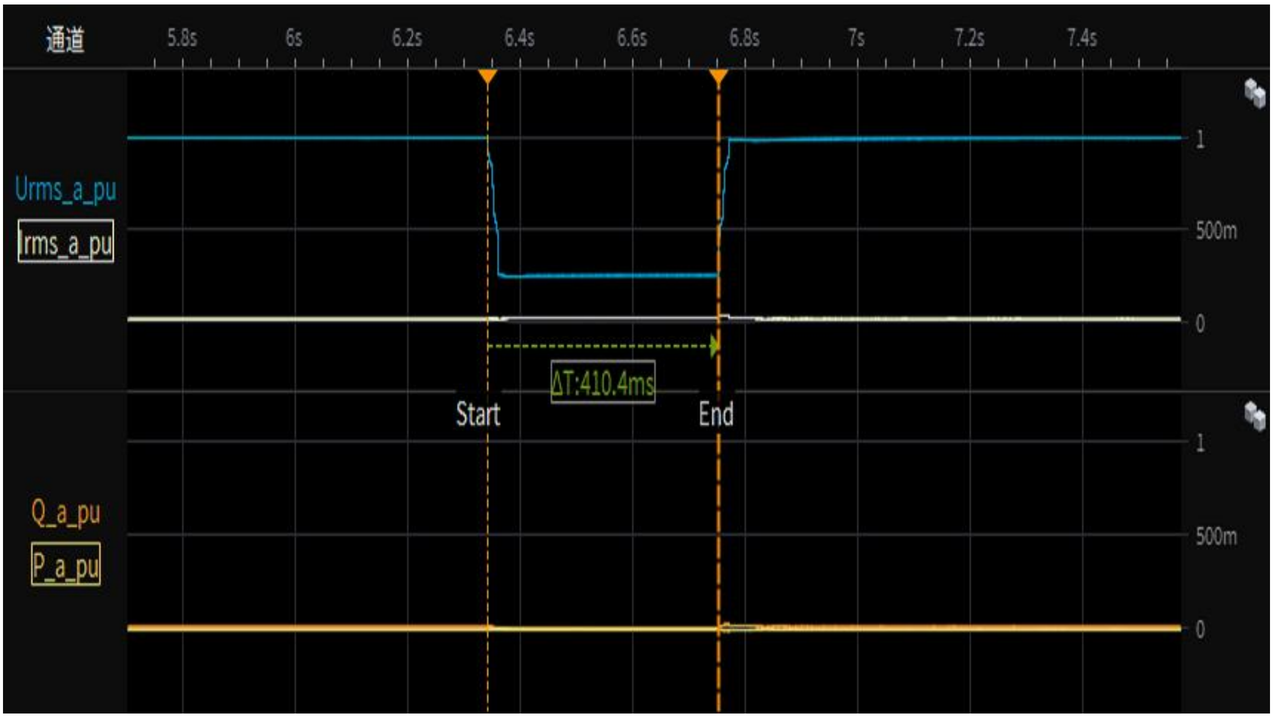
Test 1a-2.3 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase currents



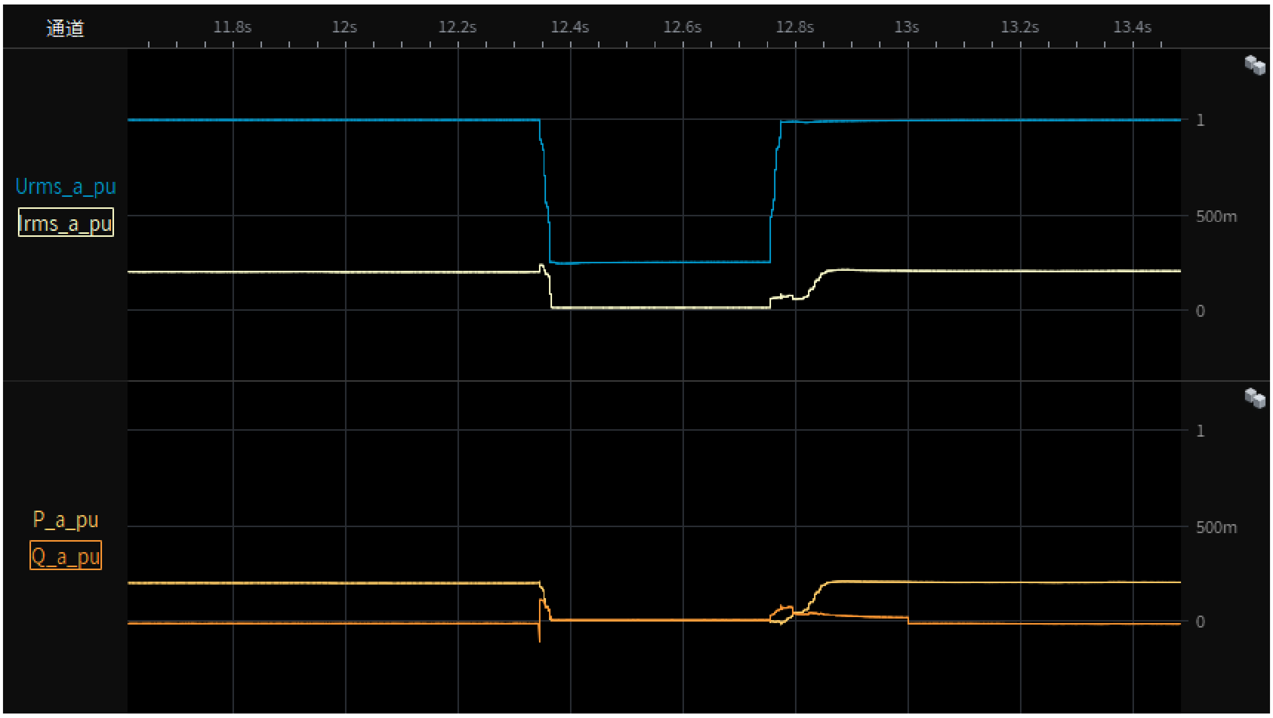
Test 1a-2.4 Depth of fault phase: 0.1p.u., two-phase-asymmetrical (type D), 95% load
restoring time

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)

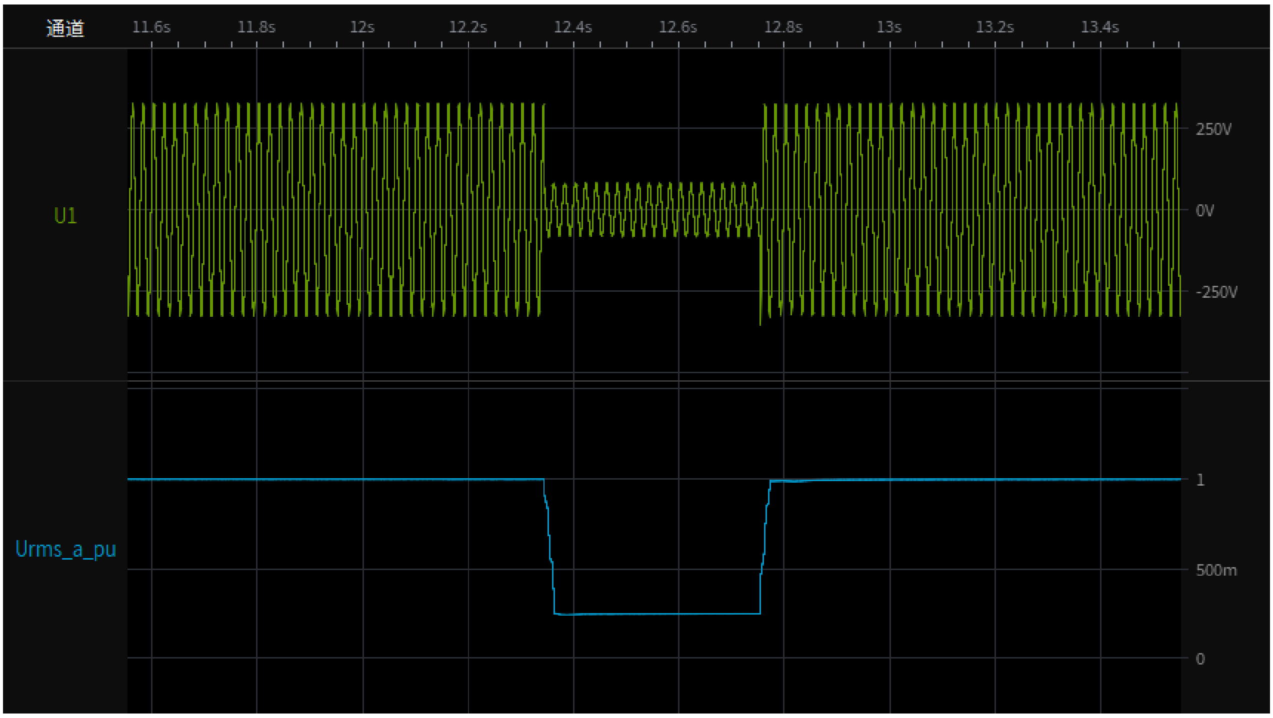


Test 2s-1.1 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)

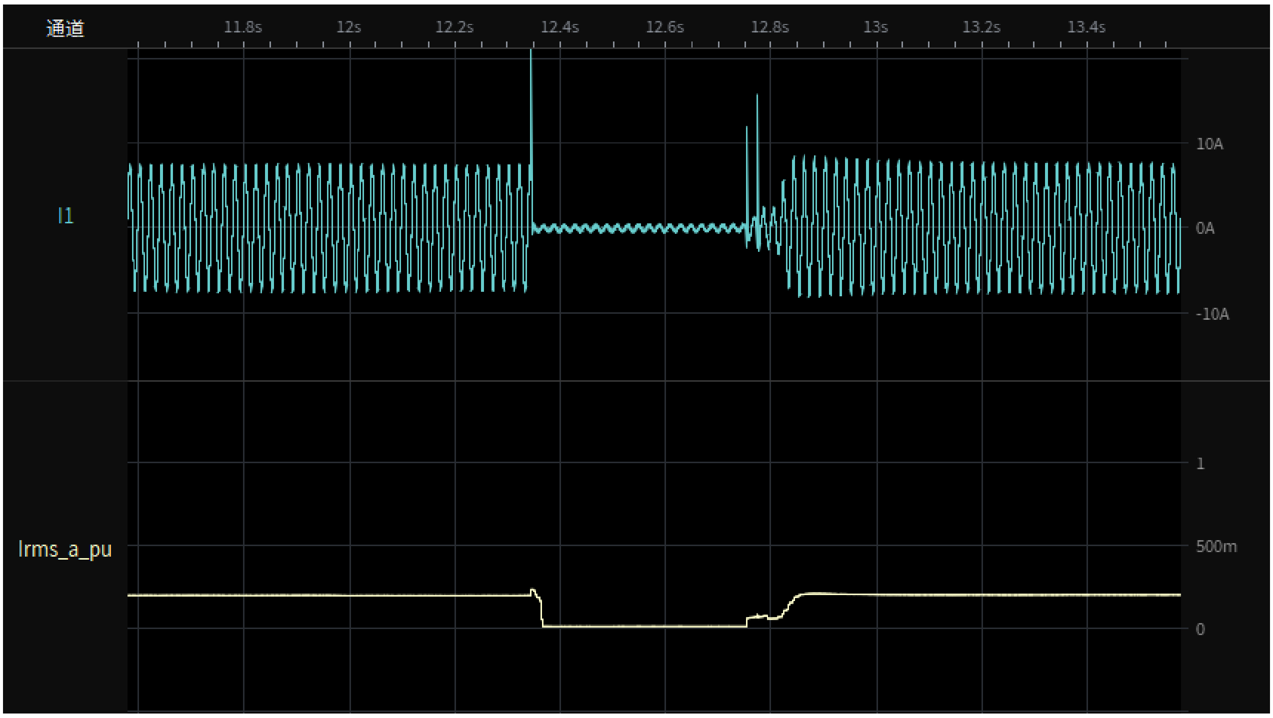


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

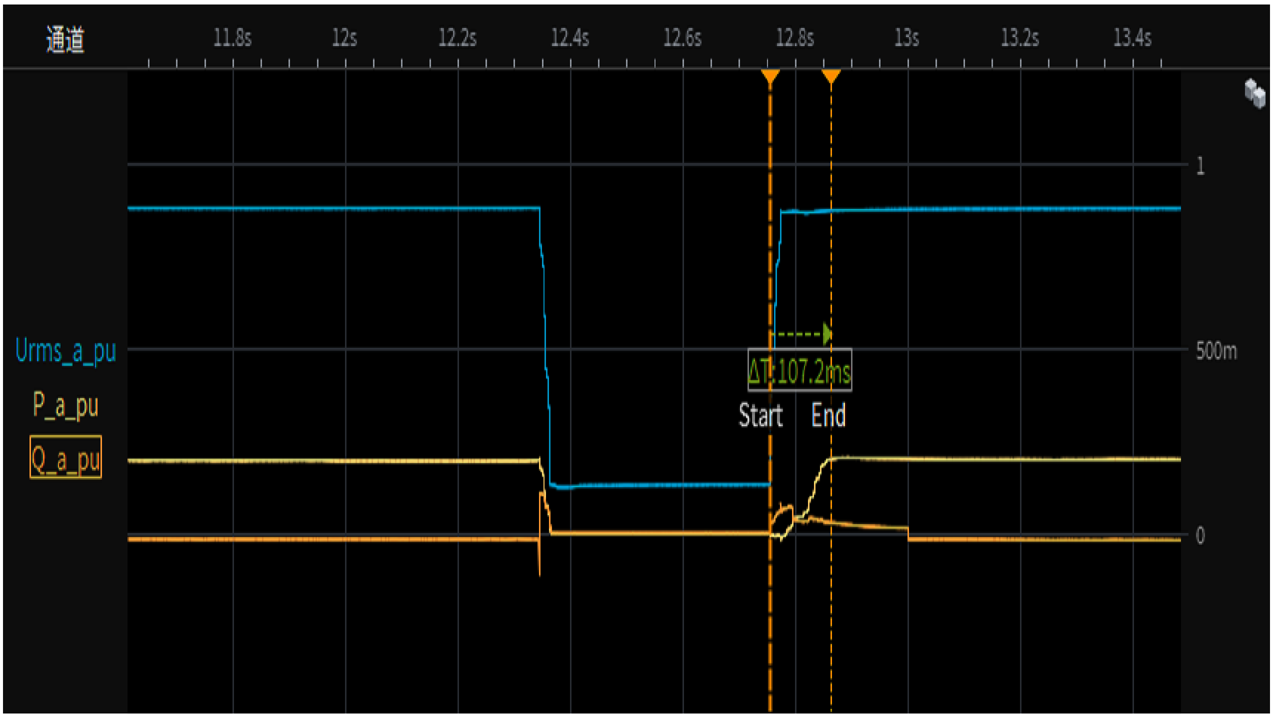


Test 2s-1.3 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents

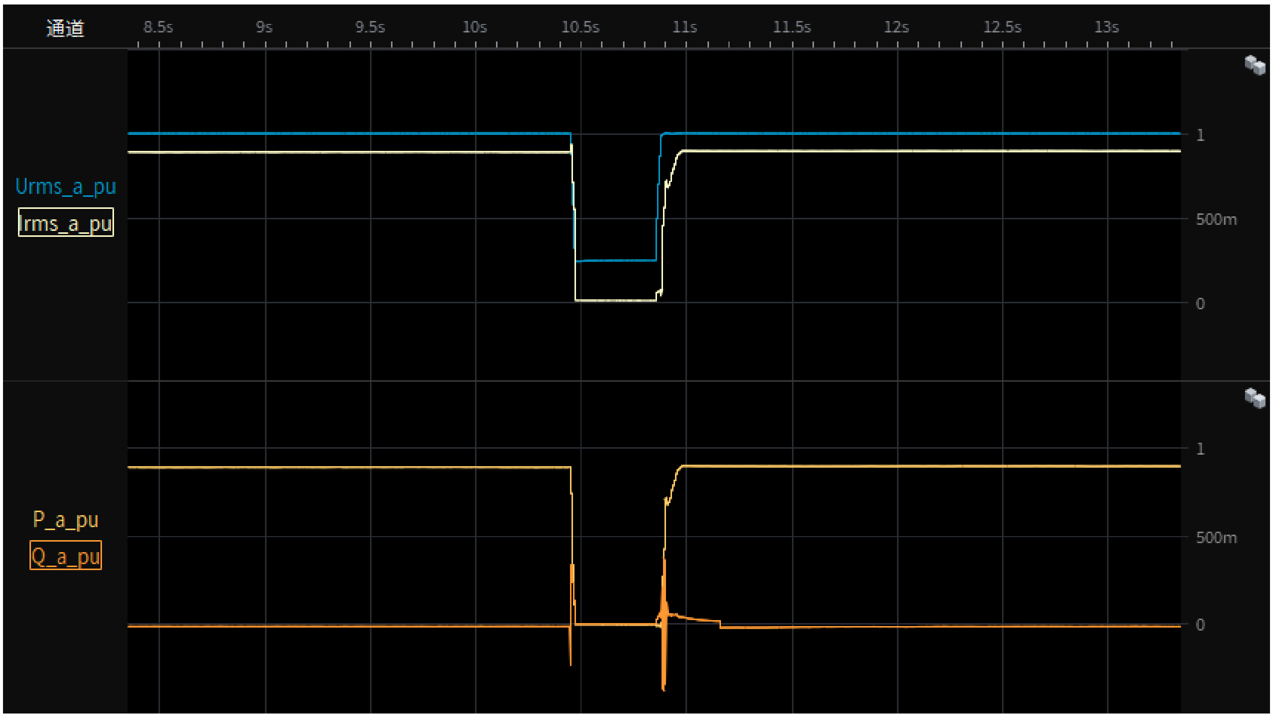


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

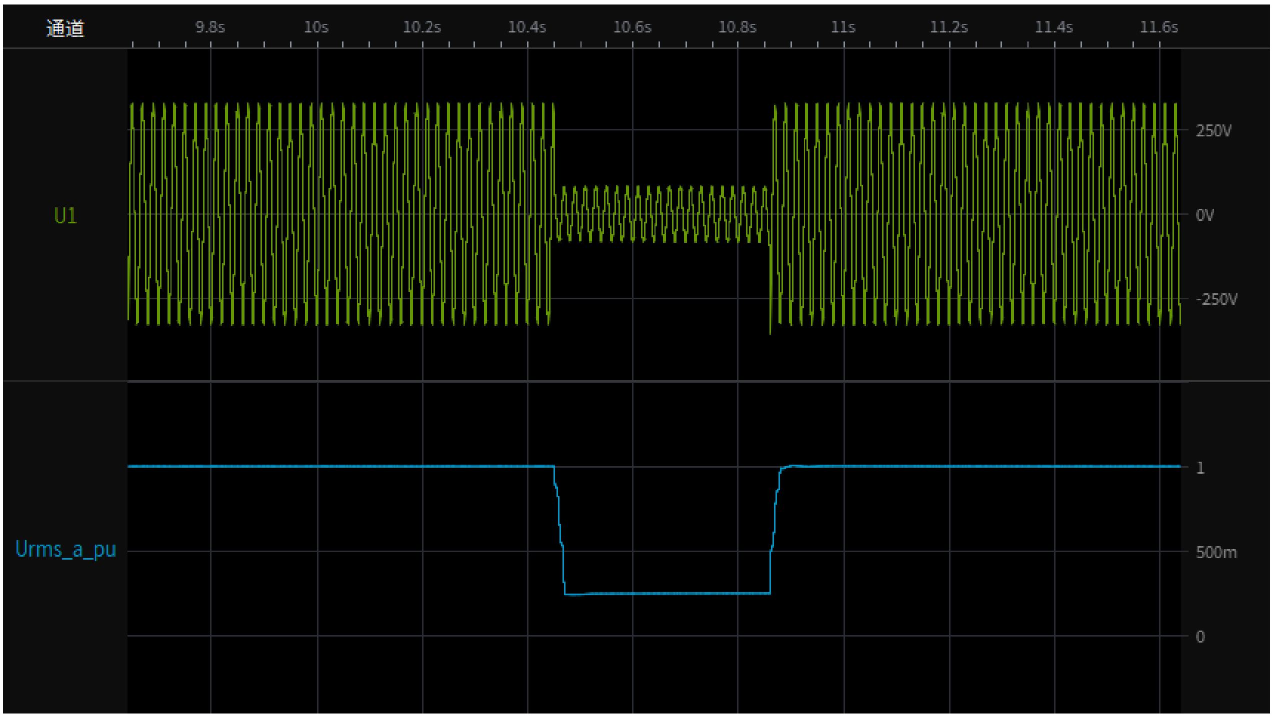


Test 2s-2.1 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),95% load Test overview(voltage,current,active and reactive power)

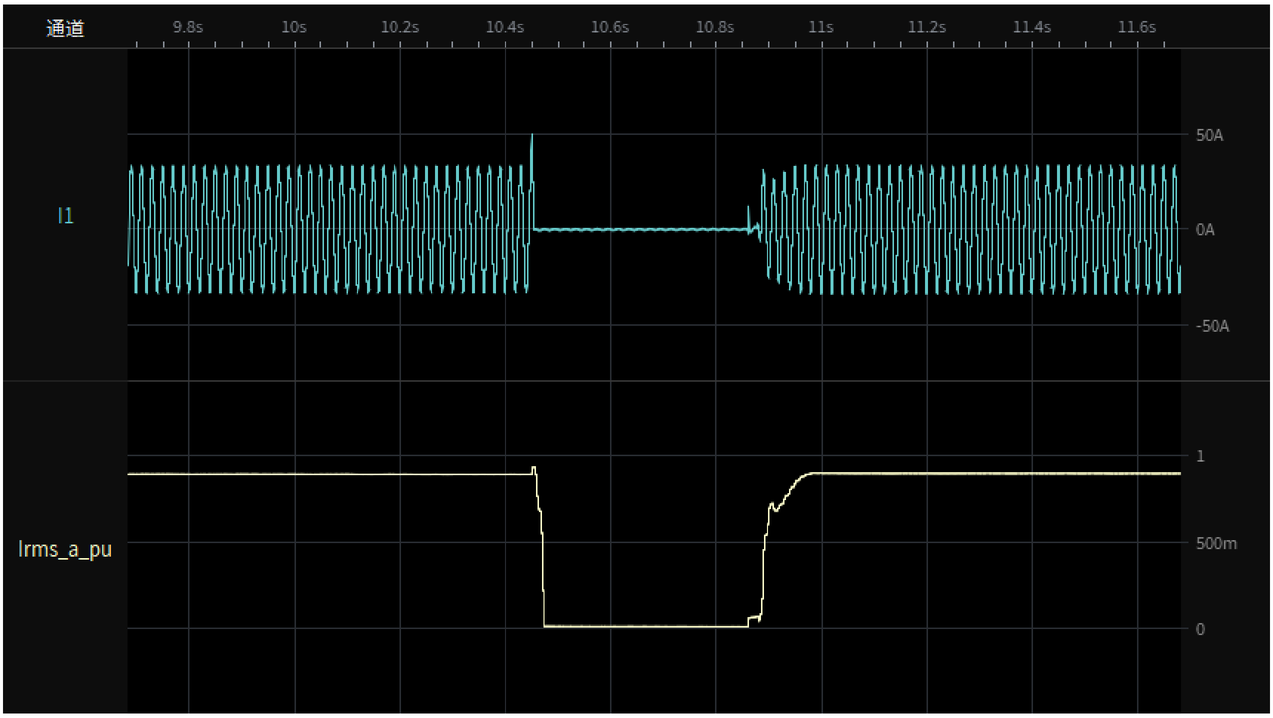


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

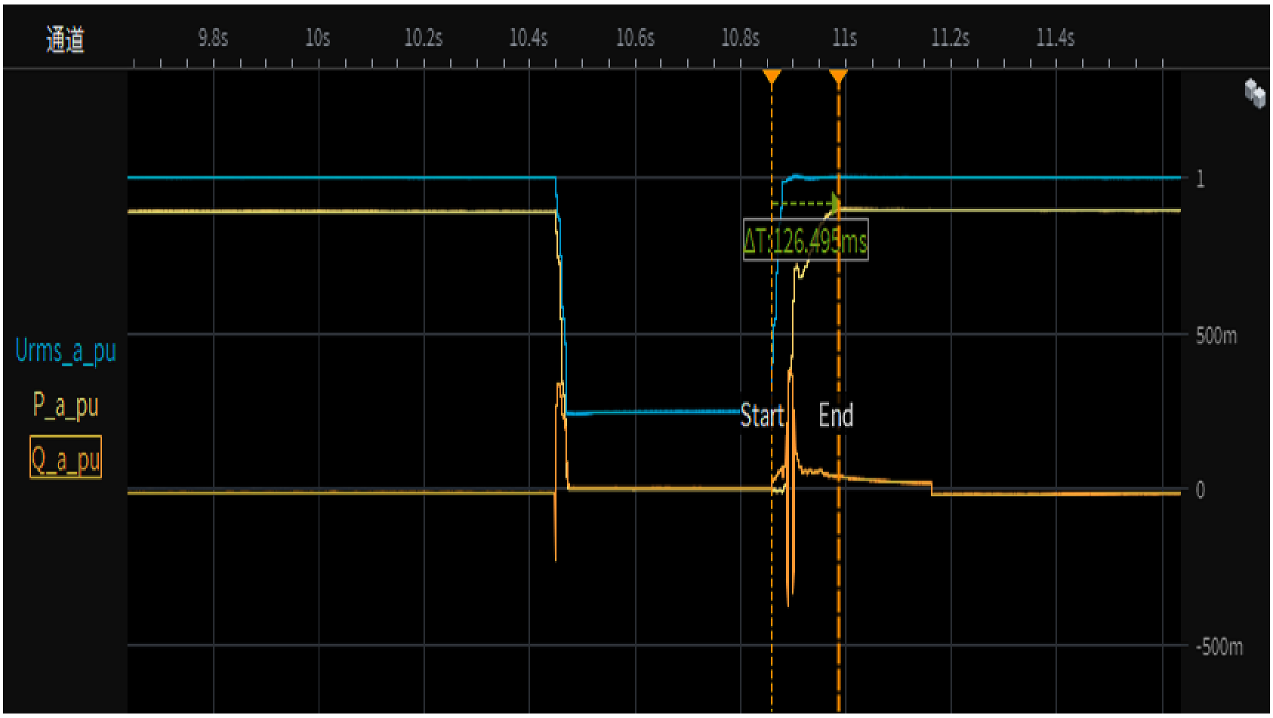


Test 2s-2.3 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents

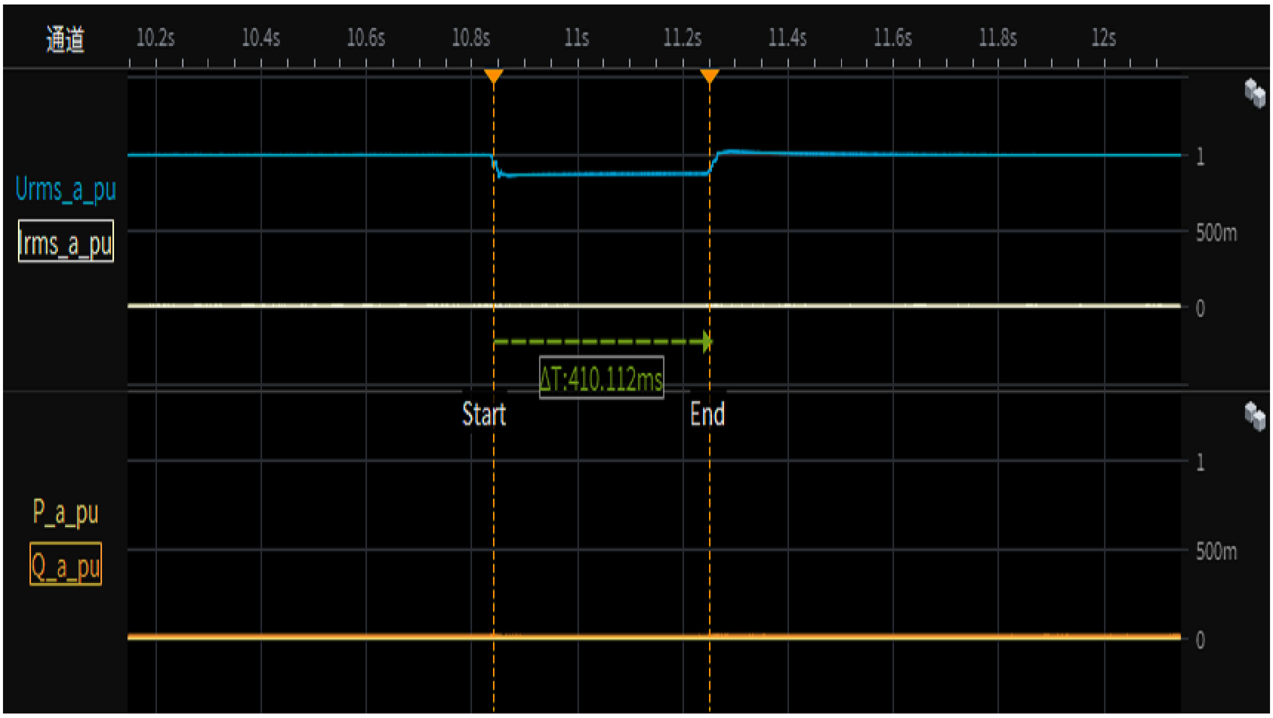


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

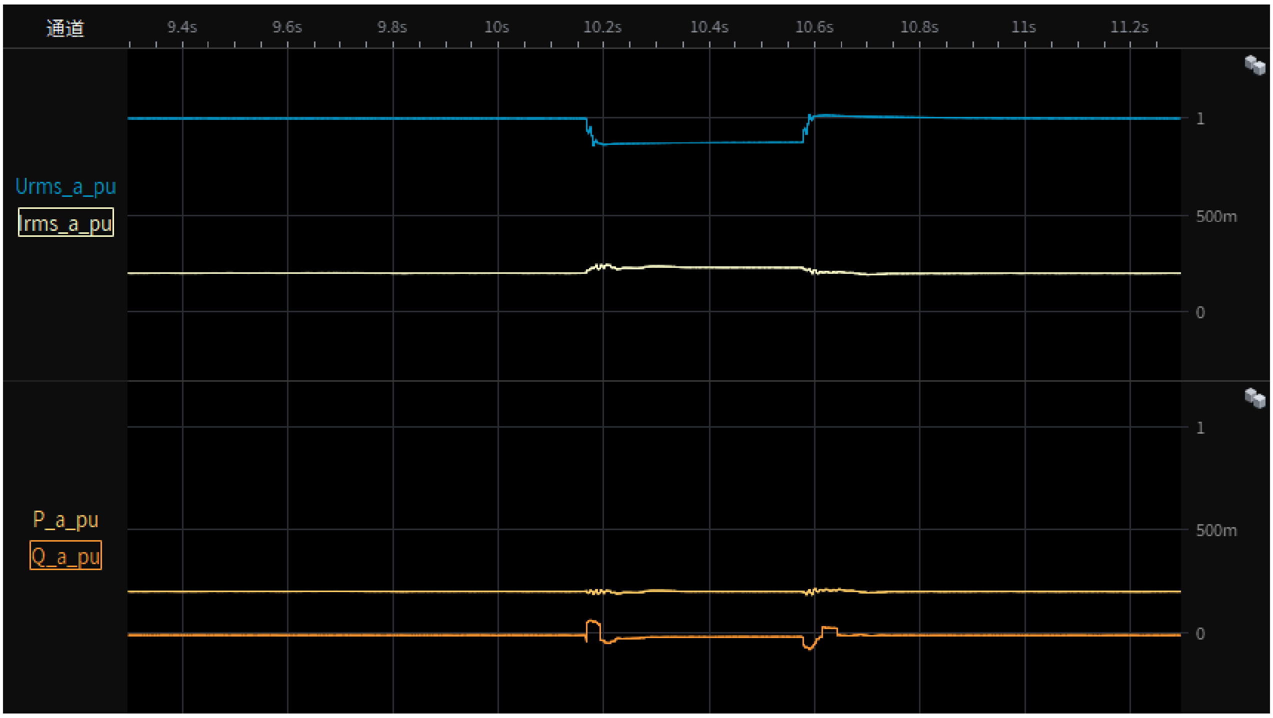
Test 2s-2.4 Depth of fault phase: 0.25p.u.,three-phase-symmetrical (type A), 95% load
restoring time



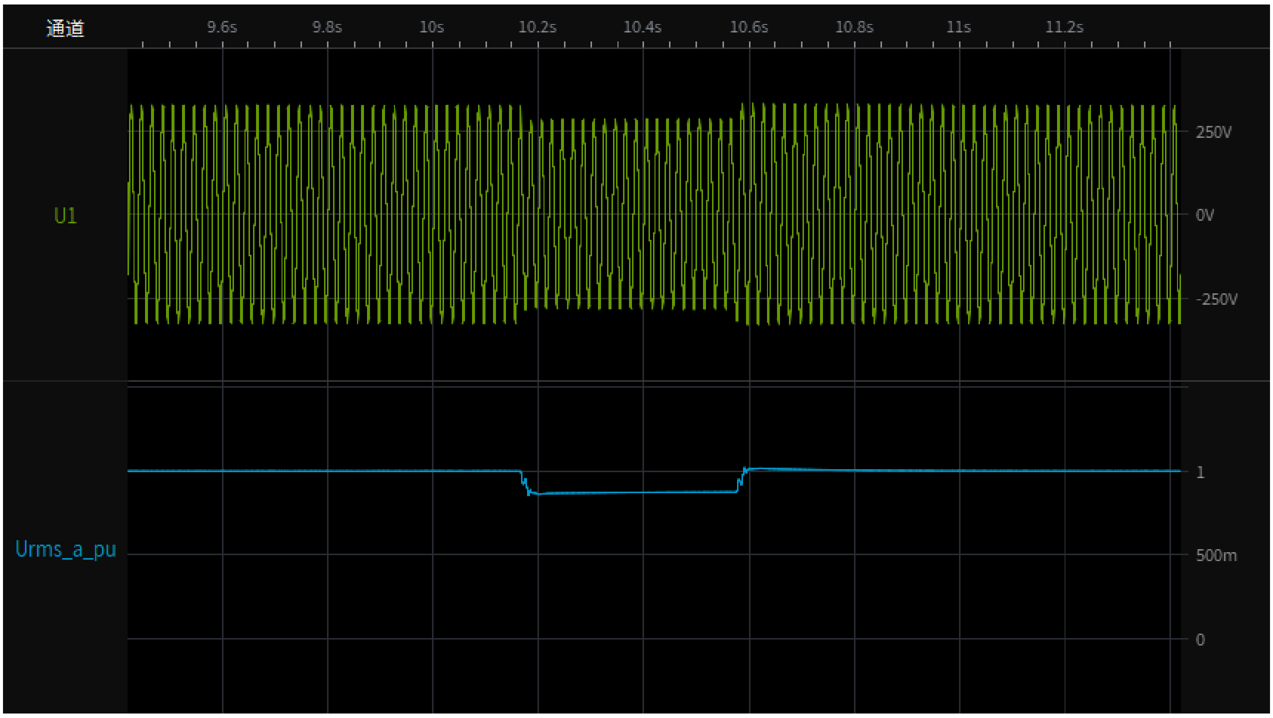
Test 2a-Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D), 0% load
Test overview(voltage,current,active and reactive power)



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)

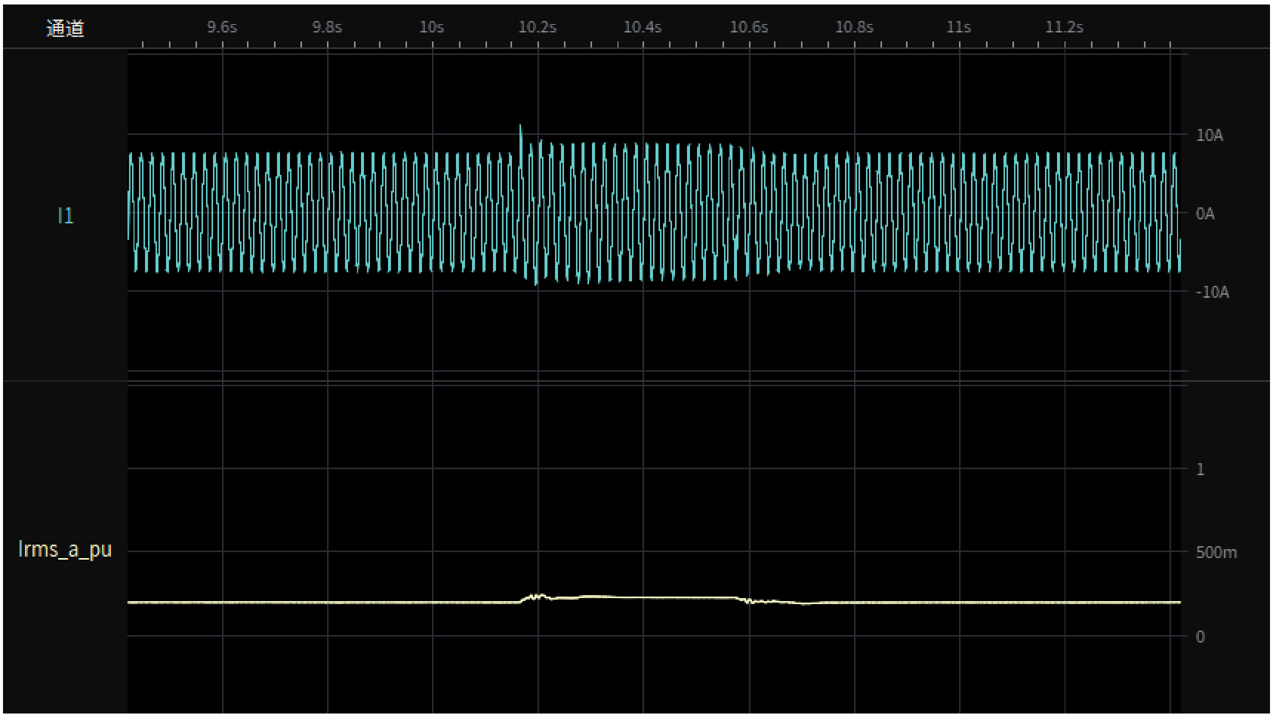


Test 2a-1.2 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

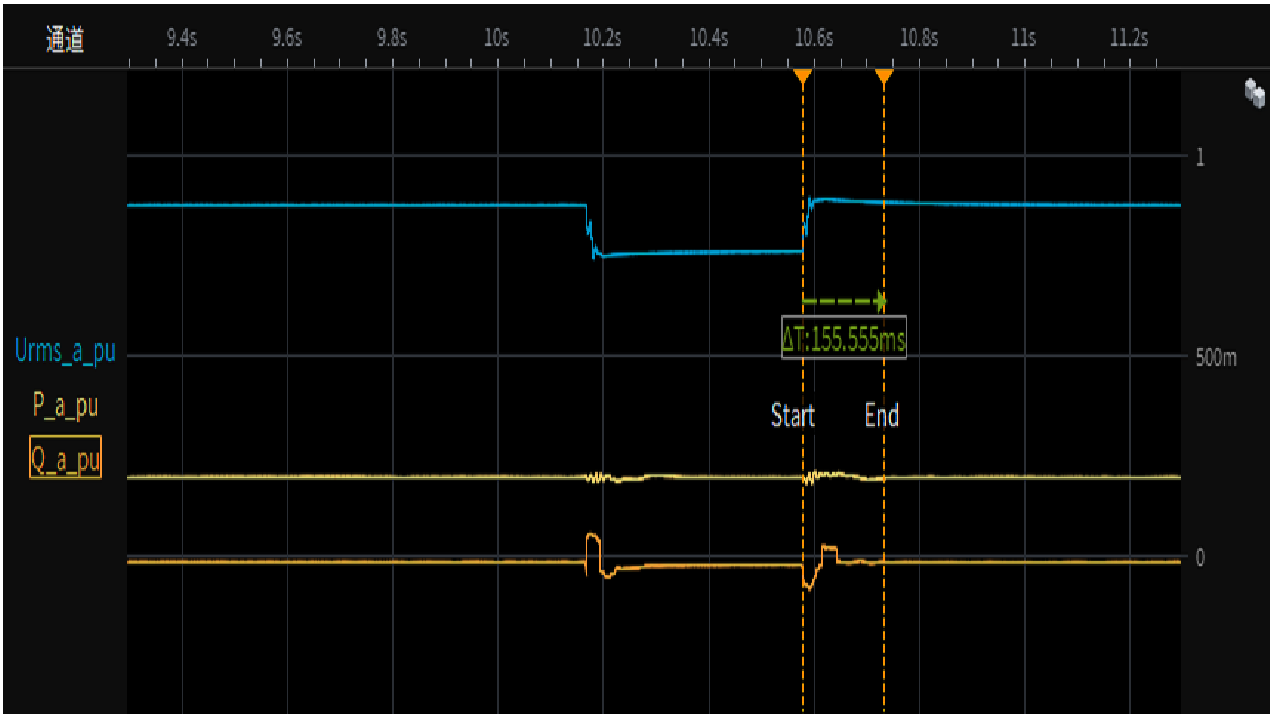


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

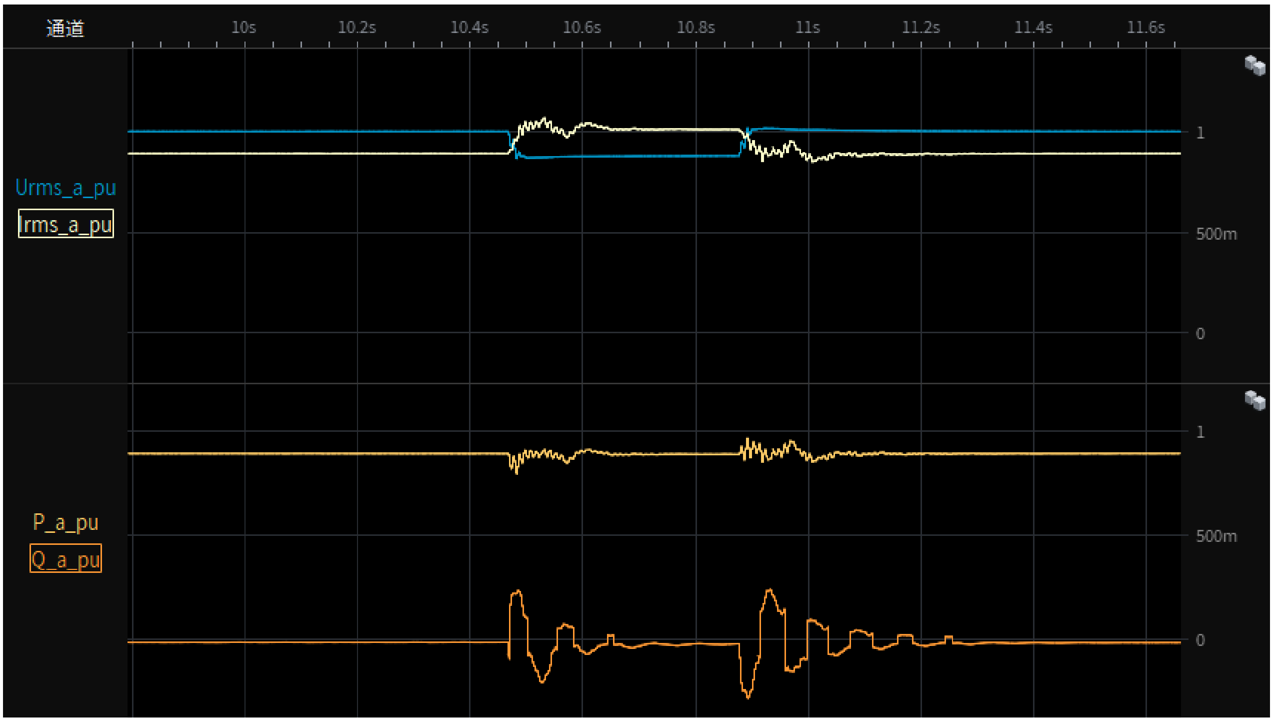


Test 2a-1.4 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),20% load
restoring time

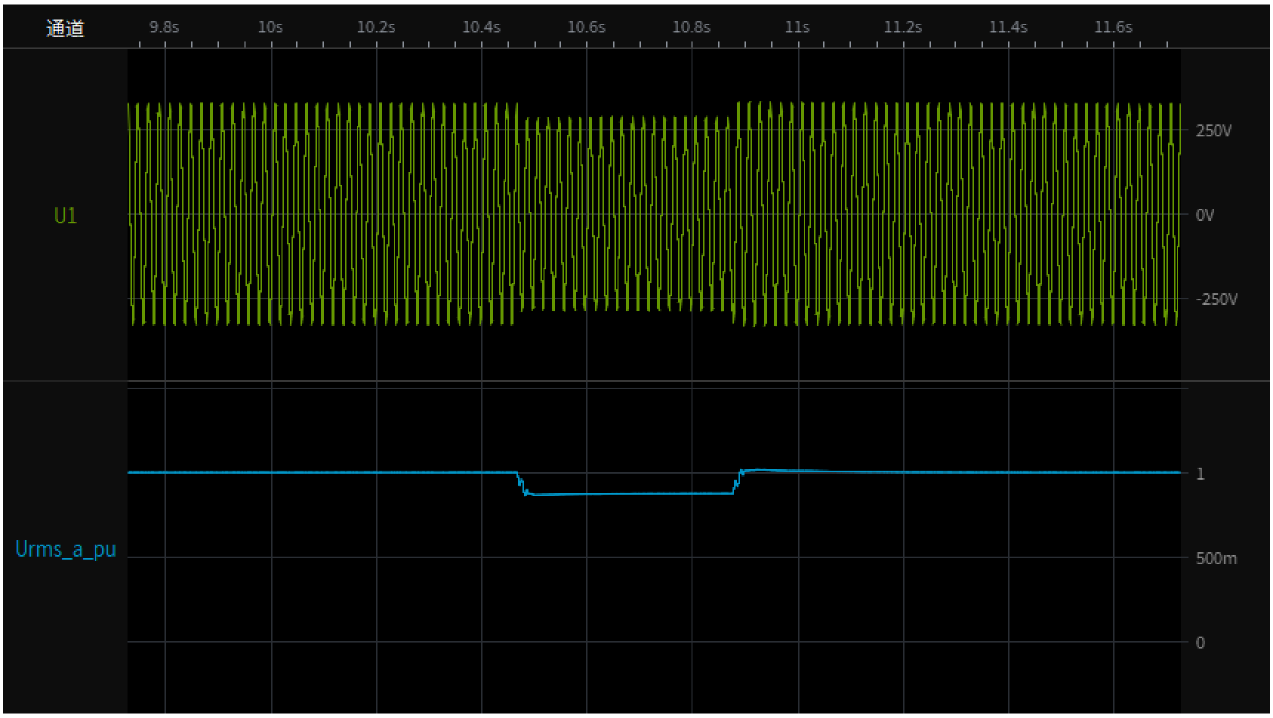


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

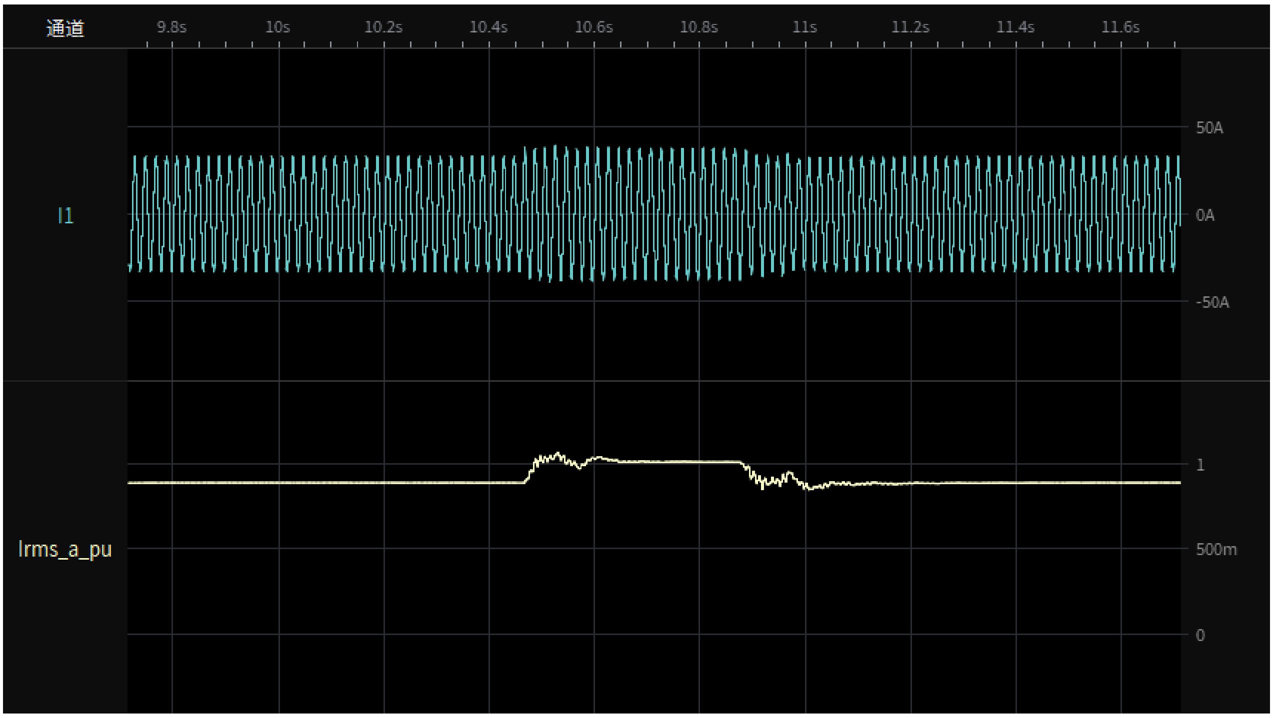


Test 2a-2.2 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

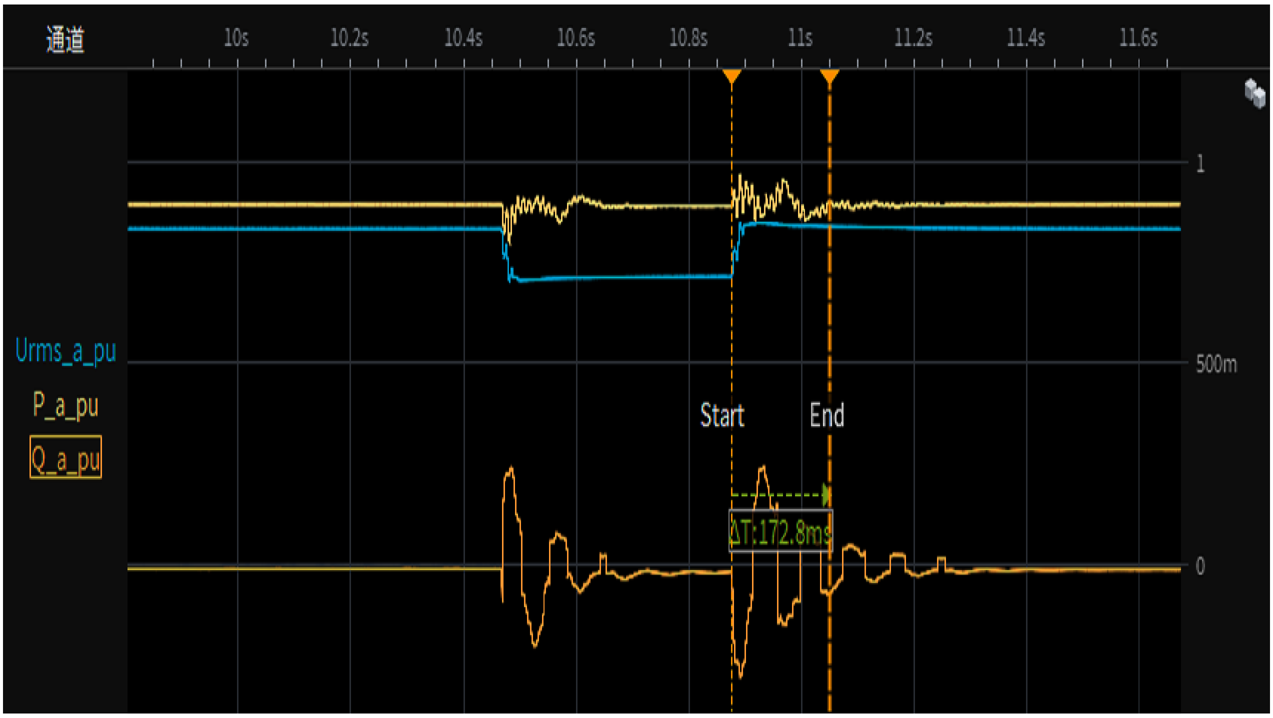


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

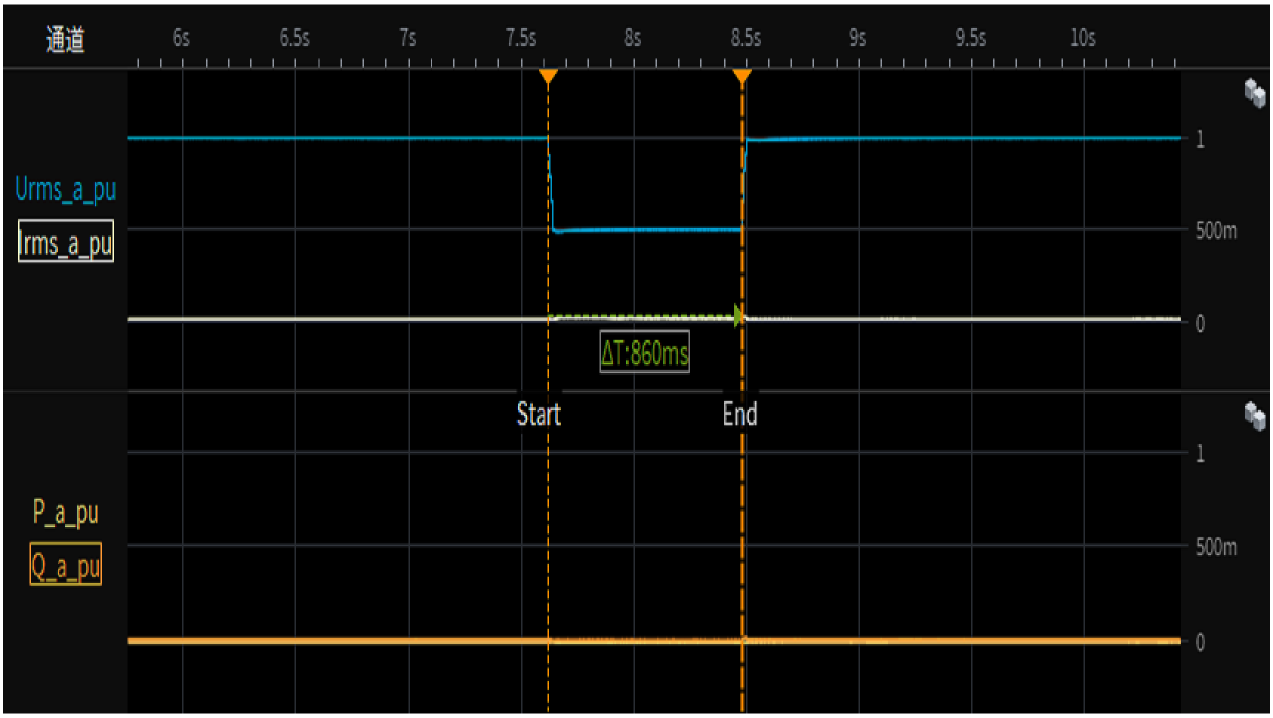


Test 2a-2.4 Depth of fault phase: 0.25p.u.,two-phase-asymmetrical (type D), 95% load
restoring time

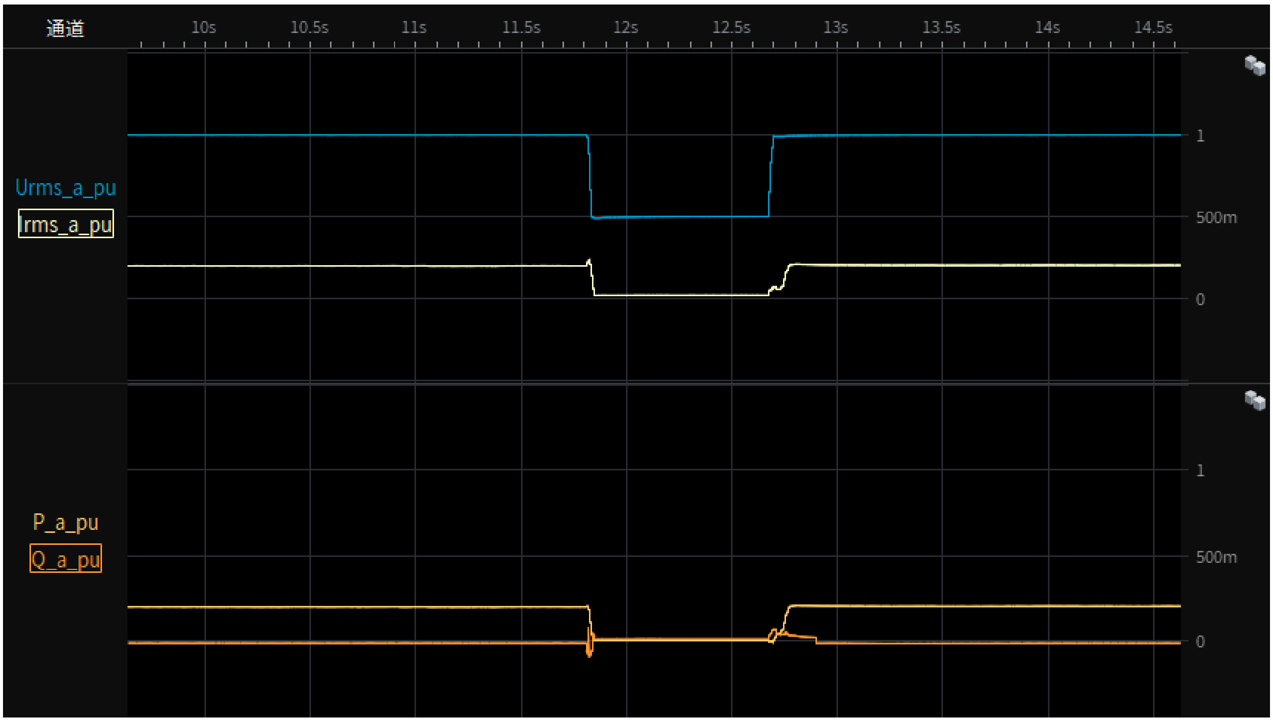


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

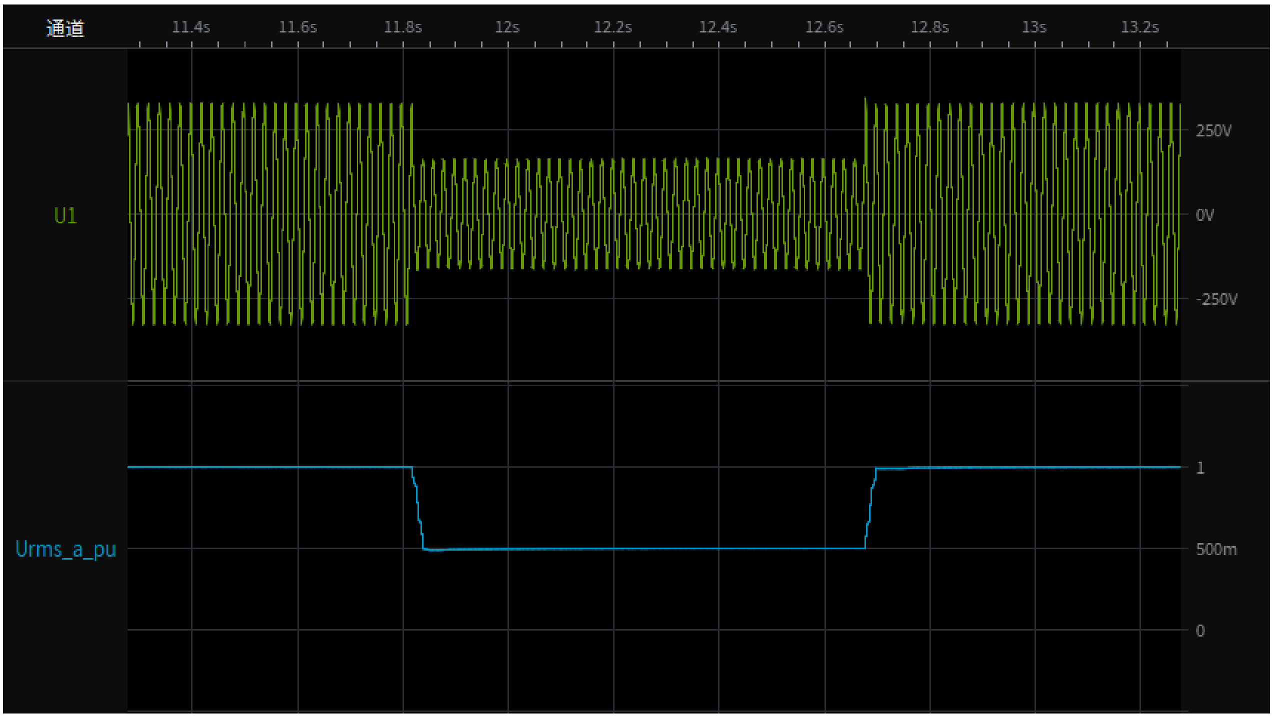


Test 3s-1.1 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)

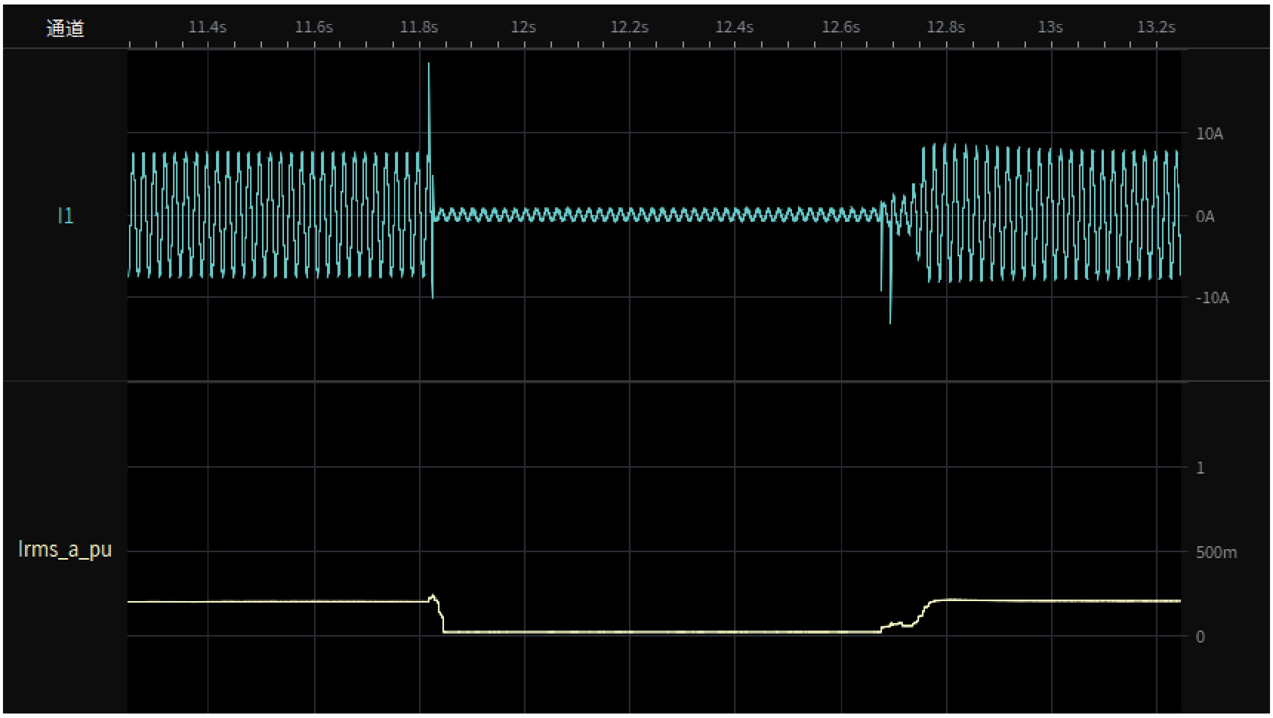


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

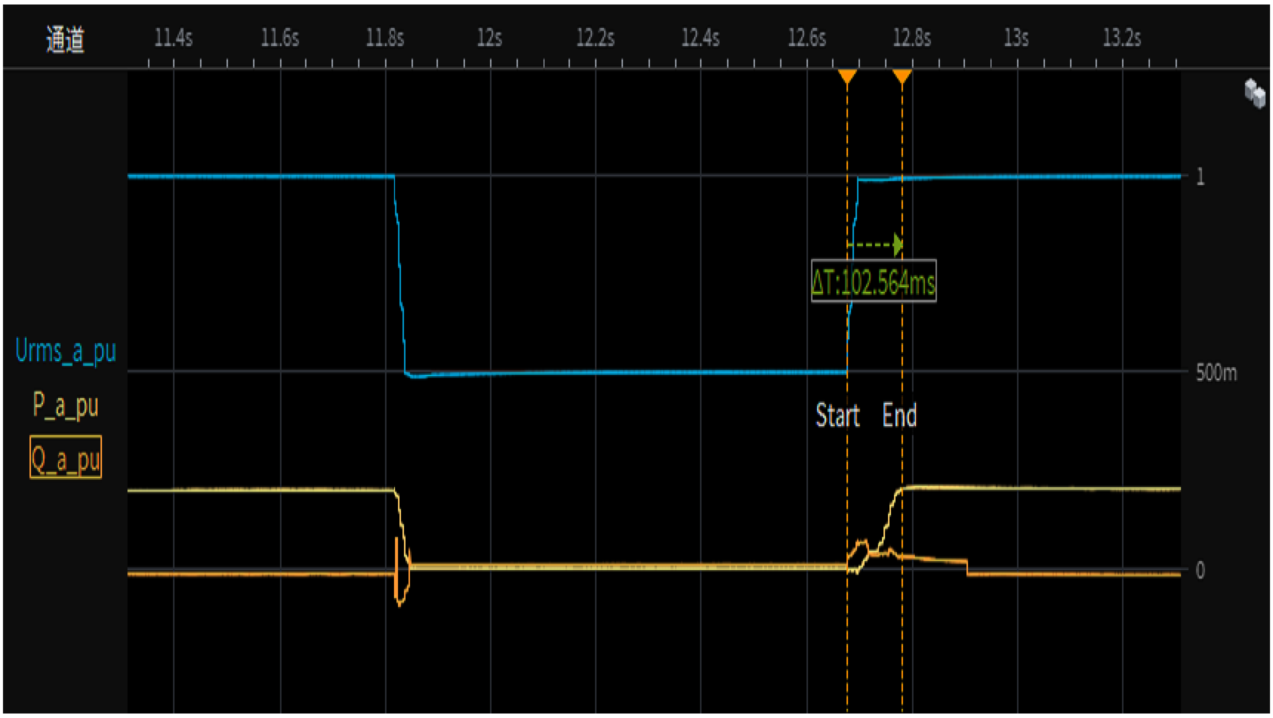


Test 3s-1.3 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents

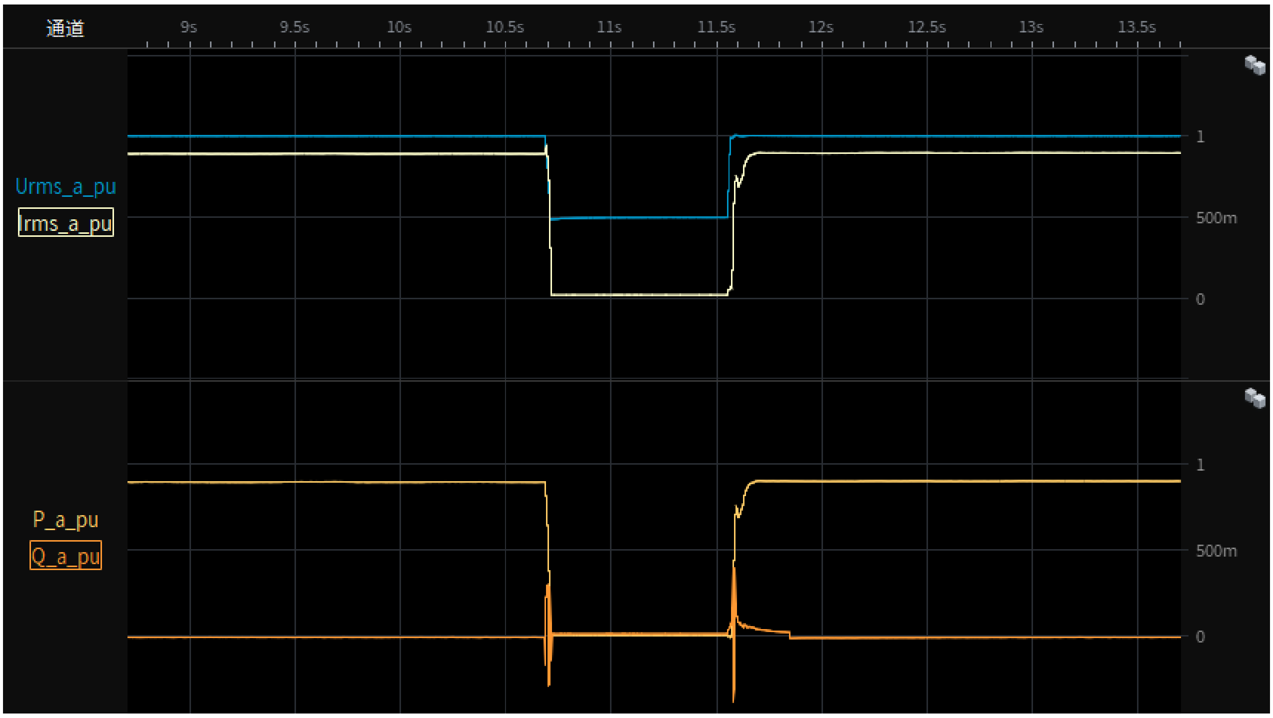


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

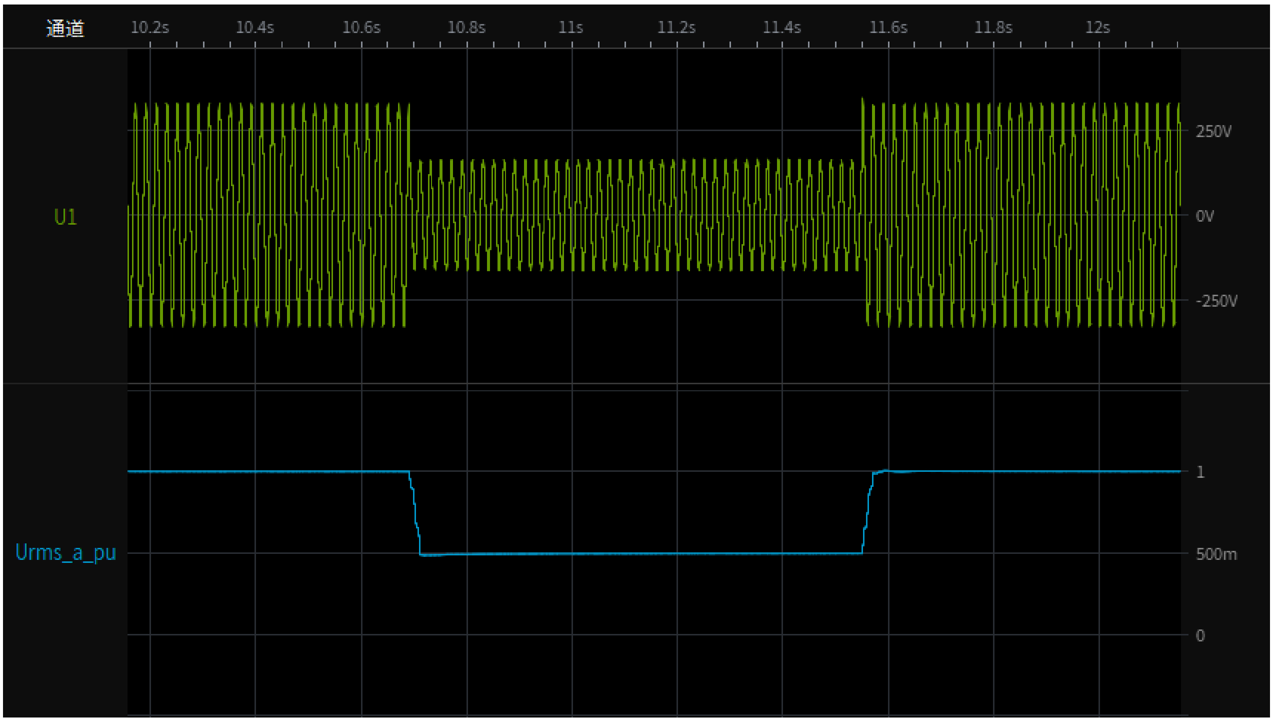


Test 3s-2.1 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),95% load
Test overview(voltage,current,active and reactive power)

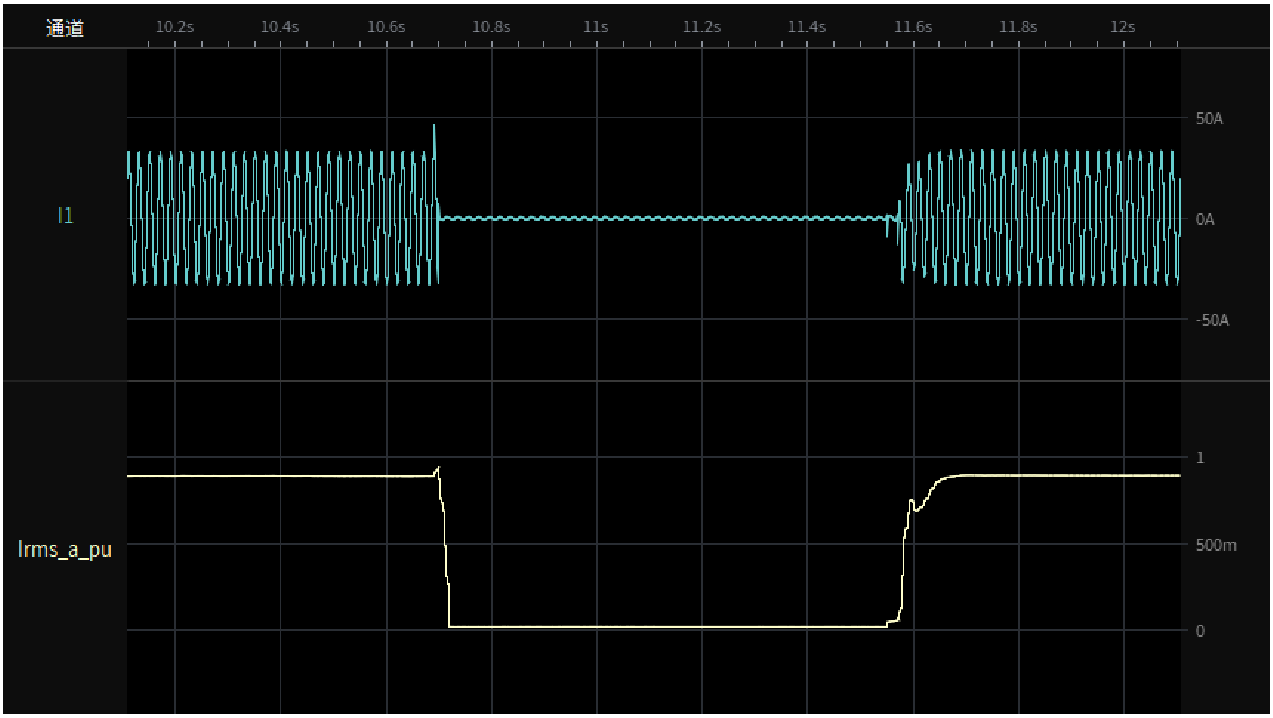


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

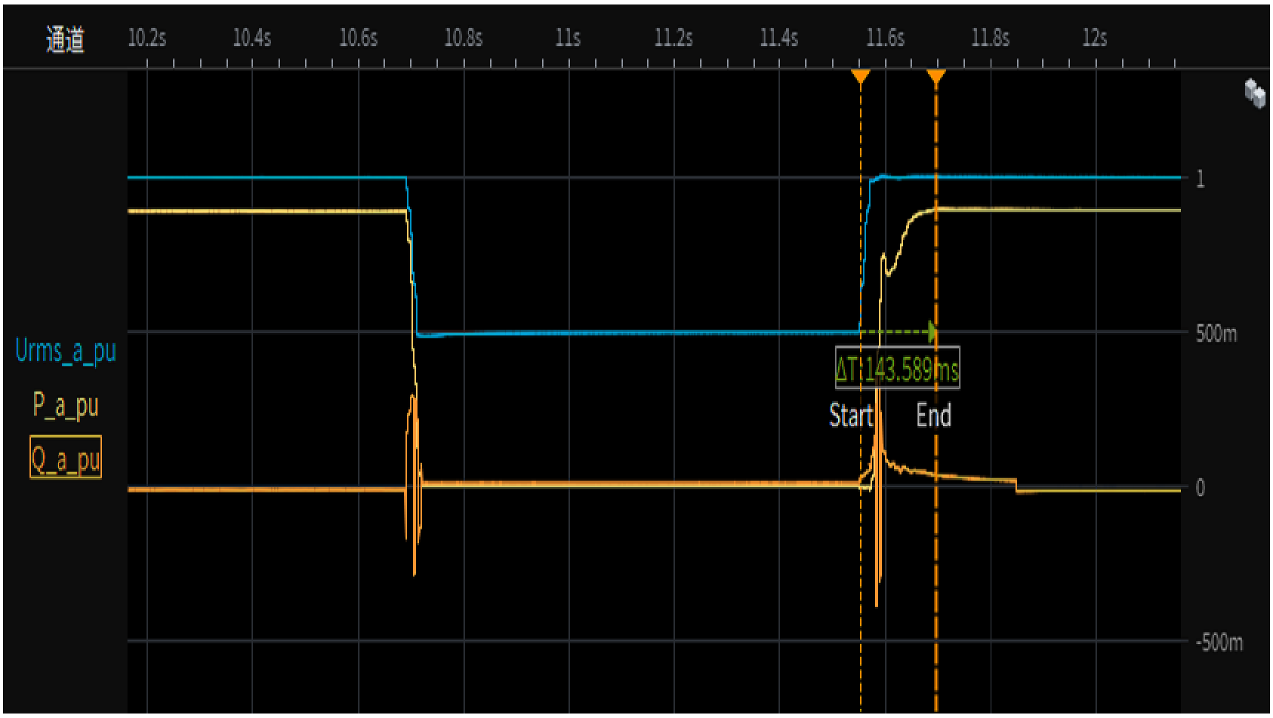


Test 3s-2.3 Depth of fault phase: 0.5p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents

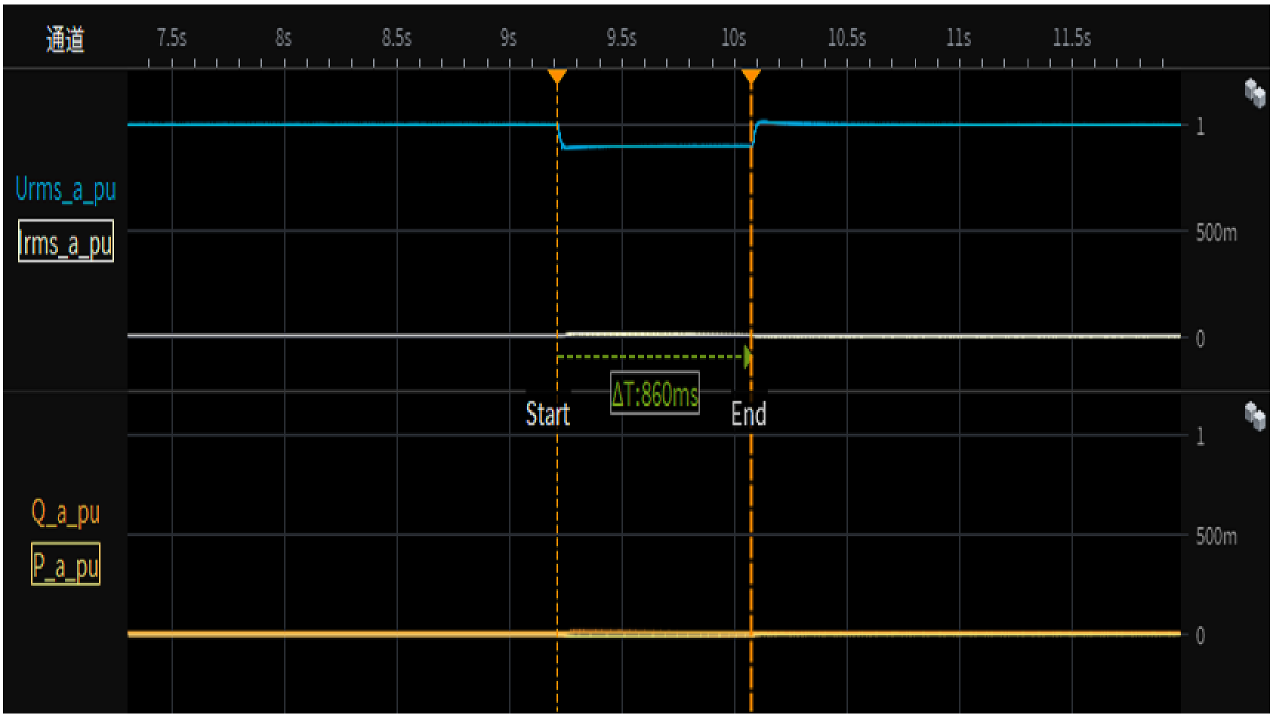


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

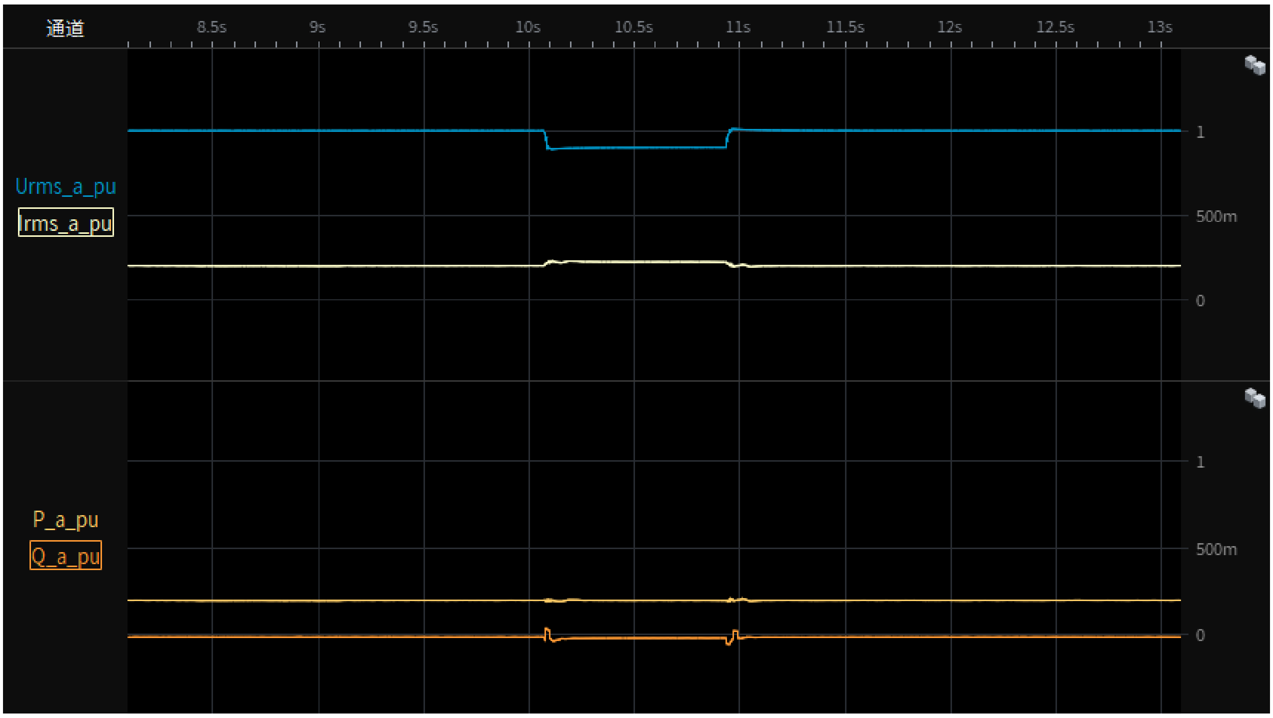


Test 3a-Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D), 0% load
Test overview(voltage,current,active and reactive power)

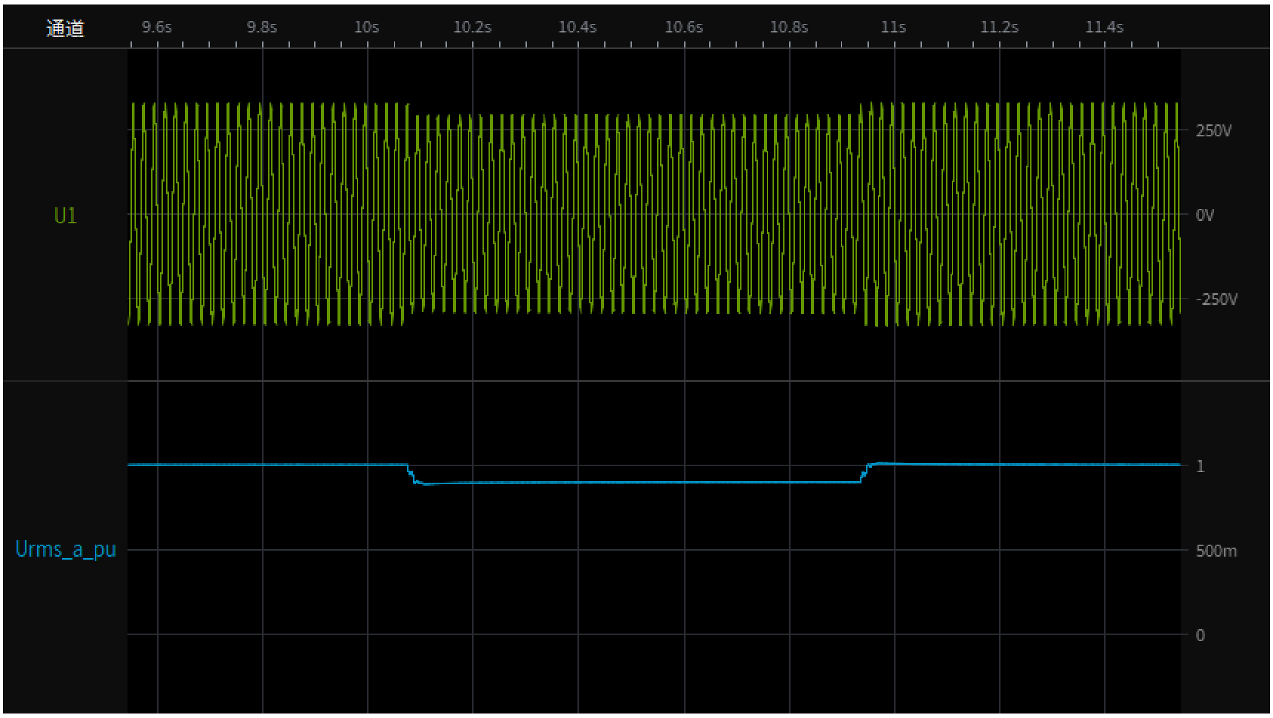


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

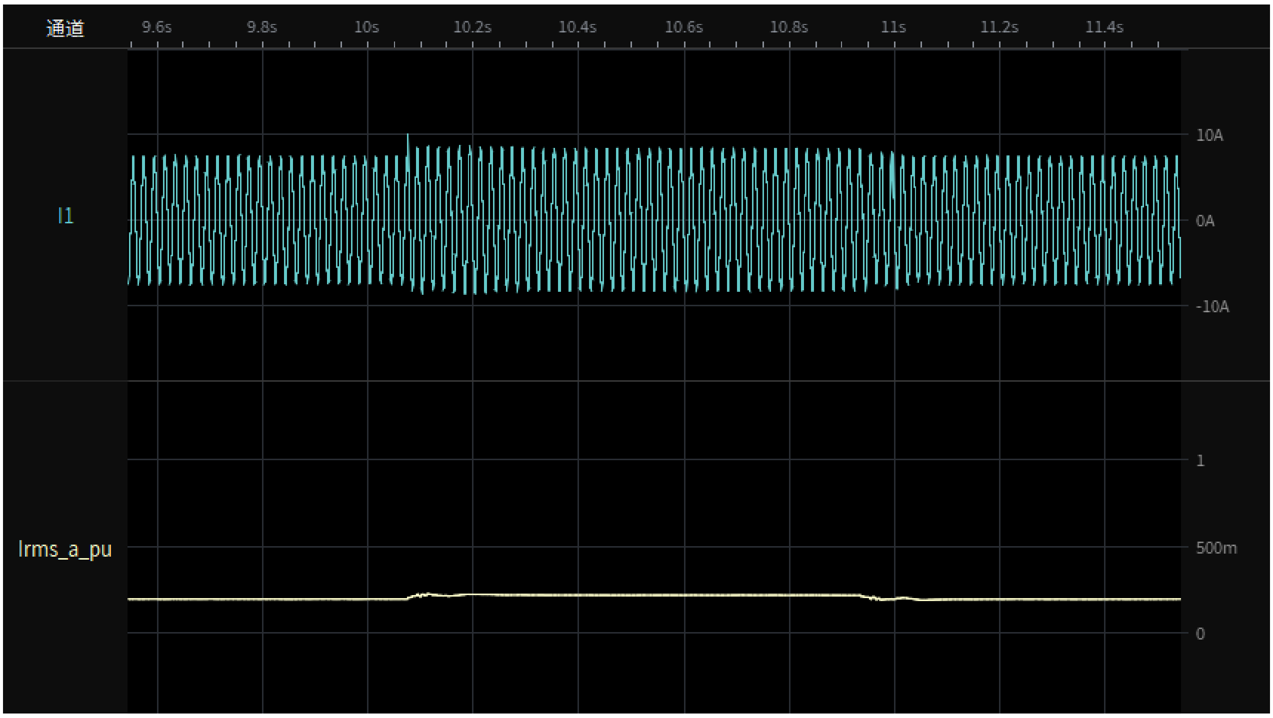


Test 3a-1.2 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

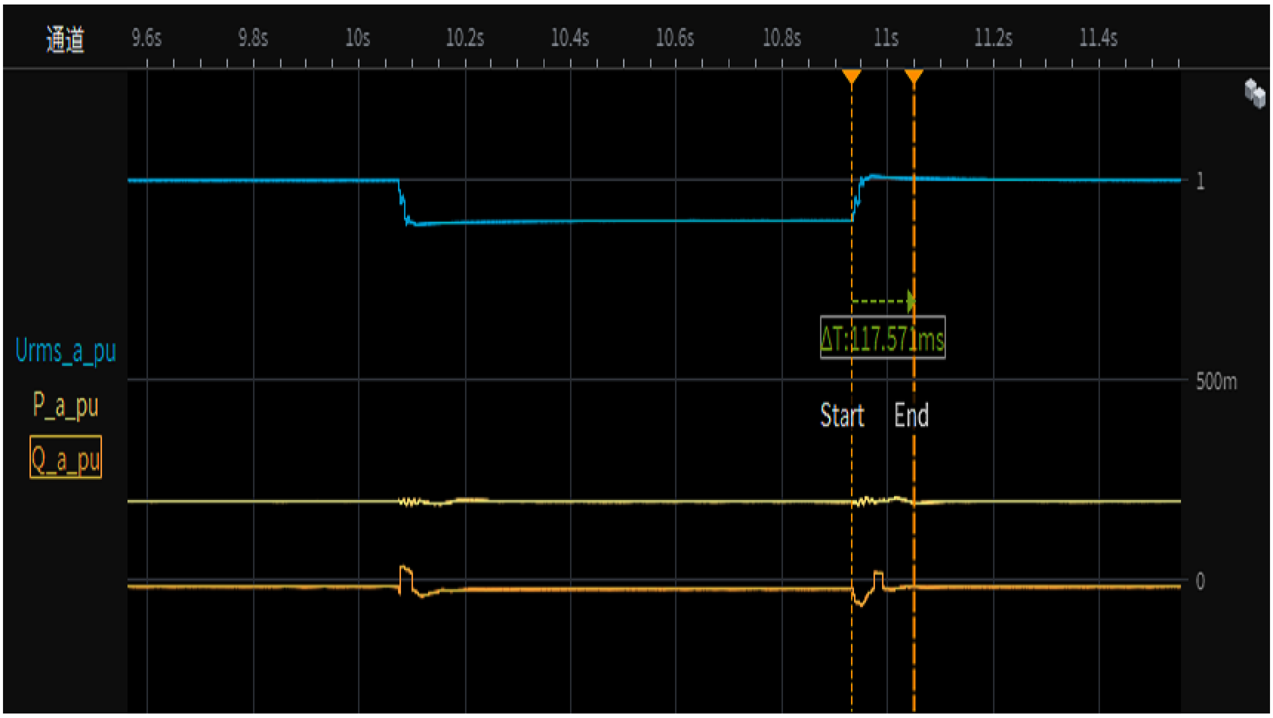


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

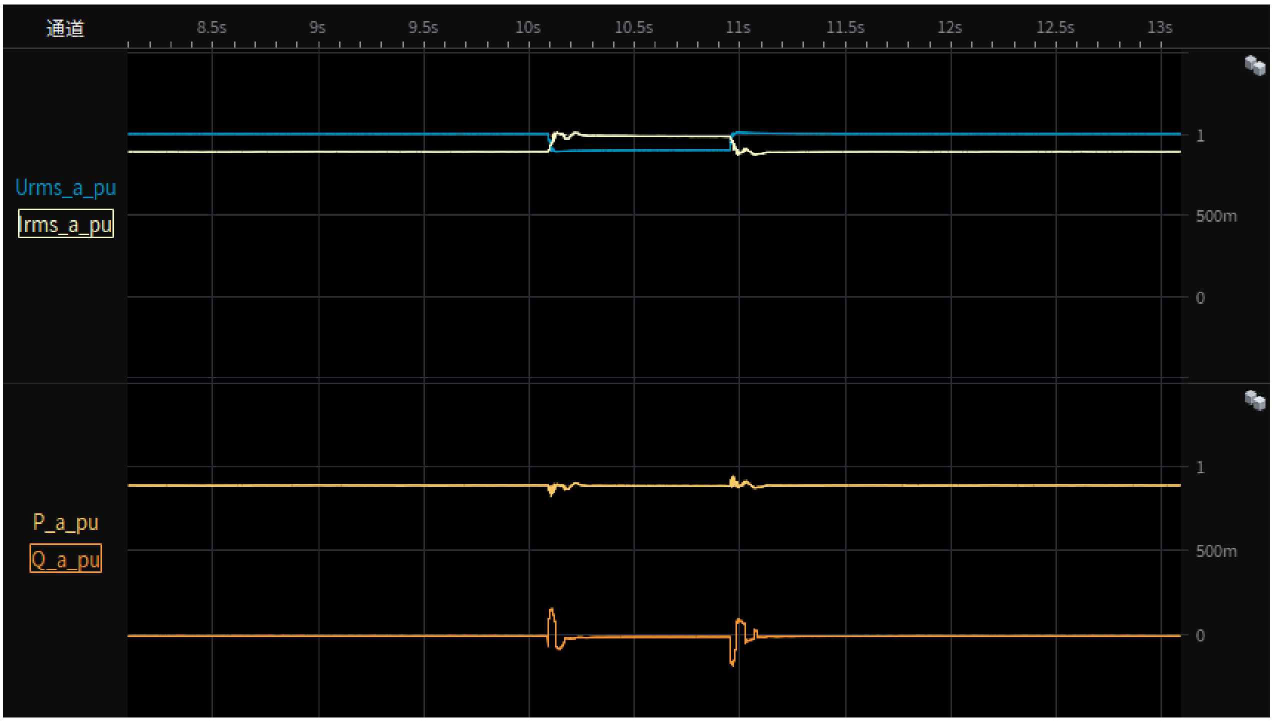


Test 3a-1.4 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),20% load
restoring time

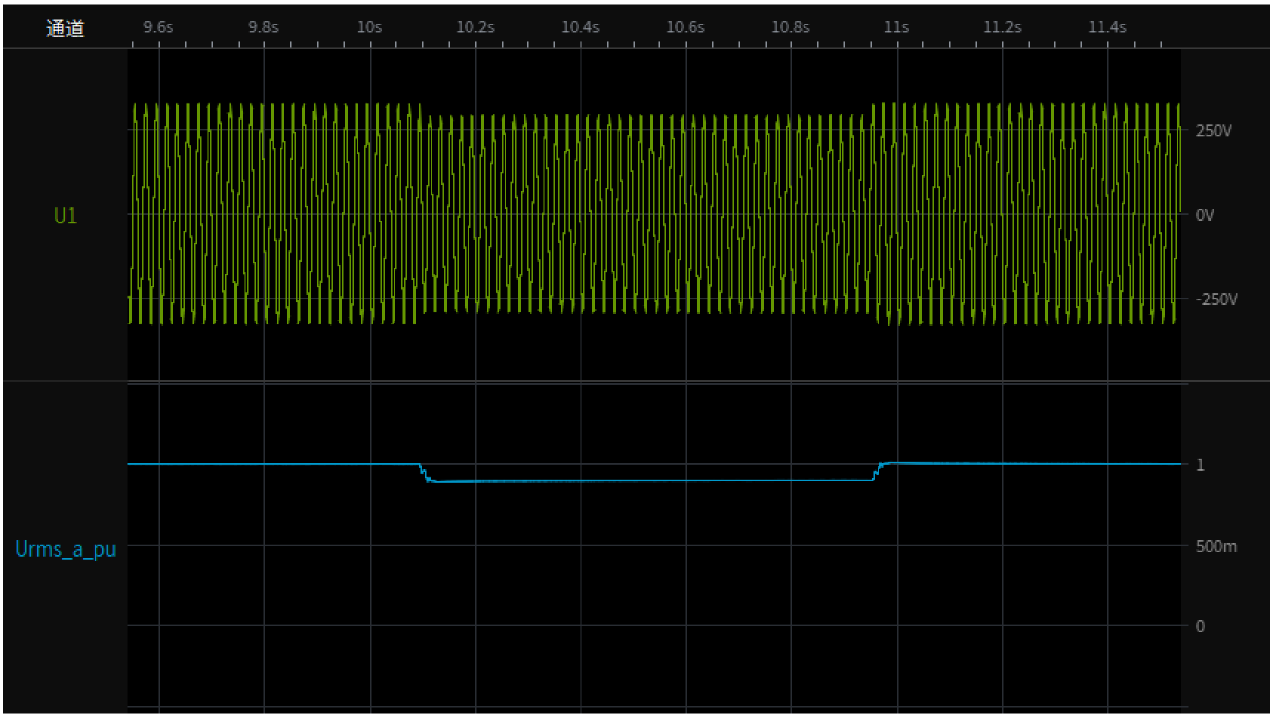


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

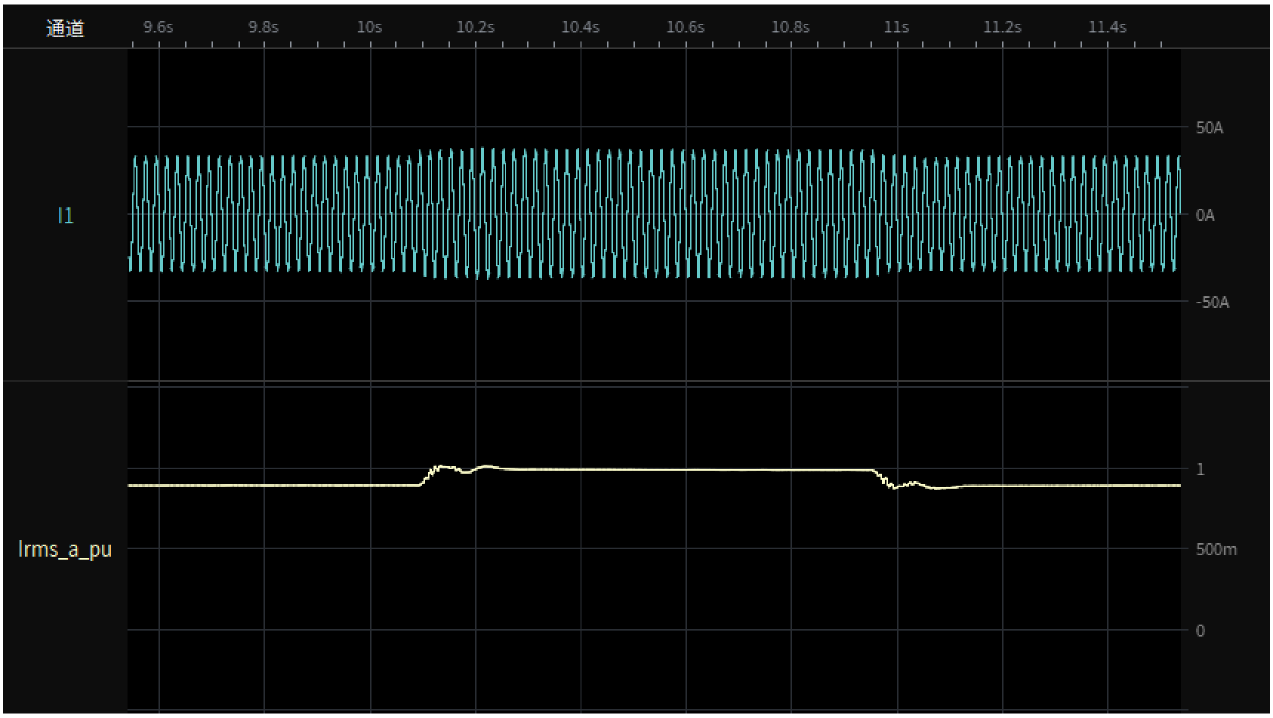


Test 3a-2.2 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

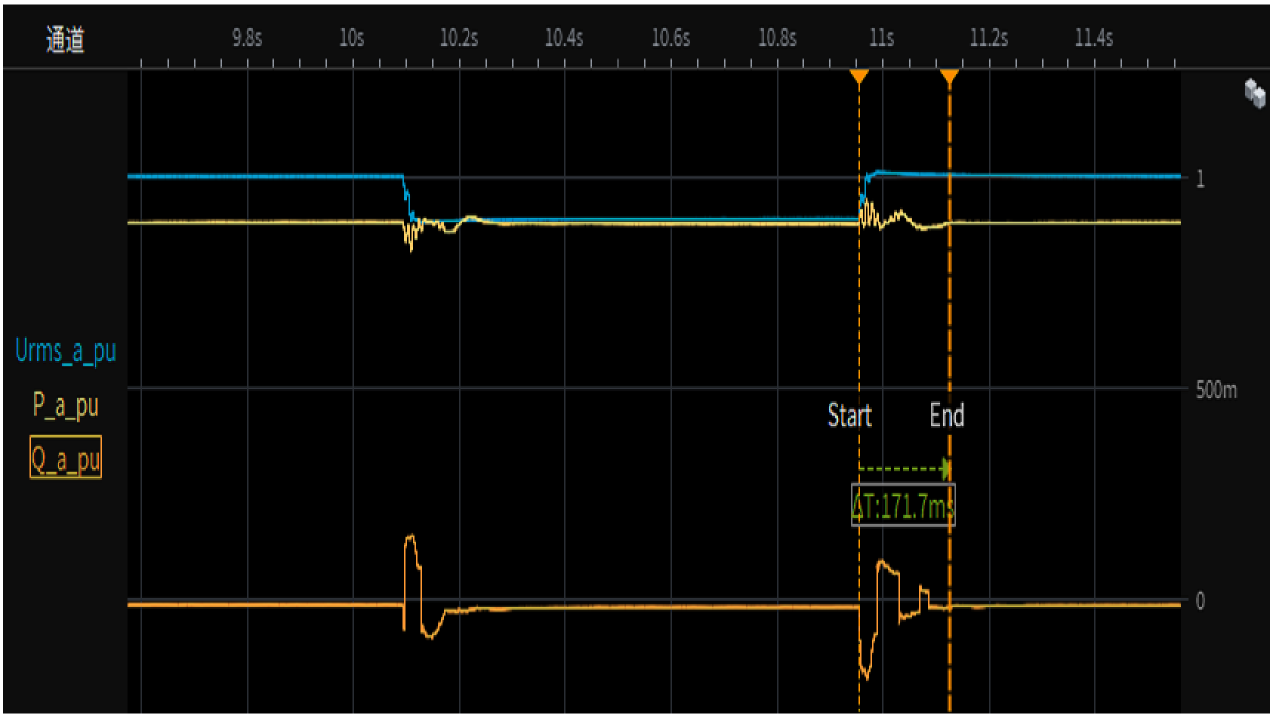


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

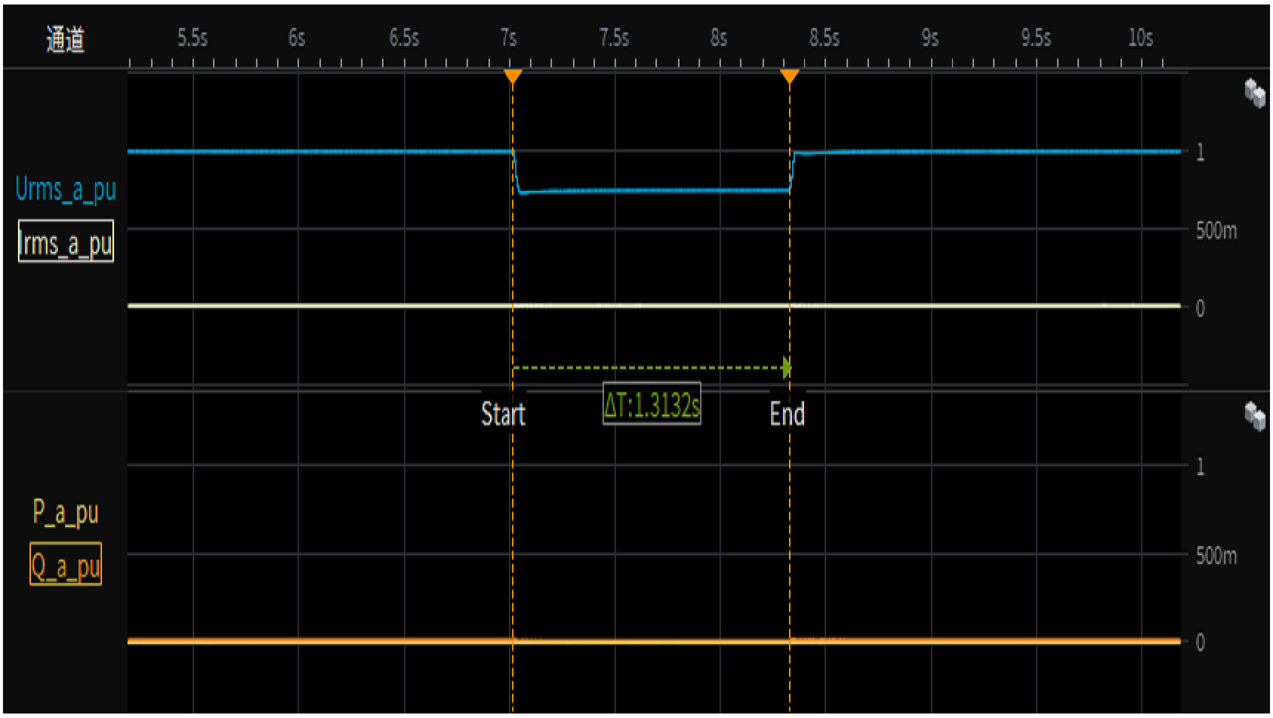


Test 3a-2.4 Depth of fault phase: 0.5p.u.,two-phase-asymmetrical (type D), 95% load
restoring time

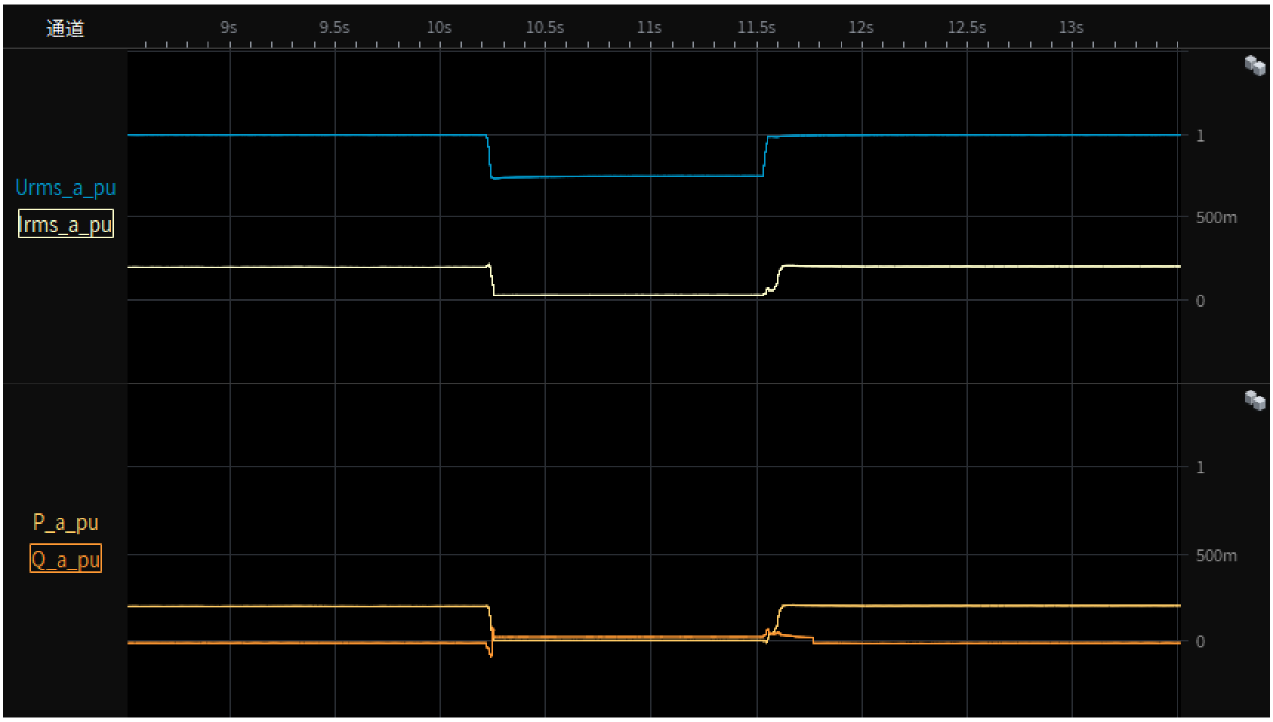


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

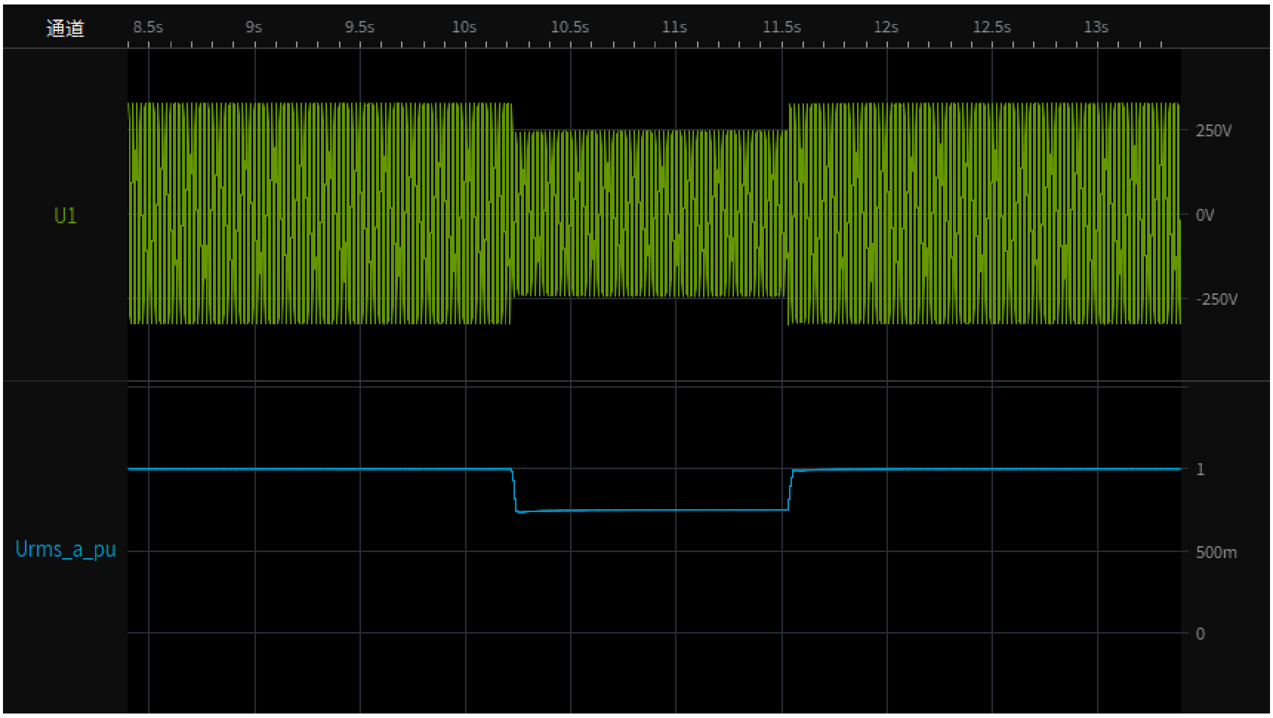


Test 4s-1.1 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)

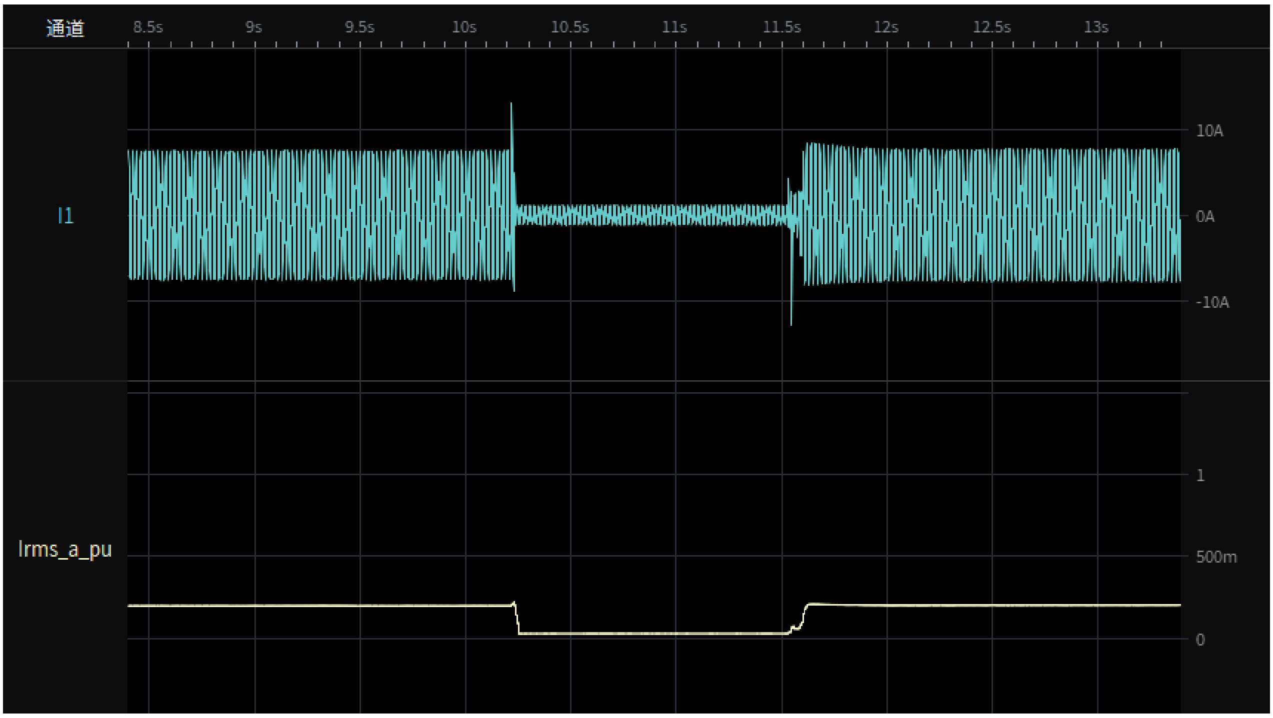


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

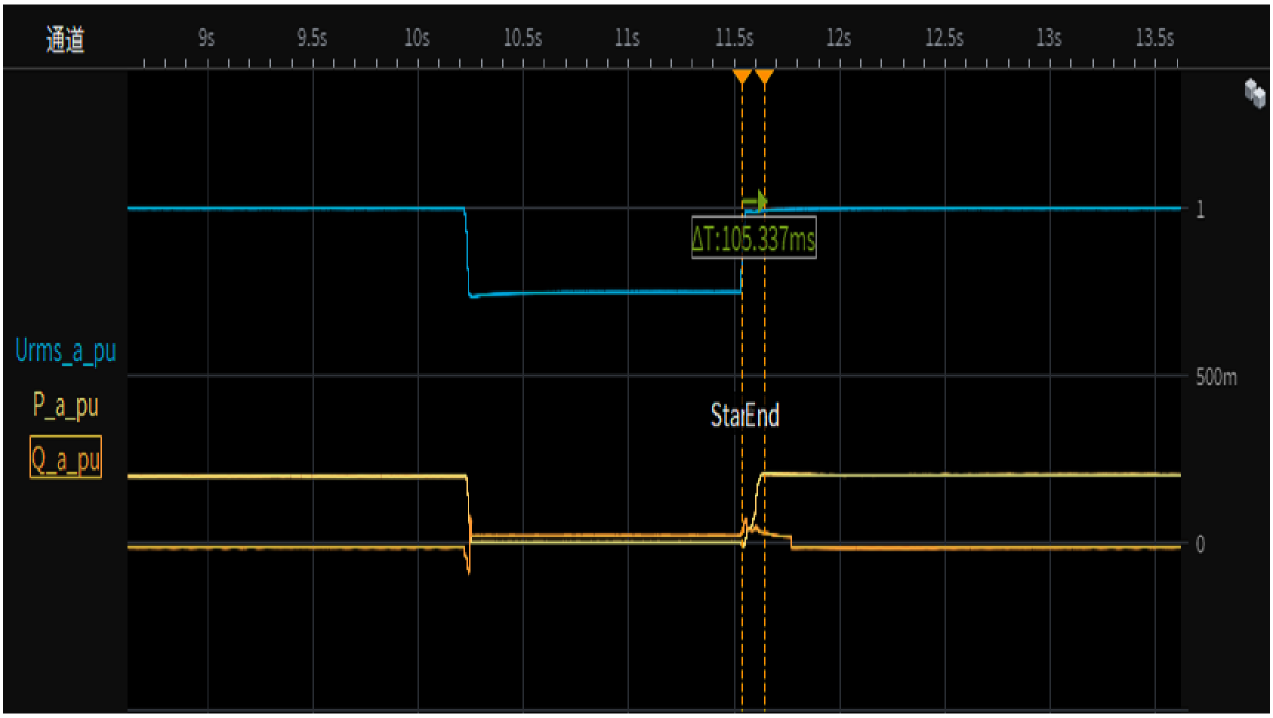


Test 4s-1.3 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents

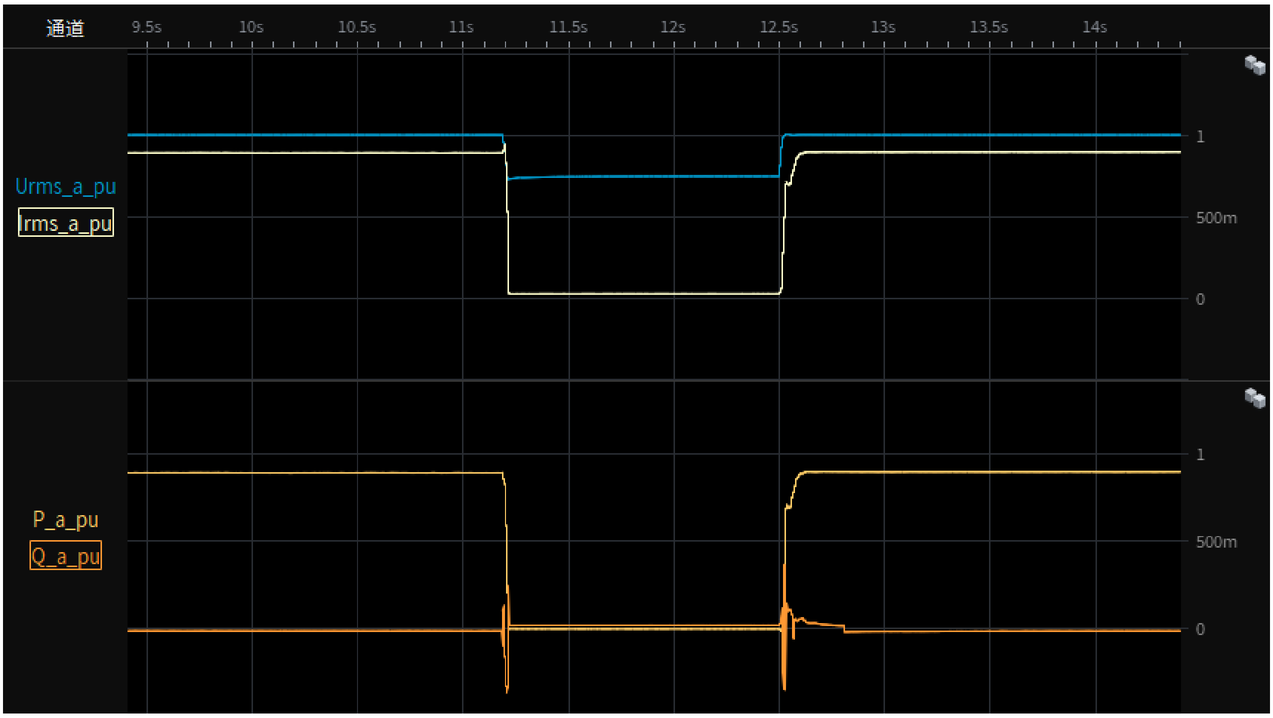


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

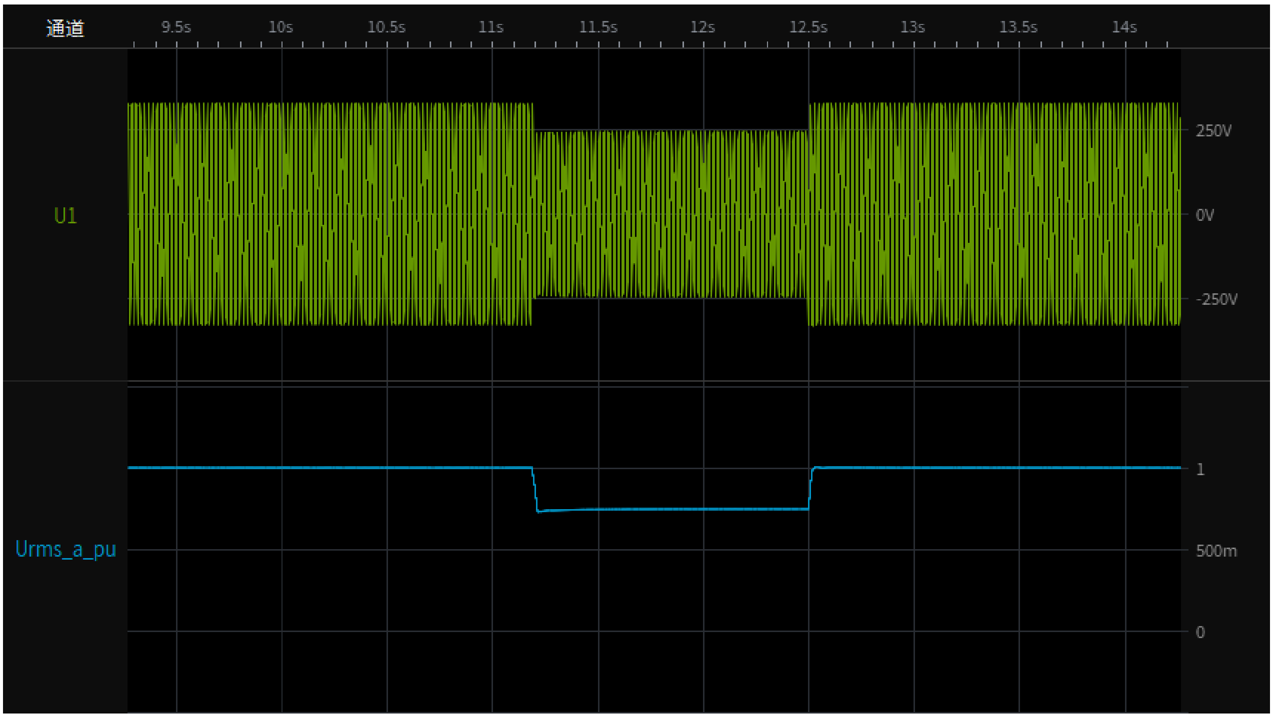


Test 4s-2.1 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),95% load Test overview(voltage,current,active and reactive power)

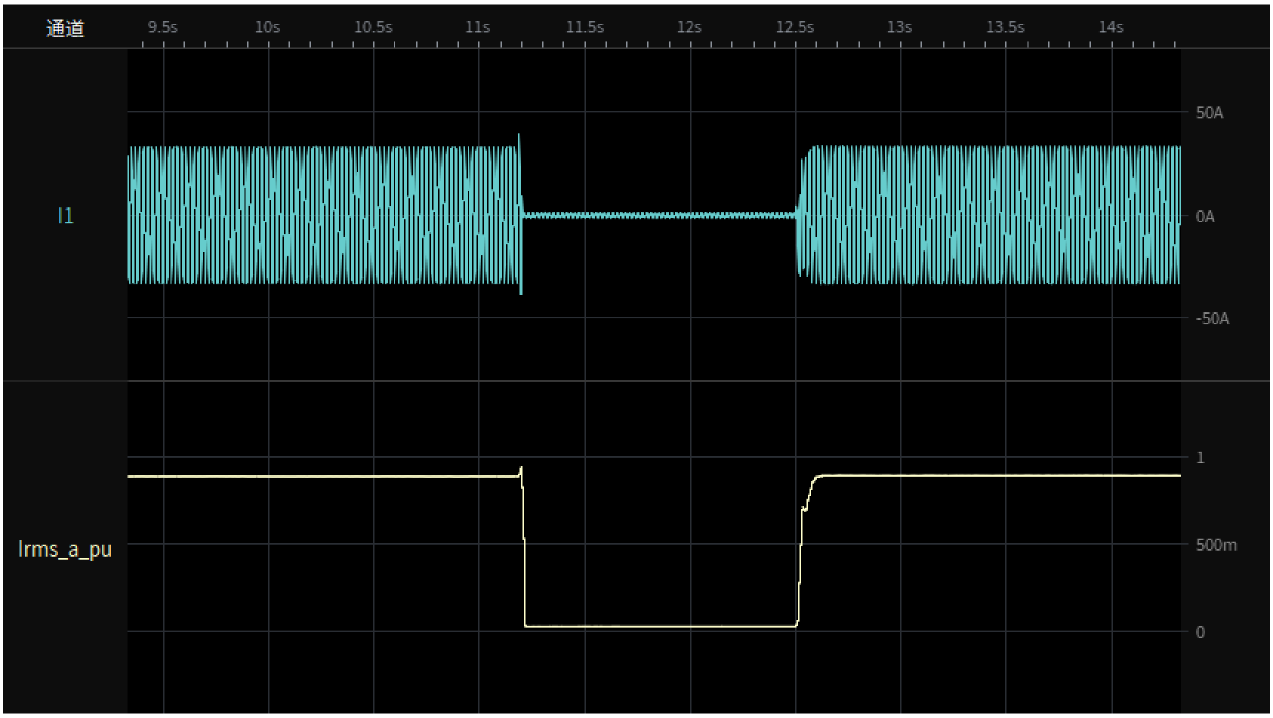


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

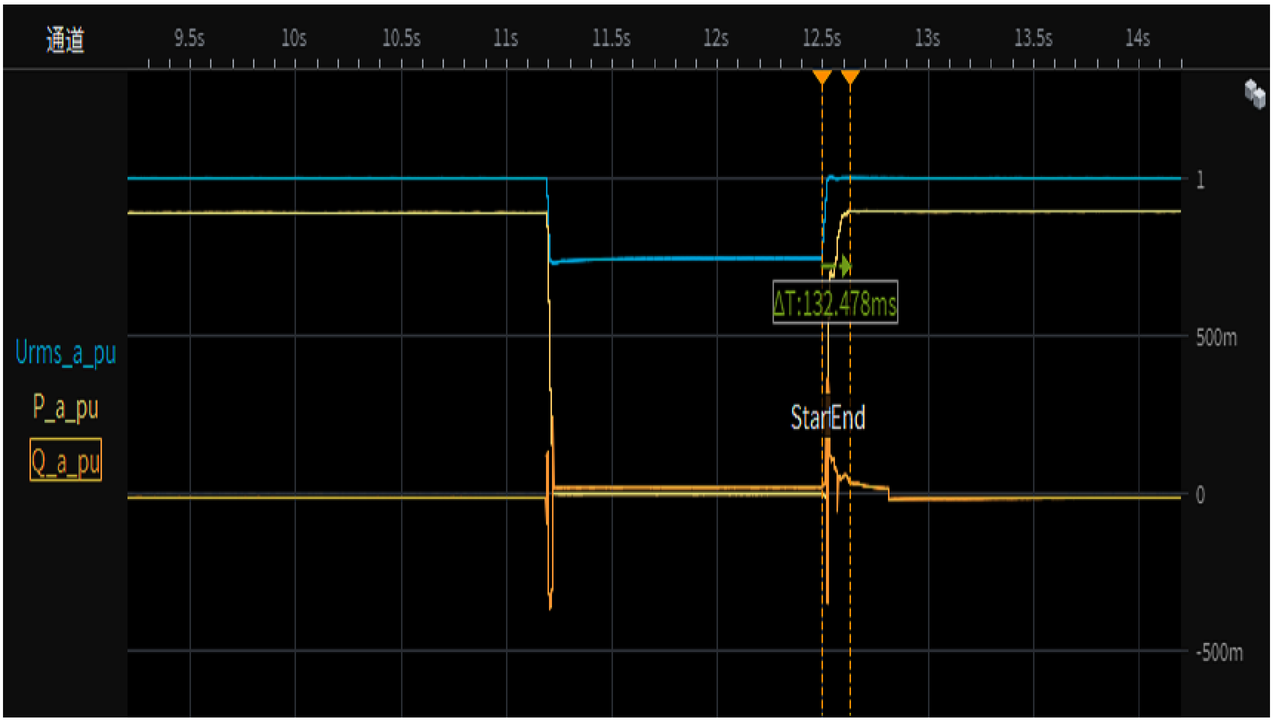


Test 4s-2.3 Depth of fault phase: 0.75p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents

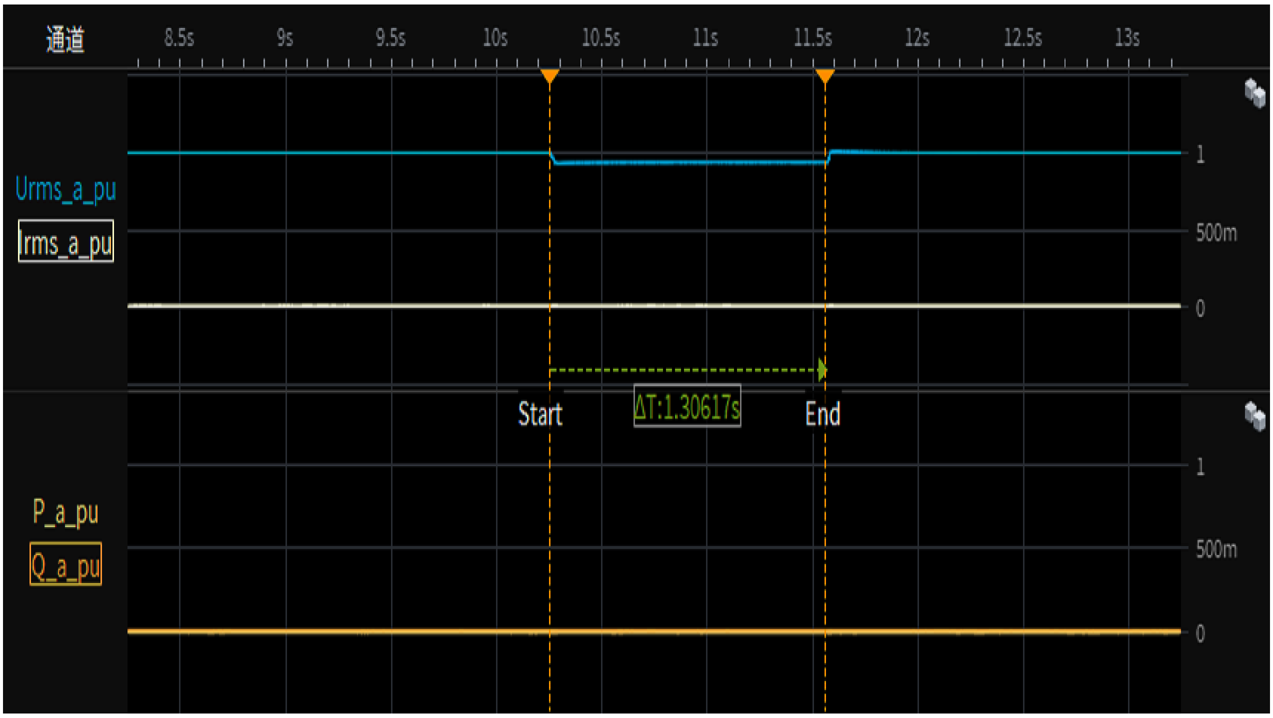


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

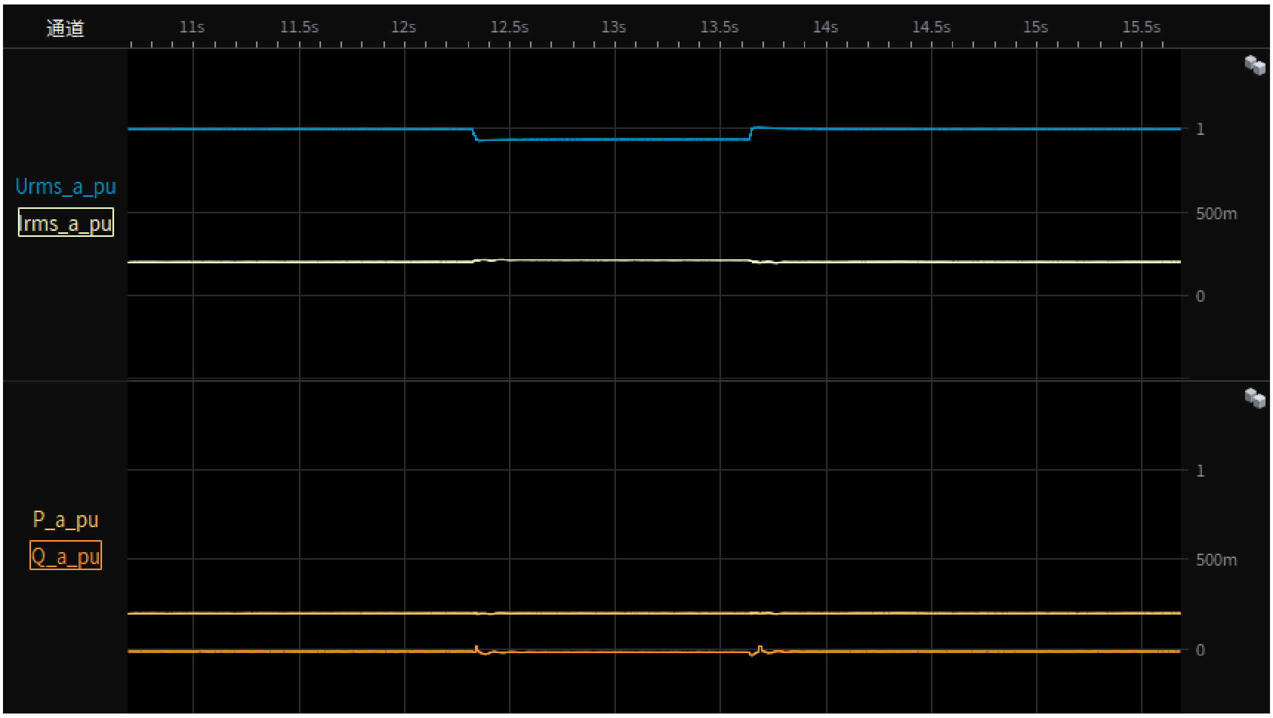


Test 4a-Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D), 0% load
Test overview(voltage,current,active and reactive power)

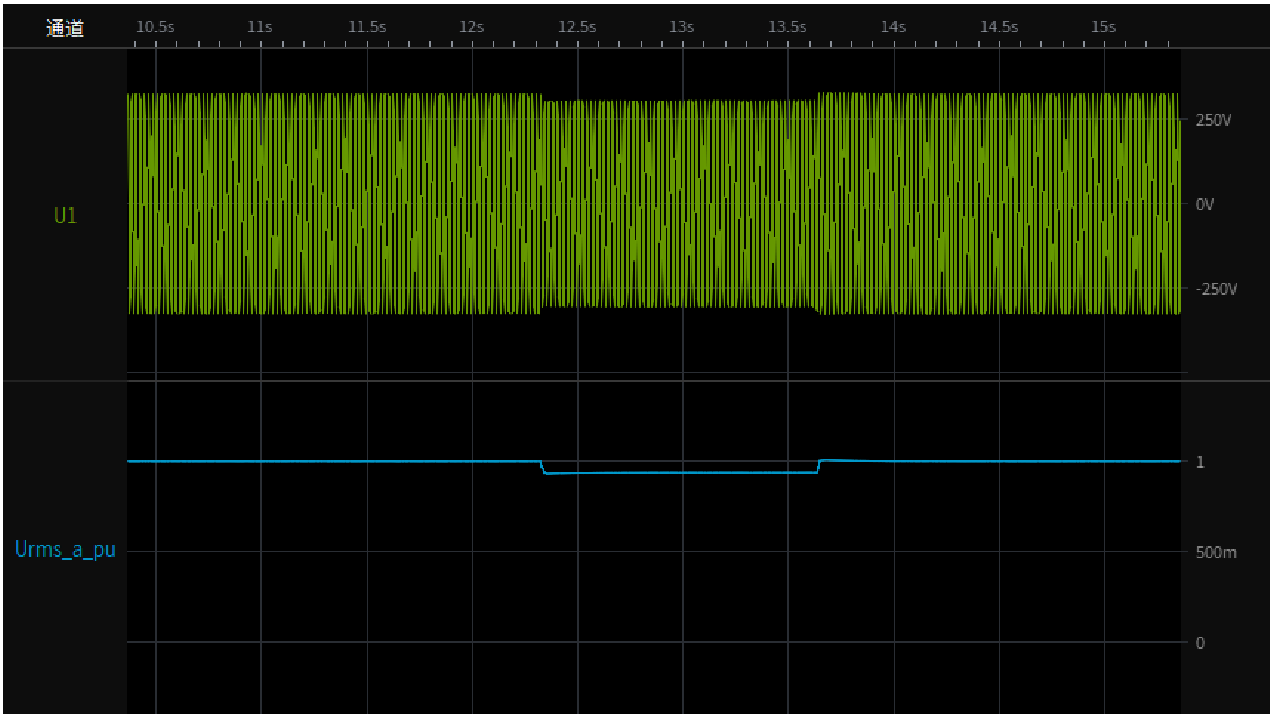


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

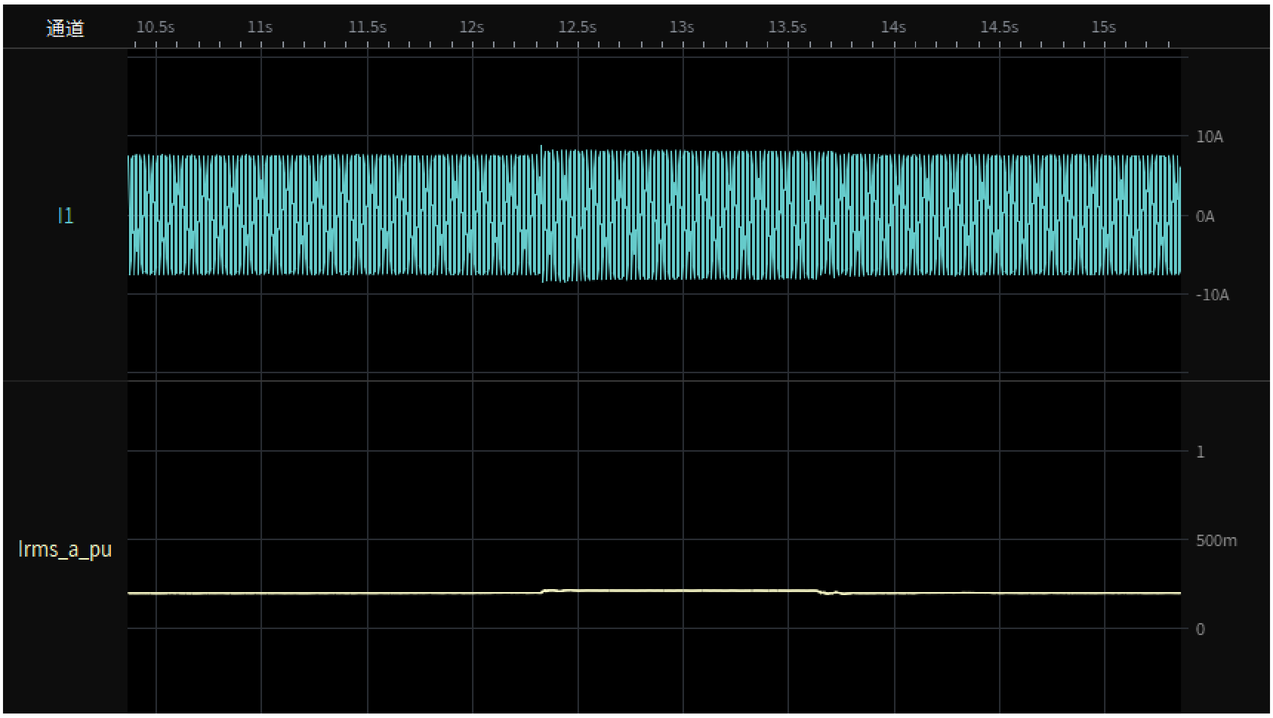


Test 4a-1.2 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

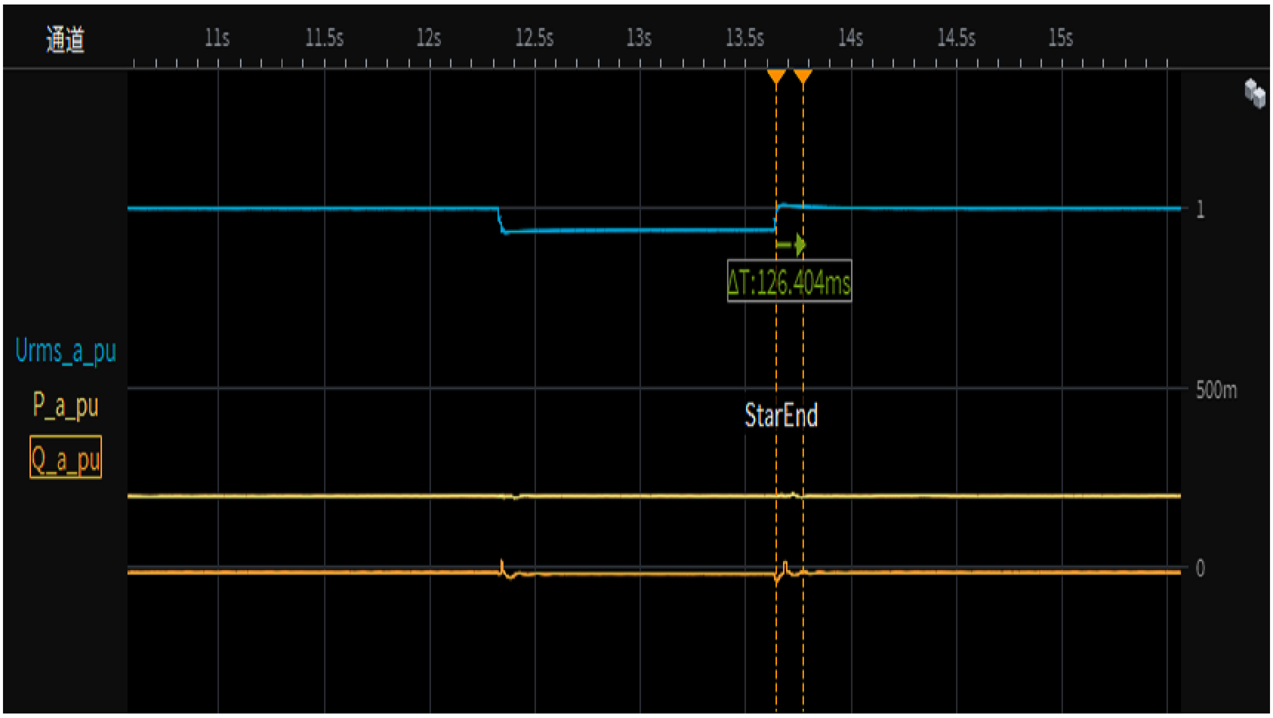


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

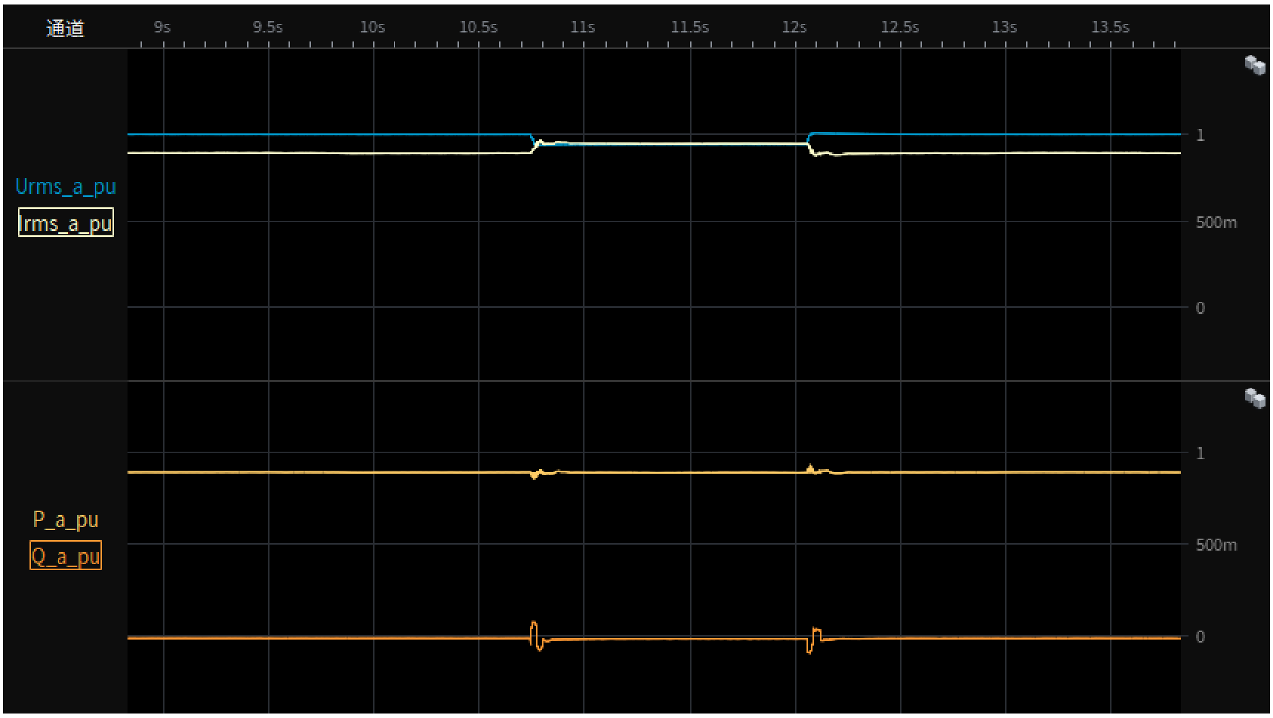


Test 4a-1.4 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),20% load
restoring time

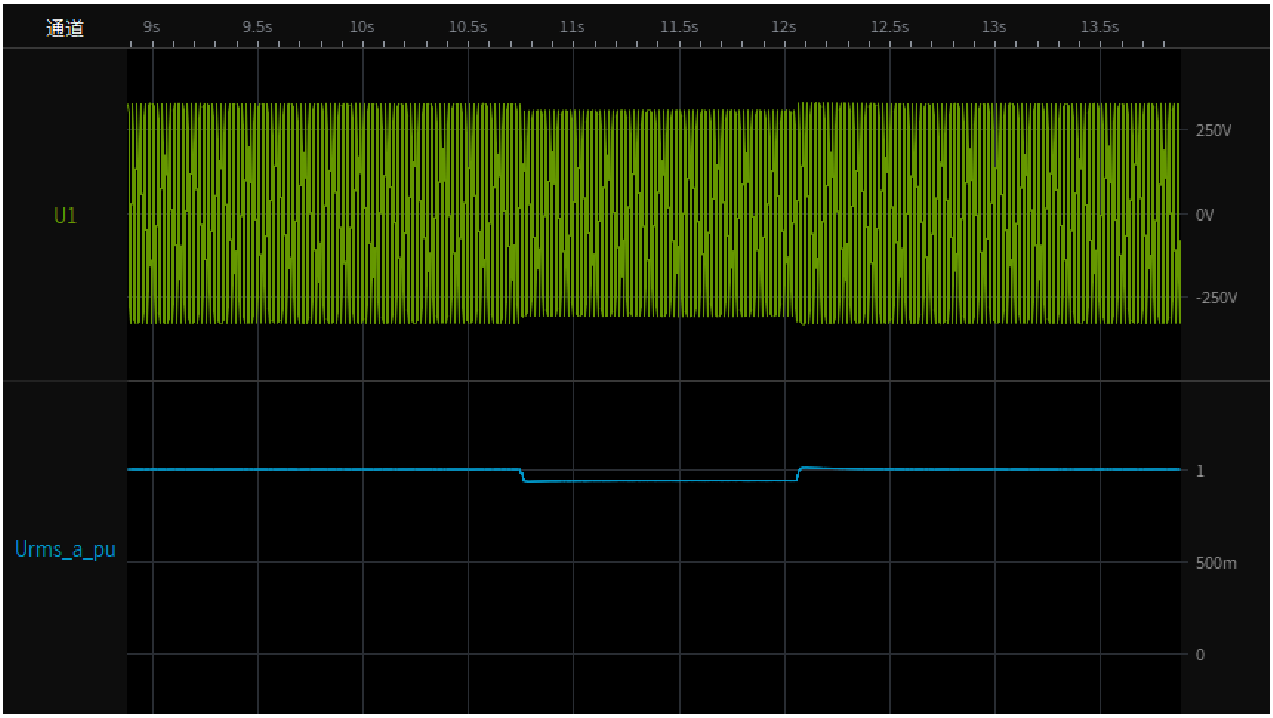


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

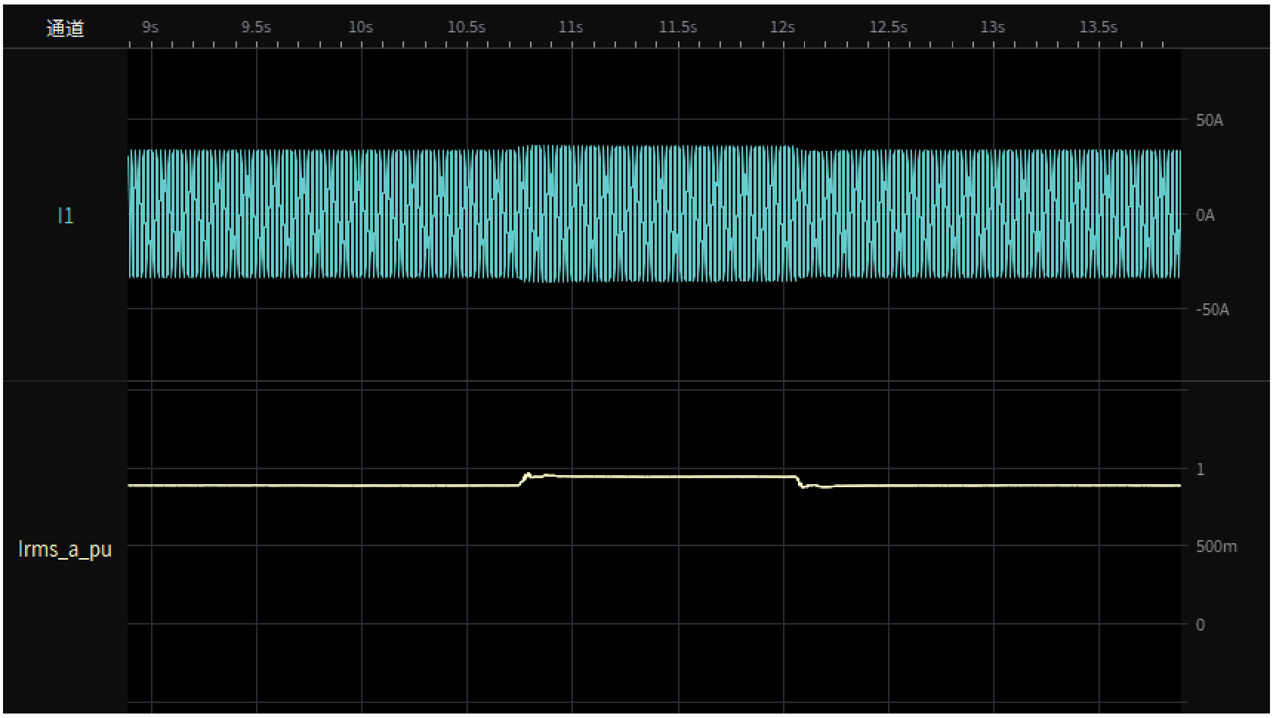


Test 4a-2.2 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

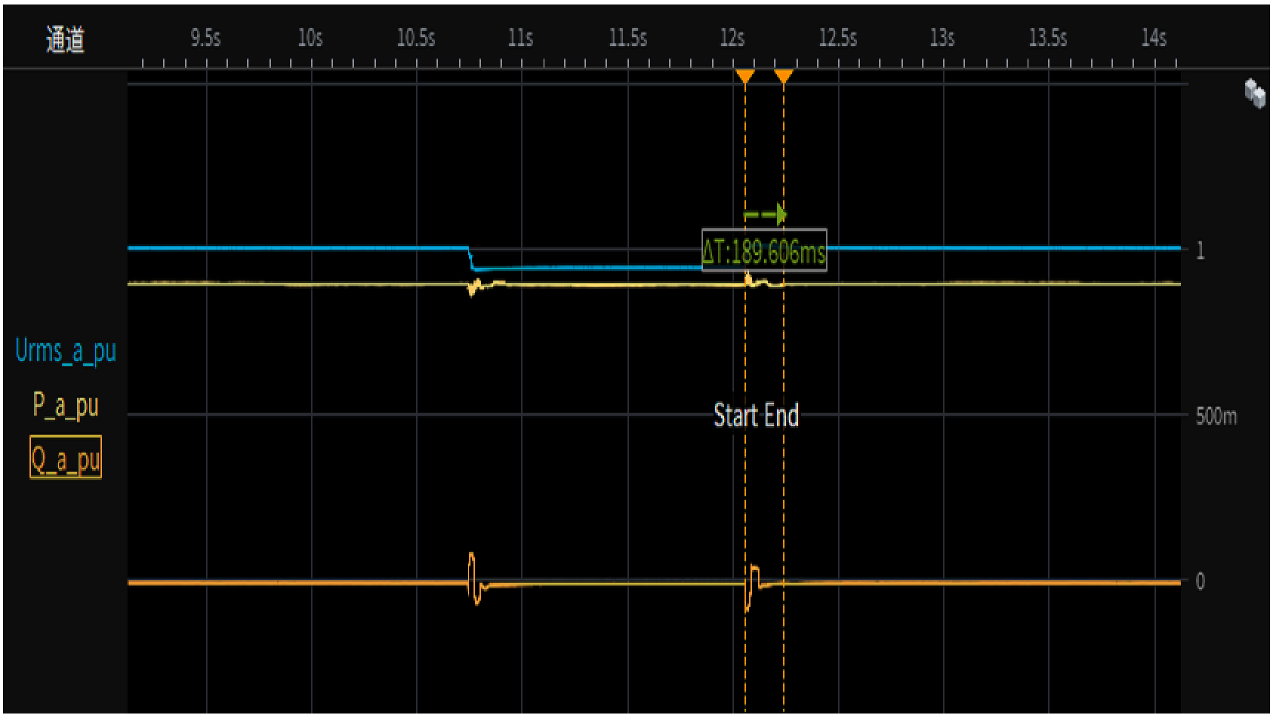


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

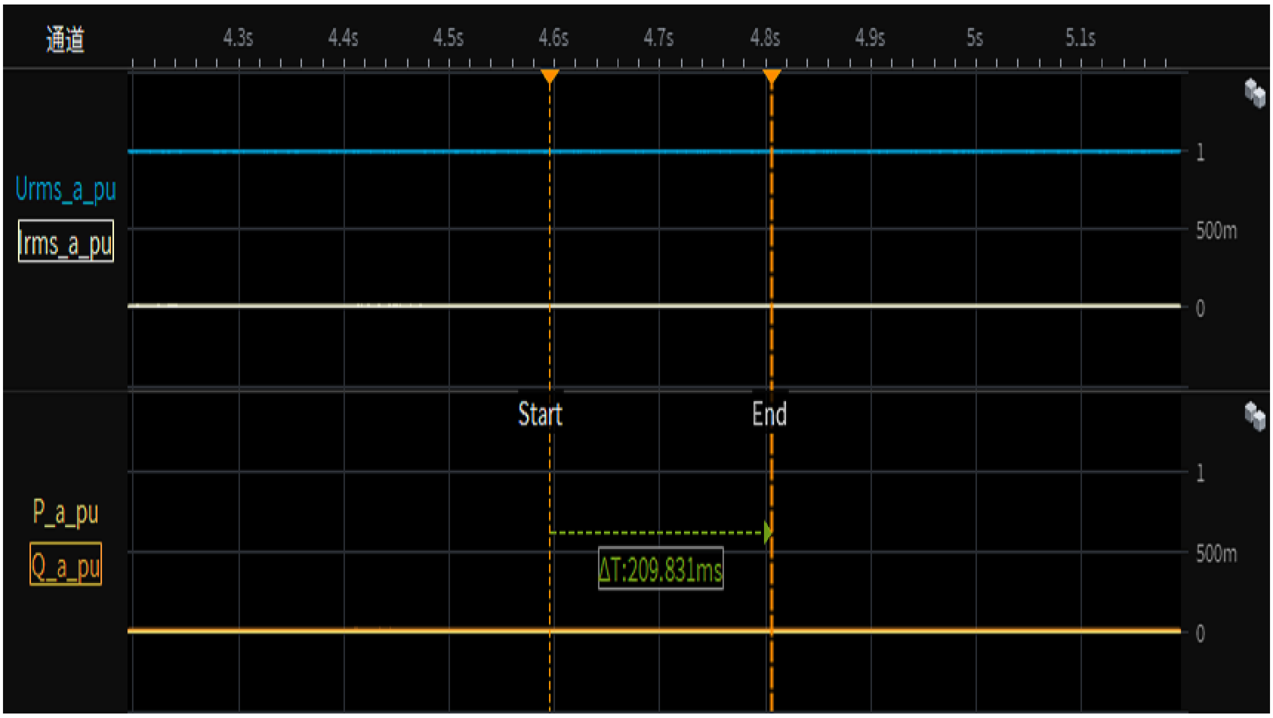


Test 4a-2.4 Depth of fault phase: 0.75p.u.,two-phase-asymmetrical (type D), 95% load
restoring time

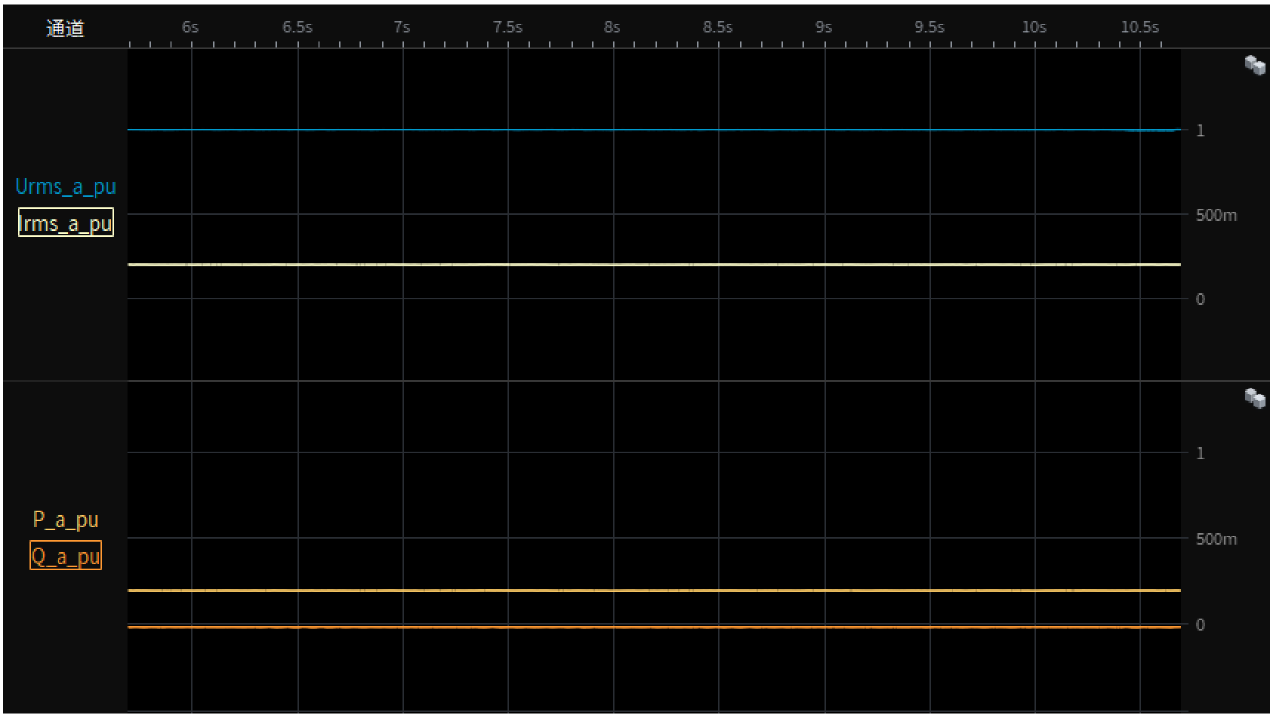


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

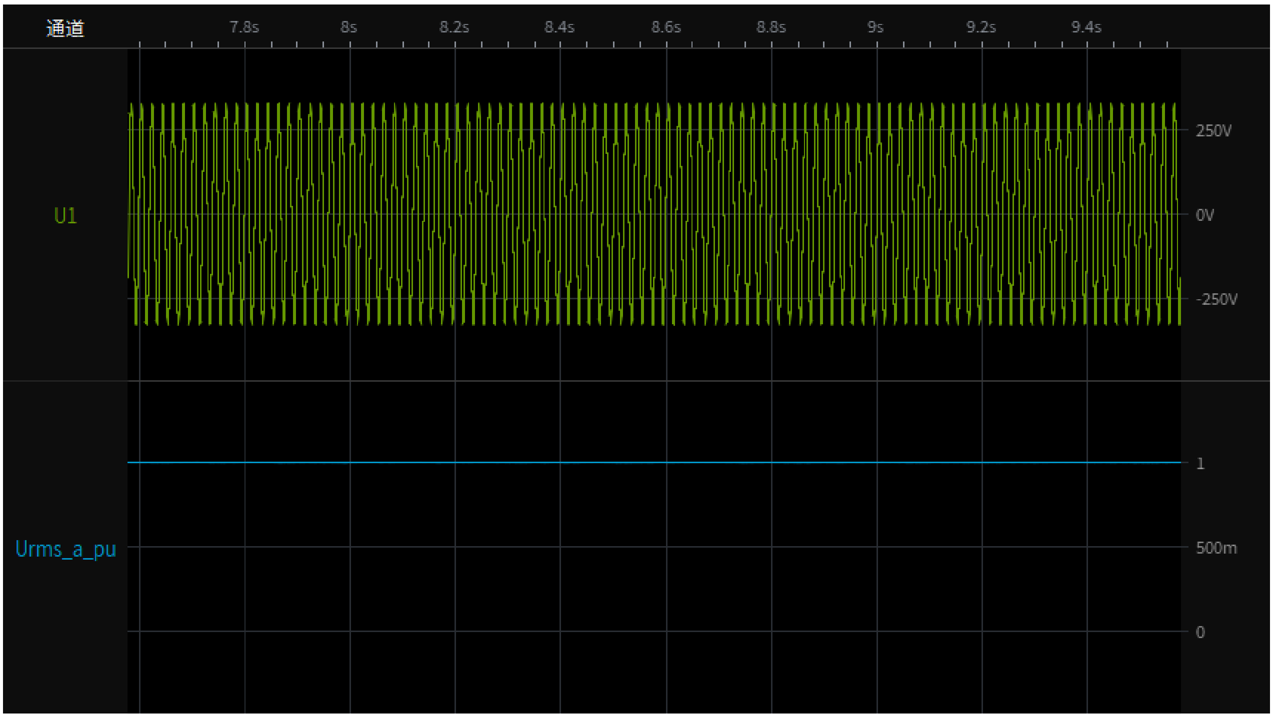


Test 5-1.1 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),20% load
Test overview(voltage,current,active and reactive power)

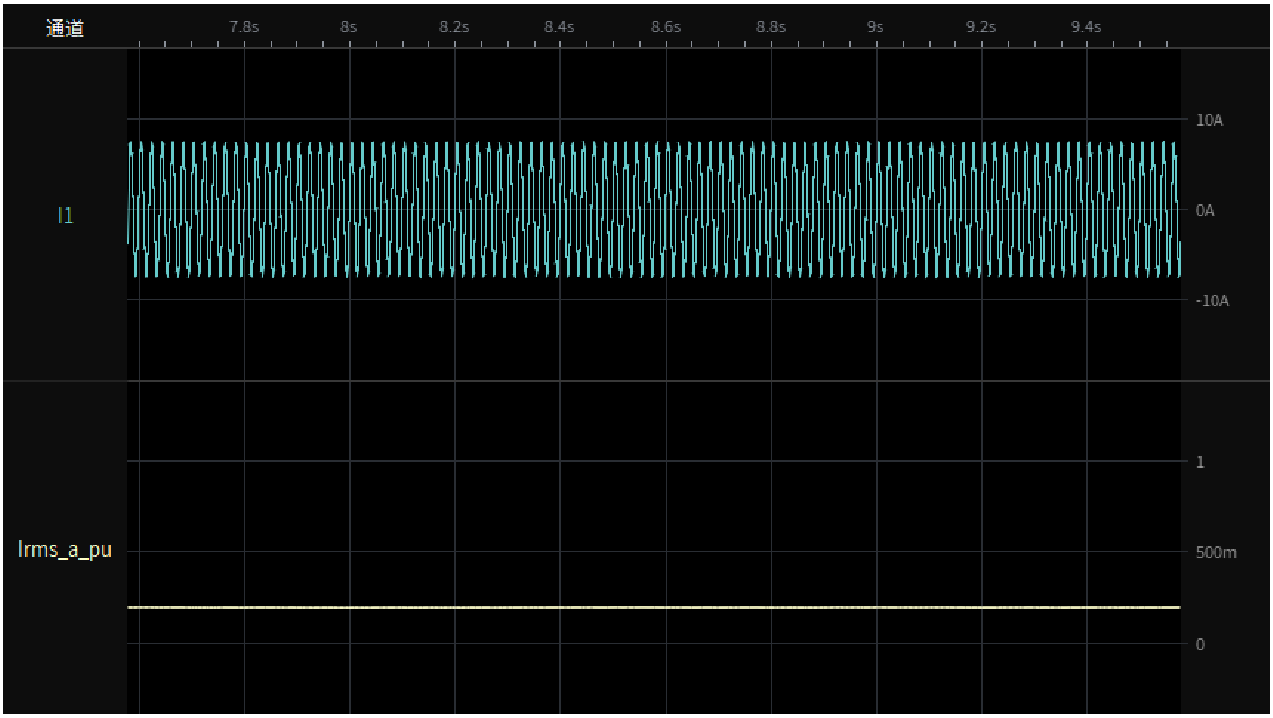


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

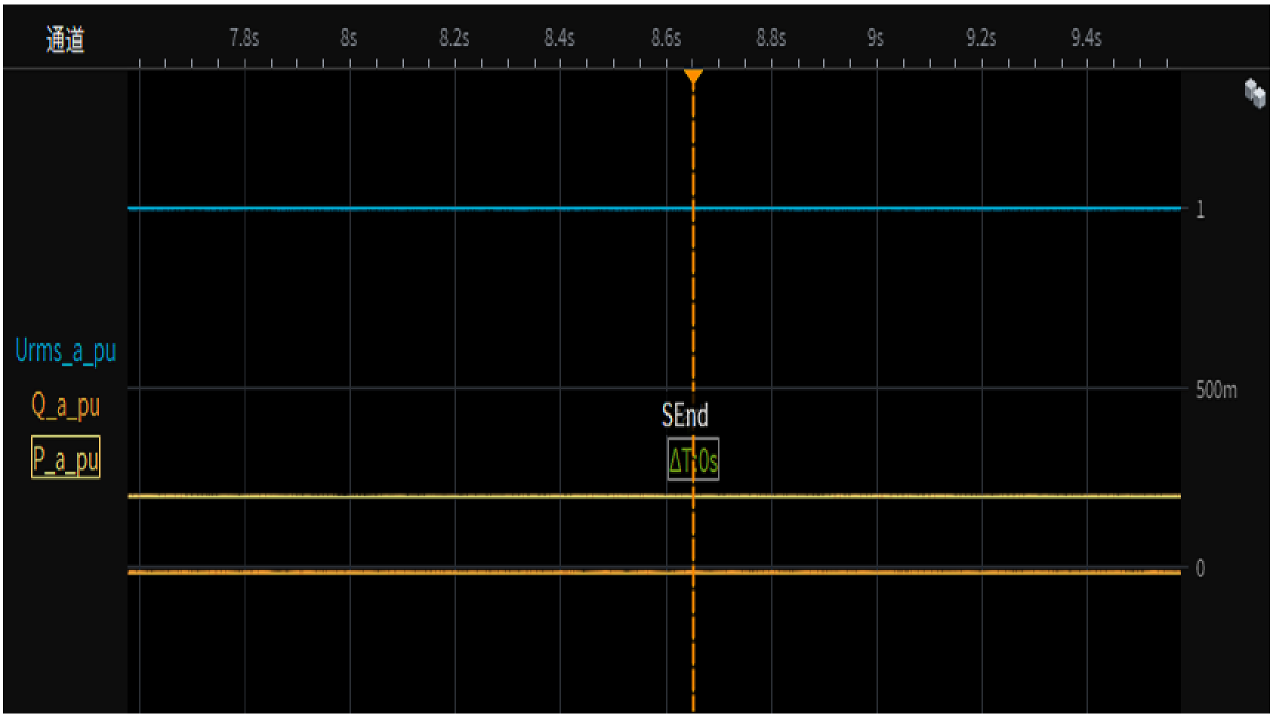


Test 5-1.3 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),20% load
Instantaneous curve and RMS value of phase currents

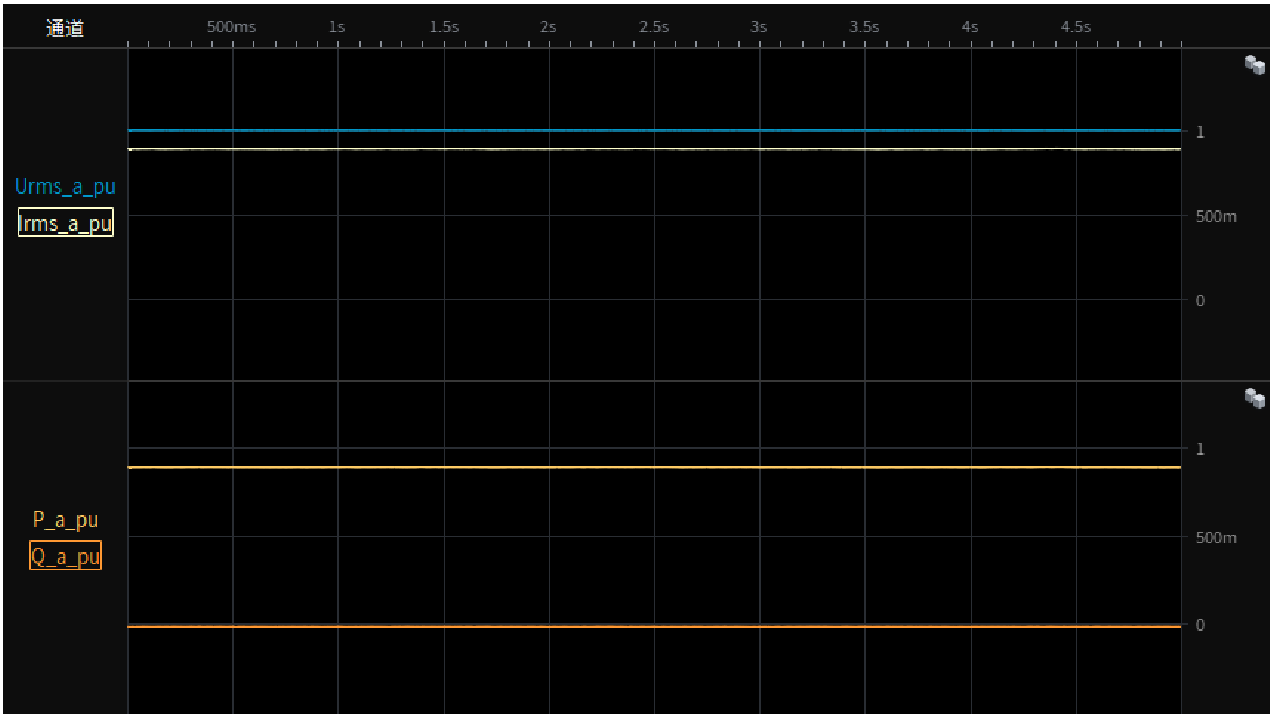


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

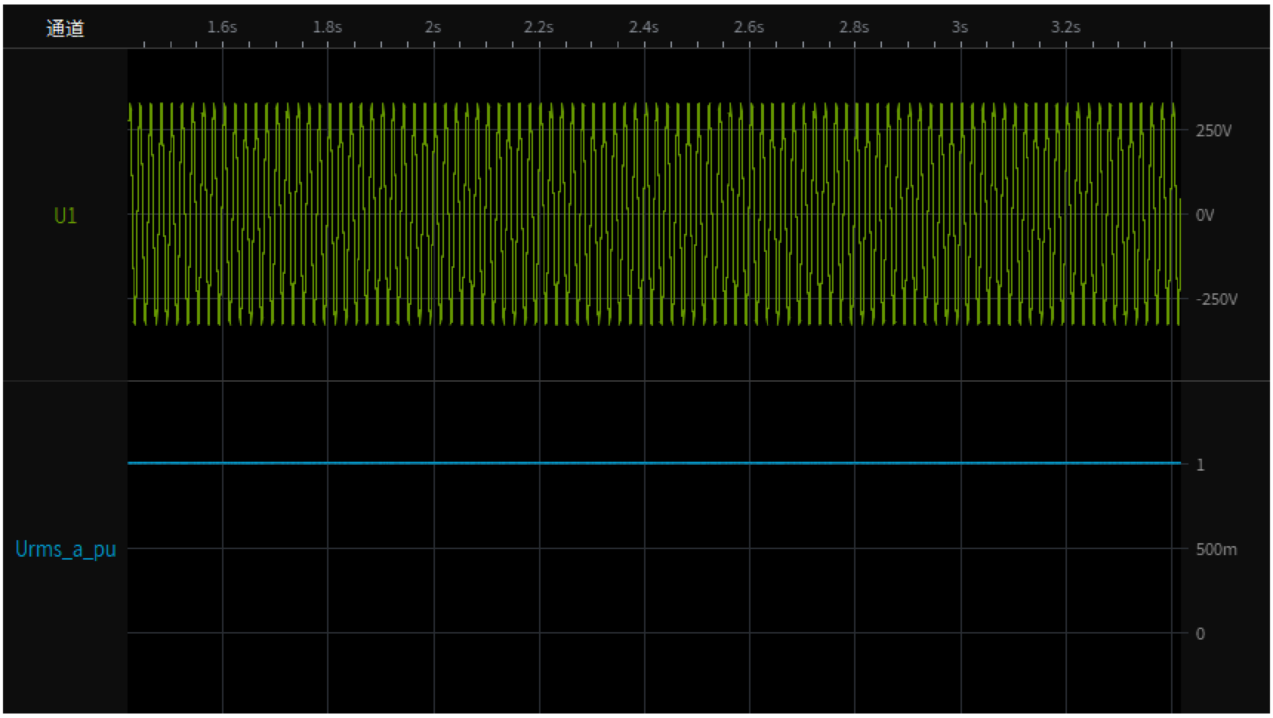


Test 5-2.1 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),95% load Test overview(voltage,current,active and reactive power)

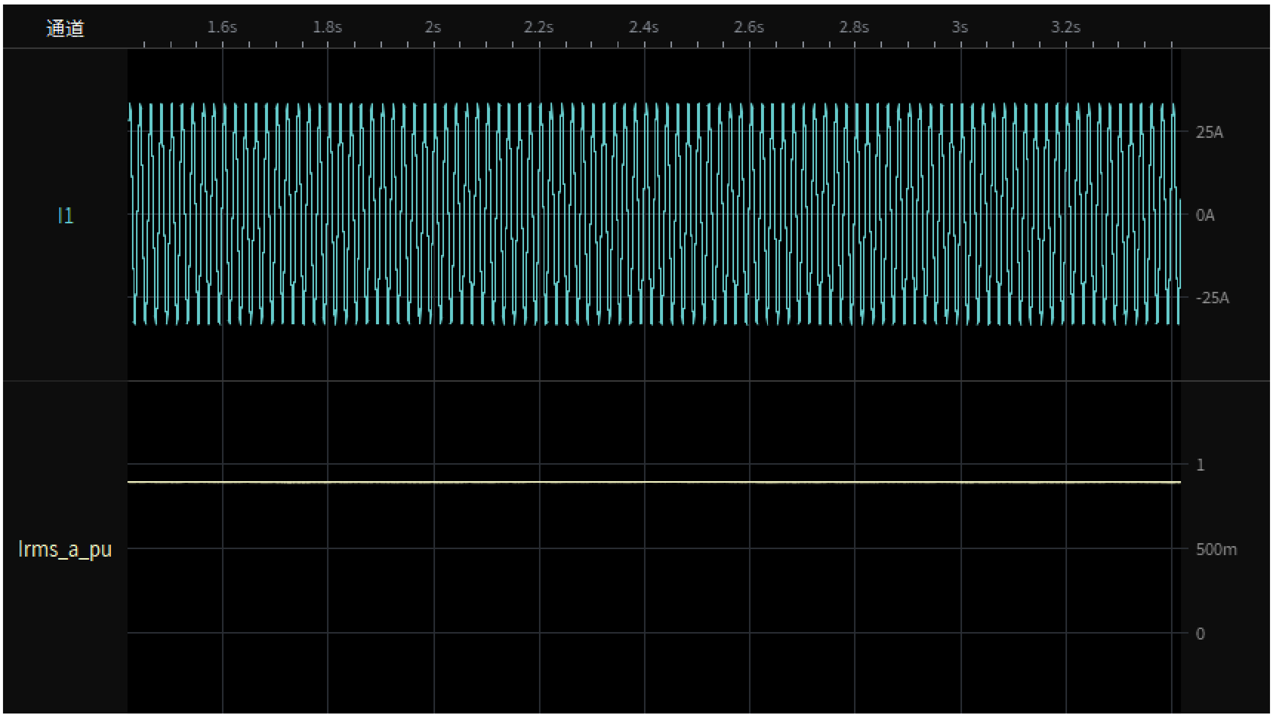


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

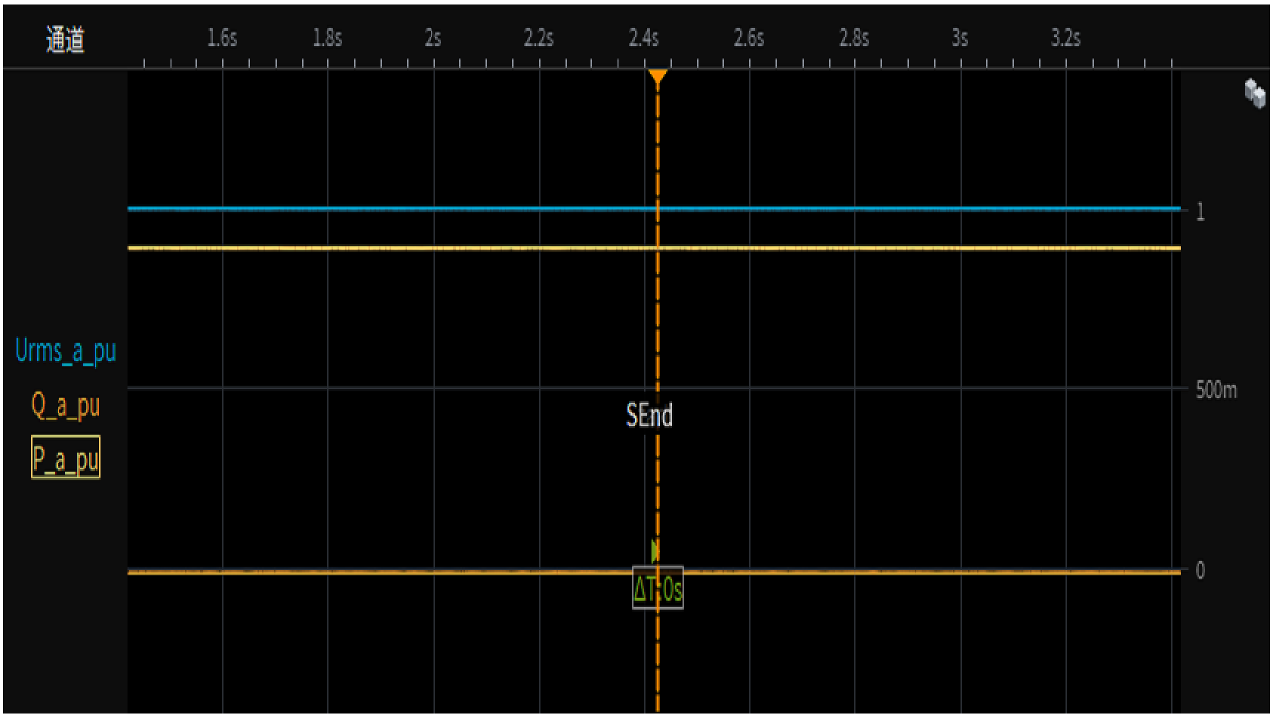


Test 5-2.3 Depth of fault phase: 0.1p.u.,LV two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase currents

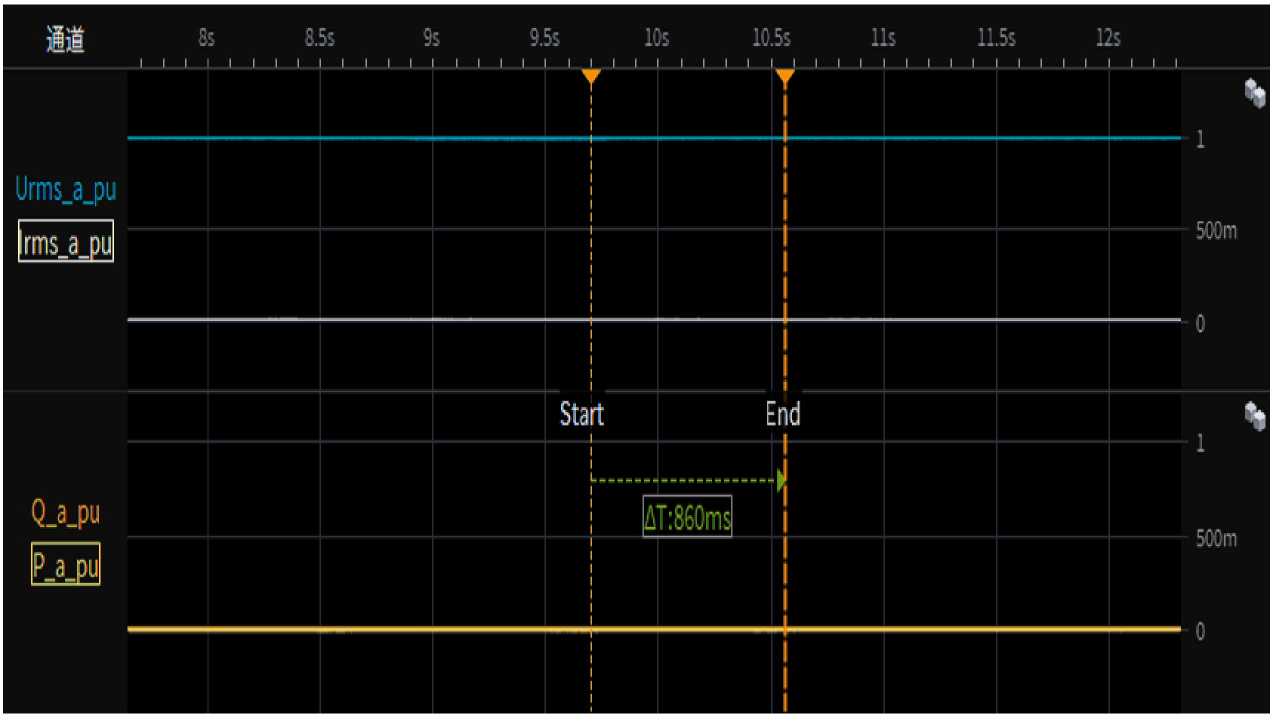


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

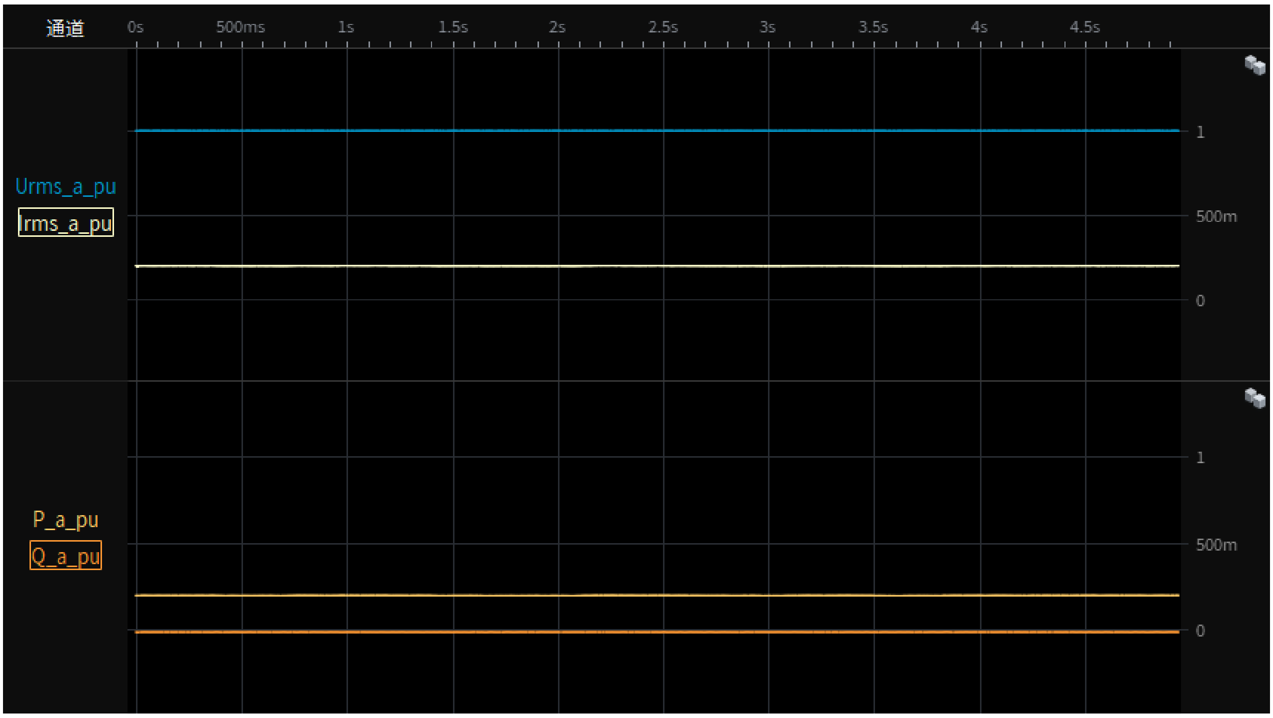


Test 6-Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D), 0% load Test overview(voltage,current,active and reactive power)

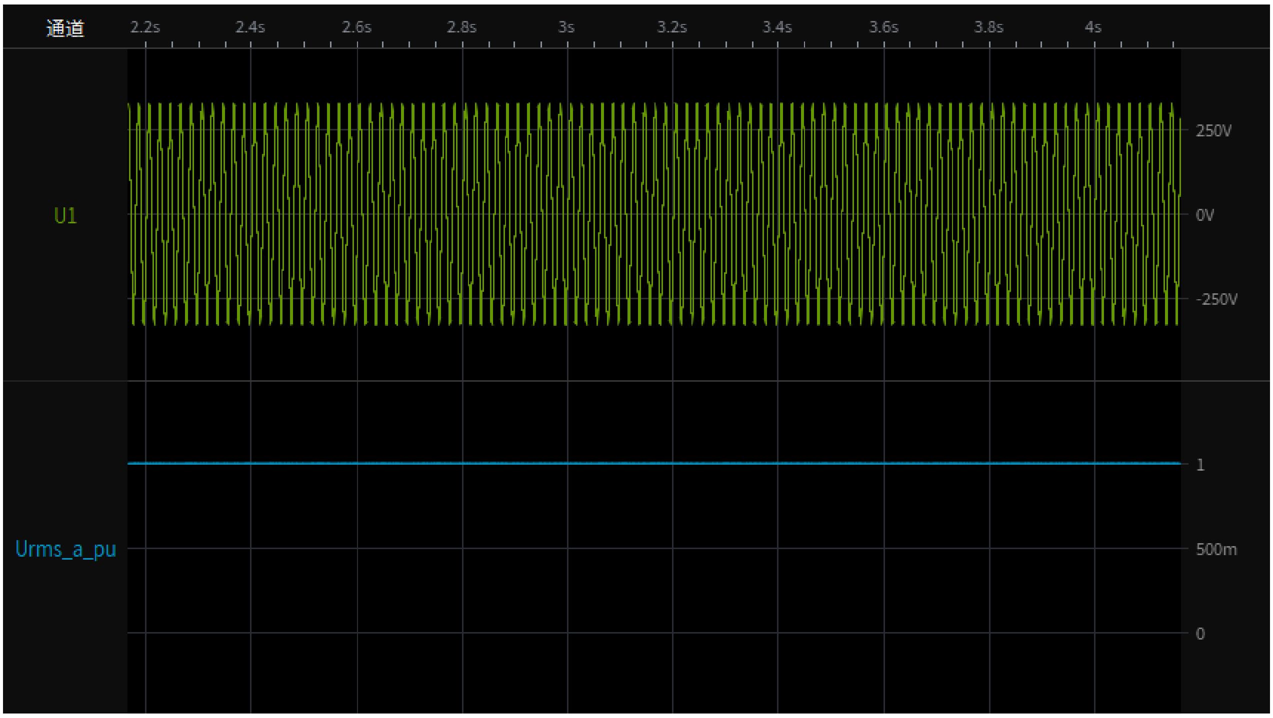


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

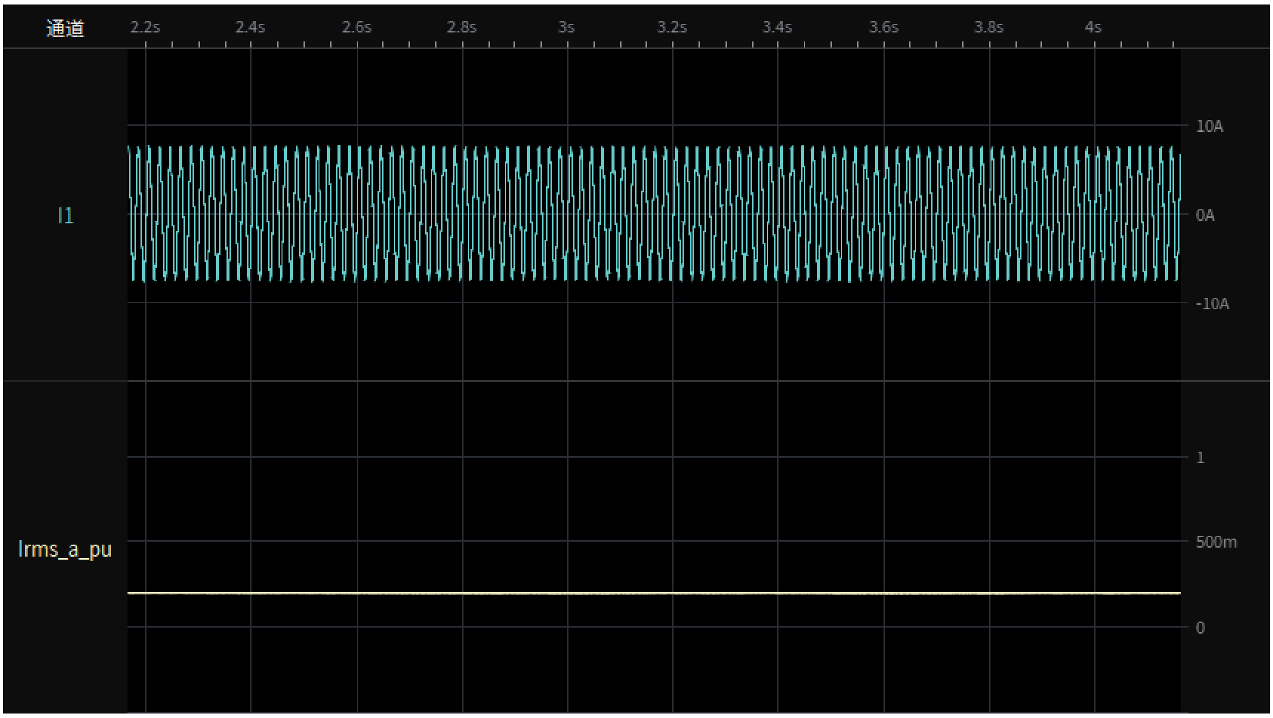
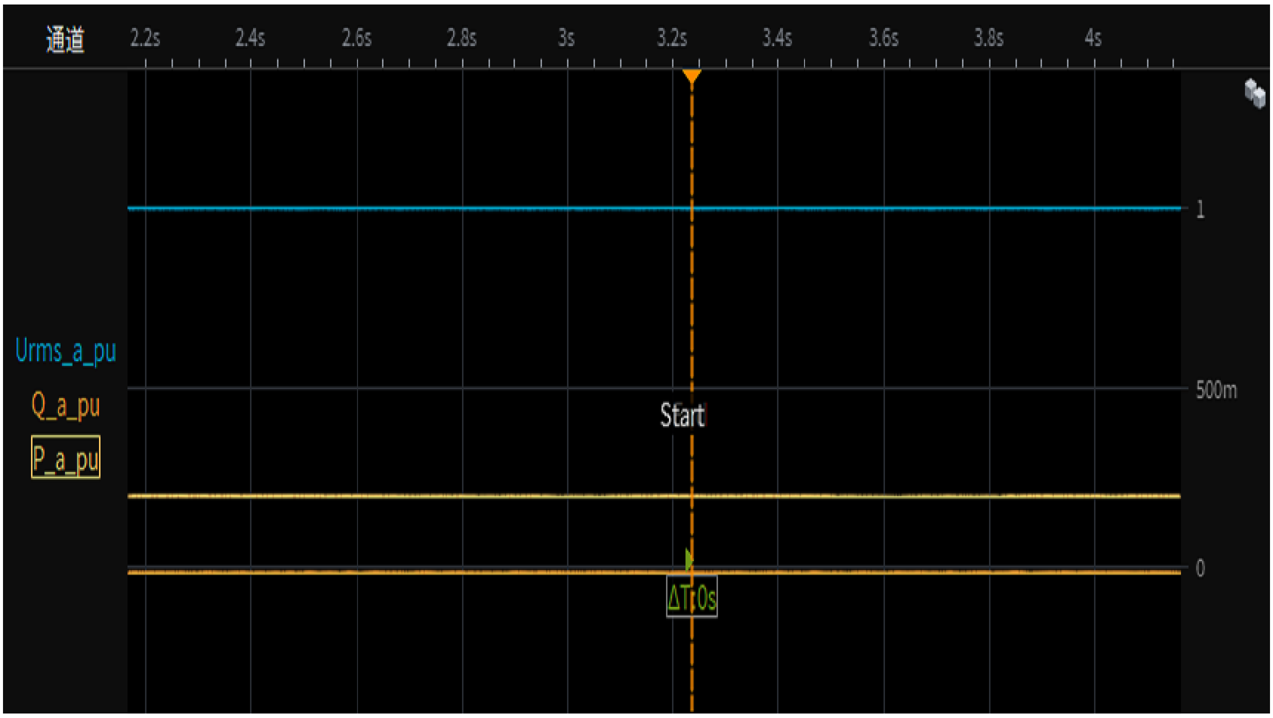
Test 6-1.1 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),20% load
Test overview(voltage,current,active and reactive power)



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

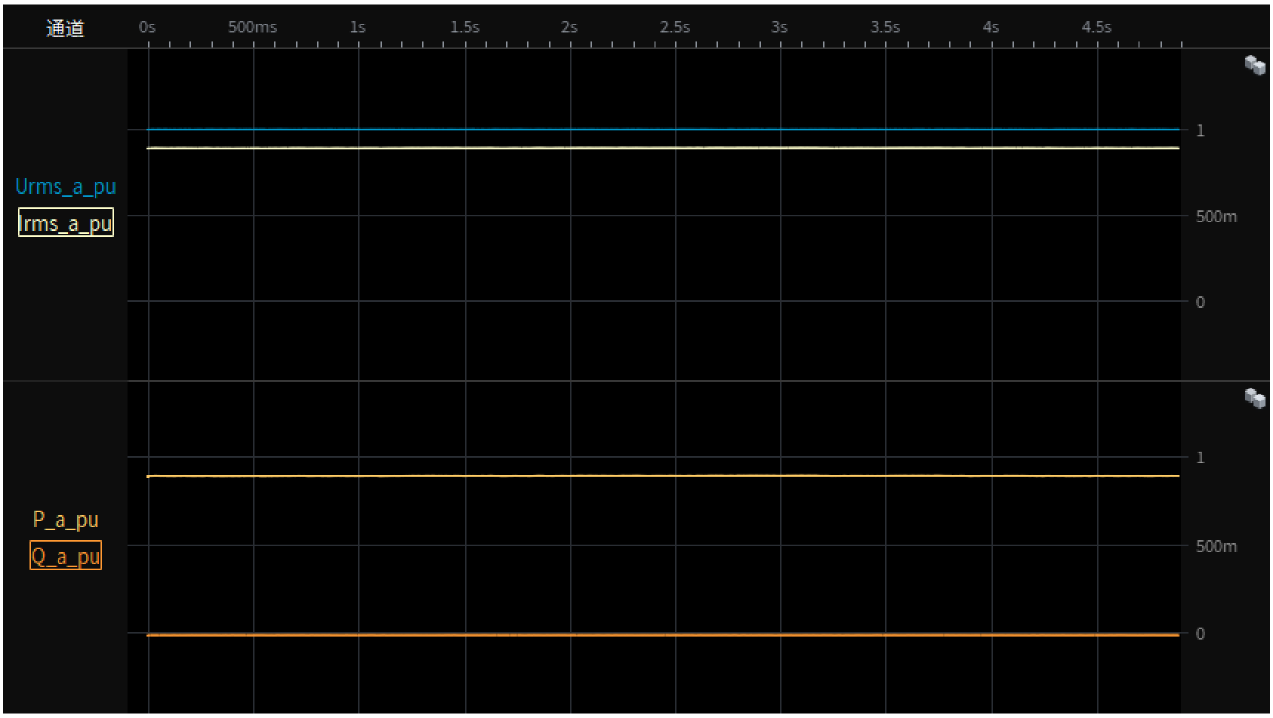


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

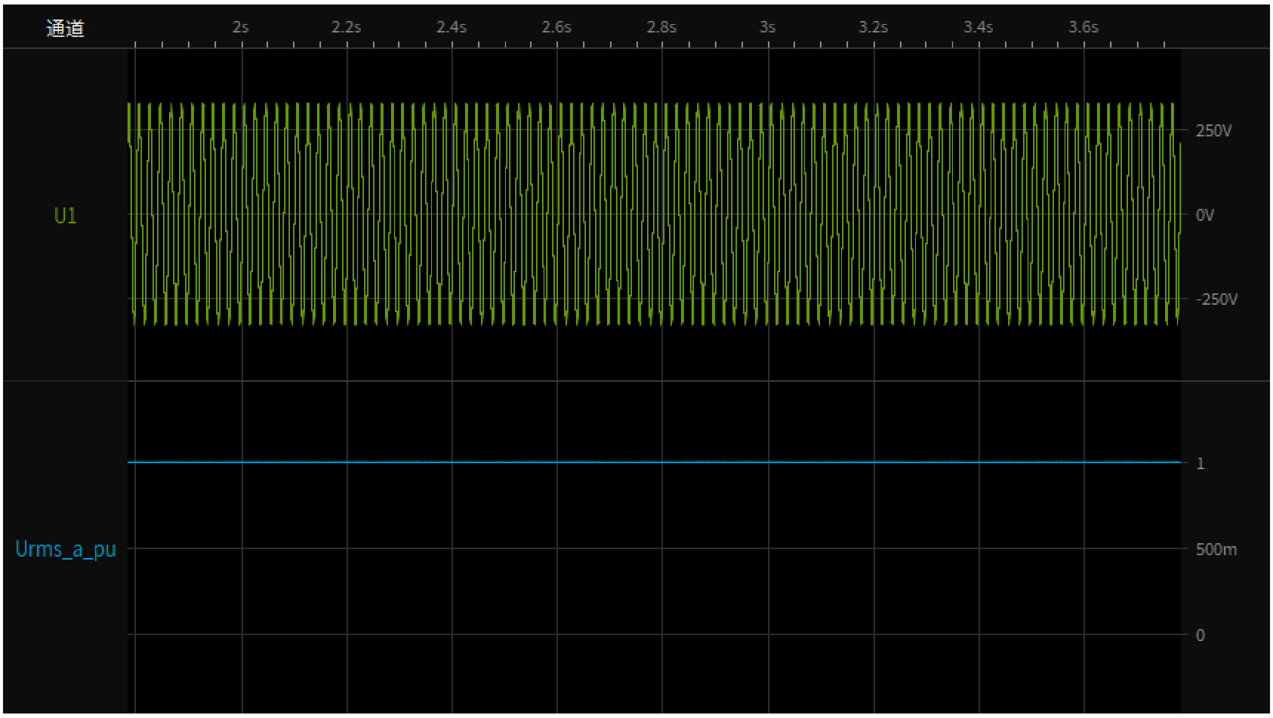
Test 6-1.3 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),20% load Instantaneous curve and RMS value of phase currents

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

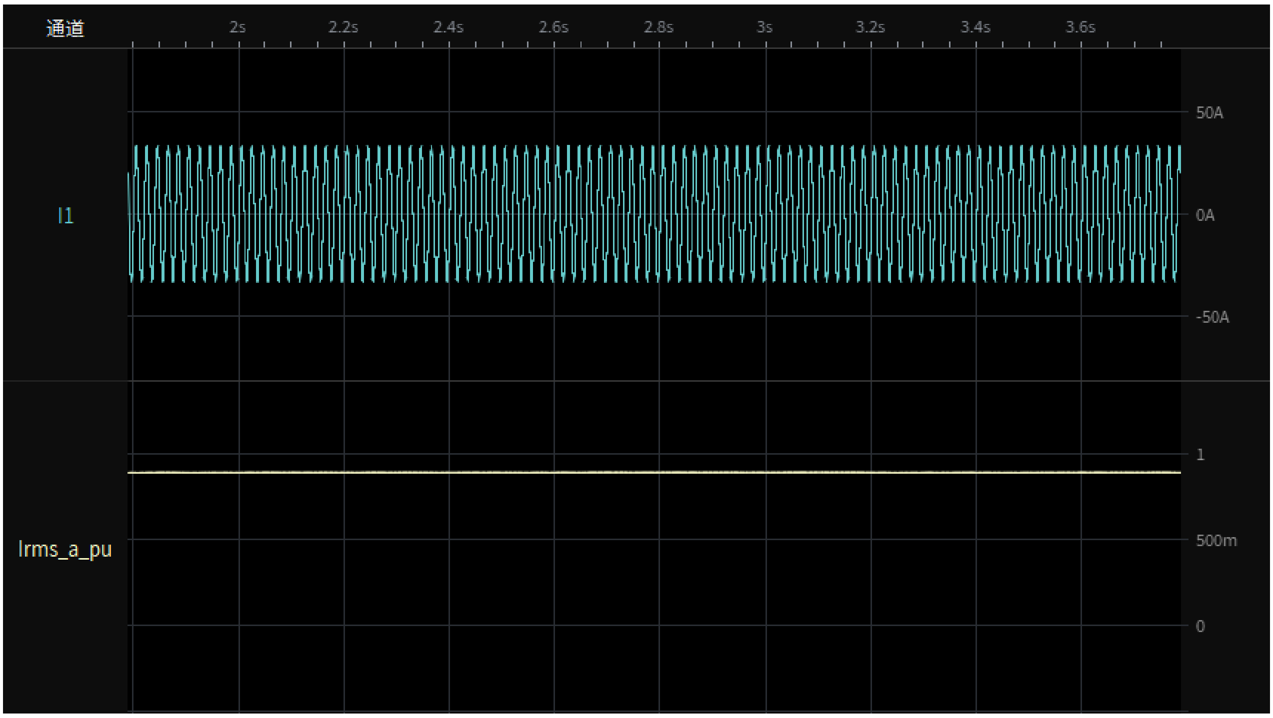
Test 6-2.1 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),95% load
Test overview(voltage,current,active and reactive power)



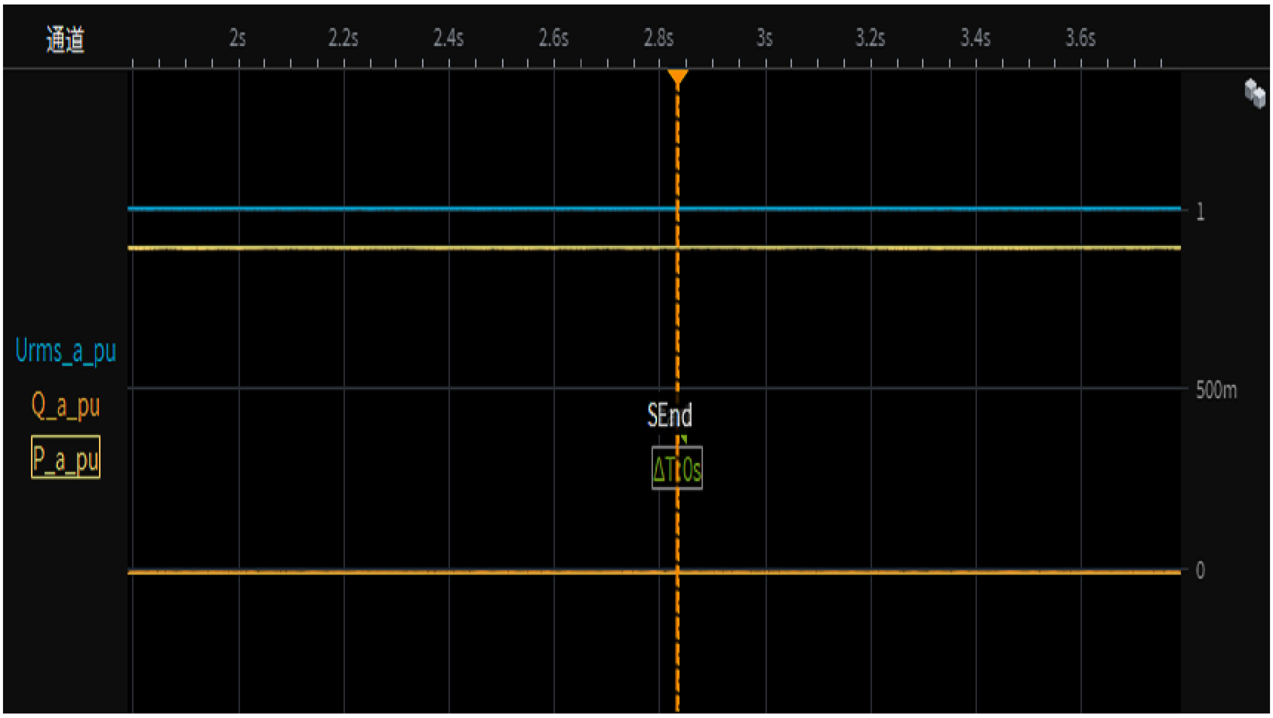
Test 6-2.2 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages



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

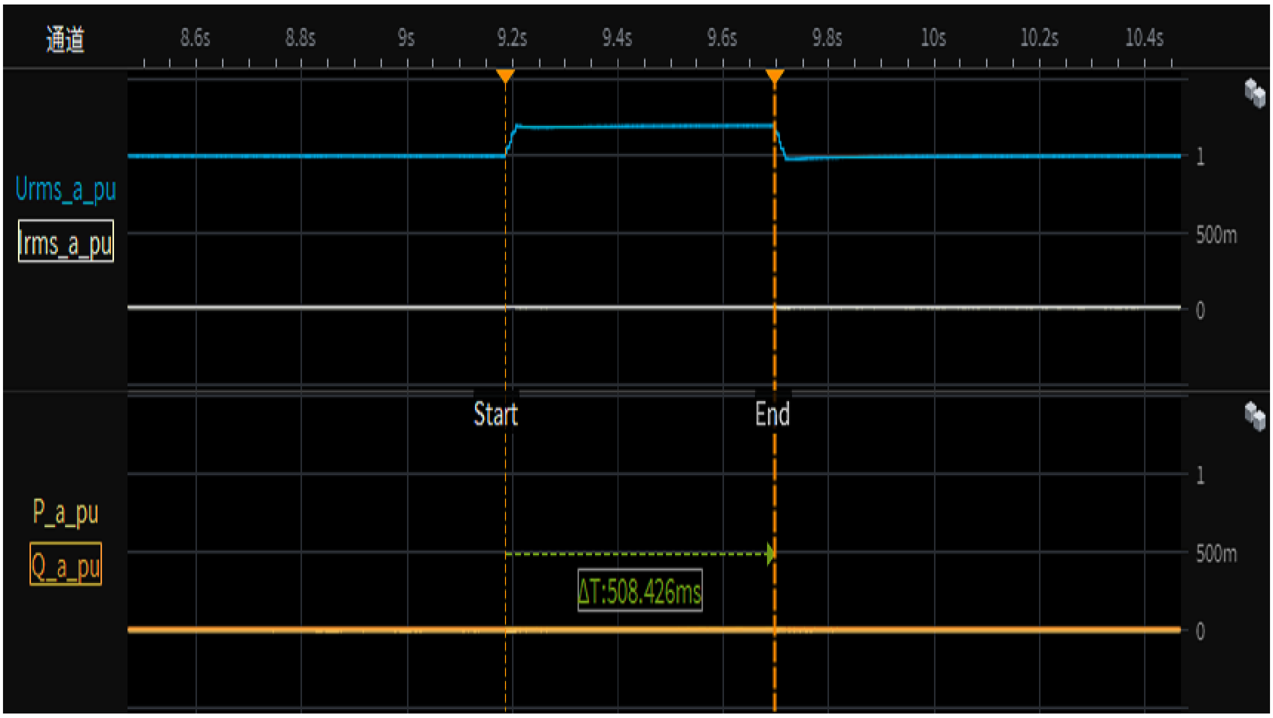


Test 6-2.4 Depth of fault phase: 0.5p.u.,LV two-phase-asymmetrical (type D), 95% load
restoring time

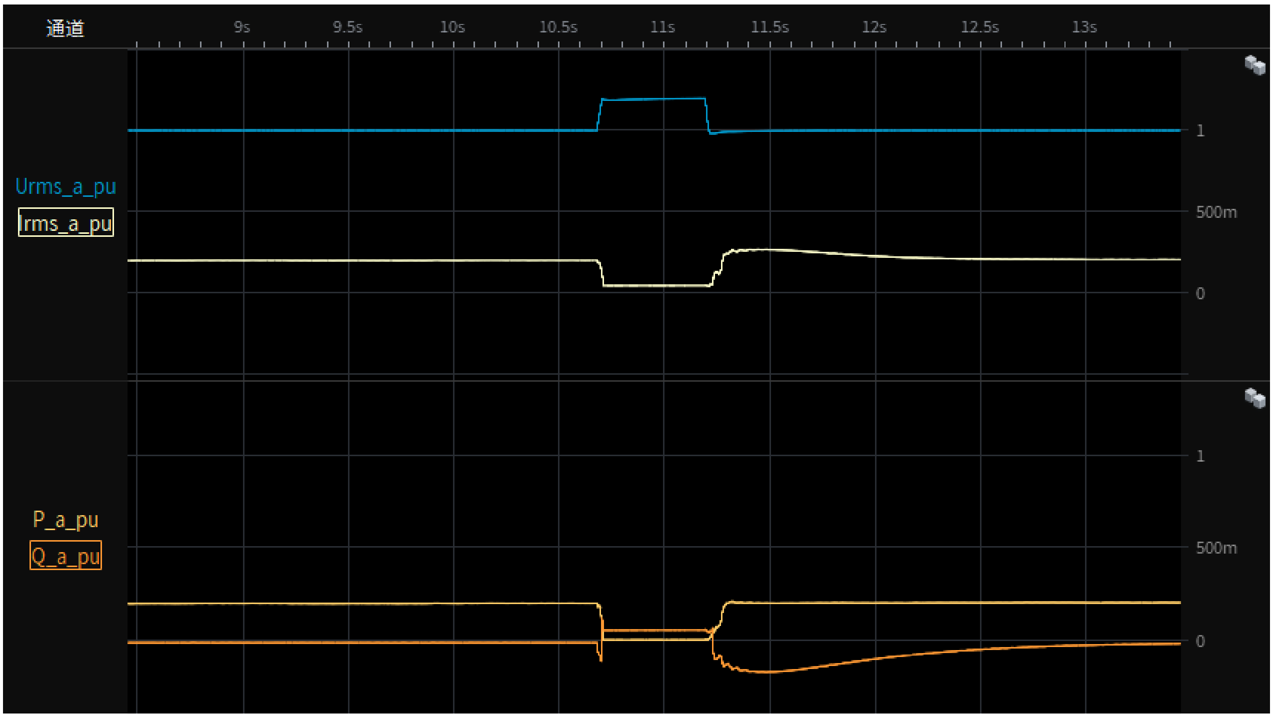


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

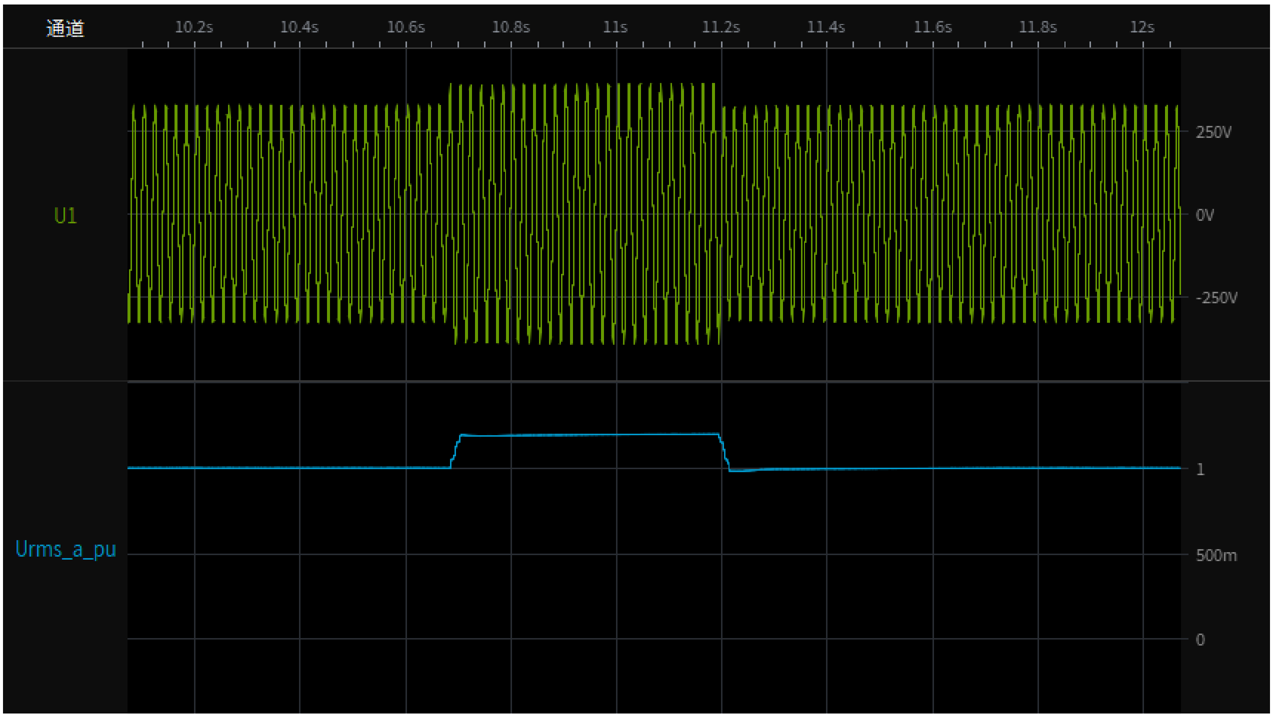


Test 7-1.1 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),20% load
Test overview(voltage,current,active and reactive power)

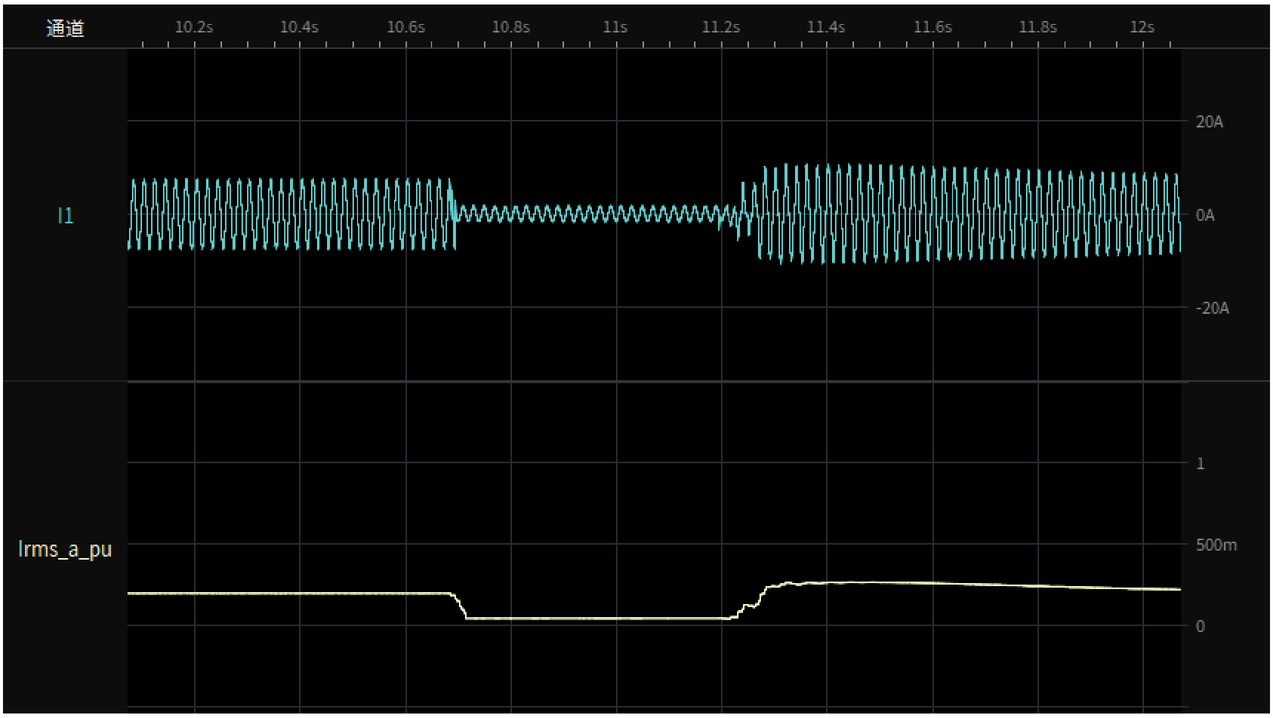


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

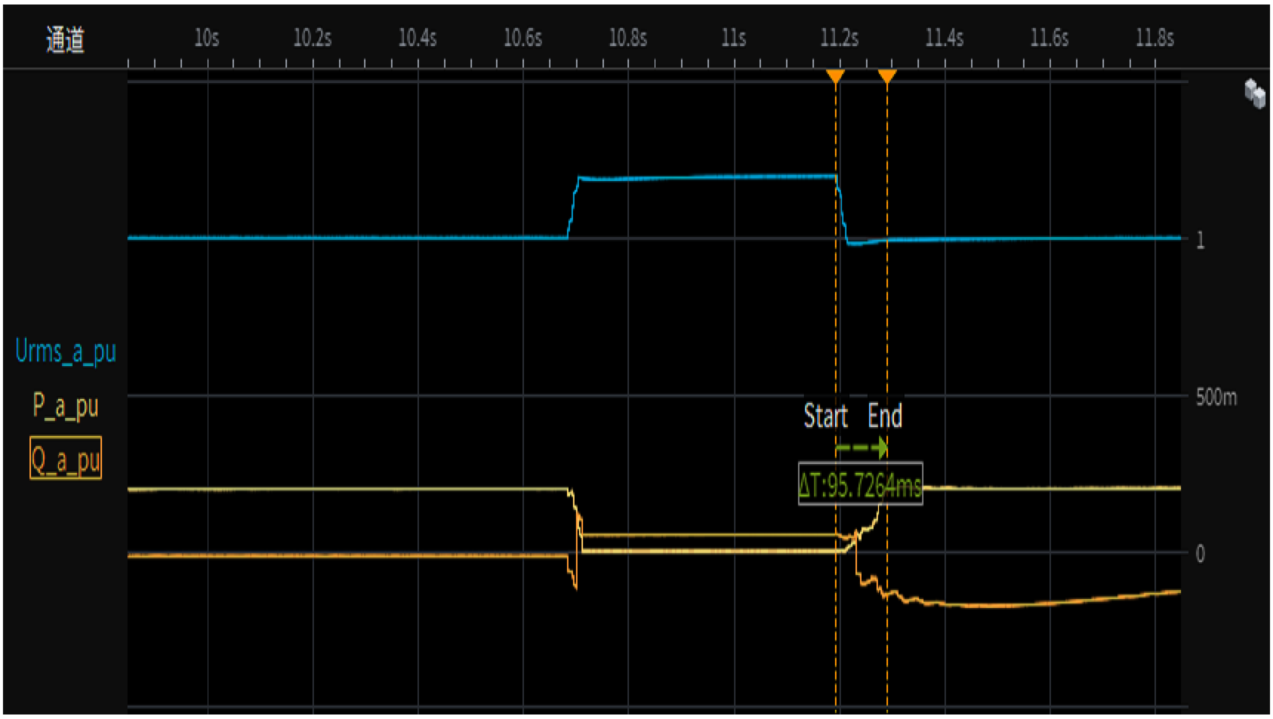


Test 7-1.3 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase currents

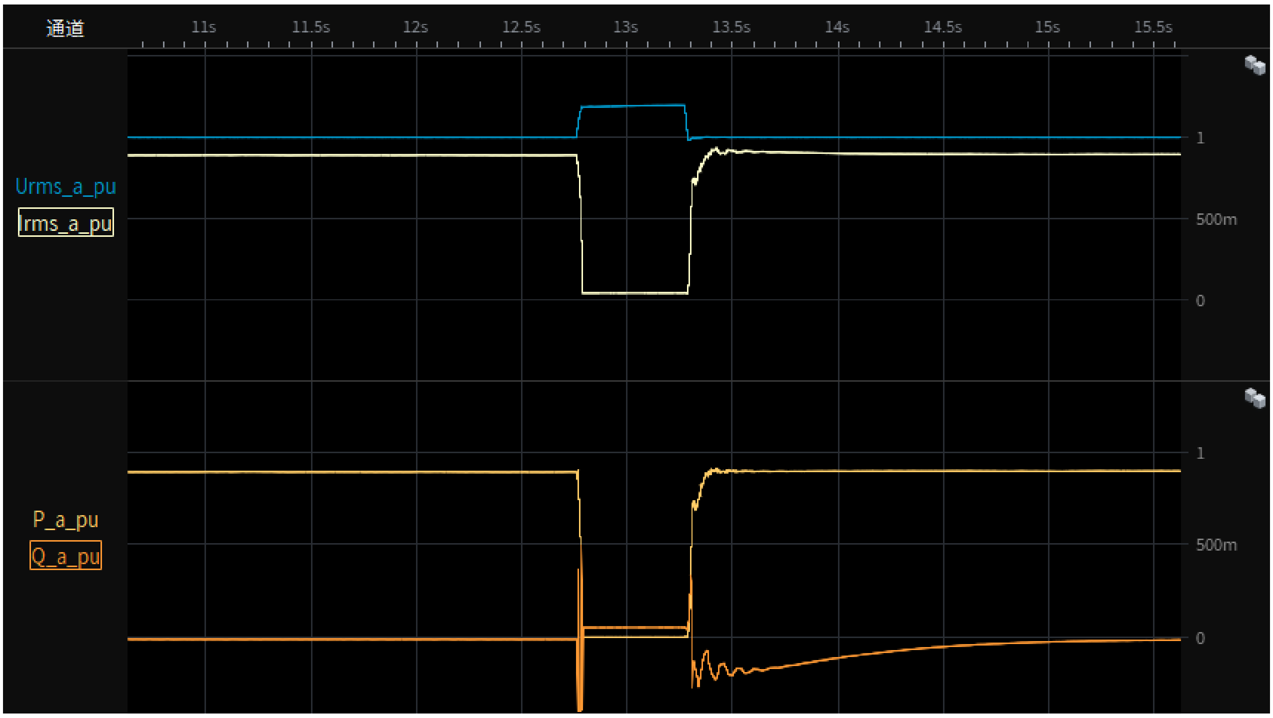


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

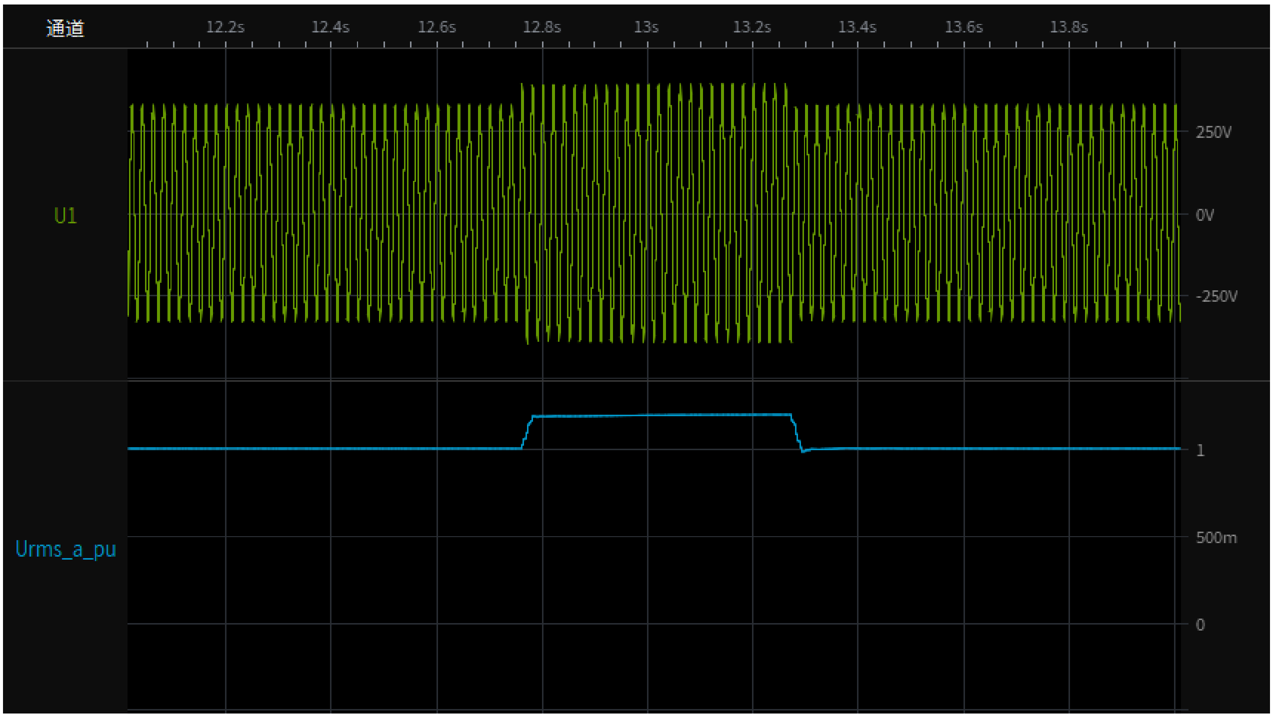


Test 7-2.1 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),95% load Test overview(voltage,current,active and reactive power)

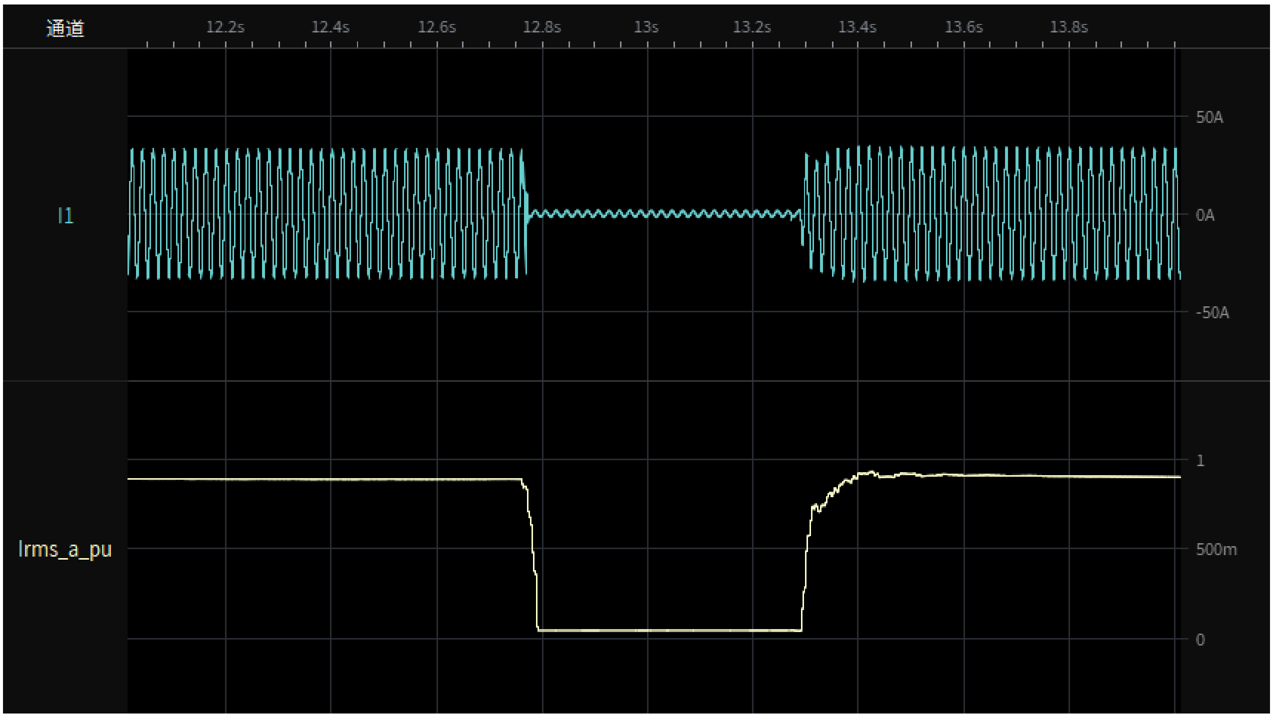


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

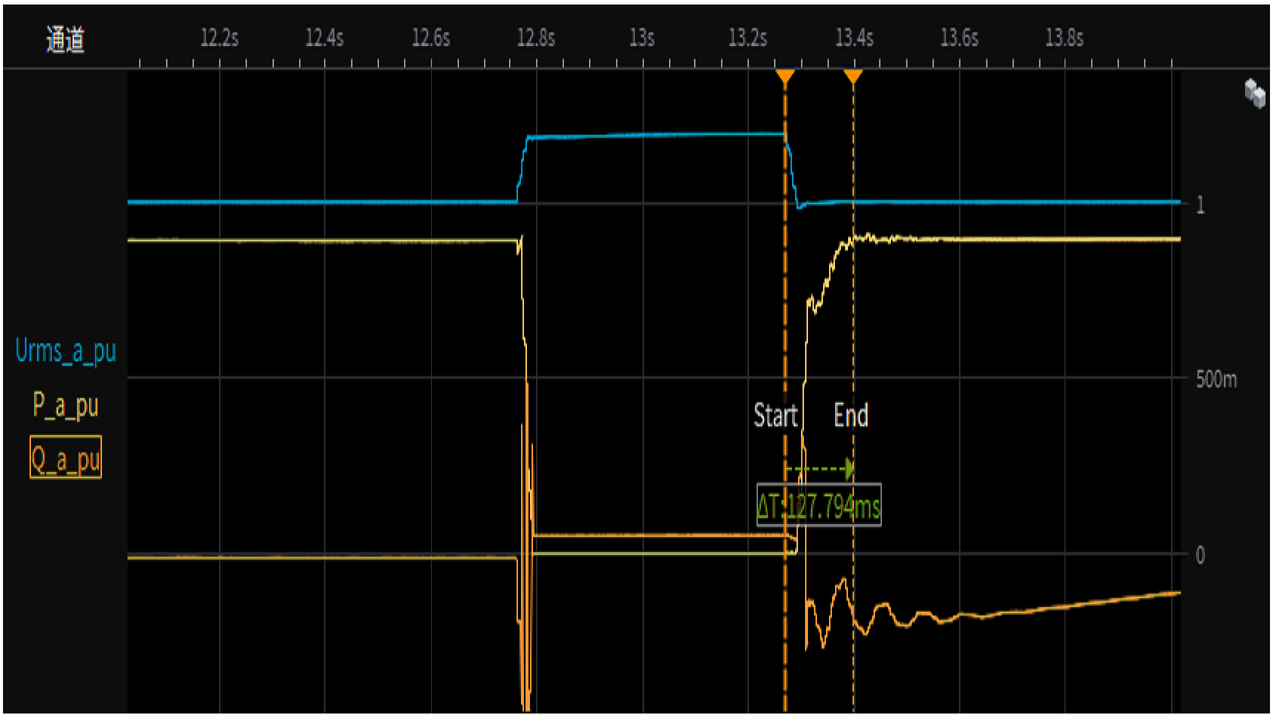


Test 7-2.3 Depth of fault phase: 1.20p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase currents

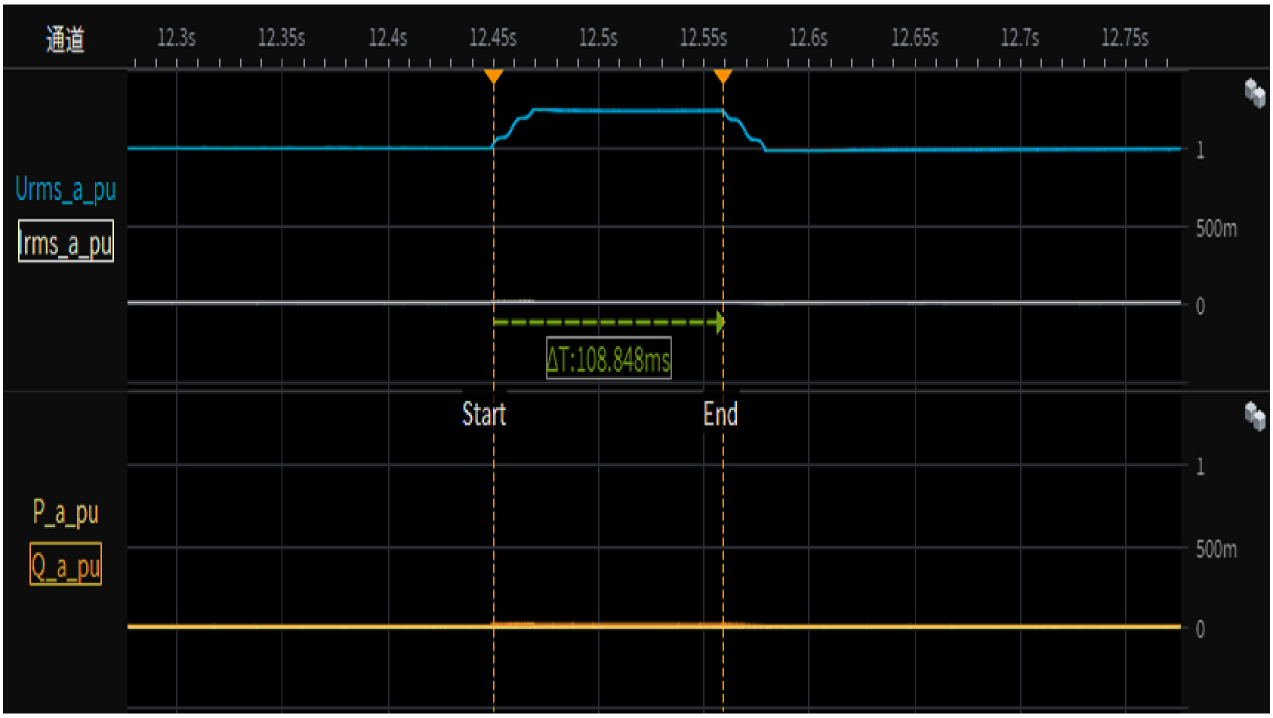


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

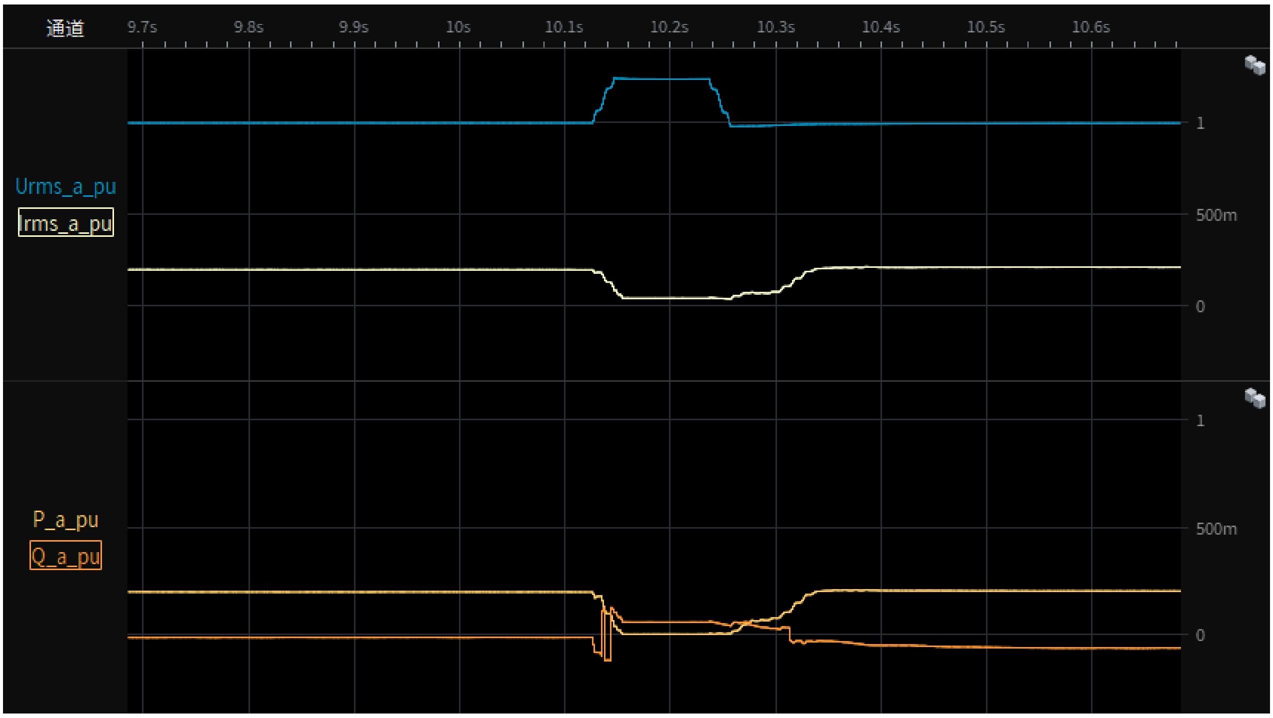


Test 8-Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A), 0% load
Test overview(voltage,current,active and reactive power)

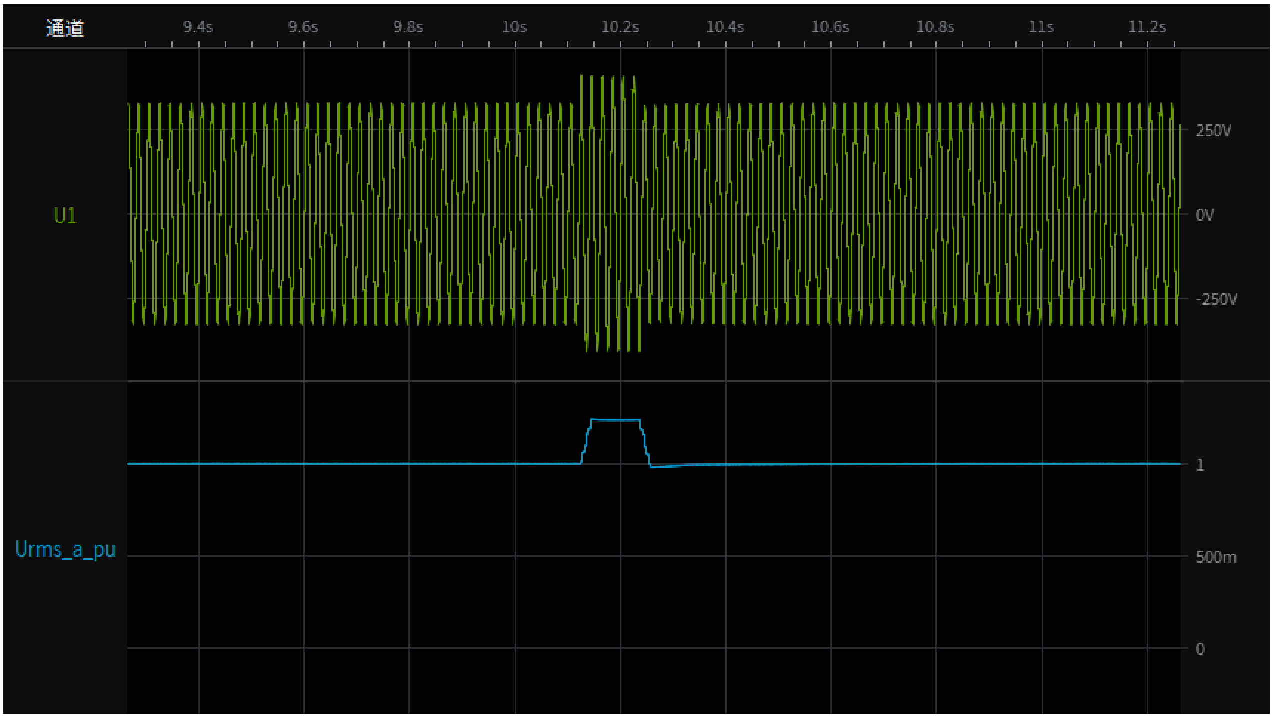


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

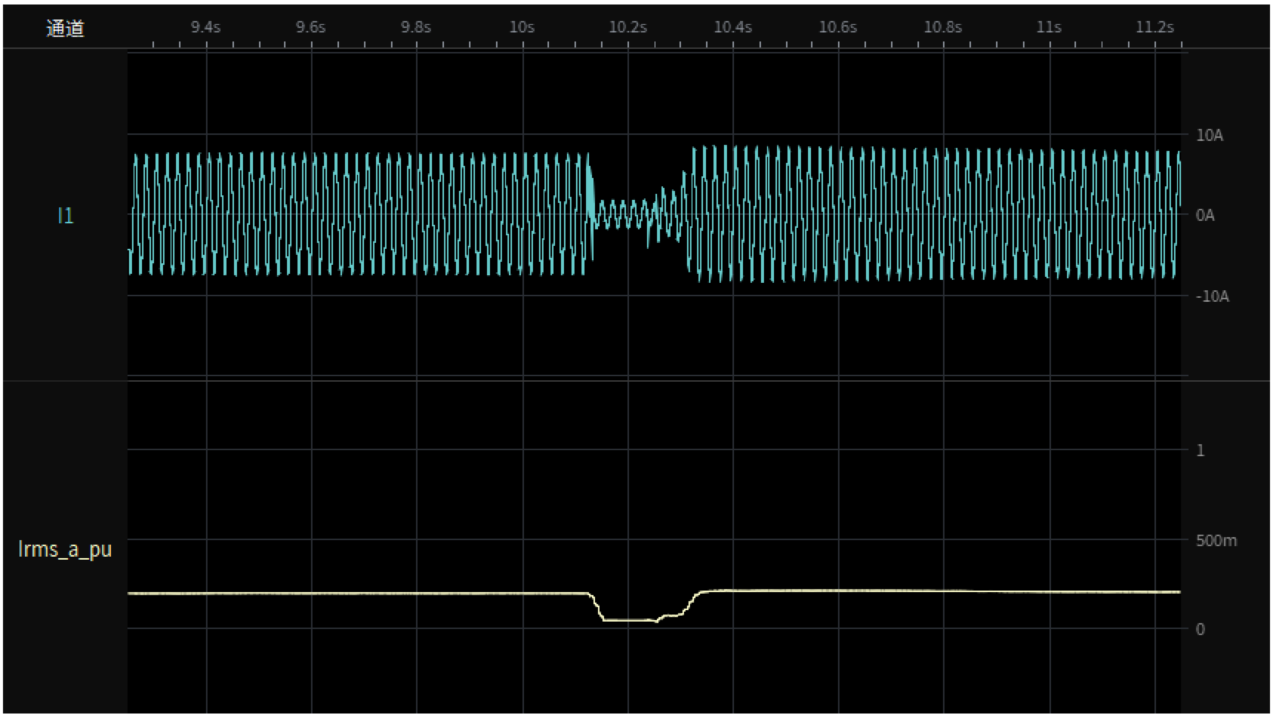


Test 8-1.2 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),20% load
Instantaneous curve and RMS value of phase-to-neutral voltages

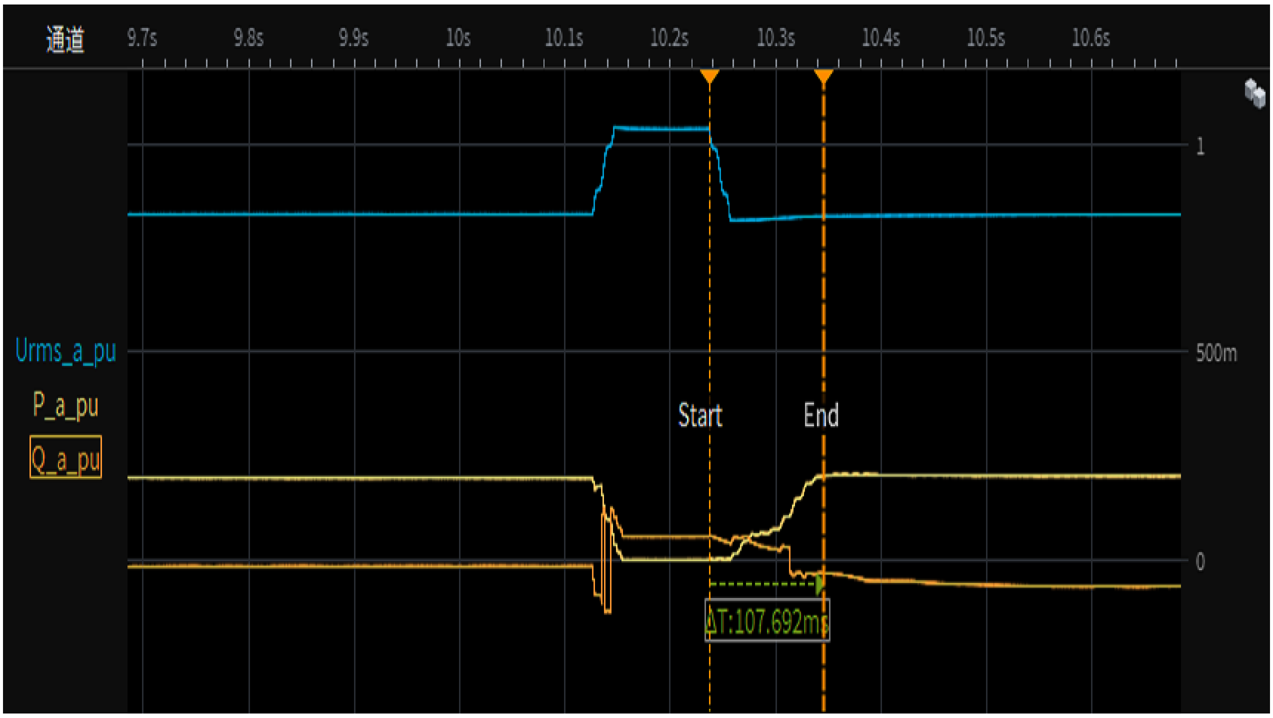


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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

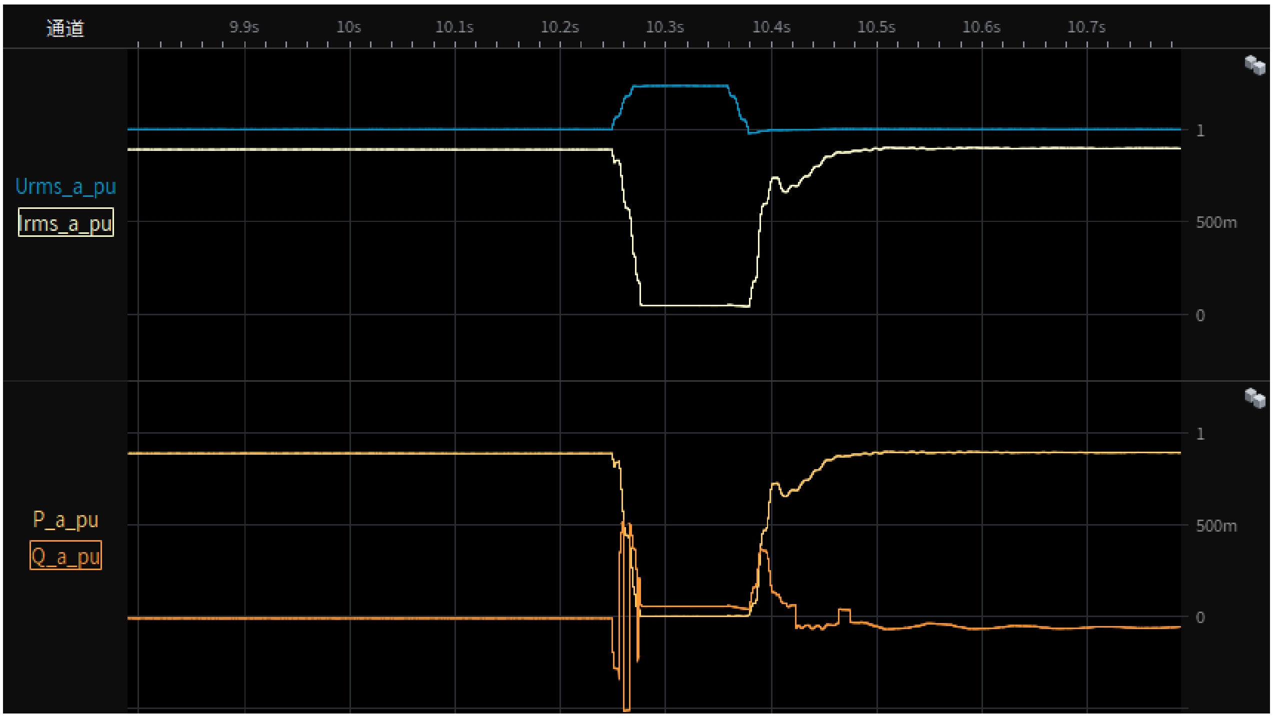


Test 8-1.4 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),20% load
restoring time

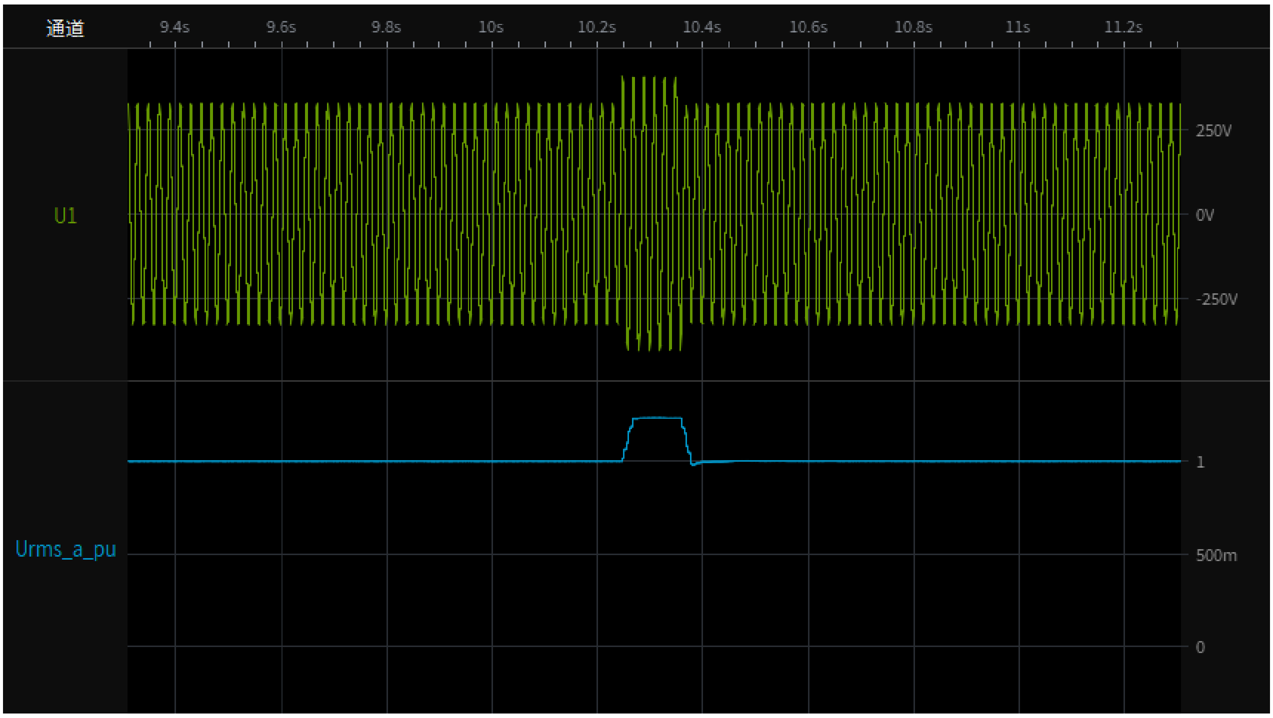


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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)

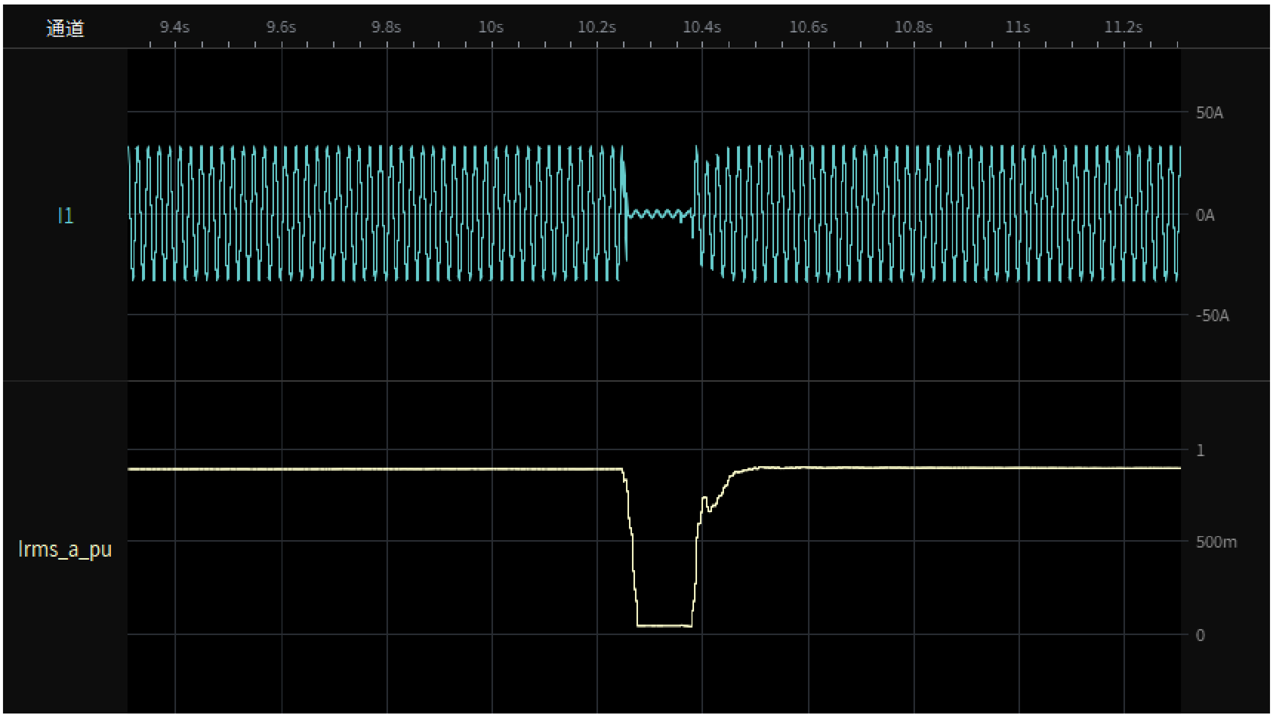


Test 8-2.2 Depth of fault phase: 1.25p.u.,three-phase-symmetrical (type A),95% load
Instantaneous curve and RMS value of phase-to-neutral voltages

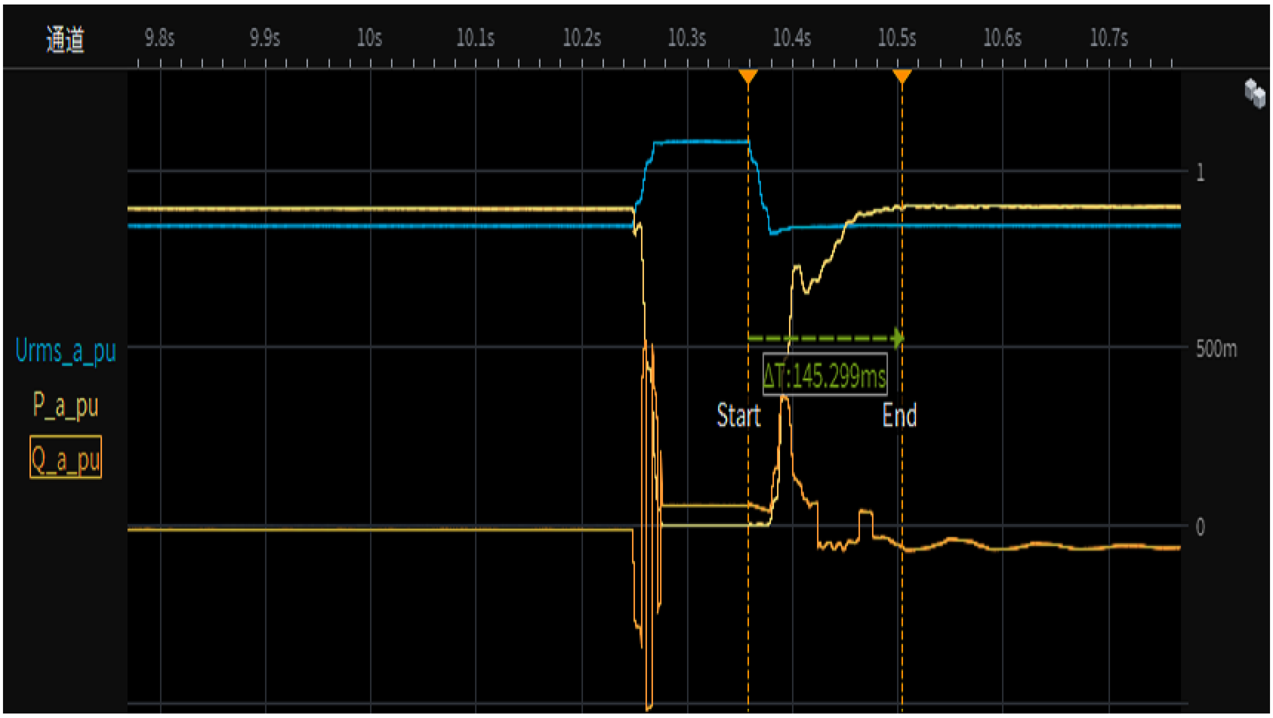


CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

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



Bbis.10	**TABLE: Verification of insensitivity to automatic reclosing in phase discrepancy**				**P**
Model	AF6K-SLP+15Battery				
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%	0.9996	90	22.50	23.47	The PV inverter continue to feed power to grid after phase angle shift has been performed. No damage, no hazard.
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%	0.9995	180	22.51	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.

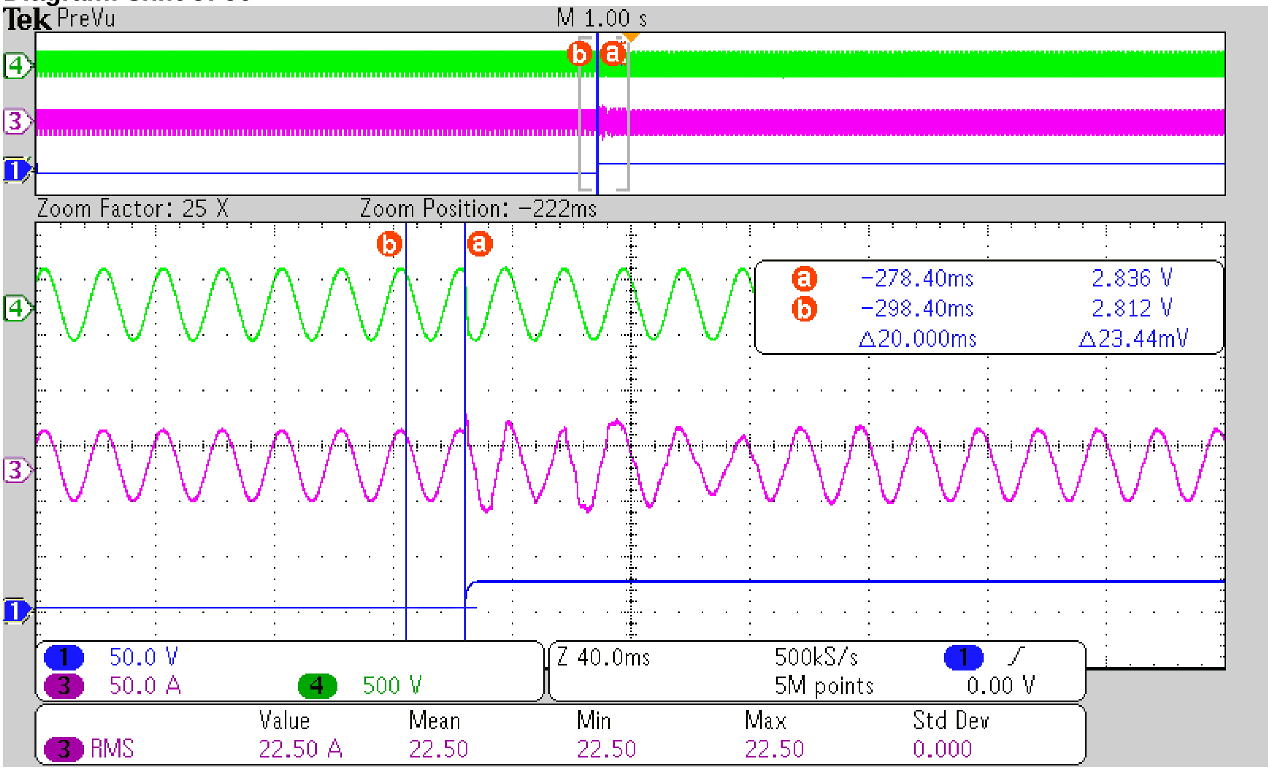
Note:
With reference to the diagram shown in Figure 75 - use of simulated network:
- the network simulator must be able to produce phase jumps in the voltage at the inverter output terminals of 90° and 180° respectively;
- the storage system must operate at a power level compatible with the characteristics 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.

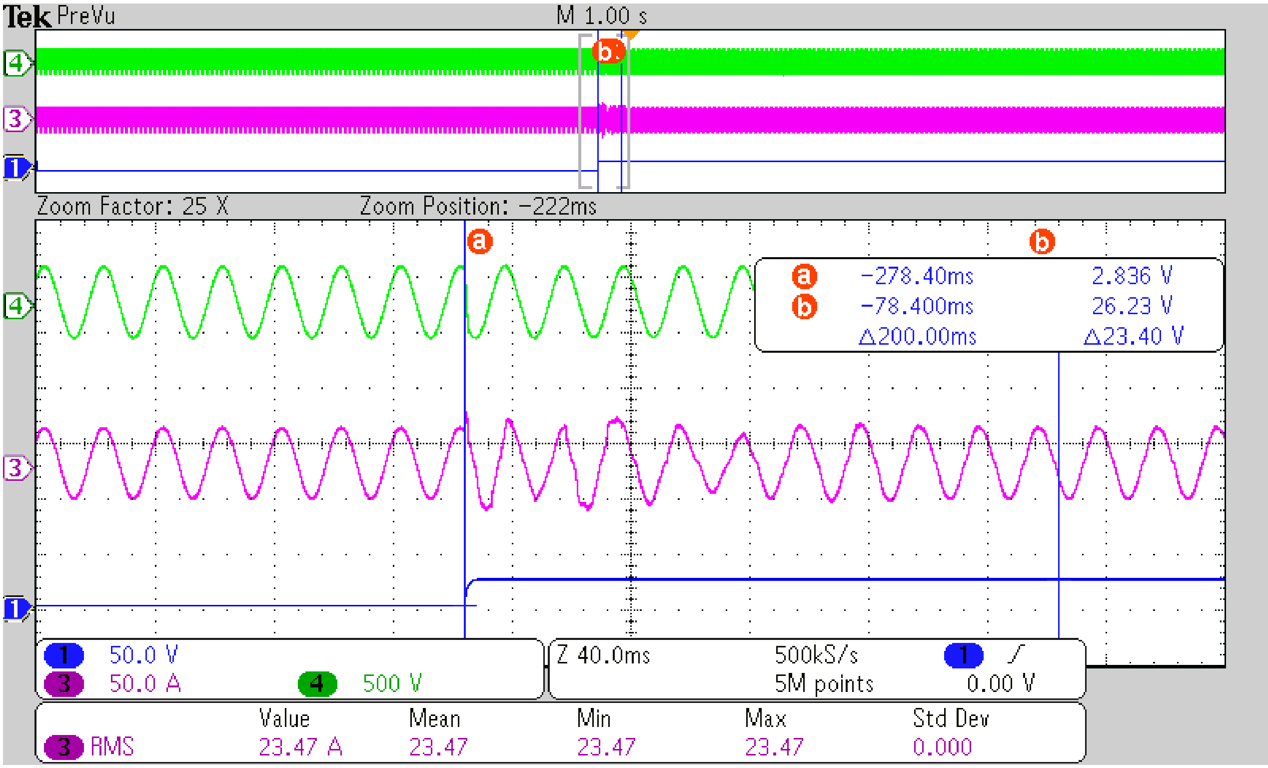
At the end of the stabilization period, 2 tests must be carried out in sequence, inducing a transient that suddenly produces a phase shift angle on the simulated mains voltage VR equal to 90 ° and 180 °.

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

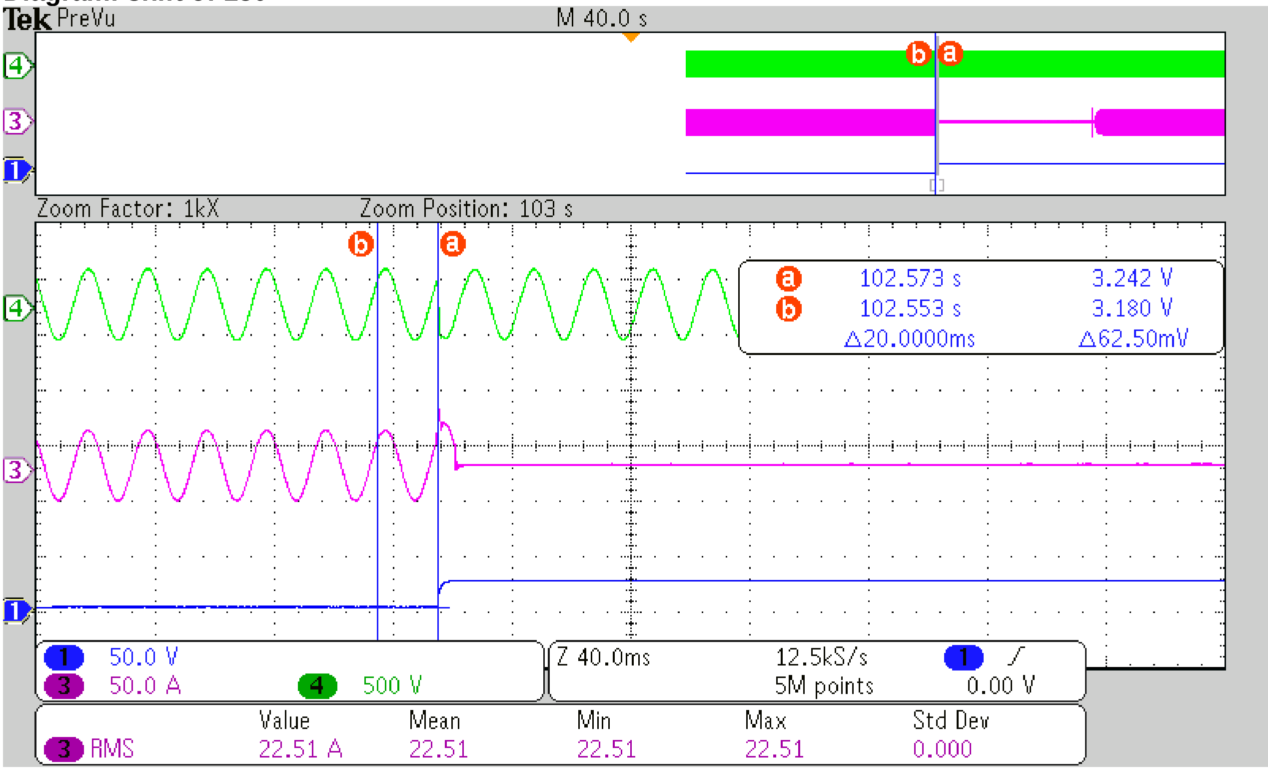
Diagram: shift of 90°

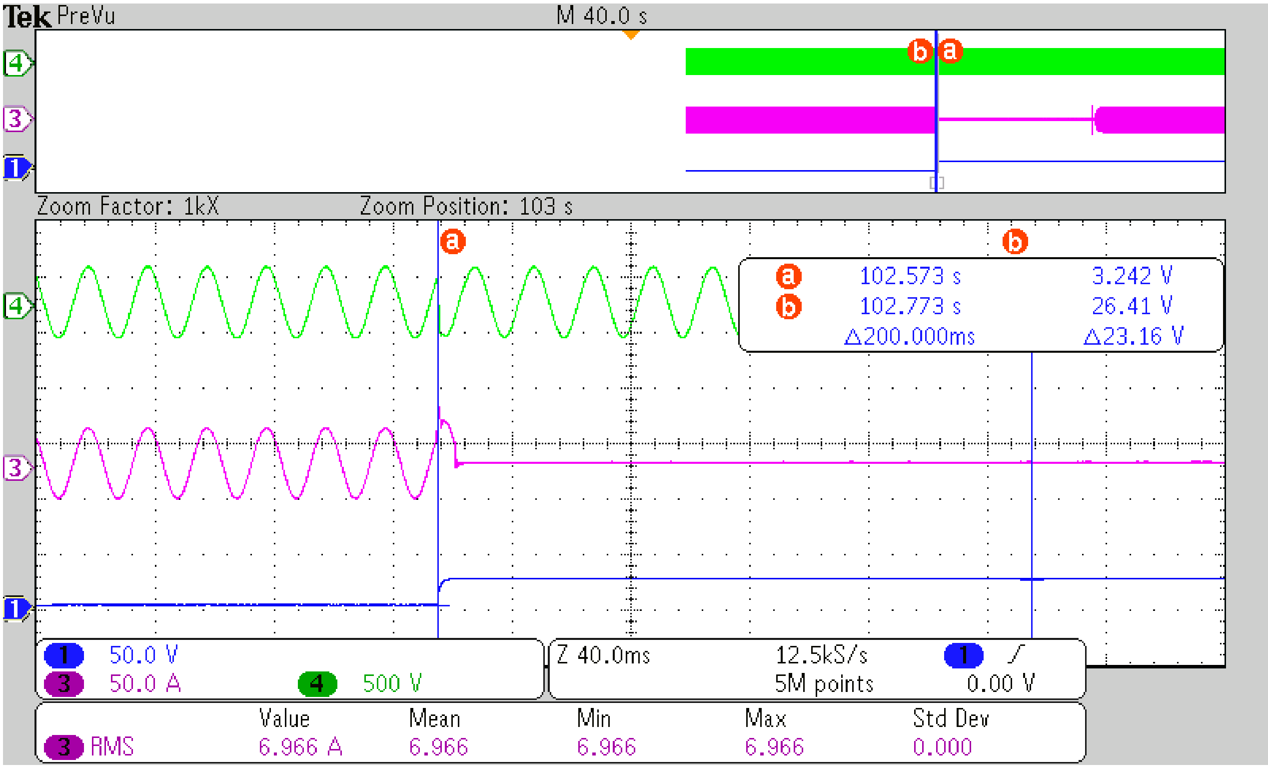




CEI 0-21			
Clause	Requirement - Test	Result - Remark	Verdict

Diagram: shift of 180°





Annex 1

ISO 9001 certificate

AXEREGISTER

CERTIFICATE

N. CN23 – 12689A

This is to certify that the Quality Management System of

AFORE NEW ENERGY TECHNOLOGY (SHANGHAI) CO.,LTD.

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

Has been independently assessed and found in conformance with the standard

ISO 9001:2015

For the following scope of activities:

R & D and Manufacture of Photovoltaic Inverter

IAF 19

For further and updated information regarding any changes in the status of this certification please contact via phone under +355696037861 / +39 0296368458 or via email to info@axe-register.com or verify directly on the website www.axe-register.com by using the organization name or the certificate number.

The validity of this certificate is subject to periodic yearly surveillance audit and triennial review of the entire management system of the certified organization.

Date of first registration	**10/07/2017**
Date of this certificate	**07/07/2023**
Date of expiry	**09/07/2026**

CS 007 26.02.18

Signatory of EA/MLA, Mutual Recognition Agreements

On behalf of the Certification Body
AXE REGISTER Ltd
Antonio Llavda
Technical Director

During validity period of the certificate a surveillance audit should be carried out once within each 12 months. The label should be pasted on specified position of right side of the certificate then it is valid. The certificate can be checked out at CNCA website (www.cnca.gov.cn).

(1) Surveillance Audit Mark

(2) Surveillance Audit Mark

AXE REGISTER
Piazza Unità d'Italia, 5 - 21047 Saronno (VA) - Italia I +39 02 96368458 I info@axe-register.com
ACM (CHINA) LIMITED, Rm B201, No 352, Waihuan Road, Minhang District, Shanghai 201199, China

Annex 2

IEC 62619 Certificate for used battery

Ref. Certif. No.

FR_718746

IEC SYSTEM FOR MUTUAL RECOGNITION OF TEST CERTIFICATES FOR ELECTRICAL EQUIPMENT (IECEE) CB SCHEME

CB TEST CERTIFICATE

Product	**Lithium-Ion Battery**
Name and address of the applicant	**Afore New Energy Technology (Shanghai) Co., Ltd.** Building 7, No.333 Wanfang Rd, Minhang District Shanghai, 201112 - CHINA
Name and address of the manufacturer	**Afore New Energy Technology (Shanghai) Co., Ltd.** Building 7, No.333 Wanfang Rd, Minhang District Shanghai, 201112 - CHINA
Name and address of the factory Note: *When more than one factory, please report on page 2*	☒ Additional Information on page 2
Ratings and principal characteristics	51,2V, 200Ah, 10,24kWh
Trademark / Brand (if any)	Afore
Customer's Testing Facility (CTF) Stage used	/
Model / Type Ref.	AF10000W-LG
Additional information (if necessary may also be reported on page 2)	☐ Additional Information on page 2
A sample of the product was tested and found to be in conformity with	IEC 62619:2017
As shown in the Test Report Ref. No. which forms part of this Certificate	CNDQ-ESH-P24020834

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

LABORATOIRE CENTRAL DES INDUSTRIES ELECTRIQUES
S.A.S au capital de 15.745.984 €
RCS Nanterre B 408 363 174
33 avenue du Général Leclerc

Date: 08/04/2024

Signature: Jérôme REYSSON
Certification Officer

1/2

IEC 62619 Certificate for used battery

IEC IECEE	Ref. Certif. No.
	FR_718746

ANNEX

Name and address of the factories:

Dongguan Lithium Valley Energy Co., Ltd.
No.11 Yinyang Road, Zhangyang Community, Zhangmutou Town, Dongguan City, Guangdong Province – CHINA

Dongguan Lithium Valley Energy Co., Ltd.
Room 101, No.4 Fuzhu 4th Street, Zhangyang Community, Zhangmutou Town, Dongguan City
Guangdong Province - CHINA

LABORATOIRE CENTRAL DES INDUSTRIES ELECTRIQUES - LCIE
33 avenue du Général Leclerc
92260 Fontenay-aux-Roses, FRANCE
www.lcie.fr

Date: 08/04/2024

Signature: **Jérôme REYSSON**
Certification Officer

Annex 3

Datasheet of the relay

HF161F-W SOLAR RELAY

c UL us
File No.:E134517

File No.:40031410

File No.:CQC10002050943
CQC18002203499

Features

- 31A switching capacity
- Applicable to inverter used for photovoltaic power generation systems
- Ideal for UPS
- 1.5mm contact gap (compliant to European Photovoltaic Standard VDE0126)
  1.8mm contact gap (compliant to IEC 62109-2-2011)
- The clearance distance between contact and coil is bigger than 6.4mm, the creepage distance is bigger than 8mm. (special code 477: 7.5mm)
- Low coil holding voltage contributes to saving energy of equipment.
- UL insulation system: Class F

RoHS compliant

CONTACT DATA

Contact gap	1.5mm	1.8mm	2.0mm	2.3mm
Contact arrangement	1A			
Contact resistance 1)	≤100mΩ (1A 6VDC)			
Contact material	$AgSnO_2$			
Contact rating	Resistive: 26A 250VAC Inductive: 31A 250VAC (cosø=0.8) 0.1s:10s	Resistive: 26A 250VAC Inductive: 33A 250VAC (cosø=0.8) 0.1s:10s	Resistive: 26A 250VAC Inductive: 31A 250VAC (cosø=0.8) 0.1s:10s	Resistive: 26A 250VAC
Max. switching voltage	277VAC			
Max. switching current	31A	33A	31A	26A
Max. switching power	7750VA	8250VA	7750VA	7202VA
Mechanical endurance	1×10^6OPS	1×10^5OPS	1×10^5OPS	1×10^5OPS
Electrical endurance	HT type: 3×10^4OPS (26A 250VAC Resistive 75°C 1.5s on 1.5s off)	HT type: 3×10^4OPS (26A 250VAC Resistive 75°C 1.5s on 1.5s off)	HT type: 3×10^4OPS (26A 250VAC Resistive 75°C 1.5s on 1.5s off)	HT type: 3×10^4OPS (26A 250VAC Resistive Room temp. 1.5s on 1.5s off)

Notes: 1)The data shown above are initial values.

COIL

Coil power	Approx. 1.4W
Holding voltage	35% to 120%U_N (at 23°C) 45% to 80%U_N (at 85°C)

Notes: 1)The coil holding voltage is the voltage of coil after being applied rated voltage for 100ms
2)The relay col does not allow applied more than maximum of holding voltage values for a long time (Eg: 120% Un at 23°C; 80% Un at 85°C) , prevent overheating burned.

COIL DATA at 23°C

Nominal Voltage VDC	Pick-up Voltage VDC max. 1)	Drop-out Voltage VDC min. 1)	Max. Voltage VDC *2)	Coil Resistance Ω
9	6.3	0.9	10.8	58 x (1±10%)
12	8.4	1.2	14.4	103 x (1±10%)
18	12.6	1.8	21.6	230 x (1±10%)
24	16.8	2.4	28.8	410 x (1±10%)

Notes: 1)The data shown above are initial values.
2)*Maximum voltage refers to the maximum voltage which relay coil could endure in a short period of time.

CHARACTERISTICS

Insulation resistance		1000MΩ (at 500VDC)
Dielectric strength	Between coil & contacts	4500VAC 1min
	Between open contacts	2500VAC 1min
Surge voltage (between coil & contacts)		10kV (1.2/50μs)
Operate time (at rated. volt.)		20ms max.
Release time (at rated. volt.)		10ms max.
Temperature rise (at rated. volt.)		95K max. (Contact load current 31A, rated voltage excitation, at 60°C)
		70K max. (Contact load current 31A, 80% of rated voltage excitation, at 85°C)
Shock resistance	Functional	196m/s²
	Destructive	980m/s²
Vibration resistance		10Hz to 55Hz 1.5mm DA
Ambient temperature		-40°C to 85°C (Apply holding voltage to coil, which is 45% to 80% that of rated voltage)
Humidity		5% to 85% RH
Termination		PCB
Unit weight		Approx. 21g
Construction		Flux proofed

Notes: The data shown above are initial values.

SAFETY APPROVAL RATINGS

UL/CUL	$AgSnO_2$	26A 277VAC at 75°C 22A 277VAC at 85°C
VDE	$AgSnO_2$	26A 277VAC at 75°C 22A 277VAC at 85°C 31A 250VAC cosØ =0.8 0.1s:10s 33A 250VAC cosØ =0.8 0.1s:10s (477)

Notes: 1) All values unspecified are at room temperature.
2) Only typical loads are listed above. Other load specifications can be available upon request.

HONGFA RELAY
ISO9001、ISO/TS16949、ISO14001、OHSAS18001、IECQ QC 080000 CERTIFIED 2019 Rev. 1.00

ORDERING INFORMATION

HF161F-W / 12 -H T (XXX)

Type	HF161F-W	
Coil voltage	9, 12, 18, 24VDC	
Contact arrangement	**H:** 1 Form A	
Contact matcrial	**T:** $AgSnO_2$	
Special code3)	**XXX:** Customer special requirement	**Nil:** Standard

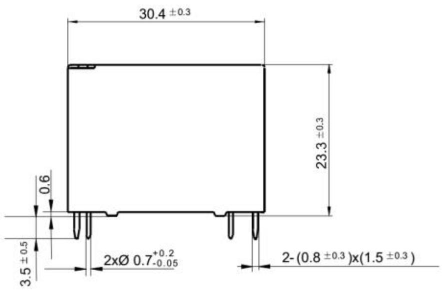
Notes: 1) Water cleaning or surface process is not suggested after the flux-proofed relays are assembled on PCB.
2) Flux-proofed relays can not be used in the environment with pollutants like H_2S, SO_2, NO_2, dust, etc.
3) The customer special requirement express as special code after evaluating by Hongfa. e.g. (414) stands for product with coil terminal of 1.4X0.4; e.g. (477) stands for Contact gap: 1.8mm.(456) stands for Contact gap: 2.0mm.(704)stands for Contact gap: 2.3mm.

OUTLINE DIMENSIONS, WIRING DIAGRAM AND PC BOARD LAYOUT

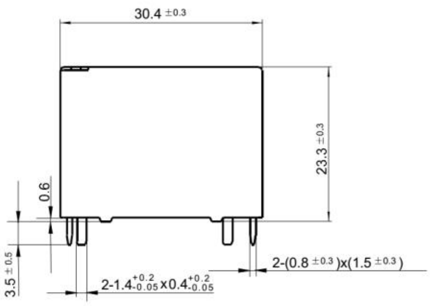
Unit: mm

Outline Dimensions

Standard type

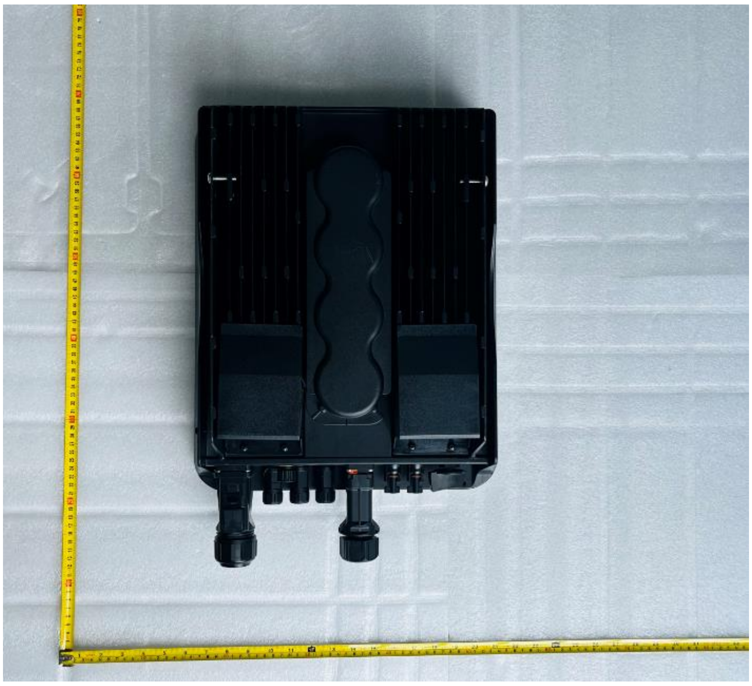


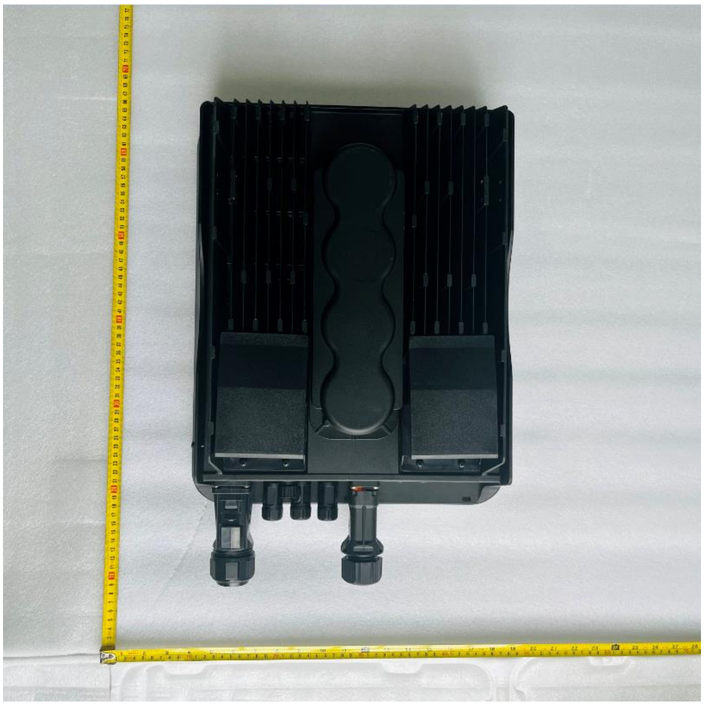
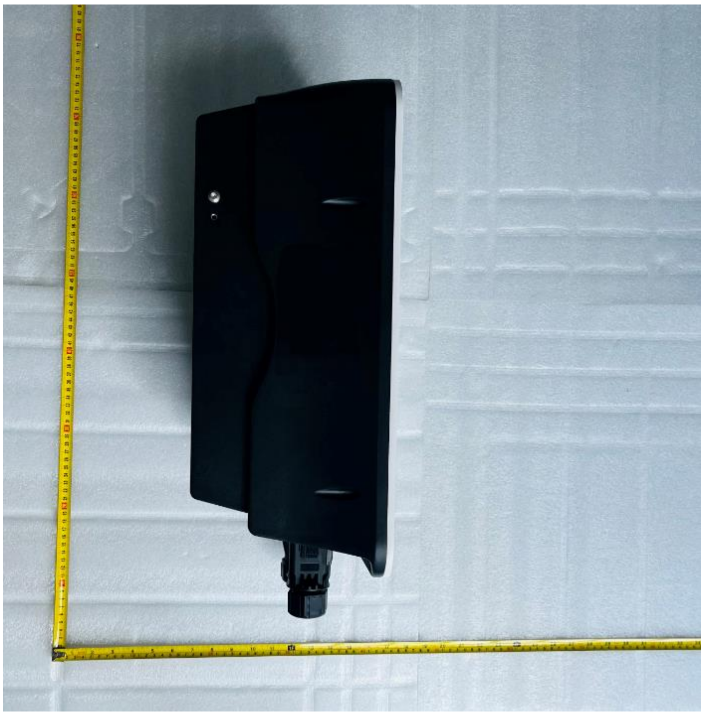
(414) special code version

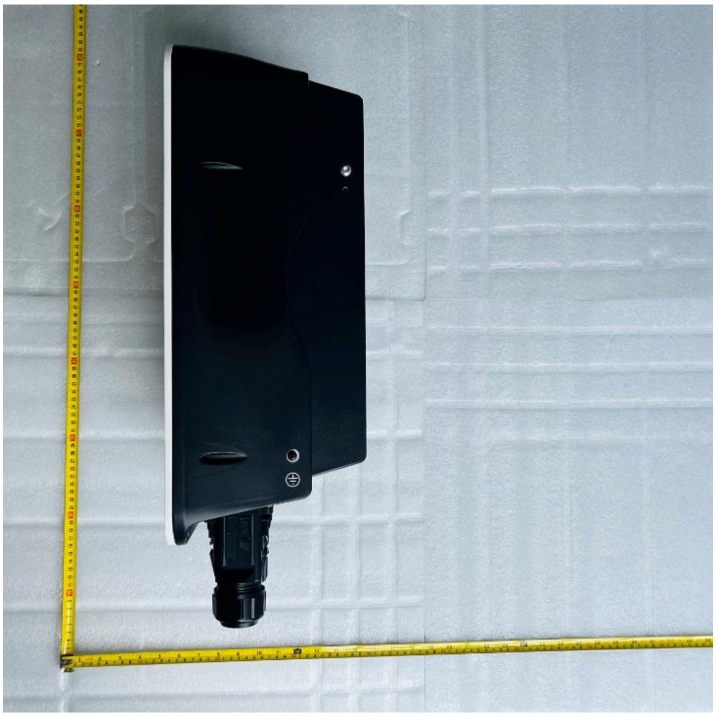
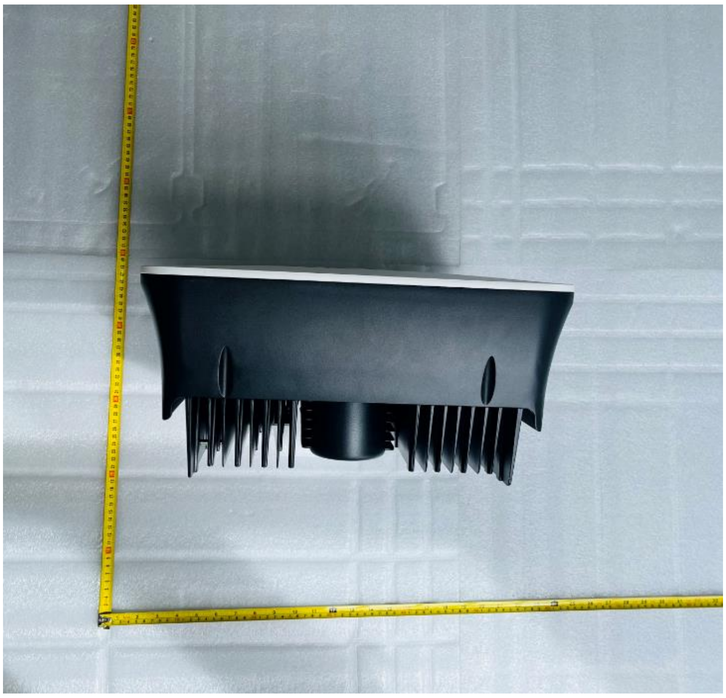


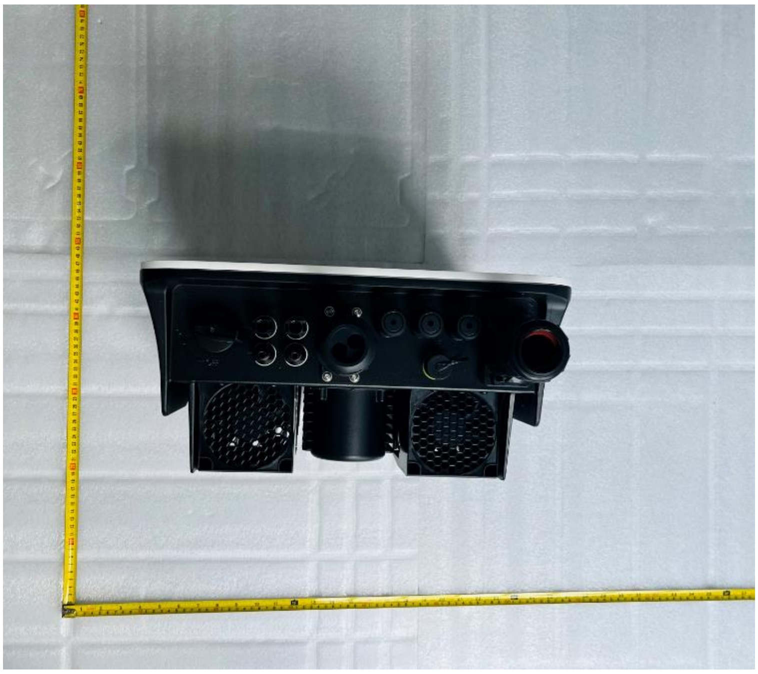
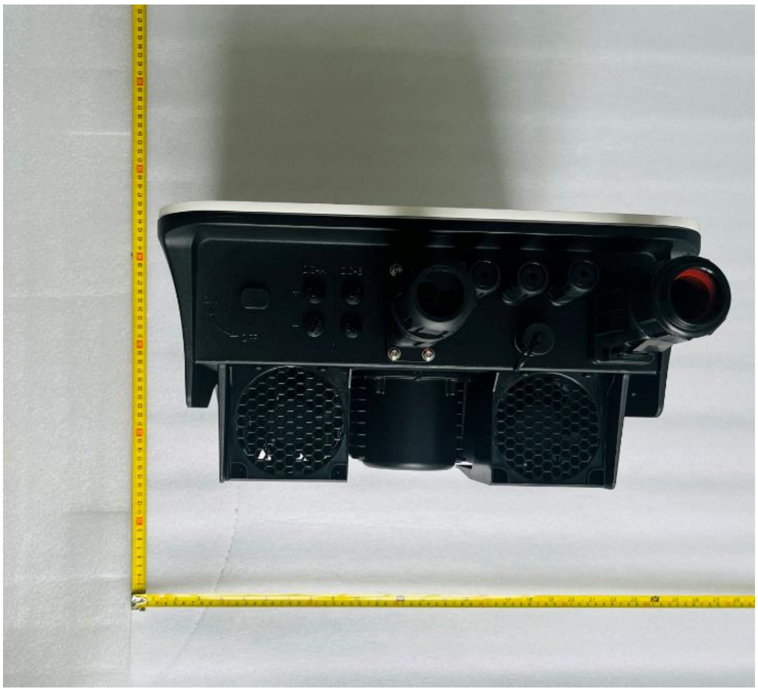
Annex 4
Pictures of the unit

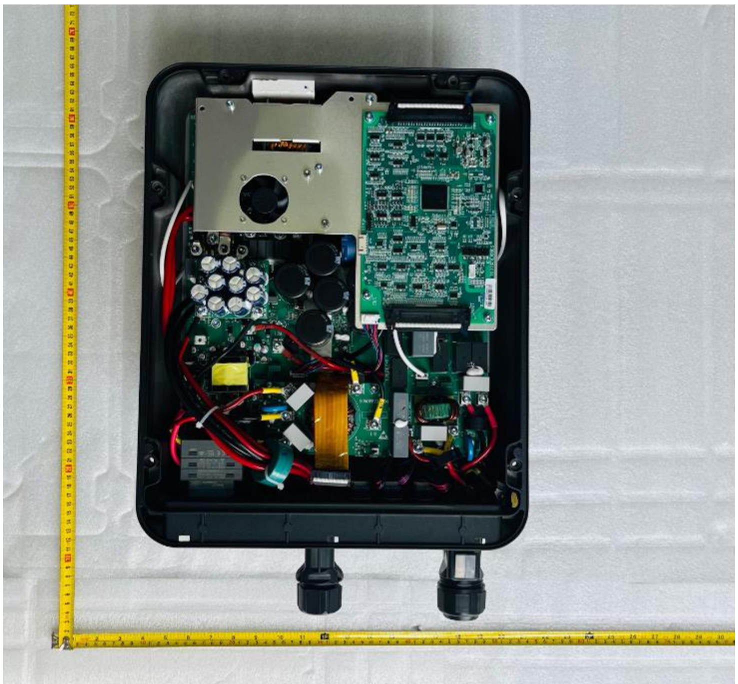
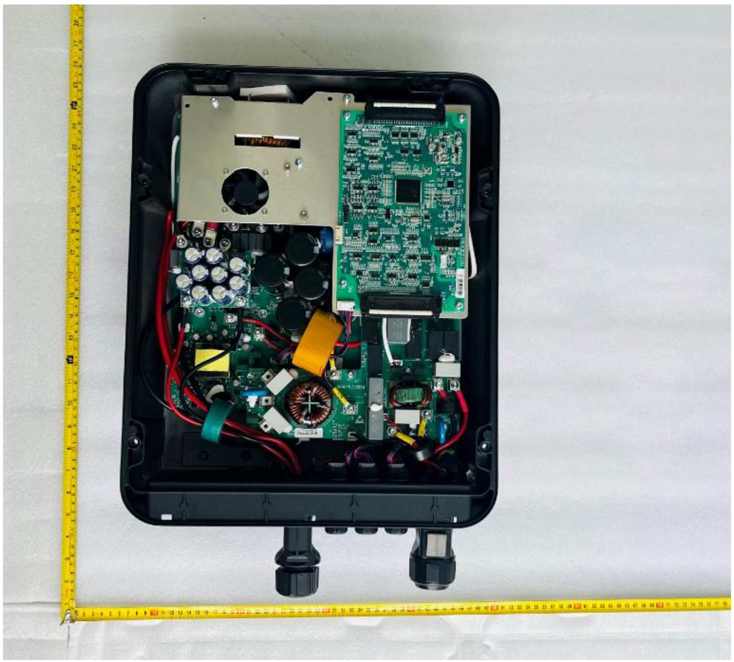
Enclosure - Front View

Enclosure - Rear for AF6K-SL and AF6K-SLP


Enclosure - Rear for AF6K-SL-0

Enclosure - Side View (Left)


Enclosure - Side View (Right)

Enclosure - Top View


Enclosure - Bottom View for AF6K-SL and AF6K-SLP

Enclosure - Bottom View for AF6K-SL-0


Internal view of inverter for AF6K-SL and AF6K-SLP

Internal view of inverter for AF6K-SL-0


--- End of test report---