Test Report issued under the responsibility of:

TEST REPORT
AS/NZS 4777.2
Grid connection of energy systems via inverters
Part 2: Inverter requirements

Report Number. .....:	SUGC260100000352
Date of issue .....:	2026-08-20
Total number of pages.....	200
Name of Testing Laboratory preparing the Report.....:	SGS-CSTC Standards Technical Services Co., Ltd. Suzhou Branch
Address .....:	1/F., Building 12, Xinxing Industry Park, No.78, Xinglin Street, Suzhou Industrial Park, Suzhou, Jiangsu, China
Applicant's name.....:	Guangzhou Felicity Solar Technology Co., Ltd.
Address .....:	(Airport Baiyun) No.2, 4, 6, 8, 10 and 12 Donghua Huaye Road, Renhe Town, Baiyun District, Guangzhou, Guangdong, P. R. China
Test specification:	
Standard.....:	AS/NZS 4777.2:2020+Amd 1:2021+Amd 2:2024
Test procedure .....:	SGS-CSTC
Non-standard test method .....:	N/A
Test Report Form No.....:	AS/NZS 4777.2
Test Report Form(s) Originator ....:	SGS-CSTC
Master TRF.....:	Dated 2024-11
Test item description .....:	Hybrid inverter
Trade Mark .....:	Felicitysolar®
Manufacturer.....:	Guangzhou Felicity Solar Technology Co., Ltd.
Address .....:	(Airport Baiyun) No.2, 4, 6, 8, 10 and 12 Donghua Huaye Road, Renhe Town, Baiyun District, Guangzhou, Guangdong, P. R. China
Model/Type reference .....:	IVGM25KHP3G3, IVGM20KHP3G3, IVGM15KHP3G3, IVGM12KHP3G3, IVGM10KHP3G3, IVGM9K9HP3G3, IVGM8KHP3G3,
Software version.....:	100
Ratings .....:	Refer to the rating on page 7 of the report

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Member of the SGS Group (SGS SA)

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
☒ **Testing Laboratory:**	SGS-CSTC Standards Technical Services Co., Ltd. Suzhou Branch	
Location/ address.....:	1/F., Building 12, Xinxing Industry Park, No.78, Xinglin Street, Suzhou Industrial Park, Suzhou, Jiangsu, China	
Tested by (name, function, signature) .....:	Jojo Shao (Project Engineer)	
Approved by (name, function, signature ....:	Michael Tong (Technical Reviewer)	

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

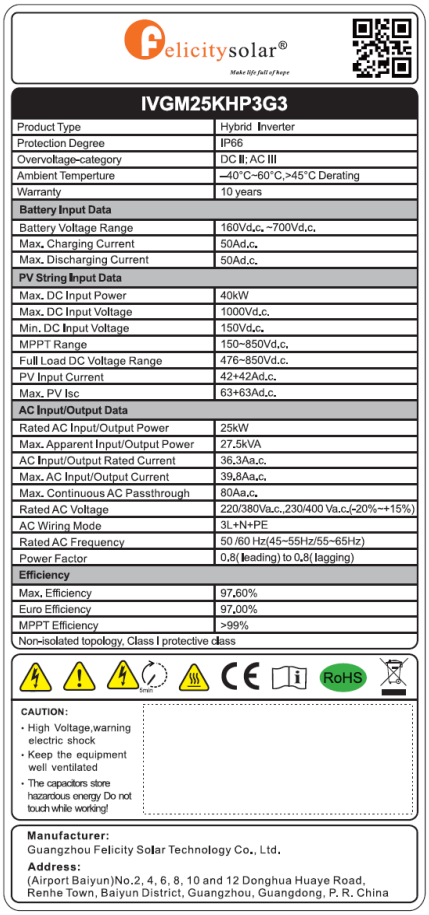
Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
The equipment has been tested according to the standard: AS/NZS 4777.2:2020+Amd 1:2021+Amd 2:2024. Testing has been carried out at 230/400V, 50Hz. *Update PV String Input Data and Protection degree, refer to the model parameter table on page 7 for details. No additional test needs to be repeated.* *All test data originate from the report SUGC260100000351, which was issued by SGS-CSTC Standards Technical Services Co., Ltd. Suzhou Branch, on April 13th, 2026. A2LA CERT #6181.03.* From the result of inspection and tests on the submitted sample, we conclude that it complies with the requirements of the standard.	SGS-CSTC Standards Technical Services Co., Ltd. Suzhou Branch 1/F., Building 12, Xinxing Industry Park, No.78, Xinglin Street, Suzhou Industrial Park, Suzhou, Jiangsu, China

Summary of compliance with National Differences (List of countries addressed):

None.

Copy of marking plate:



felicitysolar®
Make life full of hope

IVGM25KHP3G3	
Product Type	Hybrid Inverter
Protection Degree	IP66
Overvoltage-category	DC II; AC III
Ambient Temperture	–40°C~60°C,>45°C Derating
Warranty	10 years
Battery Input Data	
Battery Voltage Range	160Vd.c. ~700Vd.c.
Max. Charging Current	50Ad.c.
Max. Discharging Current	50Ad.c.
PV String Input Data	
Max. DC Input Power	40kW
Max. DC Input Voltage	1000Vd.c.
Min. DC Input Voltage	150Vd.c.
MPPT Range	150~850Vd.c.
Full Load DC Voltage Range	476~850Vd.c.
PV Input Current	42+42Ad.c.
Max. PV Isc	63+63Ad.c.
AC Input/Output Data	
Rated AC Input/Output Power	25kW
Max. Apparent Input/Output Power	27.5kVA
AC Input/Output Rated Current	36.3Aa.c.
Max. AC Input/Output Current	39.8Aa.c.
Max. Continuous AC Passthrough	80Aa.c.
Rated AC Voltage	220/380Va.c.,230/400 Va.c.(-20%~+15%)
AC Wiring Mode	3L+N+PE
Rated AC Frequency	50 /60 Hz(45~55Hz/55~65Hz)
Power Factor	0.8(leading) to 0.8(lagging)
Efficiency	
Max. Efficiency	97.60%
Euro Efficiency	97.00%
MPPT Efficiency	>99%
Non-isolated topology, Class I protective class	

RoHS

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

Manufacturer:
Guangzhou Felicity Solar Technology Co., Ltd.
Address:
(Airport Baiyun)No.2, 4, 6, 8, 10 and 12 Donghua Huaye Road, Renhe Town, Baiyun District, Guangzhou, Guangdong, P. R. China

DRM 0	X	DRM 1	X	DRM 2	X
DRM 3	X	DRM 4	X	DRM 5	X
DRM 6	X	DRM 7	X	DRM 8	X

Note:

1. The above markings are the minimum requirements required by the safety standard. For the final production samples, the additional markings which do not give rise to misunderstanding may be added.
2. Label is attached on the side surface of enclosure and visible after installation.
3. Labels of other models are as the same with **IVGM25KHP3G3**'s except the parameters of rating.
4. As declared by the applicant, the importer (and manufacturer, if it is different)'s name, registered trade name or registered trademark and the postal address will be marked on the products before being place on the market. The contact details shall be in a language easily understood by end-users and market surveillance authorities.

Test item particulars ..... :	Hybrid Inverter
Equipment mobility ..... :	☐ movable ☐ hand-held ☐ stationary ☒ fixed ☐ transportable ☐ for building-in
Connection to the mains ..... :	☐ pluggable equipment ☐ direct plug-in ☒ permanent connection ☐ for building-in
Environmental category ..... :	☒ outdoor ☐ indoor unconditional ☐ indoor conditional
Over voltage category Mains ..... :	☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV
Over voltage category PV ..... :	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV
Mains supply tolerance (%) ..... :	-90 / +110 %
Tested for power systems ..... :	TN systems
IT testing, phase-phase voltage (V) ..... :	N/A
Class of equipment ..... :	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Mass of equipment (kg) ..... :	39.4kg
Pollution degree ..... :	Outside PD3; Inside PD2
IP protection class ..... :	IP66
Possible test case verdicts:	
- test case does not apply to the test object .....:	N/A
- test object does meet the requirement .....:	P (Pass)
- test object was not evaluated for the requirement:	N/E
- test object does not meet the requirement .....:	F (Fail)
Testing .....:	
Date of receipt of test item .....:	2025-12-15
Date (s) of performance of tests .....:	2025-12-18 to2026-02-02

General remarks:
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at www.sgs.com/terms_and_conditions.htm and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested. **Throughout this report a ☐ comma / ☒ point is used as the decimal separator.**

Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided ..... :	☐ **Yes** ☒ **Not applicable**
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies) ..... :	**Guangzhou Felicity Solar Technology Co., Ltd.** (Airport Baiyun) No.2, 4, 6, 8, 10 and 12 Donghua Huaye Road, Renhe Town, Baiyun District, Guangzhou, Guangdong, P. R. China

General product information:

Product covered by this report is grid-connected PV inverter for outdoor installation. The connection to the DC input and AC output are through connectors.

The Solar inverter converts DC voltage into AC voltage.
The input and output are protected by varistors to Earth. The unit is providing EMC filtering at the output toward mains. The unit does not provide galvanic separation from input to output (isolation transformer). The output is switched off redundant by the high power switching bridge and a two relays. This assures that the opening of the output circuit can operate in case of single fault.

Equipment Under Testing:

- **IVGM25KHP3G3**

Variant models:

- IVGM20KHP3G3
- IVGM15KHP3G3
- IVGM12KHP3G3
- IVGM10KHP3G3
- IVGM9K9HP3G3
- IVGM8KHP3G3

The variant models have been included in this test report without tests because the following features don´t change regarding to the tested model:

- Same connection system and hardware topology.
- Same control algorithm.
- Same Firmware Version.

Information within this section has been provided by the client.

The results obtained apply only to the particular sample tested that is the subject of the present test report. The most unfavorable result values of the verifications and tests performed are contained herein.

Following table shows the full ratings of all the models referenced in this report, marked in **bold letters** the ones subjected to testing:

Model	**IVGM25 KHP3G3**	IVGM20 KHP3G3	IVGM15 KHP3G3	IVGM12 KHP3G3	IVGM10 KHP3G3	IVGM9 K9HP3G3	IVGM8 KHP3G3
Battery Input Data							
Battey Type	LFP(LiFePO4)						
Battey Voltage Range	160~700Vd.c.						
Max. Charging Current	50A						
Max. Discharging Current	50A						
Number of battery input	1						
PV String Input Data							
Max. DC Access power	50kW	40kW	30kW	24kW	20kW	19.8kW	16kW
Max. DC Input power	40kW	32kW	24kW	19.2kW	16kW	15.8kW	12.8kW
Max. DC Input power Voltage	1000 Vd.c.						
Min. DC Input power Voltage	150 Vd.c.						
Start-up Voltage	**180 Vd.c. ***						
Rated DC Input Voltage	600 Vd.c.						
MPPT Range	**150~850 Vd.c. ***						
Full Load DC Voltage Range	**476~850 Vd.c. ***	**381~850 Vd.c. ***	**381~850 Vd.c. ***	**305~850 Vd.c. ***	**381~850 Vd.c. ***	**376~850 Vd.c. ***	**305~850 Vd.c. ***
PV Input Current	**42A+42A ***		**42A+21A ***		**21A+21A ***		
Max. PV Isc	**63A+63A ***		**63A+32A ***		**32A+32A ***		
No. of MPP Trackers	2		2		2		
No. of Strings per MPP Tracher	2+2		2+1		2+1		
AC Output Data							
Rated AC Input / Output Power	25kW	20kW	15kW	12kW	10kW	9.9kW	8kW
Max. AC Input / Output Apparent Power	27.5kW	22kW	16.5kW	13.2kW	11kW	9.9kW	8.8kW
AC Input / Output Rated Current	36.3A	29A	21.7A	17.4A	14.5A	14.3A	11.6A
Max. AC Current	39.8A	32A	23.8A	19.2A	16A	14.3A	12.8A
Rated AC Voltage	220/380Va.c., 230/400Va.c., 3L+N+PE						
Rated AC Frequency	50/60Hz						
Power Factor	0.8(leading) to 0.8(lagging)						
General Data							
Weight	39.4kg						
Product Dimension	642mm x 445mm x 237.5mm						
Operating temperature range	-40 ºC ~ +60 ºC (>45°C derate)						
Protection degree	**IP66 ***						
Protective class	Class I						
Note: * These are the details of this change.							

AS/NZS 4777.2			
Clause	Requirement – Test	Result - Remark	Verdict

2	**GENERAL REQUIREMENTS**		**P**
2.1	General		P
	This Standard does not prevent the use of materials, methods of assembly, procedures, or additional functions and the like that are not specifically included in the requirements of this Standard, or are not mentioned in it, provided the minimum safety, functional and performance requirements specified herein are met.		P
2.2	Electrical safety	Hybrid inverter	P
	Inverters for use in inverter energy systems with photovoltaic (PV) array port/s shall conform to IEC 62109-1 and IEC 62109-2, and the requirements within this Standard.	Inverter units approved by Shenzhen Nore Testing Center Co., Ltd. in accordance with IEC 62109-1 and IEC 62109-2. Report No: SZNTC2608145SV00	P
	Throughout IEC 62109-1 and IEC 62109-2, the term “power conditioning equipment (PCE)” is used. For the purposes of this Standard, “PCE” shall be replaced with the term “inverter”.		P
	Inverters for use in inverter energy systems that have energy storage (e.g. batteries or EVs) as the only possible energy source shall conform to the electrical safety requirements of IEC 62477-1, and the requirements within this Standard.		N/A
	Inverters for use in inverter energy systems that incorporate other types of energy sources without photovoltaic (PV) arrays shall conform to IEC 62477-1, and the requirements within this Standard.		N/A
	Throughout IEC 62477-1, the term “power electronic converter system (PECS)” is used. For the purposes of this Standard, “PECS” shall be replaced with the term “inverter”.		N/A
2.3	Provision for external connections	Provided in the installation manual.	P
2.3.1	General		P
	Inverters shall be used and installed as fixed equipment only. Inverters shall not be used as portable equipment.		P
	(a) shall be for fixed equipment only; and		P

AS/NZS 4777.2			
Clause	Requirement – Test	Result - Remark	Verdict
	(b) shall provide for safe and reliable connection to any d.c. source or load or any a.c. source or load.		P
	All inverter source or load ports shall incorporate connection types for either -	See below.	P
	(i) permanently connected equipment (see Clause 2.3.2); or		N/A
	(ii) pluggable type B equipment (see Clause 2.3.3).		P
	Inverter source or load connections shall not incorporate connection types for pluggable type A equipment.		P
2.3.2	Permanently connected equipment		P
	Permanently connected inverters and EV Supply Equipment capable of reverse power transfer shall have suitable terminals for connection to fixed installation wiring.		P
2.3.3	Pluggable type B equipment		P
	Pluggable type B equipment shall have one of the following means of connection:		P
	(a) A non-detachable cord for connection to the supply by means of a connector.		N/A
	(b) An appliance inlet suitable for connection to a matching connector.		P
	Pluggable type B equipment shall not incorporate -	See below.	P
	(i) a connection by a connector or inlet complying with any of the dimensional sheets of AS/NZS 60320.1;	No such devices..	P
	(ii)a connection by a plug conforming to AS/NZS 3112; or	No such plug used.	P
	(iii) a connection by a connector or inlet where hazardous voltages are accessible by the standard test finger.		P
2.3.4	Electric vehicle connections	Inverter is not integral within an electric vehicle.	N/A
	For connection to the electrical installation of EV supply equipment capable of reverse power transfer used in an inverter energy system, Clause 2.3.2 shall apply.		N/A
	The connection of EV to the EV supply equipment used in an inverter energy system shall-		N/A

AS/NZS 4777.2			
Clause	Requirement – Test	Result - Remark	Verdict
	(a) Be Mode 3 or Mode 4 in accordance with IEC 61851-1;		N/A
	(b) utilize connectors that comply with AS IEC 62196.2 in the case of Mode 3 or IEC 62196-3 in the case of Mode 4.		N/A
2.4	Earth fault/earth leakage detection		P
2.4.1	Photovoltaic (PV) array earth fault/earth leakage detection		P
	For inverter energy systems used with PV array systems that require earth fault detection and a residual current detection, either internal or external to the inverter, the type of detection used shall be declared in accordance with IEC 62109-1 and IEC 62109-2.	An applicable test report according to IEC 62109-1, IEC 62109-2 must be provided by the manufacturer.	P
	If an external residual current device (RCD) is required, the manufacturer's installation instructions shall state the need for an RCD and shall specify its rating, type and required circuit location in accordance with Section 7.	Internal residual current device.	N/A
	Compliance shall be checked by inspection of the inverter's markings and manufacturer's documentation, and testing in accordance with IEC 62109-2.	An applicable test report according to IEC 62109-1, IEC 62109-2 must be provided by the manufacturer.	P
	Where the additional detection for functionally earthed PV arrays, as required by AS/NZS 5033, is present in the inverter, this additional detection shall, before start-up of the system -	See below.	P
	(a) open circuit the functional earth connection to the PV array;		P
	(b) measure the resistance to earth of each conductor of the PV array;	An applicable test report according to IEC 62109-1, IEC 62109-2 must be provided by the manufacturer.	P
	(c) if the earth resistance is above the resistance limit (R_{iso} limit) threshold specified in Table 2.1, the system shall reconnect the functional earth and shall be allowed to start; and	An applicable test report according to IEC 62109-1, IEC 62109-2 must be provided by the manufacturer.	P
	(d) if the earth resistance is equal to or less than the resistance limit (R_{iso} limit) threshold specified in Table 2.1, the inverter shall shut down and initiate an earth fault alarm in accordance with the requirements of IEC 62109-2.	An applicable test report according to IEC 62109-1, IEC 62109-2 must be provided by the manufacturer.	P

AS/NZS 4777.2			
Clause	Requirement – Test	Result - Remark	Verdict
2.4.2	Battery Energy Storage System (BESS) earth fault/earth leakage detection	The unit used with BESS.	P
	For inverters used with battery systems the requirements for earth fault alarm monitoring of AS/NZS 5139 may apply.	Reference installation manual.	P
	Where an inverter has a port for connecting a battery system installation that requires an alarm for monitoring of earth faults in conformance to AS/NZS 5139, the inverter should provide an alarm. Where no alarm is provided in the inverter, the inverter documentation shall require the addition of an external alarm and monitoring device.	Reference installation manual.	P
	The inverter documentation should refer to the battery system manufacturer's instructions for earth fault monitoring and earth leakage levels that indicate a fault.	Reference installation manual.	P
2.5	Compatibility with electrical installation		P
	The inverter shall be compatible with wiring practices for LV electrical installations of AS/NZS 3000 and variations as required in AS/NZS 4777.1. The inverter a.c. voltage and frequency operation shall comply with the limits specified in AS IEC 60038.	Considered.	P
2.6	Reactive power capability		P
	The inverter shall be capable of absorbing or supplying at least the specified reactive power of Clause 3.3 down to a power factor of 0.8 for all active power output or input levels above 60 % of rated apparent power. Where the active power output or input level is between 20 % and 60 % of rated apparent power, the inverter shall be capable of absorbing or supplying reactive power of at least 44 % of rated apparent power. Where the active power output or input level is below 20 % of rated apparent power, reactive power being absorbed or supplied may be reduced due to limitation of inverter power factor capabilities. Where the active power level is less than 4 % of the rated apparent power, the inverter shall not absorb or supply reactive power of more than 4 % of the rated apparent power, unless required to do so by a reactive power mode. The minimum reactive power capability requirement is	See appendix table 3.3.3 Fixed power factor mode and reactive power mode.	P

AS/NZS 4777.2			
Clause	Requirement – Test	Result - Remark	Verdict
	shown in Figure 2.1.		
	The reactive power capability of the inverter shall be declared in the test report.		P
2.7	Harmonic currents		P
	The harmonic currents of the inverter shall not exceed the limits specified in Tables 2.2 and 2.3 and the total harmonic current distortion (ITHD) to the 50th harmonic shall be less than 5%.	See appendix table 2.7 Harmonic currents.	P
2.8	Voltage fluctuations and flicker		P
	The inverter shall conform to the voltage fluctuation and flicker limits specified in AS/NZS 61000.3.3 for equipment with rated current less than or equal to 16 A per phase (a.c.).		N/A
	For equipment with rated current greater than 16 A per phase (a.c.), if the inverter cannot meet the requirements of AS/NZS 61000.3.3, the maximum permissible connection point impedance (*Z*max) shall be determined such that the voltage fluctuation and flicker limits specified in AS/NZS 61000.3.3 can be met. The impedance shall be determined in accordance with the methods given in AS/NZS 61000.3.11. The values of *P*st and *P*lt, when tested using *Z*ref, and the network impedance value (*Z*max or *Z*ref) required for compliance shall be included in the inverter documentation.		P
2.9	Transient voltage limits		P
	To prevent damage to electrical equipment connected to the same circuit as the inverter, disconnection of the inverter from the grid shall not result in transient overvoltages beyond the limits specified in Table 2.4.	See appendix table 2.9 Transient Voltage Limits (phase to neutral and phase to phase).	P
2.10	D.C. current injection		P
	In the case of a single-phase inverter, the d.c. output current of the inverter at any a.c. port including the grid-interactive alternative supply, substitute supply and/or independent supply port shall not exceed 0.5% of the inverter's rated current or 5 mA, whichever is the greater.	Three-phase inverter.	N/A
	In the case of a three-phase inverter, the d.c. output current of the inverter at any	See appendix table 2.10 Direct	P

AS/NZS 4777.2			
Clause	Requirement – Test	Result - Remark	Verdict
	a.c. port, including the grid-interactive alternative supply, substitute supply and/or independent supply port, measured in each of the phases, shall not exceed 0.5% of the inverter's per-phase rated current or 5 mA, whichever is the greater.	curent injection.	
2.11	Current balance for three-phase inverters	See appendix table 2.11 Current balance for three-phase inverters.	P
	In the case of a three-phase inverter the a.c. output current shall be generated and injected into the three-phase electrical installation as a three-phase balanced current.		P
2.12	Isolation of energy sources		P
2.12.1	General		P
	Where an energy source port has a load break switching device that is part of and within the inverter and is part of the method for isolating the energy source, the load break switching device/s shall —	The port of the PV input.	P
	(a) have a voltage rating equal to or greater than the inverter's maximum voltage rating for that port;	Considered.	P
	(b) interrupt all live conductors simultaneously;	Considered.	P
	(c) be able to be secured in the open position and only secured when the main contacts are in the open position;	Considered.	P
	(d) be either a switch disconnector that conforms to Clause 2.12.2 or a circuit breaker that conforms to Clause 2.12.3;	Considered.	P
	(e) for all energy sources other than PV and Battery systems be rated for a.c. or d.c. operation per the port type, and if d.c. rated be a non-polarized type.	No such ports.	N/A
	Where a load break switching device is part of and within the inverter, and forms part of the method for isolating the energy source/s, there shall be a warning label to isolate energy source/s prior to removal of any cover for maintenance or repair.	Considered.	P
	Documentation of permitted and safe access (including isolation) to inverters for maintenance and repair shall be	Considered.	P

AS/NZS 4777.2			
Clause	Requirement – Test	Result - Remark	Verdict
	included in manuals.		
	Combination fused switch disconnectors or fused circuit breakers shall not be used as the load break switching device as part of or within the inverter	No such switch or breakers.	N/A
	Where any load break switching device is part of and within the inverter and does not meet the requirements of this Clause (2.12.1) a warning label shall be used to indicate that an additional external load break switching device is required. Documentation for an inverter that requires an external load break switching device shall include the requirement of an additional external load break switching device that conforms to the requirements AS/NZS 4777.1.	Meet the requirement of this Clause 2.12.1	N/A
2.12.2	Switch-disconnector		P
	Where a load break switching device that is part of or within the inverter is a switch disconnector, it shall —	The port of the PV input.	P
	(a) be rated for independent manual operation;	Considered.	P
	(b) be classified as suitable for isolation and be marked with the following symbol:	Considered.	P
	(c) have a utilization category of at least DC-21B where the port is suitable for a d.c. energy source;	Considered.	P
	(d) have a utilization category at least AC-21B where the port is suitable for an a.c. energy source; and	Considered.	P
	(e) conform to additional requirements of Clause 2.12.4 for PV array energy source; (ee) conform to additional requirements of Clause 2.12.5 for battery system energy sources.	Considered.	P
	(f) have a current rating where rated operational current (I_e) and $I_{(make)}$, and $I_c{}_{(break)}$ rated current are rated such that the disconnector is capable of interrupting the maximum rated normal and fault current for that port as specified in the inverter documentation; and	Considered.	P
	(g) have a current rating for the thermal current (I_{the} and $I_{the\ solar}$) rated for the installation environment specified by		P

AS/NZS 4777.2			
Clause	Requirement – Test	Result - Remark	Verdict
	the manufacturer.		
2.12.3	Circuit breaker	No such breaker.	N/A
	Where a load break switching device that is part of or within the inverter is a circuit breaker, it shall —		N/A
	(a) Conform to AS/NZS IEC 60947.2; and		N/A
	(b) be classified as suitable for isolation and be marked with the following symbol.		N/A
2.12.4	PV array ports		P
	For inverters with an apparent power rating of less than 30 kVA where a switch disconnector is used for PV array ports that are part of or within the inverter, the switch disconnector shall conform to the requirements of AS 60947.3 for switch disconnectors for photovoltaic (PV) d.c. applications.	The isolating switch for PV array ports have , certificate No.: SGS/260260/1.	P
	For inverters with an apparent power rating of 30 kVA or more where a switch disconnector is used for PV array ports that are part of or within the inverter, the switch disconnector shall conform to AS 60947.3 for switch-disconnectors for photovoltaic (PV) d.c. applications with the following modifications:	Less than 30 kVA.	N/A
	(a) have a minimum utilization category of DC-PV1;		N/A
	(b) for inverters with IP6x or greater, have at least pollution degree 2; and		N/A
	(c) where the utilization category is DC-PV1, have a continuous backfeed current as tested by IEC 62109-1 of less than 0.3 A.		N/A
2.12.5	Battery system ports	No isolating devices at battery system ports.	N/A
	Where a switch disconnector is used for battery system ports that are part of or within the inverter, the switch disconnector shall meet the following additional requirements:		N/A
	(a) Shall conform to AS 60947.3.		N/A
	(b) Shall be of the non-polarized type.		N/A
	(c) Shall have a current rating equal to or greater than the maximum rated d.c. current for the battery system		N/A

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Clause	Requirement – Test	Result - Remark	Verdict
	port.		
	(d) Shall have a utilization category of at least DC21B.		N/A
2.13	Measurement accuracy		P
	To ensure the stable and reliable operation of the inverter protective functions and all modes of operation, the inverter shall conform to or exceed the measurement and calculation accuracy requirements specified in Table 2.5. Where the inverter utilizes an external measurement device, the measurement and calculation accuracy of the system (including the combination of the inverter and external measurement device) shall conform to the measurement and calculation accuracy requirements specified in Table 2.5.	All measurements and checks of setpoints meet measurement accuracy requirements.	P
2.14	Prioritization of protection and operational modes		P
	Inverters responding to abnormal voltage or frequency conditions shall meet the prioritization levels of Table 2.6.	Complied.	P
2.15	Firmware		P
	The inverter firmware determines the functioning of an inverter as well as responses required by this Standard. The functions may be spread over multiple programmable devices. The inverter firmware may change over the life of a specific inverter model.		P
	The inverter firmware version shall be reported in testing. The inverter firmware version identifier shall be accessible for inspection. Inverter firmware version information may be displayed via a panel/screen, external device or software interface.	Hardware version: 100 Software version: 100	P
	The inverter firmware shall be secured against inadvertent or unauthorized changes. Changes to the inverter firmware shall require the use of a tool and special instructions not provided to unauthorized personnel.	Complied. (Password protection)	P
	Inverter firmware changes and updates shall conform to the requirements of this Standard. Where an inverter firmware update affects any of the provisions specified in Sections 2, 3, 4 and 5 conformance with this Standard shall be	Complied.	P

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Clause	Requirement – Test	Result - Remark	Verdict
	determined.		

3	**OPERATIONAL MODES AND MULTIPLE MODE INVERTERS**		**P**
3.1	General		P
	Unless otherwise stated, the modes in the following Clauses are for the grid-interactive port of the inverter.		P
3.2	Inverter demand response modes (DRMs)		P
3.2.1	General	See below.	P
	The inverter shall support the demand response mode DRM 0 of Table 3.1. The inverter should support the other demand response modes of Table 3.1.	See appendix table 3.2.	P
	The inverter shall detect and initiate a response to all supported demand response commands within 2 s. The inverter shall continue to respond while the mode remains asserted.	See appendix table 3.2.	P
3.2.2	Interaction with demand response enabling device (DRED)	See below.	P
	The inverter shall have a means of connecting to a DRED. This means of connection shall include a terminal block or RJ45 socket.	RJ45	P
	The terminal block or RJ45 socket shall comply with the minimum electrical specifications in Table 3.2.	Considered.	P
	The DRED asserts demand response modes by shorting together terminals or pins as specified in Table 3.3.	Considered.	P
3.3	Inverter power quality response modes		P
3.3.1	General	See Clause 3.3.2, Clause 3.3.3 and Clause 3.3.4.	P
3.3.2	Volt response modes		P
3.3.2.1	General		P
	The volt–watt and volt–var response modes specified in Clause 3.3.2.2 and Clause 3.3.2.3 shall be able to operate concurrently when both modes are active.		P
	For three-phase inverters, the inverter shall use the average of the three single-phase voltages as the reference voltage to determine the corresponding volt response action.		P
3.3.2.2	Volt–watt response mode	See below.	P

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Clause	Requirement – Test	Result - Remark	Verdict
	The volt–watt response mode varies the maximum active power output level of the inverter in response to the voltage at its grid-interactive port. The volt–watt response mode shall be enabled by default.		P
	The response curve required for the volt–watt response mode is defined by two volt response reference values and corresponding maximum active power output levels, the default values are listed in Table 3.6. Above V_{W2}, the maximum active power output shall not exceed the limit specified at V_{W2}. An example volt-watt response mode is shown in Figure 3.1.	See appendix table 3.3.2.2.	P
3.3.2.3	Volt–var response mode		P
	The volt–var response mode varies the reactive power absorbed or supplied by the inverter in response to the voltage at its grid-interactive port. The volt–var response mode shall be enabled by default.		P
	The response curve required for the volt–var response is defined by four volt response reference values and corresponding reactive power levels, the default values are listed in Table 3.7. Below V_{V1}, reactive power shall be maintained at the level specified for V_{V1}. Above V_{V4}, reactive power shall be maintained at the level specified for V_{V4}. An example volt-var response mode is shown in Figure 3.2.	See appendix table 3.3.2.3.	P
	Where the inverter apparent power rating is reached, active power level shall be reduced to stay within the inverter apparent power rating while meeting the volt-var mode reactive power requirements of this Clause (3.3.2.3). This behavior is intended to provide reactive power priority.	Considered.	P
3.3.2.4	Voltage balance modes		P
	Three-phase inverters, or single-phase inverters used in a three-phase combination may be used for voltage balancing between phases by injecting unbalanced three-phase currents into the electrical installation.	Considered.	P
	If the voltage balance mode is available,	see below.	P

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Clause	Requirement – Test	Result - Remark	Verdict
	the following requirements apply:		
	(a) The voltage balance mode shall be disabled by default.		N/A
	(b) For single-phase inverters used in a three-phase combination, the requirements of Clause 5.2 apply.	The EUT is three-phase type.	N/A
	(c) The voltage balancing mode shall be able to -	See below.	P
	(i) operate correctly with a single fault applied;		P
	(ii) detect the fault or loss of operability and cause the inverter to revert to injecting current into the three-phase electrical installation as a three-phase balanced current; or		P
	(iii) detect the fault or loss of operability and disconnect the inverter from the electrical installation.		P
3.3.3	Fixed power factor mode and reactive power mode		P
	These modes shall be disabled by default.		P
	For the fixed power factor mode, the minimum range of settings shall be 0.8 to 1.0 supplying reactive power, and 1.0 to 0.8 absorbing reactive power, the default power factor setting shall be 1.0. The fixed power factor mode is for control of the displacement power factor over the range of inverter power output.	See appendix table 3.3.3.	P
	For the fixed power factor mode, the measurement of power factor shall be the displacement power factor of the inverter treated as a load from the perspective of the grid.	See appendix table 3.3.3.	P
	For the reactive power mode, the minimum setting range for ratio of reactive power (vars) to rated apparent power shall be at least 60 % absorbing to 60 % supplying, the default reactive power setting shall be 0 %.	See appendix table 3.3.3.	P
3.3.4	Power rate limit		P
3.3.4.1	General	See below.	P
	The power rate limit for an inverter is a power quality response mode.		P
	The inverter shall have the capability to rate limit changes in power generation		P

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Clause	Requirement – Test	Result - Remark	Verdict
	through the grid-interactive port.		
	Inverters capable of multiple mode operation should have the capability to rate limit changes in power consumption (for example increasing/decreasing of charging rates of connected energy storage).		N/A
	The power rate limit does not apply when the inverter disconnection device is required to operate (i.e. to disconnect).		P
3.3.4.2	Gradient of power rate limit		P
	The default setting for the power rate limit (W_{Gra}) for increase and decrease shall be 16.67% of rated power per minute which is a nominal ramp time of 6 min.	See appendix table 3.3.4.	P
	The power rate limit (W_{Gra}) shall be adjustable within the range 5% to 100% of rated power per minute.	See appendix table 3.3.4.	P
	It is acceptable to have two separate power rate limits for increase and decrease in output power, as follows:		N/A
	(a) To rate limit an increase in power ($W_{Gra}+$).	Considered.	P
	(b) To rate limit a decrease in power ($W_{Gra}-$).	Considered.	P
3.3.4.3	Power rate limit modes		P
3.3.4.3.1	General		P
	The inverter power rate limit (W_{Gra}) is applicable to operate in the following modes:		P
	(a) Soft ramp up after connect, reconnect or soft ramp up/down following a response to frequency disturbance.	See appendix table 3.3.4.3.2.	P
	(b) Changes in a.c. operation and control.	See appendix table 3.3.4.3.3.	P
	(c) Changes in energy source operation.		P
3.3.4.3.2	Soft ramp up after connect or reconnect, reconnect or soft ramp up/down following a response to frequency disturbance		P
	All inverters shall have this mode. This mode shall be enabled as per Clause 4.7 and for the increase in power required by Clause 4.5.3 after frequency decreased to the required limit.	See appendix table 3.3.4.3.2.	P
3.3.4.3.3	Changes in a.c. operation and control		P
	If available, this mode shall be enabled for		P

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Clause	Requirement – Test	Result - Remark	Verdict
	a change in a demand response mode of Clause 3.2 (except for DRM 0).		
	When a demand response mode of Clause 3.2 (except for DRM 0) is asserted or unasserted the power rate limit (W_{Gra}) shall apply to the increase or decrease in power generation or consumption and the transitions between power levels.	See appendix table 3.3.4.3.3.	P
3.3.4.3.4	Changes in energy source operation		P
	This mode only applies to multiple mode inverters with energy storage. It operates when there is a change in the energy resource available to the inverter, which causes a change in output through the grid-interactive port.		P
	For this mode the power rate limit (W_{Gra}) should apply to the increase or decrease in power generation or charging of the energy storage through the grid-interactive port , and to the transitions between power output levels.		P
	For this mode the power rate limit (WGra) shall be available and disabled by default		N/A
	The increase or decrease for transitions between power output levels is contingent on external situations (such as amount of available solar energy, wind energy or discharge capacity).		N/A
	Only for increases or decreases in the output which are faster than the power rate limit (W_{Gra}) does a control action to limit the ramp rate apply.		N/A
3.3.4.4	Nonlinearity of power rate limit changes		P
	The nonlinearity (NL) of the power rate limit (W_{Gra}) in response to an increase of the inverter power output, as defined by the characteristic curve depicted in Figure 5, shall be less than 10%.	Considered.	P
3.4	Multiple mode inverter operation		P
3.4.1	General		P
	When the multiple mode inverter is disconnected from the grid any alternative supply port shall ensure that all active conductors are also isolated from the grid-interactive port.		P
	Multiple mode inverters shall be arranged		P

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Clause	Requirement – Test	Result - Remark	Verdict
	to ensure that the continuity of the neutral conductor to the load from the electrical installation is not interrupted when the inverter disconnects from the grid and supplies a load via the alternative supply port.		
	When the multiple mode inverter is operating in alternative supply mode and is disconnected from the grid, the alternative supply shall conform to the requirements for d.c. current injection (refer to Clause 2.10) into the connected load circuits. The type of RCD compatible with and for use on the alternative supply mode outputs shall be declared.		N/A
3.4.2	Sinusoidal output when providing alternative supply, independent supply and substitute supply".	See appendix table 3.4.2	P
	The a.c. output voltage waveform of a multiple mode inverter when providing an alternative supply, independent supply or substitute supply shall have a voltage total harmonic distortion (THD) not exceeding of 5% and no individual harmonic at a level exceeding 5%		P
3.4.3	Volt–watt response mode for inverters with energy storage when charging		P
	An inverter with energy storage that can be charged through the grid-interactive port shall have this volt–watt response mode.	See appendix table 3.4.3 Volt-watt response mode for charging of energy storage.	P
	This volt–watt response mode is only active when power from the grid is required to charge the energy storage.	Cosidered.	P
	The response curve required for the volt–watt response is defined by two volt response reference values and corresponding maximum power input levels through the grid-interactive port, the default values are listed in Table 3.8. Example response modes are shown in Figure 3.5	Cosidered.	P
3.4.4	Independent supply inverters	Grid interactive inverter	N/A
	These inverters have an independent supply inverters port for supplying the loads within the electrical installation.		N/A
	These inverters may also have an a.c. input port that can be directly connected to either a grid or an independent a.c. energy source such as a diesel		N/A

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Clause	Requirement – Test	Result - Remark	Verdict
	generating set.		
	Stand-alone inverters shall not output power from the a.c. input port during normal operation or fault conditions.		N/A
	A stand-alone inverter with an a.c. input port that is connected to a grid, shall conform to the requirements of this Standard with modifications as described in Appendix M.		N/A
3.4.5	Substitute supply port		N/A
	Multiple mode inverters with a grid-interactive port providing a supplementary supply may be provided with the capability to provide a substitute supply via a dedicated separate port or single socket-outlet that may be on the inverter		N/A
	The substitute supply port shall provide voltage between 220 V and 240 V and a frequency of 50 Hz, in accordance with AS IEC 60038		N/A
	The substitute supply port of a substitute supply inverter is a port that provides an electrically separated supply system intended to supply power in the event of an outage of the normal supply. Substitute supply ports shall		N/A
	(a)provide a dedicated separate port for fixed wiring to be installed to an external socket outlet or an integrated single a.c. outlet;		N/A
	(b) have a maximum continuous rating of 15A;		N/A
	(c)be protected by internal current limiting protection;		N/A
	(d)conform to the requirements of IEC 62109-1 for grid isolation;		N/A
	(e)provide a connection device that is coordinated with any other supply port/s such that all live conductors are disconnected from the grid and the electrical installation before connecting live conductors to the substitute supply port. An open transition device in accordance with IEC 60947-6-1 may be used; and		N/A
	(f)where there is a socket-outlet on the inverter, the outlet shall conform to AS/NZS 3112.		N/A

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Clause	Requirement – Test	Result - Remark	Verdict
	The manufacturer shall include instructions for utilizing the substitute supply port including any requirements for external overcurrent protection.		N/A
3.5	Security of operational settings		P
	The settings of the demand response or power quality response modes of the inverter shall be secured against inadvertent or unauthorized change.	Considered.	P
	Changes to the settings shall require the use of a tool and special instructions not provided to unauthorized personnel.	By Password	P
	The regional setting provided for Australia and New Zealand within the firmware shall be in conformance to this Standard. The inverter power quality response mode setting may be modified from the default values with agreement of the local electricity distributor		P
	Legacy settings that are for Australia and New Zealand may be provided for service and repair purposes, these settings shall be identified as “OBSOLETE” and listed after the regional settings of this Standard.		P

4	**Protective functions for connection to electrical installations and the grid**		**P**
4.1	General	See below.	P
	There shall be an automatic disconnection device to prevent injection of energy into the point of supply and prevent the formation of an unintentional island with the grid or part thereof when supply from the grid is disrupted.	The automatic disconnection device is integral part of the inverter.	P
	(a) if supply from the grid is disrupted;	Considered.	P
	(b) when the grid goes outside presetlimits (e.g. undervoltage/overvoltage, under-frequency/over-frequency); or	Considered.	P
	I when the demand response mode DRM 0 (see Clause 3.2) is asserted.	Considered.	P
	For inverter energy systems connected to multiple phases the automatic disconnection device shall operate if any of the above conditions is met on any phase.	Considered.	P

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Clause	Requirement – Test	Result - Remark	Verdict
4.2	Automatic disconnection device	The unit is switched off redundant by the high power bridge of the inverter and the relays in line and neutral.	P
	The automatic disconnection device shall provide isolation in all live conductors	Considered.	P
	The automatic disconnection device shall be capable of interrupting at least the rated current.	Provided in installation manual.	P
	A semiconductor (solid-state) device shall not be used for isolation purposes.	Considered.	P
4.3	Active anti-islanding protection	See below.	P
	The combination of the inverter and the automatic disconnection device shall incorporate at least one method of active anti-islanding protection.	Considered.	P
	The method used to provide active anti-islanding protection shall be declared in documentation.	RoCoF	P
	To prevent islanding, the active anti-islanding protection system shall operate the automatic disconnection device (see Clause 4.2) no longer than 2 s after disruption to the power supply from the grid.	See appendix table 4.3 Active anti-islanding protection	P
	Compliance shall be determined by type testing in accordance with the active anti-islanding test specified in Appendix H.	Considered.	P
4.4	Voltage and frequency limits (passive anti-islanding protection)	See below.	P
	The combination of the inverter and the automatic disconnection device shall incorporate the following forms of passive anti-islanding protection:	Considered.	P
	(a) Undervoltage and overvoltage protection.	See appendix table4.4	P
	(b) Under-frequency and over-frequency protection.	See appendix table4.4	P
4.5	Limits for sustained operation		P
4.5.1	General	See below.	P
	The inverter or inverter energy system shall remain connected over the range of voltages and frequencies that it is required to be compatible with. Refer to Clause 2.5.	Considered.	P

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Clause	Requirement – Test	Result - Remark	Verdict
4.5.2	Sustained operation for voltage variations		P
	The inverter shall operate the automatic disconnection device (see Clause 4.2) within 3 s when the average voltage for a 10 min period exceeds the V_{nom_max} specified in Table 4.3.	See appendix table4.5.2	P
4.5.3	Sustained operation for frequency variations		P
4.5.3.1	General	Considered.	P
	The inverter shall maintain continuous operation for frequency variations within the limits specified in Table 4.4 and respond as defined in Table 4.5.	Considered.	P
	Compliance shall be determined by type testing in accordance with the sustained operation for frequency variations test specified in Appendix J.	Considered.	P
4.5.3.2	Response to a decrease in grid frequency		P
4.5.3.2.1	General response to a decrease in frequency		P
	The inverter shall not reduce power output through the grid-interactive port in response to a decrease in frequency.		P
	In addition, when a disturbance results in a decrease in frequency below the continuous operation range (f_{LLCO}) and where the inverter has a reduced output due to a power quality response mode or demand response mode, the inverter shall increase the power output linearly with the decrease in frequency until the lower limit frequency range (f_{Pmax}) is reached.		P
	The power output level present at the time the frequency falls below f_{LLCO} shall be held as the reference power output level used to calculate the required response to the decrease in frequency.		P
	This is expressed in the equation below: $P_{out} = P_{ref} + \left[(P_{max} - P_{ref}) \left(\frac{(f_{LLCO} - f)}{(f_{LLCO} - f_{Pmax})} \right) \right]$ where P_{out}= required power output level for a frequency between f_{LLCO} and f_{Pmax} P_{max} = maximum power output of the inverter P_{ref} =reference power output level when		P

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Clause	Requirement – Test	Result - Remark	Verdict
	the frequency falls below f_{LLCO} F_{LLCO}=lower limit of continuous operation range for frequency f_{Pmax}=frequency where power output level is maximum f =frequency between f_{LLCO} and f_{Pmax} (i.e. $f_{Pmax} \leq f \leq f_{LLCO}$) When the frequency equals f_{Pmax} the inverter power output level shall be the maximum power output level (P_{max}). The power output level reached may be limited by the energy source availability.		
	The inverter power output level shall remain at or above the highest power output level reached in response to the decrease in frequency between f_{LLCO} and f_{Pmax}. This is to provide hysteresis in the control of the inverter. When the frequency has increased above (f_{LLCO} + f_{hyst}) for at least 20 s, the inverter shall return to continuous operation. Any change in power output level shall be at a rate no greater than the power rate limit (W_{Gra}) of Clause 3.3.4.		P
4.5.3.2.2	Response to a decrease in frequency for multiple mode inverters with energy storage	See appendix table 4.5.3	P
	The response to a decrease in frequency for multiple mode inverters with energy storage is a two-stage response. The initial stage applies if the energy storage is being charged via the grid-interactive port of the inverter and requires a reduction in the power input level through the grid-interactive port, the second stage requires the inverter to increase power output through the grid-interactive port as the frequency continues to decrease.	Considered.	P
	When a disturbance results in a decrease in frequency that falls below the continuous operation range (f_{LLCO}), and where the multiple mode is generating through the grid-interactive port (from any energy source) it shall maintain at least the same power output level until $f_{stop-ch}$.	Considered.	P
	When a disturbance results in a decrease in frequency that falls below the continuous operation range (f_{LLCO}), and where the multiple mode inverter is charging the energy storage from the grid-interactive port it shall reduce the power	Considered.	P

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Clause	Requirement – Test	Result - Remark	Verdict
	input level linearly with the decrease in frequency until $f_{stop-ch}$ is reached.		
	The power input level present at the time the frequency falls below f_{LLCO} shall be held as the reference power level used to calculate the required response to the decrease in frequency.	Considered.	P
	This is expressed in the equation below: $P_{charge} = P_{ref-ch}\left[1 - \frac{(f_{LLCO} - f)}{(f_{LLCO} - f_{stop-ch})}\right]$ zero where P_{charge}= power input level via the grid-interactive port for a frequency between f_{LLCO} and $f_{stop-ch}$ P_{ref-ch}= power input level via the grid-interactive port when the frequency falls below f_{LLCO} f_{LLCO}=lower limit of continuous operation range for frequency $f_{stop-ch}$=frequency where input power level is zero f =frequency between f_{LLCO} and $f_{stop-ch}$ (i.e. $f_{stop-ch} \le f \le f_{LLCO}$) When the frequency falls below fstop-ch, the inverter shall have ceased charging the energy storage via the grid-interactive port (i.e. 0 W).	See appendix table 4.5.3	P
	When a disturbance results in a decrease in frequency that falls below $f_{stop-ch}$ the multiple mode inverter with energy storage shall increase the power output level through the grid-interactive port linearly with the decrease in frequency until f_{Pmax} is reached, the maximum discharge rate of the energy storage is reached, or the state of charge of the energy storage is exhausted.	Considered.	P
	This is expressed in the equation below: $P_{out} = \begin{cases} P_{max}\left[\frac{(f_{stop-ch} - f)}{(f_{stop-ch} - f_{Pmax})}\right] & \text{if inverter charging before disturbance} \\ P_{ref} + (P_{max} - P_{ref})\left[\frac{(f_{stop-ch} - f)}{(f_{stop-ch} - f_{Pmax})}\right] & \text{if inverter generating before disturbance} \end{cases}$ where P_{out}= required power output level for a frequency between f_{LLCO} and f_{Pmax} P_{max} = maximum power output of the inverter P_{ref} =reference power output level when	See appendix table 4.5.3	P

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Clause	Requirement – Test	Result - Remark	Verdict
	the frequency falls below f_{LLCO} f_{Pmax}=frequency where power output level is maximum $f_{stop-ch}$=frequency where input power level is zero f =frequency between $f_{stop-ch}$ and f_{Pmax} (i.e. $f_{Pmax} \leq f \leq f_{stop-ch}$)		
	When the frequency has increased above (f_{LLCO}+f_{hyst}) for at least 20 s, the inverter shall be returned to continuous operation. This is to provide hysteresis in the control of the inverter. Any change in power level shall be at a rate no greater than the power rate limit (W_{Gra}) of Clause 3.3.4.		P
4.5.3.3	Response to an increase in frequency	Considered.	P
4.5.3.3.1	General response to an increase in frequency		P
	When a disturbance results in an increase in frequency that exceeds the continuous operation range (f_{ULCO}), the inverter shall reduce the power output linearly with the increase in frequency until f_{Pmin} is reached.		P
	The power output level present at the time the frequency exceeds f_{ULCO} shall be held as the reference power level used to calculate the required response to the increase in frequency.		P
	This is expressed in the equation below: $$P_{out} = P_{ref}\left[1 - \frac{(f - f_{ULCO})}{(f_{Pmin} - f_{ULCO})}\right]$$ where P_{out}= required power output level for a frequency between f_{ULCO} and f_{Pmax} P_{ref} =reference power output level when the frequency exceeds b f_{ULCO} f_{ULCO}=upper limit of the continuous operation range for frequency f_{Pmin}=frequency where power output level is zero f =frequency between f_{ULCO} and f_{Pmin}(i.e. $f_{ULCO} \leq f \leq f_{min}$) When the frequency exceeds fPmin the inverter power output shall be ceased (i.e. 0 W).		P
	The inverter power output level shall		P

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Clause	Requirement – Test	Result - Remark	Verdict
	remain at or below the lowest power output level reached in response to the increase in frequency between f_{ULCO} and f_{Pmin}. This is to provide hysteresis in the control of the inverter. When the frequency has decreased below ($f_{ULCO} - f_{hyst}$), for at least 20 s, the inverter shall return to continuous operation. Any change in power output level shall be at a rate no greater than the power rate limit (W_{Gra}) of Clause 3.3.4. As shown in Figure 4.3.		
4.5.3.3.2	Response to an increase in frequency for multiple mode inverters with energy storage	Considered.	P
	When a disturbance results in an increase in frequency that exceeds the continuous operation range of (f_{ULCO}), the multiple mode inverter that is charging the energy storage via the grid-interactive port shall maintain at least the same power input level with the increase in frequency until $f_{transition}$ is reached.	Considered.	P
	When a disturbance results in an increase in frequency that exceeds the continuous operation range of (f_{ULCO}), the multiple mode inverter that is generating (from any energy source) shall reduce the power output linearly with the increase in frequency until $f_{transition}$ is reached. The power output level present at the time the frequency exceeds f_{ULCO} shall be held as the reference power output level used to calculate the required response to the increase in frequency.	Considered.	P
	This is expressed in the equation below: $$P_{out} = P_{ref}\left[1 - \frac{(f - f_{ULCO})}{(f_{transition} - f_{ULCO})}\right]$$ where P_{out}= required power output level for a frequency between f_{ULCO} and f_{Pmax} P_{ref} =reference power output level when the frequency exceeds f_{ULCO} f_{ULCO}=upper limit of the continuous operation range for frequency $f_{transition}$=frequency where power output level is zero f =frequency between f_{ULCO} and $f_{transition}$(i.e. $f_{ULCO} \le f \le f_{transition}$)	See appendix table 4.5.3	P

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Clause	Requirement – Test	Result - Remark	Verdict
	When the frequency exceeds $f_{transition}$ the inverter power output shall be ceased (i.e. 0 W).		
	When a disturbance results in an increase in frequency that exceeds $f_{transition}$, the multiple mode inverter shall increase the power input level through the grid-interactive port, linearly with the increase in frequency until f_{Pmin} is reached, the maximum charge rate of the energy storage is reached, or the state of charge of the energy storage is full.	Considered.	P
	This is expressed in the equation below: $P_{charge} = \begin{cases} P_{rated\text{-}ch}\left[\frac{(f - f_{transition})}{(f_{Pmin} - f_{transition})}\right] & \text{if inverter generating before disturbance} \\ P_{ref\text{-}ch} + (P_{rated\text{-}ch} - P_{ref\text{-}ch})\left[\frac{(f - f_{transition})}{(f_{Pmin} - f_{transition})}\right] & \text{if inverter charging before disturbance} \end{cases}$ where P_{charge}= required power input level for a frequency between $f_{transition}$ and f_{Pmin} $P_{ref\text{-}ch}$=reference power input level when the frequency exceeds f_{ULCO} $P_{rated\text{-}ch}$ = rated power input level of the inverter f_{Pmin}=frequency where power input level is maximum $f_{transition}$=frequency where input power level is zero f =frequency between $f_{transition}$ and f_{Pmin} (i.e. $f_{transition} \leq f \leq f_{pmin}$)	See appendix table 4.5.3	P
	This is to provide hysteresis in the control of the inverter. When the frequency has decreased below ($f_{ULCO} – f_{hyst}$), for at least 20 s, the power level of the inverter shall be restored to the pre-disturbance level at a rate no greater than the power rate limit (W_{Gra}) of Clause 3.3.4.	Considered.	P
4.5.4	Voltage disturbance withstand	See appendix table 4.5.4	P
	A voltage disturbance is any variation of voltages outside the voltage limits continuous operation Table 4.8. The inverter or inverter energy system shall respond as specified in Table 4.8 for voltage disturbances.		P
	The inverter shall cease power generation within 200 ms after the measured voltage falls below or exceeds the continuous operation limits. For voltage disturbances lasting less than the trip delay times in Table 4.1, the inverter shall restore active power output to the pre-disturbance level within 400 ms after the measured voltage		P

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Clause	Requirement – Test	Result - Remark	Verdict
	has returned to within the continuous operation limits of Table 4.8.		
	For a three-phase inverter, the inverter shall respond in the event of a voltage disturbance on any of the phases.		P
	For a multiple mode inverter meeting the performance classification for output requirement of AS IEC 62040.3 that provides an operational mode to supply load continuously during grid disruption, the inverter may disconnect the grid-interactive port in place of the cease power generation requirement, provided that when the grid voltage recovers within the voltage requirements of the AS IEC 62040.3 performance classification relevant to the inverter, the inverter shall restore active power output through the grid-interactive port to the pre-disturbance level within 400 ms.	Inverter can recover the previous active power in 400ms.	P
4.5.4.2	Multiple voltage disturbance	See appendix table 4.5.4	P
	A multiple voltage disturbance event is any number of voltage disturbances as defined in Clause 4.5.4.1 where the cumulative time that the voltage is less than the trip delay time as specified in Table 4.1, provided that each voltage disturbance occurs no more than 15 s since the previous disturbance.		P
4.5.5	Voltage phase angle shift withstand		P
	The inverter shall remain in continuous operation for a single-phase voltage angle shift within a voltage cycle of at least 60 electrical degrees. In addition, three-phase inverters shall remain in continuous operation for a voltage phase angle shift within a voltage cycle, in the positive-sequence, of at least 20 electrical degrees. Refer to Table 4.9.	See appendix table 4.5.5	P
4.5.6	Rate of change of frequency		P
	The inverter shall maintain continuous operation for frequency excursions with a rate of change of frequency (ROCOF) that do not exceed ±4.0 Hz/s for a duration of 0.25 s.	See appendix table 4.5.3	P
4.6	Disconnection on external signal	See below	P
	The automatic disconnection device shall incorporate the ability to disconnect on an external signal.	Considered.	P

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Clause	Requirement – Test	Result - Remark	Verdict
	If an external signal or demand response 'DRM 0' condition is asserted, the automatic disconnection device shall operate within 2 s.	See appendix table 3.2	P
4.7	Connection and reconnection procedure		P
	Only after all of the following conditions have been met shall the automatic disconnection device operate to connect or reconnect the inverter to the grid -	The unit provides monitoring of the voltage, frequency and synchronisation. If one of these conditions is not met, then the unit is not switching on.	P
	(a) the voltage of the grid has been maintained within the limits of AS IEC 60038 (for Australia) or IEC 60038 (for New Zealand) for at least 60 s;	Considered.	P
	(b) the frequency has been maintained within the range 47.5 Hz to the upper connection and reconnection frequency (fURF) for each region shown in Table 4.10 for at least 60 s;	Considered.	P
	I the inverter and the grid are synchronized and in-phase with each other; and	Considered.	P
	(d) no external disconnect signal is present or DRM 0 asserted requiring the system to be disconnected.	Considered.	P
4.8	Security of protection settings	See below.	P
	The settings of the automatic disconnection device shall be secured against inadvertent or unauthorized changes. Changes to the settings shall require the use of a tool and special instructions not provided to unauthorized personnel.	Changes to the internal settings shall require the use of a tool and special instructions provided to authorized personnel.	P
	The specific regional settings selected for Australia or New Zealand, once applied or confirmed for each inverter, shall be secured against unauthorized changes.	Considered.	P
4.9	Activation of protection settings		P
	The inverter shall not operate the automatic disconnection device to connect until a regional setting has been selected and activated by an authorized person.	Considered.	P
	Where the inverter does not connect due to no selection or activation of a regional configuration, the inverter shall provide a visible alert.	Considered.	P
	Legacy settings that are for Australia and New Zealand may be provided for service		P

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Clause	Requirement – Test	Result - Remark	Verdict
	and repair purposes, these settings shall be identified as “OBSOLETE” and listed after the regional settings of this Standard.		
	The inverter settings shall be able to be viewed in read-only mode for verification. A set of operational instructions for viewing inverter regional setting shall be available. Inverter regional setting may be displayed via a panel/screen, external device or software interface.	Considered.	P

5	**Multiple inverter combinations**		**N/A**
5.1	General	See below.	N/A
	If a combination is not tested, it should not be used or external devices should be used in accordance with the requirements of AS/NZS 4777.1.	The is a three-phase grid inverter, and it’s not used for combination installations.	N/A
	Possible combinations are single-phase inverters used in parallel, single-phase inverters used in multiple phase installations and three-phase inverters used in parallel.	The is a three-phase grid inverter, and it’s not used for combination installations.	N/A
5.2	Inverter current balance across multiple phases		N/A
	The maximum current imbalance in a multiple-phase inverter energy system comprised of either individual single-phase inverters connected on separate phases or a combination of single-phase inverters and multiple-phase inverters shall not exceed 21.7 A for more than 15 s.	The is a three-phase grid inverter, and it’s not used for combination installations.	N/A
5.3	Grid disconnection		N/A
	When any inverter (single-phase or multiple-phase) within a multiple-phase inverter energy system disconnects as required by Clause 4, all inverters within the multiple-phase inverter energy system shall disconnect within 2 s of the first inverter disconnecting.	The is a three-phase grid inverter, and it’s not used for combination installations.	N/A
	This applies to all inverters used in combination for multiple phases.	The is a three-phase grid inverter, and it’s not used for combination installations.	N/A
5.4	Grid connection and reconnection	No such installation.	N/A
	When multiple inverters are used together in a multiple phase combination, only after all the conditions of Clause 4.7 have been met on all connected phases shall the		N/A

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Clause	Requirement – Test	Result - Remark	Verdict
	automatic disconnection device operate to connect or reconnect any inverter of the multiple phase combination to the grid.		
	Where any inverter used in a multiple phase combination has a rated current exceeding 21.7 A per phase, the requirement of Clause 5.2 shall be met when connecting or reconnecting.		N/A
5.5	Testing combinations		N/A
5.5.1	Single-phase combinations		N/A
	Single-phase parallel combinations of inverters shall be tested for combinations with total rated current (I_{rated}) equal to or up to the maximum of 6 A per phase.	The is a three-phase grid inverter, and it's not used for combination installations.	N/A
	To determine the number of inverters to be tested, the following equation shall be used: $N = \frac{6}{I_{rated}}$ where N = number to be tested, rounded up to next whole number I_{rated} = rating of the inverter in amperes If N ≥ 2, the minimum number of inverters to be tested shall be N. If N > 6, the maximum number of inverters to be tested in a combination shall be 6.	The is a three-phase grid inverter, and it's not used for combination installations.	N/A
5.5.2	Single-phase inverters used in three-phase combinations		N/A
	For single-phase inverters with rated current (I_{rated}) greater than or equal to 5 A used in three-phase combinations, three inverters shall be tested in a three-phase arrangement [refer to Figure 5.1(a)].	The is a three-phase grid inverter, and it's not used for combination installations.	N/A
	Single-phase inverters with rated current less than 5 A and to be used in three-phase combinations shall be tested in combination with at least two inverters per phase [refer to Figure 5.1(b).	The is a three-phase grid inverter, and it's not used for combination installations.	N/A
5.5.3	Required tests for multiple inverter combinations		N/A
	Any single-phase inverter used in a multiple inverter combination shall be tested individually and meet all the requirements of this Standard. Any single-	The is a three-phase grid inverter, and it's not used for combination installations.	N/A

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Clause	Requirement – Test	Result - Remark	Verdict
	phase inverter which is to be used as part of a multiple inverter combination shall be tested in combination as specified in Clauses 5.5.1 and 5.5.2.		
5.5.4	Multiple inverters with one automatic disconnection device		N/A
	Where the inverter does not have an internal automatic disconnection device, or requires an external automatic disconnection device to provide the required disconnection function, or both, testing shall be conducted with the automatic disconnection device and with either the number of inverters required by Clause 5.5.1 and 5.5.2 or with the automatic disconnection device configured with the number of inverters specified by the manufacturer's instructions.	The is a three-phase grid inverter, and it's not used for combination installations.	N/A
6	**Generation control function**		P
6.1	General		P
	The generation control function for an inverter or multiple inverter combination should operate with the following limits:		P
	(i) Soft limit: A limit that will cause the inverter or multiple inverter combination to reduce its output, preventing generation greater than the limit.	Considered.	P
	(ii) Hard limit: A limit that when activated will cause the inverter or multiple inverter combination to disconnect (e.g. when the soft limit has not been met).	Considered.	P
	The generation control function shall monitor the response of the inverter or multiple inverter combination to the soft limit and hard limit. Where a fault or loss of operability is detected the generation control function shall respond such that on failure of —		P
	(A) the soft limit function, reduce the output of the inverter or multiple inverter combination to zero within 15 s; and	See appendix table 6.2	P
	(B) the hard limit function, operate the automatic disconnection device within 5 s.	See appendix table 6.2	P
	The generation control may use inverter internal measurements and/or external sensors for measurements. All	External power sensor SDM630-M used for measurements by Eastron, and current sensor	P

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Clause	Requirement – Test	Result - Remark	Verdict
	measurement for generation control functions shall conform to Table 2.5 specifications. The generation control function may be integrated into the inverter and/or use an external controller	CTSA016-100A/50mA used for measurements by YUANXING.	
	Where an external measurement device or controller is used, any loss of signal or failure of the device shall cause the inverter or multiple inverter combination to operate the automatic disconnection device and disconnect within 2 s, unless the only generation limit control activated is a soft export limit, in which case the inverter or multiple inverter combination shall reduce active power output to the soft export limit setting as a maximum within 15 s.	External power sensor SDM630-M used for measurements by Eastron, and current sensor CTSA016-100A/50mA used for measurements by YUANXING.	P
6.2	Generation limit control		P
6.2.1	General		P
	The generation limit control for an inverter or multiple inverter combination shall limit the active power output level, specified as an active power value (W). The generation limit control function shall have a hard limit and a soft limit implemented, and the soft limit shall be less than the hard limit.	Considered.	P
	Where a generation limit has been applied the generation limit shall be substituted for the inverter or multiple inverter combination rated apparent power for determining the corresponding level of response for the power quality response modes of the inverter or multiple inverter combination. The power quality response modes shall be based on the generation limit active power setting instead of the IES rated apparent power. For multiple inverter combinations, including multi-phase systems, the generation limit shall apply to the net active power output at the point of generation.	Considered.	P
6.2.2	Soft limit		P
	For the generation limit control function a soft limit shall be utilized to control the active power output level such that the hard limit is not exceeded.	See appendix table 6.2	P
	Where the soft limit is exceeded, the generation limit control function shall operate to reduce the active power output of the inverter or multiple inverter	See appendix table 6.2	P

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Clause	Requirement – Test	Result - Remark	Verdict
	combination to less than the soft limit within 15 s.		
6.2.3	Hard limit		P
	For inverter or multiple inverter combination the hard limit shall be applied. Where the hard limit is exceeded for 15 s the generation limit control function shall operate to disconnect the inverter or each inverter within the multiple inverter combination within 2 s.	See appendix table 6.2	P
6.3	Export limit control		P
6.3.1	General		P
	The export limit control for an inverter or multiple inverter combination shall limit the active power export level, specified as an active power value (W). The export limit may be set to allow export to the grid or to provide a minimum import load from the grid.	Considered.	P
6.3.2	Soft limit		P
	For the export limit control function, where the soft limit is exceeded the export limit control function shall operate to reduce the power output of the inverter or multiple inverter combination such that the export limit of the electrical installation is met within 15 s.	See appendix table 6.3	P
6.3.3	Hard limit		P
	For inverter or multiple inverter combination the hard limit may be applied. For the export limit control function, where the hard limit is exceeded the export limit control function shall operate to disconnect the inverter or each inverter within the multiple inverter combination within 2 s.	See appendix table 6.3	P

7	**Inverter marking and documentation**		**P**
7.1	General		P
	All markings and documentation shall be in the English language.	All markings and documentation are in the English language.	P
7.2	Marking		P
7.2.1	General		P
7.2.2	Equipment ratings		P
	Photovoltaic		-

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Clause	Requirement – Test	Result - Remark	Verdict
	Vmax PV (absolute maximum)	1000V	P
	Isc PV (absolute maximum)	IVGM25KHP3G3: 63A+63A IVGM20KHP3G3: 63A+63A IVGM15KHP3G3: 63A+32A IVGM12KHP3G3: 63A+32A IVGM10KHP3G3: 32A+32A IVGM9K9HP3G3: 32A+32A IVGM8KHP3G3: 32A+32A	P
	Wind (a.c. or d.c.)		-
	Voltage (nominal or range)	-	N/A
	Rated current (maximum continuous)	-	N/A
	Frequency (nominal or range) (a.c. wind only)	-	N/A
	Energy storage ports		P
	Voltage (nominal)	700Vd.c.	P
	Rated current (maximum continuous)	IVGM25KHP3G3: 50A, IVGM20KHP3G3: 50A, IVGM15KHP3G3: 50A, IVGM12KHP3G3: 50A, IVGM10KHP3G3: 50A, IVGM9K9HP3G3: 50A, IVGM8KHP3G3: 50A,	P
	Other energy sources or inputs (a.c. or d.c.)		P
	Voltage (nominal or range)	230Vac/400Vac, 3L+N+PE	P
	Rated current (maximum continuous)	IVGM25KHP3G3: 36.3A, IVGM20KHP3G3: 29A, IVGM15KHP3G3: 21.7A, IVGM12KHP3G3: 17.4A, IVGM10KHP3G3: 14.5A, IVGM9K9HP3G3: 14.3A, IVGM8KHP3G3: 11.6A,	P
	Power factor (range)	0.8 lead-0.8 lag	P
	Frequency (nominal or range) (a.c. sources only)	50Hz	P
	a.c. output ratings (for each port)		P
	Voltage (nominal or range)	230Vac/400Vac, 3L+N+PE	P
	Rated current	IVGM25KHP3G3: 36.3A, IVGM20KHP3G3: 29A, IVGM15KHP3G3: 21.7A, IVGM12KHP3G3: 17.4A, IVGM10KHP3G3: 14.5A, IVGM9K9HP3G3: 14.3A, IVGM8KHP3G3: 11.6A	P
	Frequency (nominal or range)	50Hz	P

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Clause	Requirement – Test	Result - Remark	Verdict
	Rated apparent power	IVGM25KHP3G3: 25kW, IVGM20KHP3G3: 20kW, IVGM15KHP3G3: 15kW, IVGM12KHP3G3: 12kW, IVGM10KHP3G3: 10kW, IVGM9K9HP3G3: 9.9kW, IVGM8KHP3G3: 8 kW	P
	Power factor range(range)	0.8 lead-0.8 lag	P
	d.c. output ratings		-
	Voltage (nominal or range)	-	N/A
	Rated current	-	N/A
	All ports		--
	Protective class (I, II or III)	Class I	P
	Over voltage Category	DC side: overvoltage II; AC side: overvoltage III;	P
	Inverter topology	**Non-Isolation**	**P**
	Ingress protection (IP) rating	**IP66**	**P**
7.2.3	Ports		P
	Each port shall be marked with its classification and indicate whether a.c or d.c. voltage as appropriate.	The classification marking were provided adjacent to the connection terminals.	P
7.2.4	External and ancillary equipment	External power sensor SDM630-M used for measurements by Eastron, and current sensor CTSA016-100A/50mA used for measurements by YUANXING.	P
7.2.5	Residual current devices (RCDs)		P
	Where an external RCD is required, the inverter shall be marked with a warning along with the rating and type of RCD required. The warning shall be located in a prominent position and written in lettering at least 5 mm high. It shall contain the following or an equivalent statement: **WARNING: AN RCD IS REQUIRED ON THE [*NAME*] PORTS OF THE INVERTER**	The Residual current devices (RCDs) is integral part of inverter. An applicable test report according to IEC 62109-1, IEC 62109-2 must be provided by the manufacturer.	P
	If the inverter energy system requires a Type B RCD, the inverter shall be marked with a warning. The warning shall be located in a prominent position and written in lettering at least 5 mm high. It shall contain the following:	The Residual current devices (RCDs) is integral part of inverter. An applicable test report according to IEC 62109-1, IEC 62109-2 must be provided by the	N/A

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Clause	Requirement – Test	Result - Remark	Verdict
	WARNING: A TYPE B RCD IS REQUIRED ON THE [*NAME*] PORTS OF THE INVERTER	manufacturer.	
7.2.6	Demand response modes		P
	The demand response modes supported by the inverter should be permanently marked on the name plate or on a durable sticker located on or near the demand response interface port to indicate the demand response modes of which the unit is capable.	The demand response modes supported by the inverter has permanently marked on the nameplate closed the communication terminals for DRED.	P
7.3	Documentation		P
7.3.1	General	Considered.	P
7.3.2	Equipment ratings	Considered.	P
	Photovoltaic		-
	V_{max} PV (absolute maximum)	1000Vdc	P
	PV input operating voltage range	150-1000Vd.c.	P
	Maximum operating PV input current	IVGM25KHP3G3: 42A+42A IVGM20KHP3G3: 42A+42A IVGM15KHP3G3: 42A+21A IVGM12KHP3G3: 42A+21A IVGM10KHP3G3: 21A+21A IVGM9K9HP3G3: 21A+21A IVGM8KHP3G3: 21A+21A	P
	I_{sc} PV (absolute maximum)	IVGM25KHP3G3: 63A+63A IVGM20KHP3G3: 63A+63A IVGM15KHP3G3: 63A+32A IVGM12KHP3G3: 63A+32A IVGM10KHP3G3: 32A+32A IVGM9K9HP3G3: 32A+32A IVGM8KHP3G3: 32A+32A	P
	Maximum inverter backfeed current to arrayTI	0A	P
	Wind (a.c. or d.c.)		-
	Voltage (nominal or range)	-	N/A
	Rated current (maximum continuous)	-	N/A
	Current (inrush)	-	N/A
	Frequency (nominal or range) (a.c. wind only)	-	N/A
	Energy storage ports		P
	Voltage (nominal or range)	160-700Vd.c	P
	Nominal battery voltage	500 Vd.c	P
	Rated current (maximum continuous) input	IVGM25KHP3G3: 50A, IVGM20KHP3G3: 50A,	P

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Clause	Requirement – Test	Result - Remark	Verdict
	and output	IVGM15KHP3G3: 50A, IVGM12KHP3G3: 50A, IVGM10KHP3G3: 50A, IVGM9K9HP3G3: 50A, IVGM8KHP3G3: 50A,	
	Storage type	LFP(LiFePO4)	P
	Other energy sources or inputs (a.c. or d.c.)		P
	Voltage (nominal or range)	230Vac/400Vac, 3L+N+PE	P
	Rated current (maximum continuous)	IVGM25KHP3G3: 36.3A, IVGM20KHP3G3: 29A, IVGM15KHP3G3: 21.7A, IVGM12KHP3G3: 17.4A, IVGM10KHP3G3: 14.5A, IVGM9K9HP3G3: 14.3A, IVGM8KHP3G3: 11.6A	P
	Power factor (range)	0.8 lead-0.8 lag	P
	Frequency (nominal or range) (a.c. sources only)	50Hz	P
	a.c. output ratings (for each port)		P
	Voltage (nominal or range)	230Vac/400Vac, 3L+N+PE	P
	Rated current	IVGM25KHP3G3: 36.3A, IVGM20KHP3G3: 29A, IVGM15KHP3G3: 21.7A, IVGM12KHP3G3: 17.4A, IVGM10KHP3G3: 14.5A, IVGM9K9HP3G3: 14.3A, IVGM8KHP3G3: 11.6A	P
	Current (inrush)	140A	P
	Frequency (nominal or range)	50Hz	P
	Rated apparent power	IVGM25KHP3G3: 27.5kW, IVGM20KHP3G3: 22kW, IVGM15KHP3G3: 16.5kW, IVGM12KHP3G3: 13.2kW, IVGM10KHP3G3: 11kW, IVGM9K9HP3G3: 9.9kW, IVGM8KHP3G3: 8.8kW	P
	Power factor range	0.8 lead-0.8 lag	P
	Maximum output fault current	120A	P
	Maximum output overcurrent protection	RMS 60A for software overcurrent protection, 90A for first level hardware overcurrent protection,	P
	d.c. output ratings		-
	Voltage (nominal or range)	-	N/A

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Clause	Requirement – Test	Result - Remark	Verdict
	Rated current	-	N/A
	All ports		--
	Protective class (I, II or III)	Class I	P
	Over voltage category	DC side: overvoltage II; AC side: overvoltage III;	P
	Inverter topology	Non-Isolation	P
	Active anti-islanding method	ROCOF	P
	Ingress protection (IP) rating	IP66	P
	Temperature operating range	-40° C ~ +60° C(above 45° C derating)	P
7.3.3	Ports	Reference installation manual.	P
7.3.4	External and ancillary equipment	Considered.	P
7.3.5	RCDs		N/A
7.3.6	Multiple mode inverters		P
7.3.7	Multiple inverter combinations		N/A
7.3.8	Firmware	Provided in installation manual.	P
Appendix A	**General test and reporting requirement (Normative)**		**P**
Appendix B	**Harmonic current limit test (Normative)**		**P**
Appendix C	**Transient voltage limit test (Normative)**		**P**
Appendix D	**DC injection test (Normative)**		**P**
Appendix E	**Demand response mode testing including disconnection on external signal (Normative)**		**P**
Appendix F	**Fixed power factor mode and reactive power mode test (Normative)**		**P**
Appendix G	**Power quality (voltage) response mode testing (Normative)**		**P**

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Clause	Requirement – Test	Result - Remark	Verdict
Appendix H	**Active anti-islanding test (Normative)**		**P**
Appendix I	**Voltage and frequency limits tests (Normative)**		**P**
Appendix J	**Sustained operation test procedures (Normative)**		**P**
Appendix K	**Multiple inverter testing (Informative)**		**N/A**
Appendix L	**Generation control function testing**		**P**
Appendix M	**Stand-alone inverters**		**N/A**

Test Results

2.7 Harmonic currents **Appendix B.2 Harmonic Current Limit Test**							**P**
Test: IVGM25KHP3G3							
L1 phase							
Generating Unit rating per phase (rpp)							
	At 50% of rated output current			**100% of rated output current**			
	Watts	4236.972		Watts	8098.547		
	VA	4248.682		VA	8110.515		
	Vrms	230.096		Vrms	230.232		
	Arms	18.465		Arms	35.228		
	PF	0.997		PF	0.999		
	Frequency	50.000		Frequency	50.000		
Harmonic	Value A	Angle degrees	% of fundamental	Value A	Angle degrees	% of fundamental	Limit in % of fundamental
1st	18.384	N/A	101.478	35.176	N/A	97.086	--
2nd	0.029	N/A	0.163	0.046	N/A	0.128	1.0
3rd	0.184	N/A	1.015	0.409	N/A	1.129	4.0
4th	0.014	N/A	0.080	0.025	N/A	0.068	1.0
5th	0.125	N/A	0.687	0.183	N/A	0.504	4.0
6th	0.029	N/A	0.160	0.037	N/A	0.103	1.0
7th	0.193	N/A	1.065	0.213	N/A	0.587	4.0
8th	0.012	N/A	0.066	0.014	N/A	0.038	1.0
9th	0.206	N/A	1.140	0.171	N/A	0.471	2.0
10th	0.010	N/A	0.056	0.013	N/A	0.037	0.5
11th	0.109	N/A	0.602	0.131	N/A	0.361	2.0
12th	0.016	N/A	0.088	0.020	N/A	0.055	0.5
13th	0.072	N/A	0.399	0.055	N/A	0.150	2.0
14th	0.006	N/A	0.035	0.010	N/A	0.027	0.5
15th	0.047	N/A	0.259	0.032	N/A	0.088	1.0
16th	0.006	N/A	0.034	0.010	N/A	0.026	0.5
17th	0.041	N/A	0.227	0.032	N/A	0.088	1.0
18th	0.010	N/A	0.057	0.014	N/A	0.040	0.5
19th	0.030	N/A	0.167	0.028	N/A	0.077	1.0
20th	0.004	N/A	0.020	0.007	N/A	0.018	0.5
21st	0.026	N/A	0.143	0.027	N/A	0.074	0.6
22nd	0.005	N/A	0.026	0.008	N/A	0.022	0.5
23rd	0.021	N/A	0.114	0.020	N/A	0.055	0.6
24th	0.007	N/A	0.040	0.012	N/A	0.034	0.5
25th	0.023	N/A	0.126	0.014	N/A	0.039	0.6
26th	0.003	N/A	0.015	0.007	N/A	0.019	0.5
27th	0.023	N/A	0.128	0.015	N/A	0.042	0.6
28th	0.003	N/A	0.018	0.007	N/A	0.021	0.5
29th	0.016	N/A	0.086	0.018	N/A	0.050	0.6
30th	0.006	N/A	0.030	0.010	N/A	0.028	0.5
31st	0.011	N/A	0.058	0.014	N/A	0.038	0.6
32nd	0.003	N/A	0.016	0.006	N/A	0.016	0.5
33rd	0.015	N/A	0.084	0.014	N/A	0.040	0.6
THD (to 50th)	N/A	N/A	0.328	N/A	N/A	0.281	5.0

L2 phase							
Generating Unit rating per phase (rpp)							
	At 50% of rated output current			**100% of rated output current**			
	Watts	4239.299		Watts	8187.634		
	VA	4252.617		VA	8201.058		
	Vrms	230.231		Vrms	230.363		
	Arms	18.471		Arms	35.601		
	PF	0.997		PF	0.999		
	Frequency	50.000		Frequency	50.000		
Harmonic	Value A	Angle degrees	% of fundamental	Value A	Angle degrees	% of fundamental	Limit in % of fundamental
1st	18.354	N/A	101.312	35.199	N/A	97.150	--
2nd	0.027	N/A	0.147	0.054	N/A	0.148	1.0
3rd	0.146	N/A	0.806	0.366	N/A	1.010	4.0
4th	0.014	N/A	0.078	0.026	N/A	0.073	1.0
5th	0.121	N/A	0.666	0.182	N/A	0.501	4.0
6th	0.029	N/A	0.160	0.041	N/A	0.114	1.0
7th	0.186	N/A	1.028	0.206	N/A	0.568	4.0
8th	0.012	N/A	0.064	0.015	N/A	0.042	1.0
9th	0.192	N/A	1.061	0.168	N/A	0.463	2.0
10th	0.011	N/A	0.061	0.014	N/A	0.039	0.5
11th	0.100	N/A	0.552	0.126	N/A	0.349	2.0
12th	0.013	N/A	0.073	0.021	N/A	0.057	0.5
13th	0.066	N/A	0.364	0.046	N/A	0.126	2.0
14th	0.006	N/A	0.035	0.010	N/A	0.029	0.5
15th	0.043	N/A	0.238	0.035	N/A	0.095	1.0
16th	0.005	N/A	0.028	0.010	N/A	0.027	0.5
17th	0.041	N/A	0.224	0.026	N/A	0.070	1.0
18th	0.009	N/A	0.052	0.014	N/A	0.040	0.5
19th	0.032	N/A	0.176	0.024	N/A	0.067	1.0
20th	0.003	N/A	0.017	0.007	N/A	0.020	0.5
21st	0.032	N/A	0.175	0.018	N/A	0.051	0.6
22nd	0.005	N/A	0.025	0.008	N/A	0.021	0.5
23rd	0.028	N/A	0.157	0.016	N/A	0.045	0.6
24th	0.006	N/A	0.035	0.012	N/A	0.034	0.5
25th	0.025	N/A	0.140	0.015	N/A	0.040	0.6
26th	0.003	N/A	0.016	0.007	N/A	0.018	0.5
27th	0.021	N/A	0.114	0.015	N/A	0.041	0.6
28th	0.004	N/A	0.019	0.008	N/A	0.022	0.5
29th	0.018	N/A	0.100	0.012	N/A	0.034	0.6
30th	0.005	N/A	0.026	0.010	N/A	0.028	0.5
31st	0.016	N/A	0.086	0.011	N/A	0.031	0.6
32nd	0.003	N/A	0.014	0.006	N/A	0.016	0.5
33rd	0.014	N/A	0.079	0.011	N/A	0.029	0.6
THD (to 50th)	N/A	N/A	0.324	N/A	N/A	0.246	5.0

L3 phase							
Generating Unit rating per phase (rpp)							
	At 50% of rated output current			**100% of rated output current**			
	Watts	4217.057		Watts	8096.004		
	VA	4225.570		VA	8104.910		
	Vrms	230.143		Vrms	230.300		
	Arms	18.361		Arms	35.193		
	PF	0.997		PF	0.999		
	Frequency	50.000		Frequency	50.000		
Harmonic	Value A	Angle degrees	% of fundamental	Value A	Angle degrees	% of fundamental	Limit in % of fundamental
1st	18.205	N/A	100.494	35.155	N/A	97.029	--
2nd	0.039	N/A	0.216	0.070	N/A	0.192	1.0
3rd	0.204	N/A	1.129	0.415	N/A	1.146	4.0
4th	0.019	N/A	0.106	0.037	N/A	0.102	1.0
5th	0.126	N/A	0.697	0.189	N/A	0.521	4.0
6th	0.043	N/A	0.240	0.062	N/A	0.170	1.0
7th	0.186	N/A	1.024	0.209	N/A	0.578	4.0
8th	0.016	N/A	0.089	0.021	N/A	0.059	1.0
9th	0.196	N/A	1.084	0.162	N/A	0.447	2.0
10th	0.012	N/A	0.067	0.016	N/A	0.044	0.5
11th	0.099	N/A	0.547	0.131	N/A	0.361	2.0
12th	0.022	N/A	0.122	0.031	N/A	0.085	0.5
13th	0.066	N/A	0.363	0.051	N/A	0.141	2.0
14th	0.009	N/A	0.048	0.013	N/A	0.037	0.5
15th	0.043	N/A	0.238	0.031	N/A	0.084	1.0
16th	0.008	N/A	0.046	0.013	N/A	0.036	0.5
17th	0.041	N/A	0.224	0.027	N/A	0.075	1.0
18th	0.016	N/A	0.086	0.022	N/A	0.062	0.5
19th	0.031	N/A	0.174	0.026	N/A	0.071	1.0
20th	0.005	N/A	0.029	0.010	N/A	0.026	0.5
21st	0.029	N/A	0.163	0.020	N/A	0.054	0.6
22nd	0.007	N/A	0.038	0.011	N/A	0.031	0.5
23rd	0.027	N/A	0.148	0.018	N/A	0.051	0.6
24th	0.011	N/A	0.060	0.019	N/A	0.053	0.5
25th	0.023	N/A	0.129	0.018	N/A	0.051	0.6
26th	0.004	N/A	0.024	0.010	N/A	0.027	0.5
27th	0.020	N/A	0.113	0.015	N/A	0.042	0.6
28th	0.006	N/A	0.033	0.013	N/A	0.035	0.5
29th	0.018	N/A	0.099	0.014	N/A	0.040	0.6
30th	0.008	N/A	0.044	0.017	N/A	0.046	0.5
31st	0.015	N/A	0.084	0.013	N/A	0.036	0.6
32nd	0.004	N/A	0.023	0.009	N/A	0.025	0.5
33rd	0.014	N/A	0.080	0.013	N/A	0.035	0.6
THD (to 50th)	N/A	N/A	0.330	N/A	N/A	0.290	5.0
Note: The reference network impedance: 0.15 Ω + j0.15 Ω for phase conductor and 0.1 Ω + j0.1 Ω for the neutral conductor.							

2.8 Voltage Fluctuations and Flicker		P
Limit	Pst = 1.0	Plt = 0.65
Test: IVGM25KHP3G3		
Test value (L1 Phase)	0.410	0.402
Test value (L2 Phase)	0.410	0.401
Test value (L3 Phase)	0.400	0.401

Note:

The reference network impedance: 0.15 Ω + j0.15 Ω for phase conductor and 0.1 Ω + j0.1 Ω for the neutral conductor.

For equipment with rated current greater than 21.7 A per phase (a.c.), if the inverter cannot meet the requirements of AS/NZS 61000.3.3, the maximum permissible connection point impedance (Z_{max}) shall be determined such that the voltage fluctuation and flicker limits specified in AS/NZS 61000.3.3 can be met. The impedance shall be determined in accordance with the methods given in AS/NZS 61000.3.11.

2.9 Transient Voltage Limits (phase to neutral) **Appendix C Transient Voltage Limit Test**	**P**

Test: IVGM25KHP3G3

L1 to N

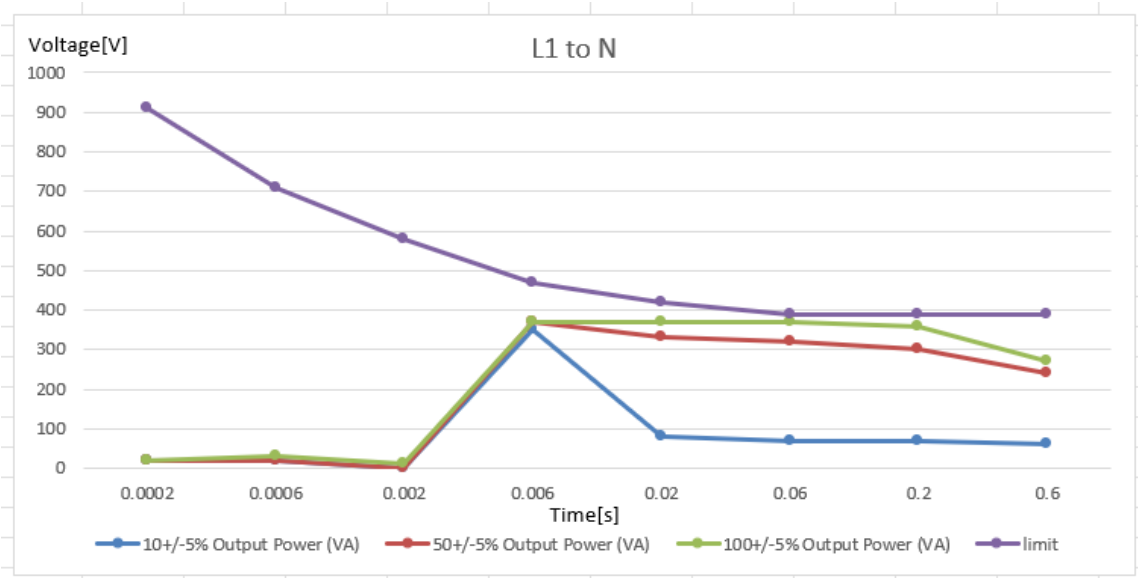
	10+/-5% Output Power (VA)		50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)
Limit	0.0002	910	0.0002	910	0.0002	910
Test value	0.0002	20	0.0002	20	0.0002	20
Limit	0.0006	710	0.0006	710	0.0006	710
Test value	0.0006	20	0.0006	20	0.0006	30
Limit	0.002	580	0.002	580	0.002	580
Test value	0.002	0	0.002	0	0.002	10
Limit	0.006	470	0.006	470	0.006	470
Test value	0.006	350	0.006	370	0.006	370
Limit	0.02	420	0.02	420	0.02	420
Test value	0.02	80	0.02	330	0.02	370
Limit	0.06	390	0.06	390	0.06	390
Test value	0.06	70	0.06	320	0.06	370
Limit	0.2	390	0.2	390	0.2	390
Test value	0.2	70	0.2	300	0.2	360
Limit	0.6	390	0.6	390	0.6	390
Test value	0.6	60	0.6	240	0.6	270

L2 to N

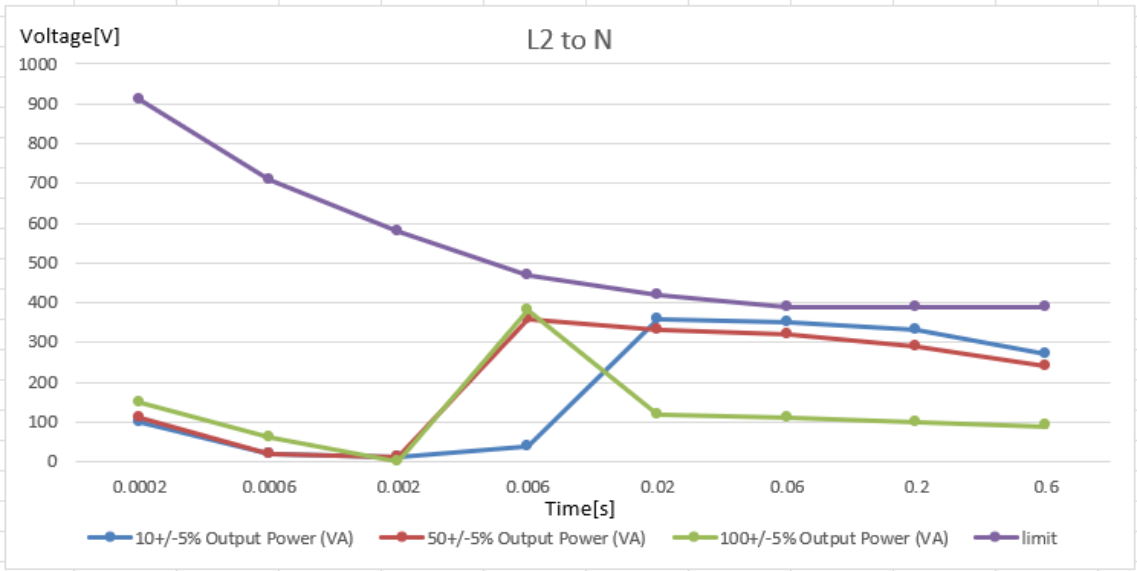
	10+/-5% Output Power (VA)		50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)
Limit	0.0002	910	0.0002	910	0.0002	910
Test value	0.0002	100	0.0002	110	0.0002	150
Limit	0.0006	710	0.0006	710	0.0006	710
Test value	0.0006	20	0.0006	20	0.0006	60
Limit	0.002	580	0.002	580	0.002	580
Test value	0.002	10	0.002	10	0.002	0
Limit	0.006	470	0.006	470	0.006	470

Test value	0.006	40	0.006	360	0.006	380
Limit	0.02	420	0.02	420	0.02	420
Test value	0.02	360	0.02	330	0.02	120
Limit	0.06	390	0.06	390	0.06	390
Test value	0.06	350	0.06	320	0.06	110
Limit	0.2	390	0.2	390	0.2	390
Test value	0.2	330	0.2	290	0.2	100
Limit	0.6	390	0.6	390	0.6	390
Test value	0.6	270	0.6	240	0.6	90
L3 to N						
	10+/-5% Output Power (VA)		50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)
Limit	0.0002	910	0.0002	910	0.0002	910
Test value	0.0002	90	0.0002	280	0.0002	120
Limit	0.0006	710	0.0006	710	0.0006	710
Test value	0.0006	20	0.0006	340	0.0006	50
Limit	0.002	580	0.002	580	0.002	580
Test value	0.002	0	0.002	360	0.002	10
Limit	0.006	470	0.006	470	0.006	470
Test value	0.006	380	0.006	370	0.006	350
Limit	0.02	420	0.02	420	0.02	420
Test value	0.02	360	0.02	350	0.02	380
Limit	0.06	390	0.06	390	0.06	390
Test value	0.06	350	0.06	0	0.06	370
Limit	0.2	390	0.2	390	0.2	390
Test value	0.2	330	0.2	30	0.2	350
Limit	0.6	390	0.6	390	0.6	390
Test value	0.6	270	0.6	100	0.6	280

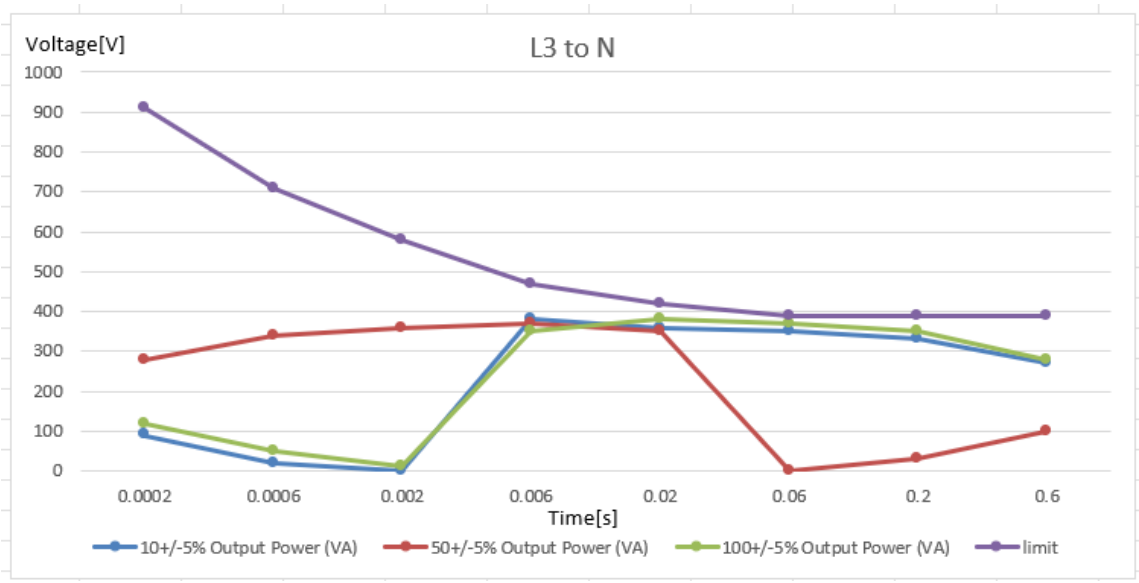
Test condition: L1 to N:



Test condition: L2 to N:



Test condition: L3 to N:



Note:
Results shall not exceed limits in Table 2.4 of AS/NZS 4777.2. Test Specifications: Inverter shall be connected to test circuit AS/NZS 4777.2 Figure C1. Grid nominal voltage within +/-5%, Via DC-input set AC- output power so that it equals to 10+/-5% of rated output (VA). Switch S shall be opened and the output voltage duration (Sample frequency of at least 10kHz) of the inverter shall be recorded. Test shall be repeated at 50+/-5% and 100+/-5% of rated output power.

2.9 Transient Voltage Limits (phase to phase) **Appendix C Transient Voltage Limit Test**	**P**

Test: IVGM25KHP3G3

L1 to L2

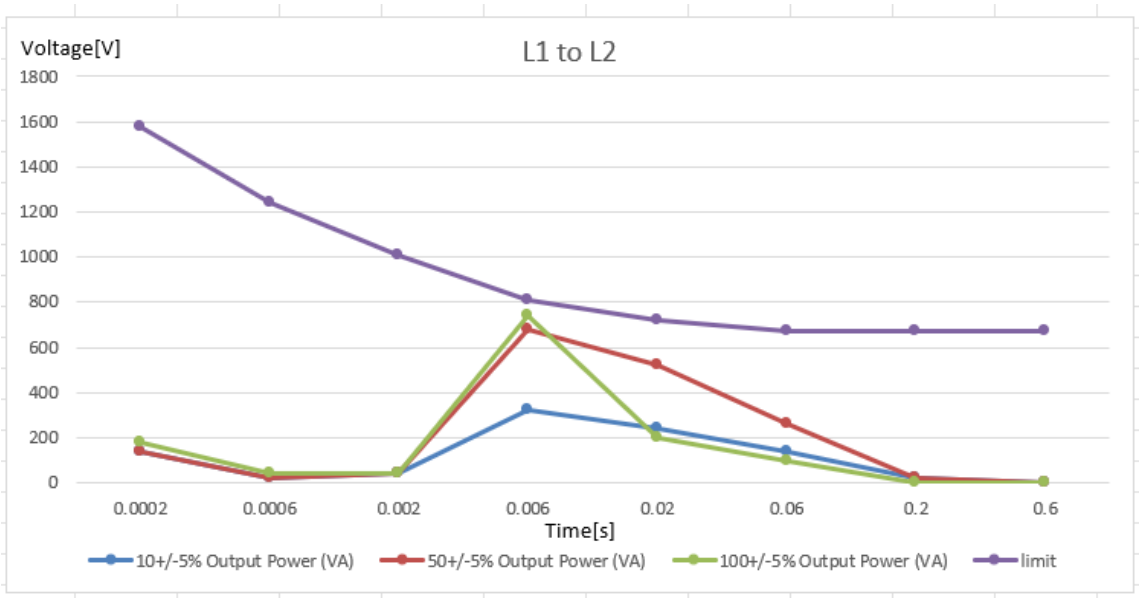
	10+/-5% Output Power (VA)		50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)
Limit	0.0002	1580	0.0002	1580	0.0002	1580
Test value	0.0002	140	0.0002	140	0.0002	180
Limit	0.0006	1240	0.0006	1240	0.0006	1240
Test value	0.0006	20	0.0006	20	0.0006	40
Limit	0.002	1010	0.002	1010	0.002	1010
Test value	0.002	40	0.002	40	0.002	40
Limit	0.006	810	0.006	810	0.006	810
Test value	0.006	320	0.006	680	0.006	740
Limit	0.02	720	0.02	720	0.02	720
Test value	0.02	240	0.02	520	0.02	200
Limit	0.06	670	0.06	670	0.06	670
Test value	0.06	140	0.06	260	0.06	100
Limit	0.2	670	0.2	670	0.2	670
Test value	0.2	20	0.2	20	0.2	0
Limit	0.6	670	0.6	670	0.6	670
Test value	0.6	0	0.6	0	0.6	0

L2 to L3

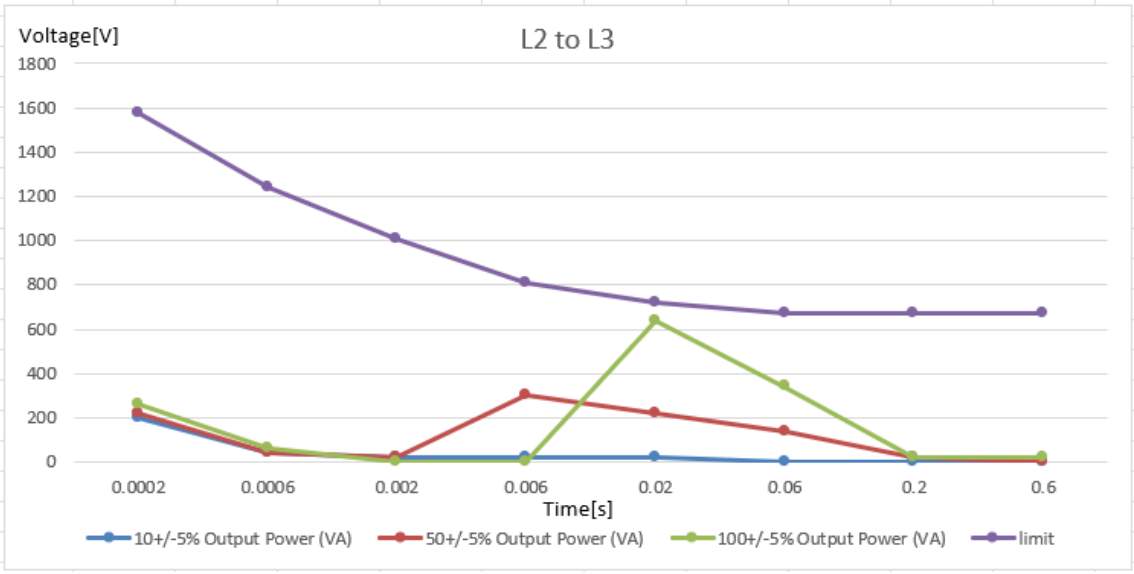
	10+/-5% Output Power (VA)		50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)
Limit	0.0002	1580	0.0002	1580	0.0002	1580
Test value	0.0002	200	0.0002	220	0.0002	260
Limit	0.0006	1240	0.0006	1240	0.0006	1240
Test value	0.0006	40	0.0006	40	0.0006	60
Limit	0.002	1010	0.002	1010	0.002	1010
Test value	0.002	20	0.002	20	0.002	0
Limit	0.006	810	0.006	810	0.006	810

Test value	0.006	20	0.006	300	0.006	0
Limit	0.02	720	0.02	720	0.02	720
Test value	0.02	20	0.02	220	0.02	640
Limit	0.06	670	0.06	670	0.06	670
Test value	0.06	0	0.06	140	0.06	340
Limit	0.2	670	0.2	670	0.2	670
Test value	0.2	0	0.2	20	0.2	20
Limit	0.6	670	0.6	670	0.6	670
Test value	0.6	0	0.6	0	0.6	20
L3 to L1						
	10+/-5% Output Power (VA)		50+/-5% Output Power (VA)		100+/-5% Output Power (VA)	
	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)	Duration (s)	Line to neutral (V)
Limit	0.0002	1580	0.0002	1580	0.0002	1580
Test value	0.0002	80	0.0002	80	0.0002	100
Limit	0.0006	1240	0.0006	1240	0.0006	1240
Test value	0.0006	60	0.0006	60	0.0006	80
Limit	0.002	1010	0.002	1010	0.002	1010
Test value	0.002	40	0.002	40	0.002	40
Limit	0.006	810	0.006	810	0.006	810
Test value	0.006	420	0.006	500	0.006	720
Limit	0.02	720	0.02	720	0.02	720
Test value	0.02	320	0.02	380	0.02	440
Limit	0.06	670	0.06	670	0.06	670
Test value	0.06	160	0.06	200	0.06	220
Limit	0.2	670	0.2	670	0.2	670
Test value	0.2	20	0.2	20	0.2	20
Limit	0.6	670	0.6	670	0.6	670
Test value	0.6	0	0.6	0	0.6	0

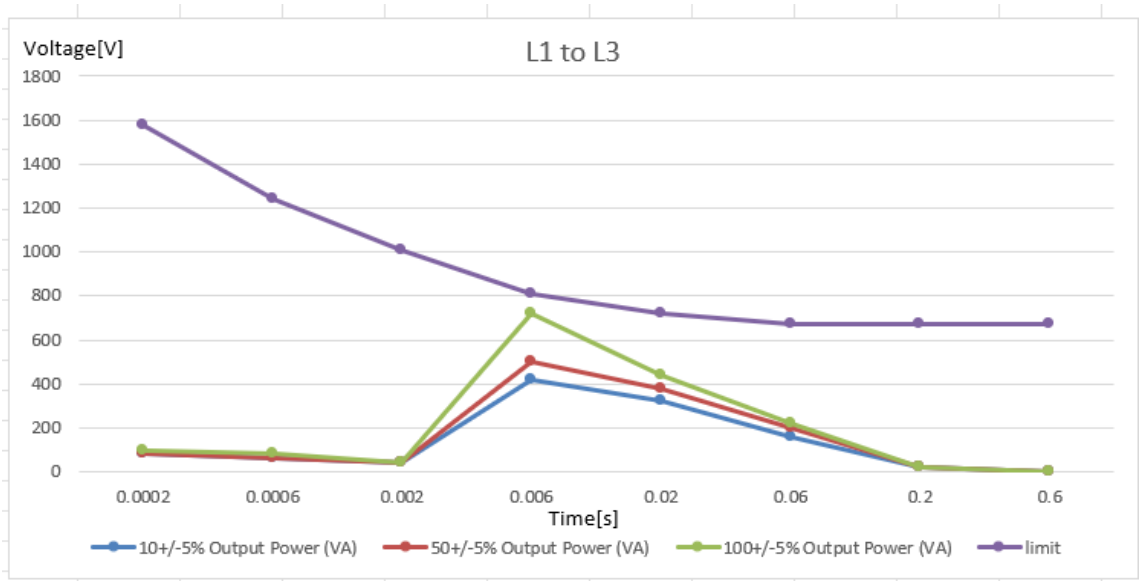
Test condition: L1 to L2



Test condition: L2 to L3

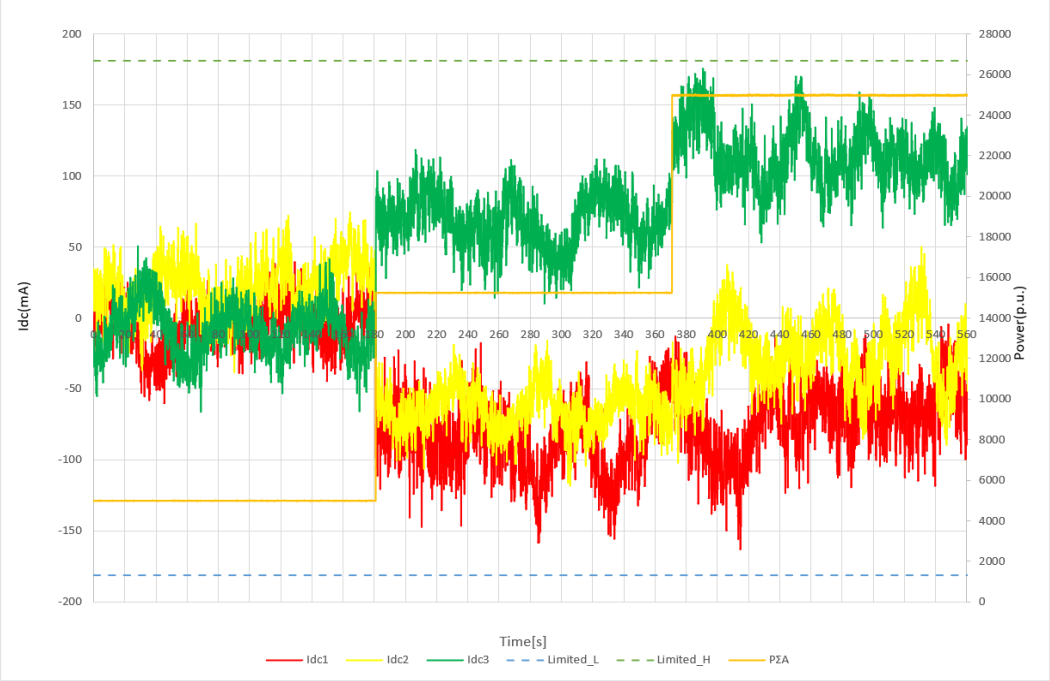


Test condition: L1 to L3



Note:
Results shall not exceed limits in Table 2.4 of AS/NZS 4777.2. Test Specifications: Inverter shall be connected to test circuit AS/NZS 4777.2 Figure C1. Grid nominal voltage within +/-5%, Via DC-input set AC- output power so that it equals to 10+/-5% of rated output (VA). Switch S shall be opened and the output voltage duration (Sample frequency of at least 10kHz) of the inverter shall be recorded. Test shall be repeated at 50+/-5% and 100+/-5% of rated output power.

2.10 Direct current injection **Appendix D D.C. injection test**						**P**
Test: IVGM25KHP3G3						
	Testing at 20+/-5% Output Power					
Phases	L1-L2 (mA)	L1-L3 (mA)	L2-L3 (mA)	L1-N (mA)	L2-N (mA)	L3-N (mA)
Abs. Max. Test Value:	--	--	--	60.2	74.3	66.3
Abs. Ave. Test Value:	--	--	--	5.5	21.8	-14.0
	Testing at 60+/-5% Output Power					
Phases	L1-L2 (mA)	L1-L3 (mA)	L2-L3 (mA)	L1-N (mA)	L2-N (mA)	L3-N (mA)
Abs. Max. Test Value:	--	--	--	158.4	117.8	118.3
Abs. Ave. Test Value:	--	--	--	-17.1	6.2	12.6
	Testing at 100+/-5% Output Power					
Phases	L1-L2 (mA)	L1-L3 (mA)	L2-L3 (mA)	L1-N (mA)	L2-N (mA)	L3-N (mA)
Abs. Max. Test Value:	--	--	--	161.8	101.4	175.5
Abs. Ave. Test Value:	--	--	--	-25.8	31.5	-9.1



(Limit: 181.159mA)

Note:
In the case of a single-phase inverter: not exceed 0.5% of the inverter's rated current or 5 mA, whichever is the greater.
In the case of a three-phase inverter: shall not exceed 0.5% of the inverter's per-phase rated current or 5 mA, whichever is the greater.

2.11 Current balance for three-phase inverters						**P**
Setting values	PF cos φ = 1			Rated output current: 36.3 A		
Test value	L1	L2	L3	L1 – L2	L2 – L3	L3 – L1
100% of rated current	36.090	36.474	36.050	-0.384	0.424	-0.040
	36.070	36.457	36.027	-0.387	0.430	-0.043
	36.069	36.457	36.024	-0.387	0.433	-0.046
	36.081	36.468	36.038	-0.387	0.430	-0.043
	36.084	36.470	36.032	-0.386	0.438	-0.052
Limit [A]: 5% of rated current	1.812A					
Note: The a.c. output current for each phase for three-phase balanced current shall be within 5% of the measured value of the other phases at rated current when injected into a balanced three phase voltage.						

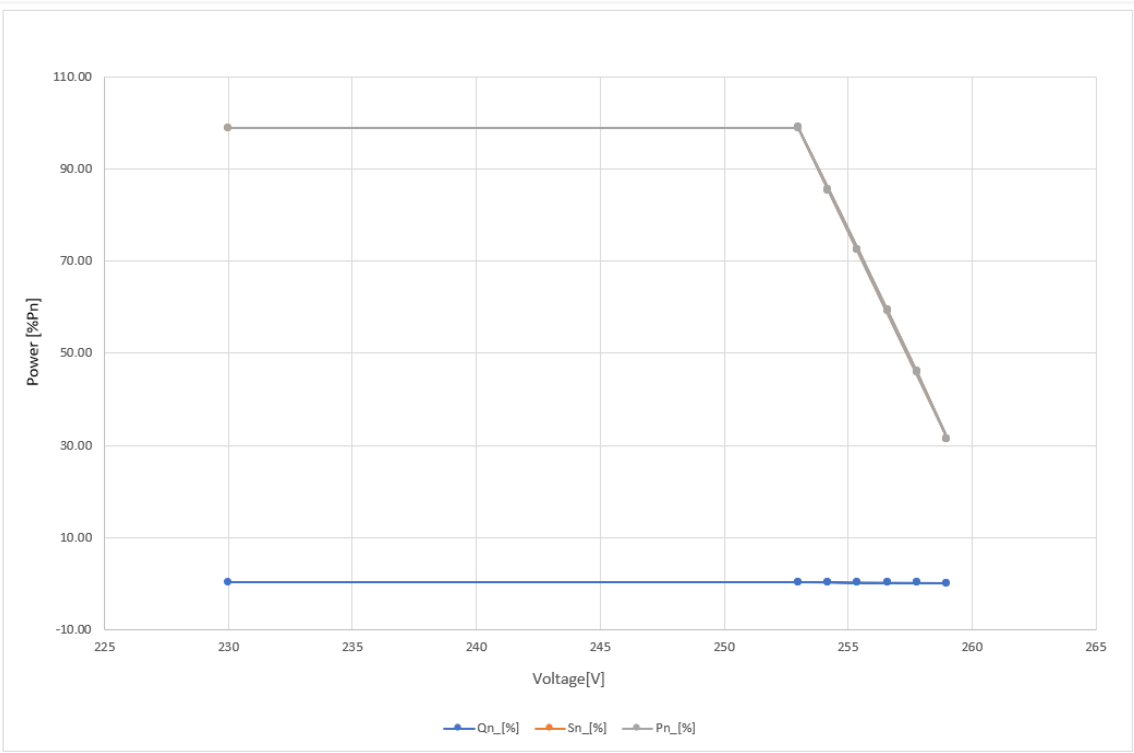
3.2 Inverter demand response modes (DRMs) **Appendix E Demand and power quality response**					**P**
Test: IVGM25KHP3G3					
Mode	Requirement	Measurement			Result
		Active power (kW)	Reactive power (kVar)	Switching Time (s)	
DRM 0	Operate the disconnection device	0.001	0.154	0.326	P
DRM 1	Do not consume power	0.001	0.036	0.908	P
DRM 2	Do not consume at more than 50% of rated power	-12.216	0.002	0.604	P
DRM 1 and DRM 2		0.001	0.043	0.436	P
DRM 3	Do not consume at more than 75% of rated power AND Source reactive power if capable	-17.966	14.956	0.700	P
DRM 2 and DRM 3		-12.298	15.247	0.512	P
DRM 4	Increase power consumption (subject to constraints from other active DRMs)	-25.020	0.033	0.380	P
DRM 5	Do not generate power	0.079	0.040	0.276	P
DRM 6	Do not generate at more than 50% of rated power	12.150	0.079	0.304	P
DRM 5 and DRM 6		0.079	0.040	0.632	P
DRM 7	Do not generate at more than 75% of rated power AND absorb reactive power if capable	17.837	15.185	*100.328	P
DRM 6 and DRM 7		12.242	15.168	0.348	P
DRM 8	Increase power generation (subject to constraints from other active DRMs)	25.067	0.109	0.330	P
Note: Switching time limit: 2s					

3.3.2.2 Volt-watt response mode (Australia A Setting) **Appendix G.2.1**			**P**
Volt-Watt response default set-point values for inverter			
Region	**Default value**	V_{W1}	V_{W2}
Australia A	Voltage	253V	260
	Inverter maximum active power output level (P) % of Srated	100%	20%
Australia B	Voltage	250V	260
	Inverter maximum active power output level (P) % of Srated	100%	20%
Australia C	Voltage	253V	260
	Inverter maximum active power output level (P) % of Srated	100%	20%
New Zealand	Voltage	242V	250
	Inverter maximum active power output level (P) % of Srated	100%	20%
Note: Australia C parameter set is intended for application in isolated or remote power systems.			

3.3.2.2 Volt-watt response mode (Australia A/Australia C Setting) Appendix G.2.1	**P**

Test: IVGM25KHP3G3

Voltage (V)	Time for output to stabilize (s)	Stable reactive power output $\%S_{rated}$ (%)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
253.0	--	+0.21	98.95	100
254.2	6.2	+0.21	85.62	86
255.4	8.4	+0.18	72.52	73
256.6	8.4	+0.14	59.28	59
257.8	8.4	+0.09	45.96	45
259.0	8.6	+0.04	31.32	31
257.8	8.4	-0.04	45.77	45
256.6	8.2	+0.04	59.13	59
255.4	8.2	+0.08	72.35	73
254.2	8.2	+0.12	85.38	86
253.0	8.6	+0.16	99.02	100
259.0	8.6	+0.21	31.38	31

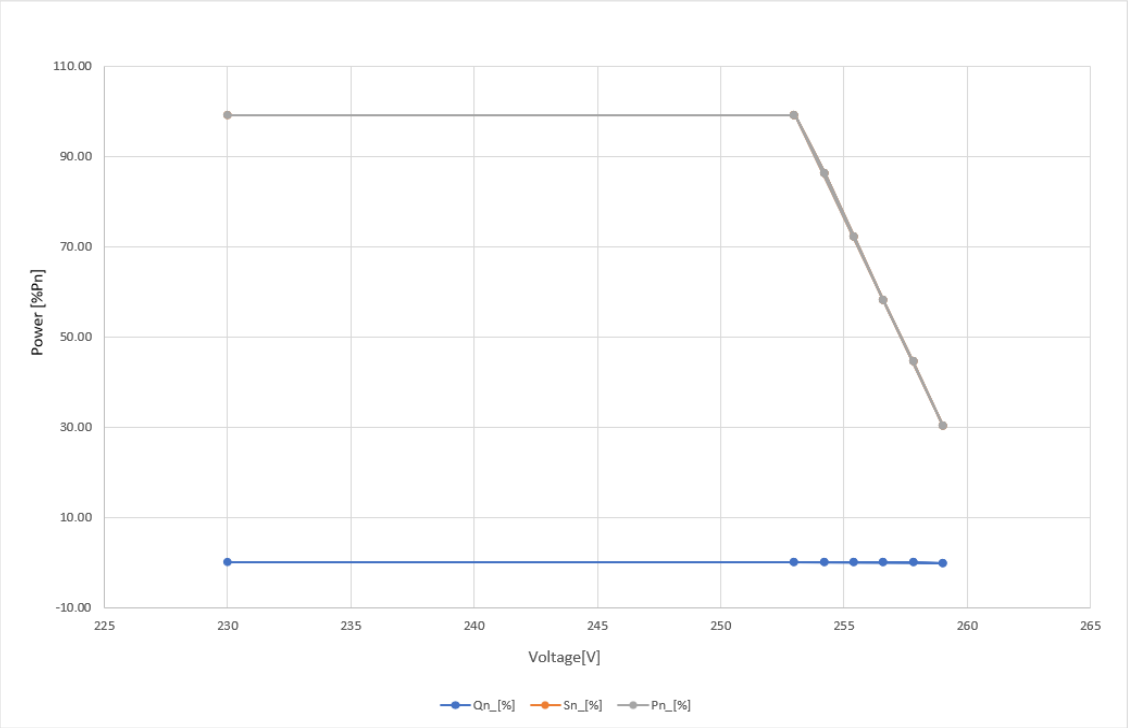


Note:

3.3.2.2 Volt-watt response mode (New Zealand Setting) Appendix G.2.1	**P**

Test: IVGM25KHP3G3

Voltage (V)	Time for output to stabilize (s)	Stable reactive power output $\%S_{rated}$ (%)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
242.0	--	+0.32	99.27	100
243.4	8.4	+0.28	86.49	86
244.8	8.6	+0.25	72.41	72
246.2	8.6	+0.19	58.26	58
247.6	8.2	+0.14	44.84	44
249.0	8.6	+0.06	30.52	30
247.6	8.8	+0.14	44.82	44
246.2	8.6	+0.20	58.25	58
244.8	8.6	+0.25	72.43	72
243.4	8.6	+0.28	86.52	86
242.0	9.0	+0.32	99.28	100
249.0	8.8	+0.07	30.51	30



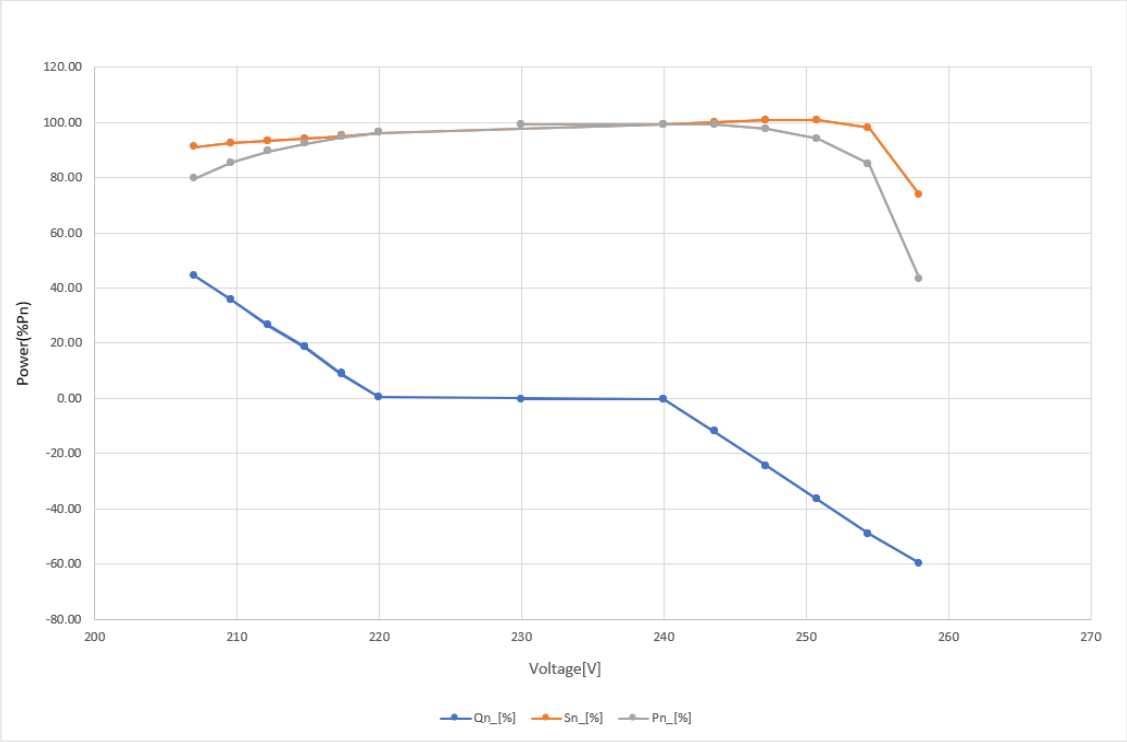
Note:

3.3.2.3 Volt-var response mode **Appendix G.2.2**					**P**
Volt-Var response set-point values for inverter					
Region	**Default value**	V_{V1}	V_{V2}	V_{V3}	V_{V4}
Australia A	Voltage	207 V	220 V	240 V	258 V
	Inverter reactive power level (Q) % of S_{rated}	44 % supplying	0 %	0 %	60 % absorbing
Australia B	Voltage	205 V	220 V	235 V	255 V
	Inverter reactive power level (Q) % of S_{rated}	30 % supplying	0 %	0 %	40 % absorbing
Australia C	Voltage	215 V	230 V	240 V	255 V
	Inverter reactive power level (Q) % of S_{rated}	44 % supplying	0 %	0 %	60 % absorbing
New Zealand	Voltage	207 V	220 V	235 V	244 V
	Inverter reactive power level (Q) % of S_{rated}	60 % supplying	0 %	0 %	60 % absorbing
Note: Inverters may operate at a reactive power level with a range up to 100 % supplying or absorbing.					

3.3.2.3 Volt-var response mode (Australia A Setting) Appendix G.2.2	**P**

Test: IVGM25KHP3G3

Voltage (V)	Time for output to stabilize (s)	Stable reactive power output $\%S_{rated}$ (%)	Typical reactive power level $\%S_{rated}$ (%)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
240.0	--	-0.27	0	99.18	100
243.6	6.6	-12.10	-12	99.16	99
247.2	6.8	-24.54	-24	97.67	97
250.8	6.8	-36.60	-36	93.94	93
254.4	6.4	-49.01	-48	84.89	84
258.0	6.6	-59.83	-60	42.97	43
254.4	5.8	-49.01	-48	84.90	84
250.8	6.0	-36.61	-36	93.92	93
247.2	6.4	-24.54	-24	97.66	97
243.6	6.2	-12.11	-12	99.16	99
240.0	6.6	-0.27	0	99.17	100
220.0	--	+0.52	0	96.16	100
217.4	7.2	+8.63	+9	94.66 *	100
214.8	7.4	+18.47	+18	92.23 *	98
212.2	7.4	+26.44	+26	89.48 *	96
209.6	7.2	+35.65	+35	85.29 *	94
207.0	6.8	+44.49	+44	79.47 *	90
209.6	6.8	+35.77	+35	85.25 *	94
212.2	6.6	+26.64	+26	89.43 *	96
214.8	7.6	+18.72	+18	92.20 *	98
217.4	7.4	+8.92	+9	94.64 *	100
220.0	7.2	+0.52	0	96.17	100
259.0	7.2	-59.92	-60	30.89	31



Criteria for acceptance：

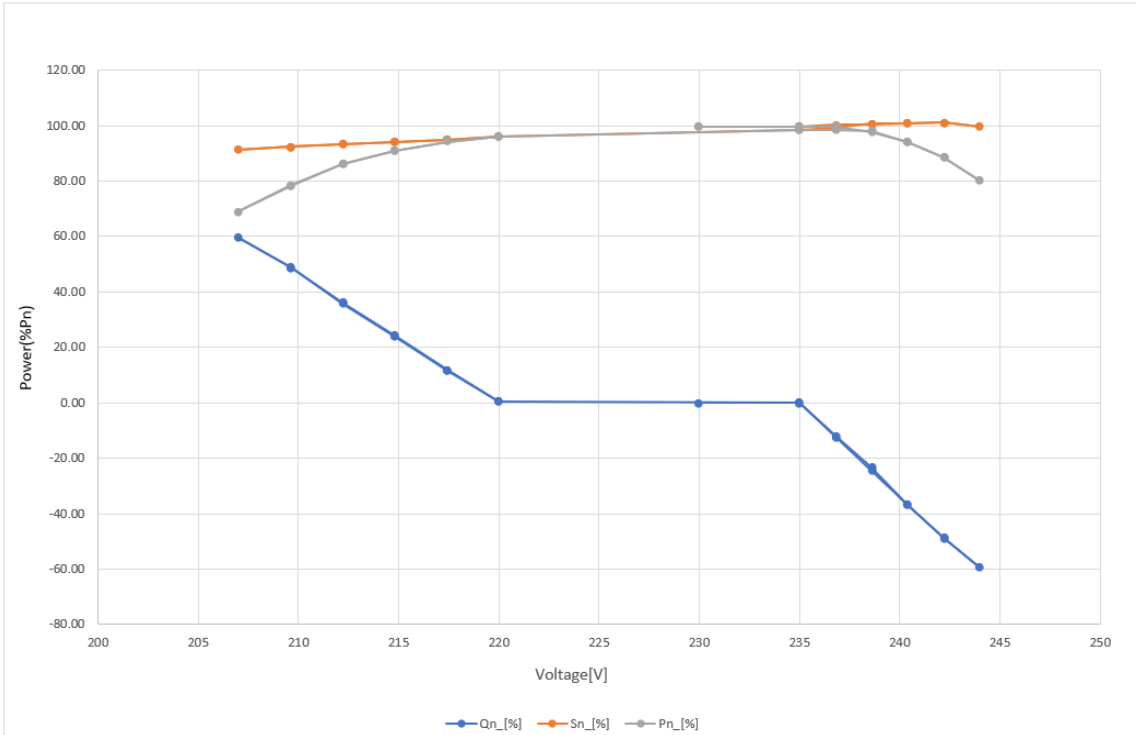
When tested in accordance with Clauses G.2.1 and G.2.2, the voltage response shall be linear and conform to Clause 3.3.2. For inverters with energy storage, when tested in accordance with Clause G.2.3, the voltage response shall be linear and conform to Clause 3.4.3.

Note:
* The active power is limited due to the current limitation.

3.3.2.3 Volt-var response mode (New Zealand Setting) Appendix G.2.2	**P**

Test: IVGM25KHP3G3

Voltage (V)	Time for output to stabilize (s)	Stable reactive power output $\%S_{rated}$ (%)	Typical reactive power level $\%S_{rated}$ (%)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
235.0	--	-0.07	0	99.68	100
236.8	8.2	-12.31	-12	99.51	99
238.6	6.8	-24.48	-24	97.59	97
240.4	6.8	-36.96	-36	93.94	93
242.2	6.6	-48.92	-48	88.49	88
244.0	6.6	-59.28	-60	80.28	80
242.2	8.0	-48.88	-48	88.52	88
240.4	8.2	-36.85	-36	94.01	93
238.6	8.0	-23.45	-24	97.99	97
236.8	8.6	-11.98	-12	98.44	99
235.0	8.4	+0.24	0	98.58 *	100
220.0	--	+0.52	0	96.21	100
217.4	8.0	+11.66	12	94.25 *	99
214.8	8.2	+23.91	24	90.98 *	97
212.2	8.2	+35.84	36	86.08 *	93
209.6	8.0	+48.88	48	78.41 *	88
207.0	8.6	+59.65	60	69.05 *	80
209.6	8.4	+48.99	48	78.33 *	88
212.2	8.6	+36.04	36	86.00 *	93
214.8	8.6	+24.14	24	90.92 *	97
217.4	8.6	+11.91	12	94.22 *	99
220.0	8.2	+0.52	0	96.22	100
249.0	8.0	-59.19	-60	30.38	30



Criteria for acceptance：

When tested in accordance with Clauses G.2.1 and G.2.2, the voltage response shall be linear and conform to Clause 3.3.2. For inverters with energy storage, when tested in accordance with Clause G.2.3, the voltage response shall be linear and conform to Clause 3.4.3.

Note:
* The active power is limited due to the current limitation.

3.3.3 Fixed power factor mode and reactive power mode Appendix F	**P**

Test: IVGM25KHP3G3

Displacement power factor reporting table

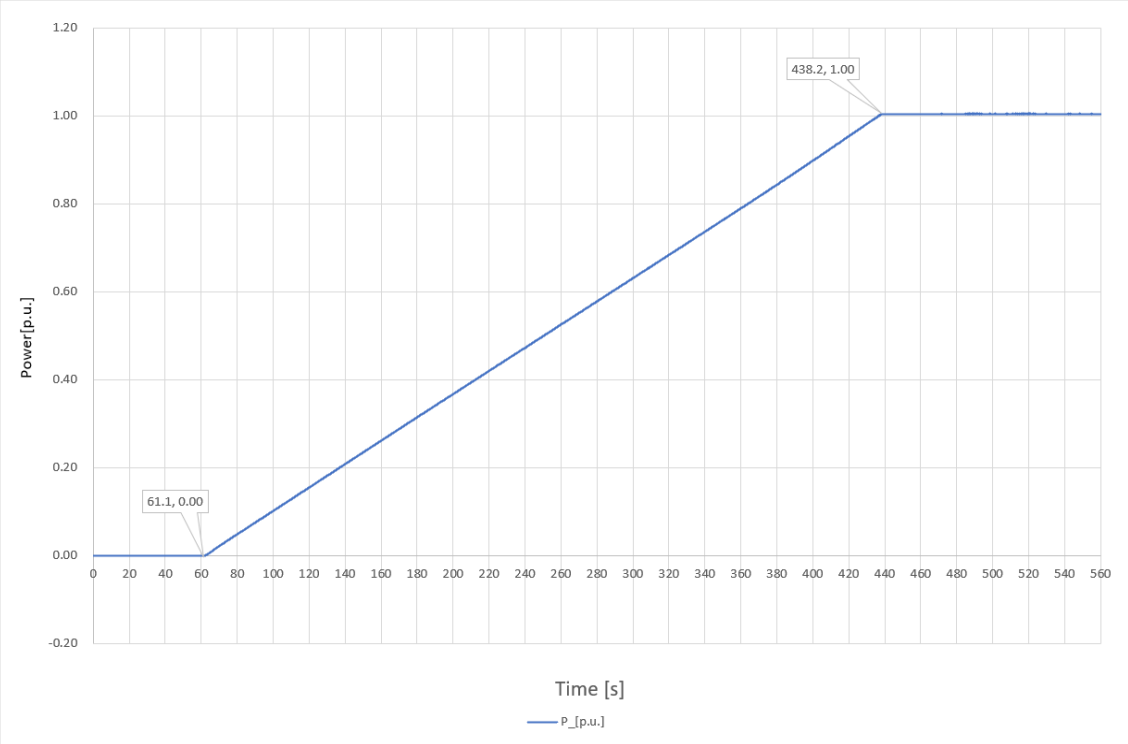
Power factor (PF) setpoint	Measurement	Current output as percentage of rated current output			
		25+/-5%	50+/-5%	75+/-5%	100+/-5%
Unity	Power (W)	6406	12515	18768	24754
	Reactive power (Var)	231	221	297	313
	PF cos (phi)	0.9993	0.9998	0.9999	0.9999
	Supply/absorb	Supply	Supply	Supply	Supply
PF limit absorb (0.8)	Power (W)	8040	15706	23326	28041
	Reactive power (Var)	-4737	-9158	-13708	-16703
	PF cos (phi)	0.8027	0.8057	0.8043	0.8036
PF limit supply (0.8)	Power (W)	7944	15461	23069	28064
	Reactive power (Var)	4820	9362	13894	16704
	PF cos (phi)	0.8003	0.8029	0.8032	0.8032

Reactive power setpoint(%var/S_{rated})	Measurement	Active power output as a percentage of rated apparent power		
		20+/-5%[a]	60+/-5%[a]	80+/-5%
60% absorb	Power (W)	4966	14937	19792
	Reactive power (Var)	-14929	-14949	-14971
	Reactive power (%S_{rated})	-59.72	-59.80	-59.89
60%supply	Power (W)	4995	15019	20097
	Reactive power (Var)	15066	14992	15040
	Reactive power (%S_{rated})	60.26	59.97	60.16

Note:

[a] : Inverter reactive power output measurements that meet or exceed the minimum capability of Figure 2.1 are acceptable.

3.3.4 Power rate limit			P
Test: IVGM25KHP3G3			
3.3.4.3.2 Test (a): Soft ramp up after connect or reconnect			
Time measurement from 0% to 100% P_{rated} (min)	377.1 s		
W_{Gra}	15.91%		
Limit W_{Gra} :	16.67%		



3.3.4.3.3 Test (b): Change in a.c. operation and control (DRM control only)			
DRM mode	DRM 1 to 2	DRM1 to 3	DRM 1 to 4
Power change (%)	Increase: 0% to -50%	Increase: 0% to -75%	Increase: 0% to -100%
Time measurement	188.9 s	282.8 s	369.2 s
W_{Gra}	-16.20%	-16.12%	-16.41%
Limit W_{Gra} : (Default : -16.67%)	-16.67%	-16.67%	-16.67%
DRM mode	DRM 2 to 1	DRM 3 to 1	DRM 4 to 1
Power change (%)	Increase: -50% to 0%	Increase: -75% to 0%	Increase: -100% to 0%
Time measurement	189.9 s	281.9 s	370.1 s
W_{Gra}	15.80%	16.18 %	16.37 %
Limit W_{Gra} : (Default : 16.67%)	16.67%	16.67%	16.67%
DRM mode	DRM 5 to 6	DRM 6 to 7	DRM 7 to 8
Power change (%)	Increase: 0% to 50%	Increase: 50% to 75%	Increase: 75% to 100%
Time measurement	190.0 s	91.4 s	86.6 s
W_{Gra}	15.79%	16.41%	17.32%

Limit W_{Gra} : (Default : 16.67%)	16.67%	16.67%	16.67%
DRM mode	DRM 6 to 5	DRM 7 to 6	DRM 8 to 7
Power change (%)	Increase: 50% to 0%	Increase: 75% to 50%	Increase: 100% to 75%
Time measurement	178.4 s	94.3 s	92.5 s
W_{Gra}	-16.48%	-15.91%	-16.21%
Limit W_{Gra} : (Default : -16.67%)	-16.67%	-16.67%	-16.67%

3.4.2 Sinusoidal output in stand-alone mode				P
Test: IVGM25KHP3G3				
Harmonics	**Output power (Pn)**			**Limits [%]**
	5%			
	L1	**L2**	**L3**	
2nd	0.018	0.021	0.015	5
3rd	1.273	1.313	1.269	5
4th	0.006	0.005	0.009	5
5th	0.917	0.938	0.914	5
6th	0.005	0.004	0.009	5
7th	0.616	0.626	0.614	5
8th	0.004	0.002	0.006	5
9th	0.442	0.449	0.439	5
10th	0.002	0.003	0.008	5
11th	0.350	0.354	0.349	5
12th	0.003	0.003	0.009	5
13th	0.278	0.278	0.276	5
14th	0.002	0.003	0.009	5
15th	0.219	0.219	0.218	5
16th	0.003	0.002	0.007	5
17th	0.174	0.172	0.173	5
18th	0.003	0.003	0.007	5
19th	0.131	0.130	0.131	5
20th	0.003	0.002	0.007	5
21st	0.091	0.088	0.089	5
22nd	0.002	0.003	0.008	5
23rd	0.056	0.054	0.055	5
24th	0.003	0.003	0.008	5
25th	0.031	0.031	0.030	5
26th	0.002	0.002	0.006	5
27th	0.032	0.034	0.031	5
28th	0.002	0.002	0.004	5
29th	0.040	0.042	0.041	5
30th	0.003	0.002	0.003	5
31st	0.043	0.045	0.043	5
32nd	0.002	0.002	0.003	5

33rd	0.047	0.047	0.047	5
34th	0.002	0.002	0.003	5
35th	0.043	0.044	0.043	5
36th	0.002	0.002	0.003	5
37th	0.042	0.042	0.042	5
38th	0.001	0.001	0.002	5
39th	0.039	0.040	0.039	5
40th	0.001	0.001	0.002	5
41st	0.037	0.037	0.037	5
42nd	0.001	0.001	0.002	5
43rd	0.034	0.034	0.034	5
44th	0.001	0.001	0.002	5
45th	0.032	0.032	0.032	5
46th	0.001	0.001	0.002	5
47th	0.028	0.028	0.028	5
48th	0.005	0.006	0.005	5
49th	0.026	0.026	0.026	5
50th	0.004	0.005	0.005	5
THD	2.041	2.041	2.081	5
Harmonics	**Output power (Pn)**			**Limits [%]**
	50%			
	L1	**L2**	**L3**	
2nd	0.018	0.021	0.015	5
3rd	1.273	1.313	1.269	5
4th	0.006	0.005	0.009	5
5th	0.917	0.938	0.914	5
6th	0.005	0.004	0.009	5
7th	0.616	0.626	0.614	5
8th	0.004	0.002	0.006	5
9th	0.442	0.449	0.439	5
10th	0.002	0.003	0.008	5
11th	0.350	0.354	0.349	5
12th	0.003	0.003	0.009	5
13th	0.278	0.278	0.276	5
14th	0.002	0.003	0.009	5
15th	0.219	0.219	0.218	5
16th	0.003	0.002	0.007	5
17th	0.174	0.172	0.173	5

18th	0.003	0.003	0.007	5
19th	0.131	0.130	0.131	5
20th	0.003	0.002	0.007	5
21st	0.091	0.088	0.089	5
22nd	0.002	0.003	0.008	5
23rd	0.056	0.054	0.055	5
24th	0.003	0.003	0.008	5
25th	0.031	0.031	0.030	5
26th	0.002	0.002	0.006	5
27th	0.032	0.034	0.031	5
28th	0.002	0.002	0.004	5
29th	0.040	0.042	0.041	5
30th	0.003	0.002	0.003	5
31st	0.043	0.045	0.043	5
32nd	0.002	0.002	0.003	5
33rd	0.047	0.047	0.047	5
34th	0.002	0.002	0.003	5
35th	0.043	0.044	0.043	5
36th	0.002	0.002	0.003	5
37th	0.042	0.042	0.042	5
38th	0.001	0.001	0.002	5
39th	0.039	0.040	0.039	5
40th	0.001	0.001	0.002	5
41st	0.037	0.037	0.037	5
42nd	0.001	0.001	0.002	5
43rd	0.034	0.034	0.034	5
44th	0.001	0.001	0.002	5
45th	0.032	0.032	0.032	5
46th	0.001	0.001	0.002	5
47th	0.028	0.028	0.028	5
48th	0.005	0.006	0.005	5
49th	0.026	0.026	0.026	5
50th	0.004	0.005	0.005	5
THD	2.259	2.277	2.268	5

Harmonics	Output power (Pn)			Limits [%]
	100%			
	L1	L2	L3	
2nd	0.012	0.017	0.009	5
3rd	1.470	1.520	1.471	5
4th	0.005	0.005	0.008	5
5th	1.018	1.043	1.019	5
6th	0.005	0.005	0.010	5
7th	0.644	0.648	0.648	5
8th	0.004	0.003	0.004	5
9th	0.432	0.443	0.430	5
10th	0.003	0.002	0.007	5
11th	0.343	0.348	0.344	5
12th	0.004	0.003	0.006	5
13th	0.264	0.268	0.260	5
14th	0.003	0.002	0.005	5
15th	0.204	0.206	0.204	5
16th	0.003	0.002	0.005	5
17th	0.167	0.167	0.164	5
18th	0.003	0.002	0.005	5
19th	0.134	0.134	0.133	5
20th	0.003	0.002	0.004	5
21st	0.105	0.104	0.103	5
22nd	0.002	0.001	0.005	5
23rd	0.082	0.082	0.081	5
24th	0.003	0.002	0.005	5
25th	0.062	0.061	0.060	5
26th	0.002	0.002	0.004	5
27th	0.046	0.045	0.045	5
28th	0.002	0.001	0.003	5
29th	0.033	0.031	0.032	5
30th	0.002	0.002	0.003	5
31st	0.024	0.024	0.024	5
32nd	0.002	0.002	0.003	5
33rd	0.017	0.017	0.018	5
34th	0.002	0.001	0.003	5
35th	0.018	0.017	0.018	5

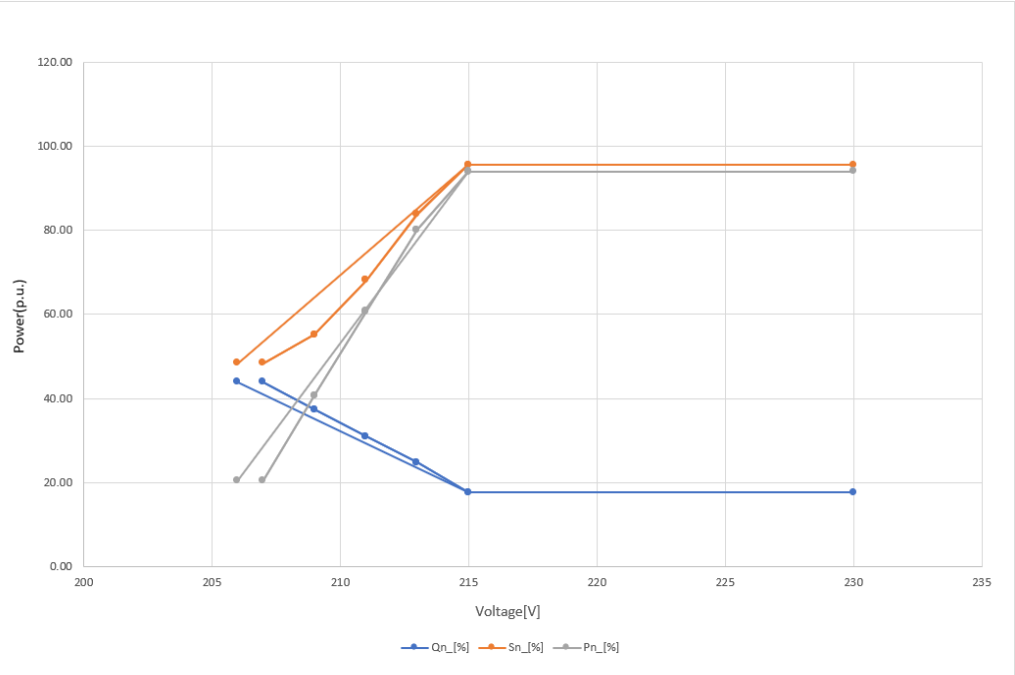
36th	0.002	0.002	0.003	5
37th	0.018	0.018	0.019	5
38th	0.002	0.001	0.002	5
39th	0.019	0.017	0.018	5
40th	0.002	0.002	0.002	5
41st	0.018	0.018	0.019	5
42nd	0.002	0.002	0.003	5
43rd	0.019	0.018	0.018	5
44th	0.002	0.002	0.002	5
45th	0.018	0.018	0.019	5
46th	0.002	0.002	0.002	5
47th	0.018	0.017	0.018	5
48th	0.003	0.003	0.002	5
49th	0.017	0.018	0.018	5
50th	0.007	0.008	0.009	5
THD	2.296	2.315	2.302	5
Note:				

3.4.3 Volt–watt response mode for inverters with energy storage when charging Appendix G.2.3			**P**
Volt-Watt response default set-point values for multiple mode inverters with energy storage when charging			
Region	**Default value**	$V_{W1\text{-}ch}$	$V_{W2\text{-}ch}$
Australia A	Voltage	207V	215V
	$P_{charge}/P_{rated\text{-}ch}$	20%	100%
Australia B	Voltage	195V	215V
	$P_{charge}/P_{rated\text{-}ch}$	0%	100%
Australia C	Voltage	207V	215V
	$P_{charge}/P_{rated\text{-}ch}$	20%	100%
New Zealand	Voltage	216V	224V
	$P_{charge}/P_{rated\text{-}ch}$	20%	100%
Note: Note1: P_{charge} refers to power input level through the grid-interactive port. Note2: $P_{rated\text{-}ch}$ refers to the rated active power input through the grid-interactive port used for charging the energy storage.			

3.4.3 Volt-watt response mode for inverters with energy storage test (Australia A&C Setting) Appendix G.2.3	**P**

Test: IVGM25KHP3G3

Voltage (V)	Time for output to stabilize (s)	Stable reactive power output % $P_{rated-ch}$ (%)	Typical reactive power level % $P_{rated-ch}$ (%)	Stable active power output % $P_{rated-ch}$ (%)	Expected active power output % $P_{rated-ch}$ (%)
215.0	--	17.54	17	94.00 *	100
213.0	8.0	24.78	24	80.09	80
211.0	8.2	30.94	30	60.69	60
209.0	8.6	37.37	37	40.62	40
207.0	8.6	43.89	44	20.46	20
209.0	8.4	37.35	37	40.67	40
211.0	8.2	30.92	30	60.73	60
213.0	8.0	24.75	24	80.16	80
215.0	8.2	17.56	17	94.00 *	100
206.0	8.4	43.91	44	20.46	20



Criteria for acceptance：

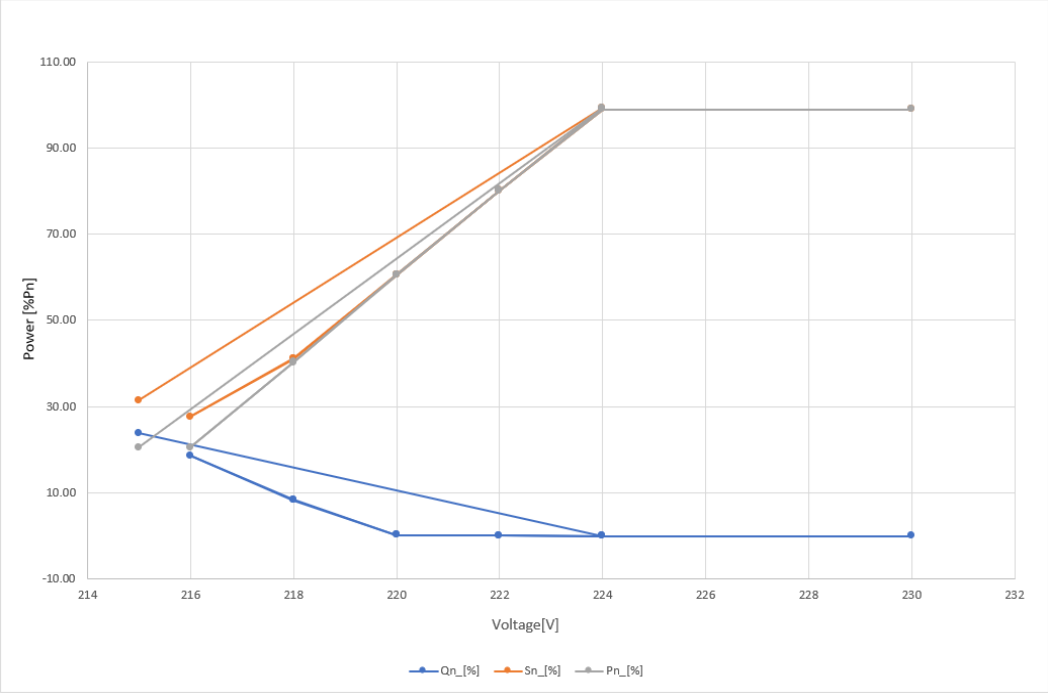
When tested in accordance with Clauses G.2.1 and G.2.2, the voltage response shall be linear and conform to Clause 3.3.2. For inverters with energy storage, when tested in accordance with Clause G.2.3, the voltage response shall be linear and conform to Clause 3.4.3.

Note:
For the test, the $P_{rated-ch}$ is 25kW.
* The active power is limited due to the current limitation.

3.4.3 Volt-watt response mode for inverters with energy storage test (New Zealand Setting) Appendix G.2.3	**P**

Test: IVGM25KHP3G3

Voltage (V)	Time for output to stabilize (s)	Stable reactive power output % $P_{rated\text{-}ch}$ (%)	Typical reactive power level % $P_{rated\text{-}ch}$ (%)	Stable active power output % $P_{rated\text{-}ch}$ (%)	Expected active power output % $P_{rated\text{-}ch}$ (%)
224.0	--	-0.15	0	99.07	100
222.0	8.4	-0.02	0	80.16	80
220.0	8.6	+0.06	0	60.50	60
218.0	8.4	+8.30	9	40.17	40
216.0	8.6	+18.54	18	20.39	20
218.0	8.4	+8.21	9	40.29	40
220.0	8.0	+0.07	0	60.61	60
222.0	8.2	-0.02	0	80.23	80
224.0	8.2	-0.15	0	99.38	100
215.0	8.4	+23.81	23	20.41	20



Criteria for acceptance：

When tested in accordance with Clauses G.2.1 and G.2.2, the voltage response shall be linear and conform to Clause 3.3.2. For inverters with energy storage, when tested in accordance with Clause G.2.3, the voltage response shall be linear and conform to Clause 3.4.3.

Note:
For the test, the $P_{rated\text{-}ch}$ is 25kW.

4.3 Active anti-islanding protection Appendix H Active anti-islanding test (Testing according to IEC 62116)	P

Table: tested condition and run-on time

No.	P_{EUT} (% of EUT rating)	Reactive load (% of normal)	P_{AC}	Q_{AC}	Run-on time (ms)	P_{EUT} (kW)	Q_{EUT} (kVar) (Cap.)	Q_{EUT} (kVar) (Ind.)	Actual Q_f	Which load is selected to be adjusted (R or L)
Test Condition A										
1	100	100	-5	5	98	22.50	25.30	25.60	1.058	R/L
2	100	100	-5	0	450	22.50	25.30	24.40	1.042	R
3	100	100	-5	-5	78	22.50	25.30	23.20	1.016	R/L
4	100	100	0	5	120	23.70	25.30	25.60	1.018	L
5	100	100	0	0	588	23.70	25.30	24.40	0.998	--
6	100	100	0	-5	76	23.70	25.30	23.20	0.972	L
7	100	100	5	5	126	24.90	25.30	25.60	0.964	R/L
8	100	100	5	0	160	24.90	25.30	24.40	0.950	R
9	100	100	5	-5	248	24.90	25.30	23.20	0.927	R/L
Test Condition B										
10	66	66	0	-5	100	15.75	16.85	15.44	0.982	L
11	66	66	0	-4	150	15.75	16.85	15.59	0.982	L
12	66	66	0	-3	86	15.75	16.85	15.74	0.991	L
13	66	66	0	-2	298	15.75	16.85	15.89	0.991	L
14	66	66	0	-1	110	15.75	16.85	16.04	1.000	L
15	66	66	0	0	205	15.75	16.85	16.25	1.009	--
16	66	66	0	1	147	15.75	16.85	16.40	0.991	L
17	66	66	0	2	88	15.75	16.85	16.55	1.009	L
18	66	66	0	3	314	15.75	16.85	16.70	1.018	L
19	66	66	0	4	111	15.75	16.85	16.85	1.024	L
20	66	66	0	5	72	15.75	16.85	17.00	1.027	L
Test Condition C										
21	33	33	0	-5	116	7.65	8.40	7.64	0.968	L
22	33	33	0	-4	130	7.65	8.40	7.73	0.968	L
23	33	33	0	-3	137	7.65	8.40	7.82	0.981	L
24	33	33	0	-2	151	7.65	8.40	7.91	0.987	L
25	33	33	0	-1	175	7.65	8.40	8.00	1.000	L
26	33	33	0	0	276	7.65	8.40	8.10	1.000	--
27	33	33	0	1	160	7.65	8.40	8.19	1.006	L
28	33	33	0	2	308	7.65	8.40	8.28	1.018	L
29	33	33	0	3	83	7.65	8.40	8.37	1.018	L
30	33	33	0	4	124	7.65	8.40	8.46	1.024	L
31	33	33	0	5	85	7.65	8.40	8.55	1.036	L

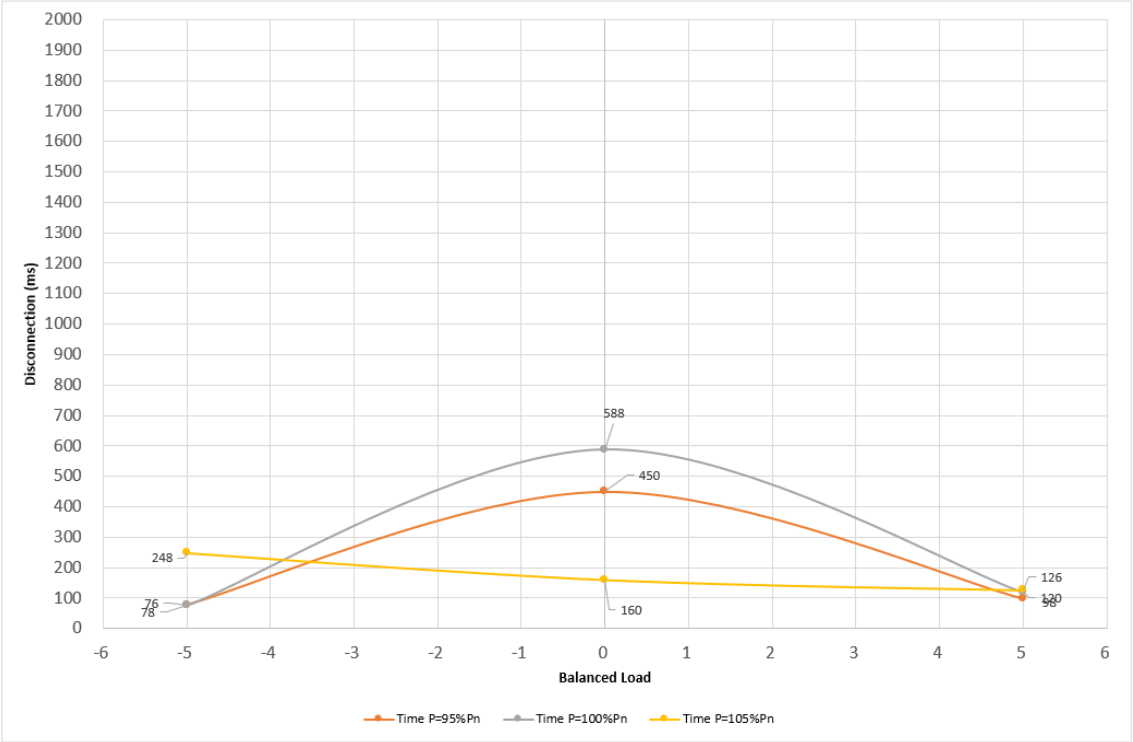
4.3 Active anti-islanding protection Appendix H Active anti-islanding test (Testing according to IEC 62116)	P

Table: tested condition and run-on time

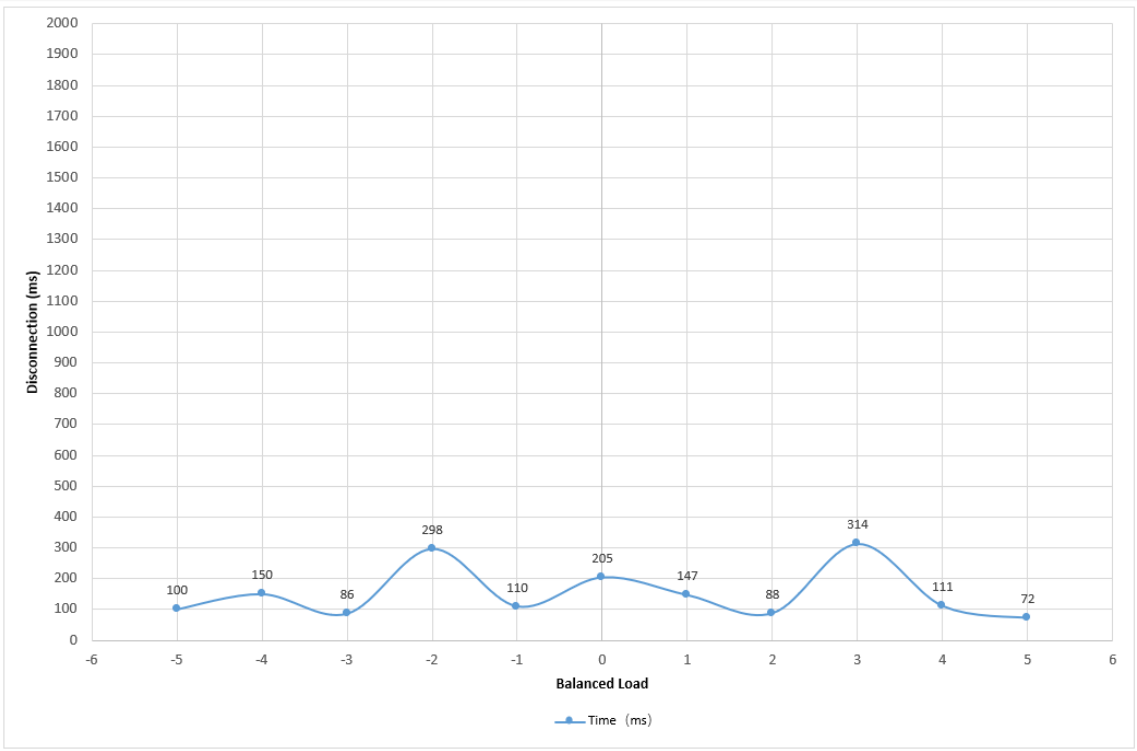
No.	P_{EUT} (% of EUT rating)	Reactive load (% of normal)	P_{AC}	Q_{AC}	Run-on time (ms)	P_{EUT} (kW)	Q_{EUT} (kVar) (Cap.)	Q_{EUT} (kVar) (Ind.)	Actual Q_f	Which load is selected to be adjusted (R or L)

Remark:
For test condition A:
If any of the recorded run-on times are longer than the one recorded for the rated balance condition, then the non-shaded parameter combinations also require testing.
For test condition B and C:
If run-on times are still increasing at the 95 % or 105 % points, additional 1 % increments is taken until run-on times begin decreasing.

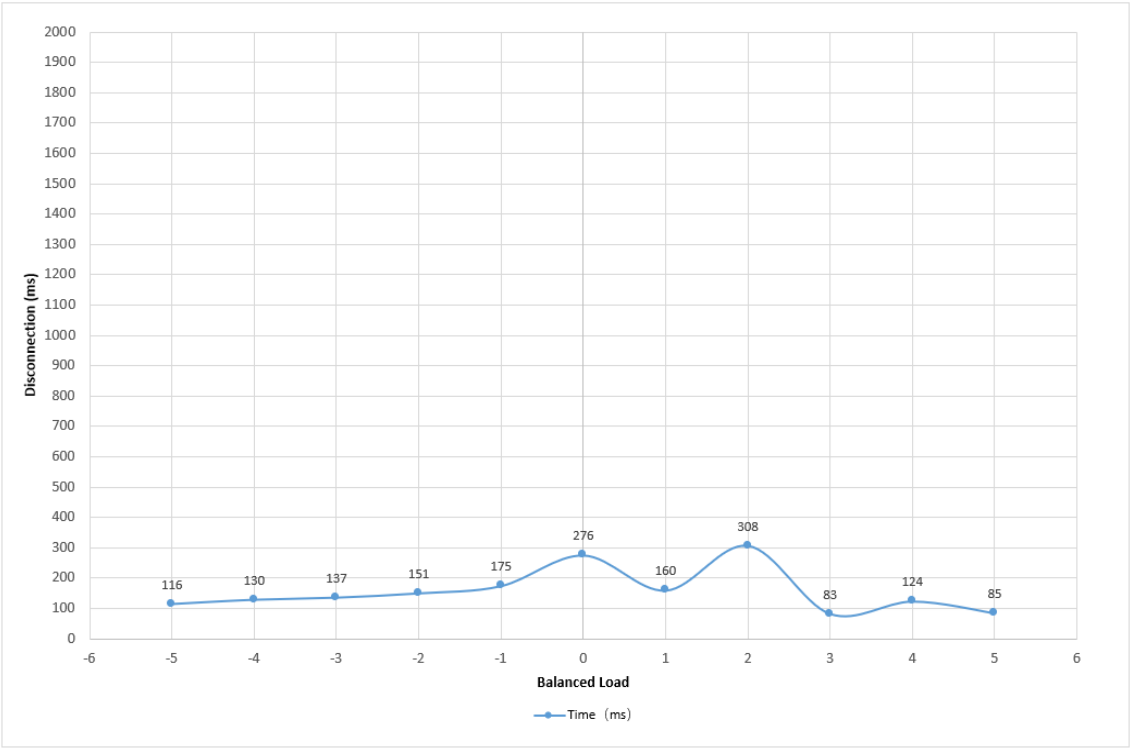
Test Condition A



Test Condition B



Test Condition C



4.4 Voltage and frequency limits (passive anti-islanding protection) **Appendix I.2 Under- and over-voltage trip settings and reconnection test**	**P**

Passive anti-islanding voltage limit values for inverter			
Protective function	Protective function limit (V)	Trip delay time (s)	Maximum disconnection time (s)
Under voltage 2 (V<<)	70	1	2
Under voltage 1 (V<)	180	10	11
Over voltage 1 (V>)	265	1	2
Over voltage 2 (V>>)	275	--	0.2

Passive anti-islanding frequency limit values for inverter			
Australia A			
	Protective function limit value (Hz)	Trip delay time (s)	Maximum disconnection time (s)
Under frequency 1 (F<)	47	1	2
Over-frequency 1 (F>)	52	--	0.2
Australia B			
Under frequency 1 (F<)	47	1	2
Over-frequency 1 (F>)	52	--	0.2
Australia C			
Under frequency 1 (F<)	45	5	6
Over-frequency 1 (F>)	55	--	0.2
New Zealand			
Under frequency 1 (F<)	45	1	2
Over-frequency 1 (F>)	55	--	0.2

Note:
Measurement accuracy:
Voltage: ±1% Vn
Frequency: ±10 mHz
The trip settings for Australia A, Australia B, Australia C and New Zealand.

4.4 Voltage and frequency limits (passive anti-islanding protection) Appendix I.2 Under- and over-voltage trip settings and reconnection test						**P**
Test: IVGM25KHP3G3						
Clause I.2 Test report	Description	Min. value	Max. value	Test resolution		Units
Over voltage 2 (V>>)	When stepping the grid source voltage to 2.5 V above the overvoltage 2 (V > >) limit in Table 4.1 (2 ms), the time taken from the start of the step and the device under test disconnecting [I.2.2(d)]	0.0	0.2	L1:	0.062	s
					0.064	
					0.067	
				L2:	0.070	
					0.054	
					0.060	
				L3:	0.080	
					0.059	
					0.068	
	The reconnect time after decreasing grid source voltage to grid test voltage [I.2.2(e)]	60.0	--	L1:	74.5	s
					73.7	
					73.1	
				L2:	72.3	
					72.4	
					72.3	
				L3:	73.1	
					72.5	
					72.4	
	The measured ramp rate after restoration in I.2.2 (e). Provide test data in a graphical and tabular form showing active power output measured at 15 s intervals until power output has stabilized at (100 ± 4) % of rated apparent power [I.2.2(f)]	According to Figure 3.4	According to Figure 3.4	L1:	15.62	%/min
					15.54	
					15.57	
				L2:	15.66	
					15.67	
					15.68	
				L3:	15.70	
					15.65	
					15.67	
Undervoltage 2 (V<<)	When stepping the grid source voltage to 2.5 V below the undervoltage 2 (V < <) limit in Table 4.1 (2 ms), the time taken from the start of the step and the device	1.0	2.0	L1:	1.008	s
					1.024	
					1.048	
				L2:	1.040	

	under test disconnecting [I.2.3(b)]				1.040	
					1.012	
				L3:	1.036	
					1.040	
					1.012	
	The reconnect time after increasing grid source voltage to grid test voltage [I.2.3(c)]	60.0	--		77.00	s
				L1:	80.30	
					77.70	
					78.00	
				L2:	78.10	
					75.50	
					78.20	
				L3:	77.60	
					77.20	
	The stabilized active power output after restoration of grid voltage [I.2.3(e)]	--	--		4098	W
				L1:	4093	
					4097	
					4130	
				L2:	4132	
					4134	
					4109	
				L3:	4118	
					4114	
	When stepping the grid source voltage to 50 V (2 ms), holding for 900 ms then returning to grid test voltage (2ms). The time taken between first and second points where the voltage passes through the undervoltage 2 (V <<) limit in Table 4.1[I.2.3 (f)]	--	--	1000		ms
	The device remained connected at all times for Step I.2.3 (f)	--	--	Y		Y/N
	OR If the device under test is a multiple mode inverter meeting the performance classification for output requirements of AS IEC 62040.3 the inverter reconnected within 400 ms when the grid voltage recovered to within the voltage requirements of the relevant AS IEC 62040.3 performance classification	--	--	N		Y/N
	The real power output 400 ms after	--	I.2.3(e	L1:	4060	W

	restoration of grid test voltage [I.2.3 (g)]		) value above ±5%		4101	
					4056	
				L2:	4070	
					3993	
					4124	
				L3:	4074	
					4010	
					4040	
Undervoltage 1 (V<)	When stepping the grid source voltage in < 1 V steps with a dwell time of 15 s to 2.5 V below the undervoltage 1 (V <) limit in Table 4.1, the time taken from the start of a voltage step and the device under test disconnecting [I.2.4(c)]	10.0	11.0		10.040	s
				L1:	10.060	
					10.060	
					10.020	
				L2:	10.080	
					10.020	
					10.060	
				L3:	10.060	
					10.080	
	Grid source voltage recorded when device under test disconnected [I.2.4 (c)]	177.7	182.3		179.46	V
				L1:	179.70	
					179.45	
					179.85	
				L2:	179.84	
					179.84	
					179.74	
				L3:	179.75	
					179.74	
	When the grid source voltage was set to 203 V, the device under test remained disconnected for two times the reconnection time in I.2.3 (c) [I.2.4(d)]	--	--	Y		Y/N
	When increasing the grid source voltage by 4 V, the time taken from the start of a voltage step and the device under test reconnecting [I.2.4(e)]	60	--		64.1	s
				L1:	63.7	
					62.4	
					63.8	
				L2:	63.1	
					61.9	
				L3:	62.4	

					63.6	
					63.5	
Overvoltage 1 (V>)	When stepping the grid source voltage in < 1 V steps with a dwell time of 15 s to 2.5 V above the overvoltage 1 (V >) limit in Table 4.1, the time taken from the start of a voltage step and the device under test disconnecting [I.2.5(c)]	1.0	2.0	L1:	1.140	s
					1.136	
					1.136	
				L2:	1.152	
					1.132	
					1.140	
				L3:	1.132	
					1.136	
					1.124	
	The grid source voltage recorded when device under test disconnected [I.2.5(c)]	262.7	267.3	L1:	264.56	V
					264.55	
					264.55	
				L2:	264.64	
					264.67	
					264.65	
				L3:	264.60	
					264.57	
					264.56	
	When the grid source voltage was set to 255 V, the device under test remained disconnected for two times the reconnection time in I.2.2 [I.2.5(d)]	--	--	Y		Y/N
	When decreasing the grid source voltage by 4 V, the time taken from the start of a voltage step and the device under test reconnecting [I.2.5(e)]	60	--	L1:	61.2	s
					65.1	
					65.0	
				L2:	65.3	
					64.5	
					65.4	
				L3:	79.6	
					109.8	
					86.6	

Criteria for acceptance

When tested in accordance with Clause I.2, the device under test shall conform to the following:

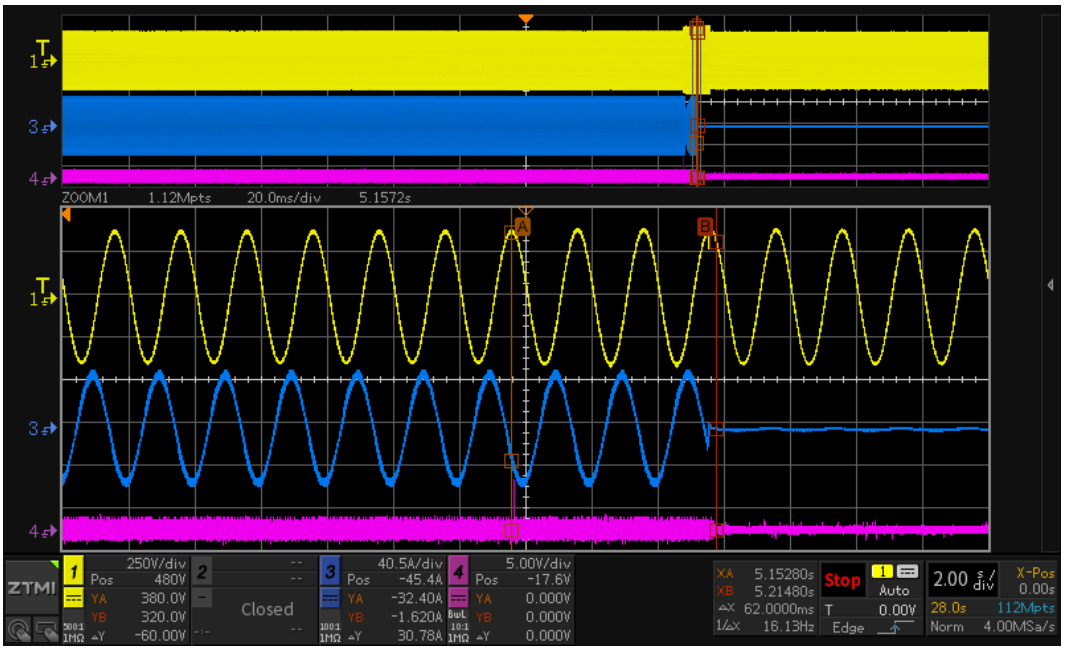
(a) The limits specified in Table 4.1.

(b) The measured voltage of each limit shall conform to the measurement accuracy specified in Table 2.5.

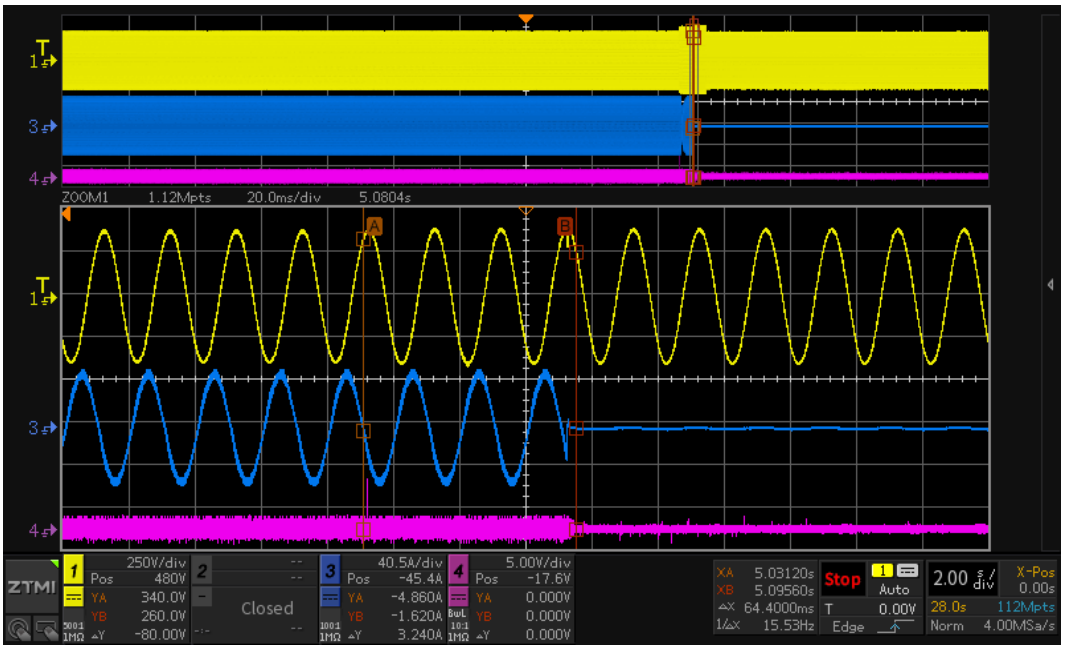
(c) The disconnection time shall be greater than the trip delay time and less than the maximum

disconnection time of Table 4.1. (d) The device under test shall remain connected for an undervoltage step of less than trip delay time of Table 4.1. (e) The connection or reconnection time and behaviour shall conform to Clause 4.7. (f) The active power output for each interval recorded as part of the steps in Clause I.2.2 shall conform to the nonlinearity requirements of Clause 3.3.5.4 and the default ramp rate of Clause 3.3.5.2.
Note: Due to the different duration of power grid fault, the reconnection time of inverter is different.

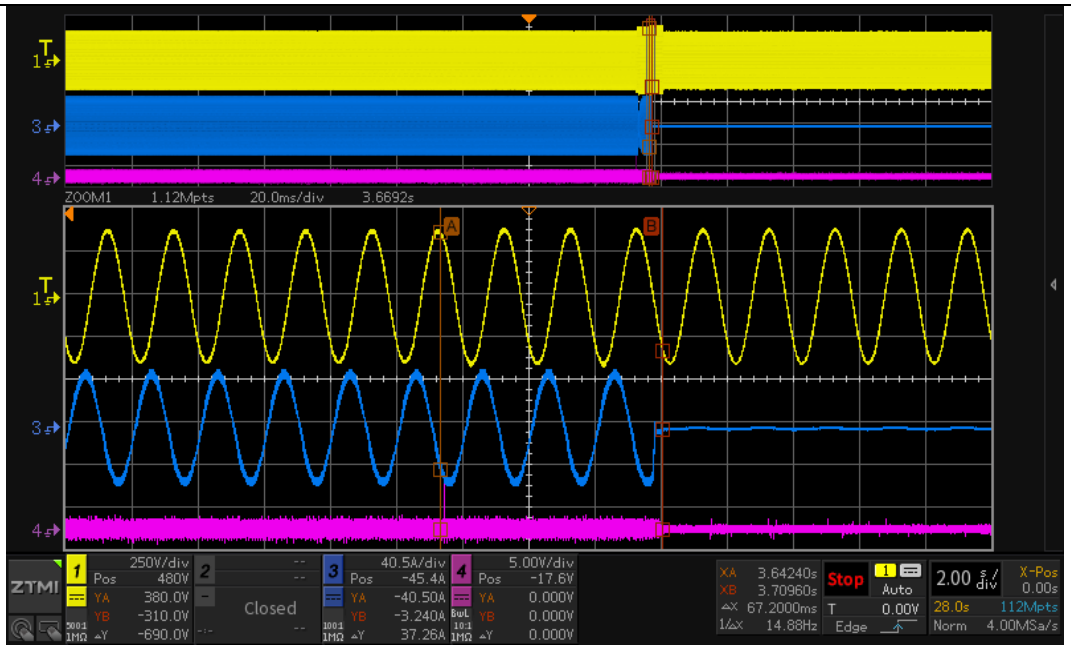
Diagram of over-voltage 2 protection: L1 Phase



Test 1

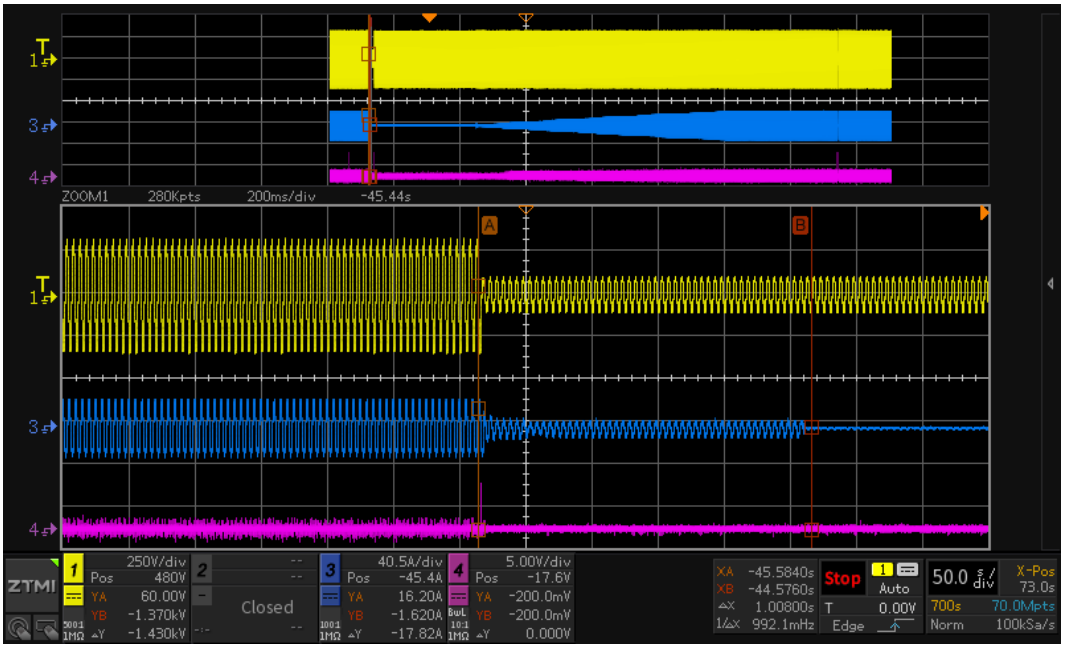


Test 2

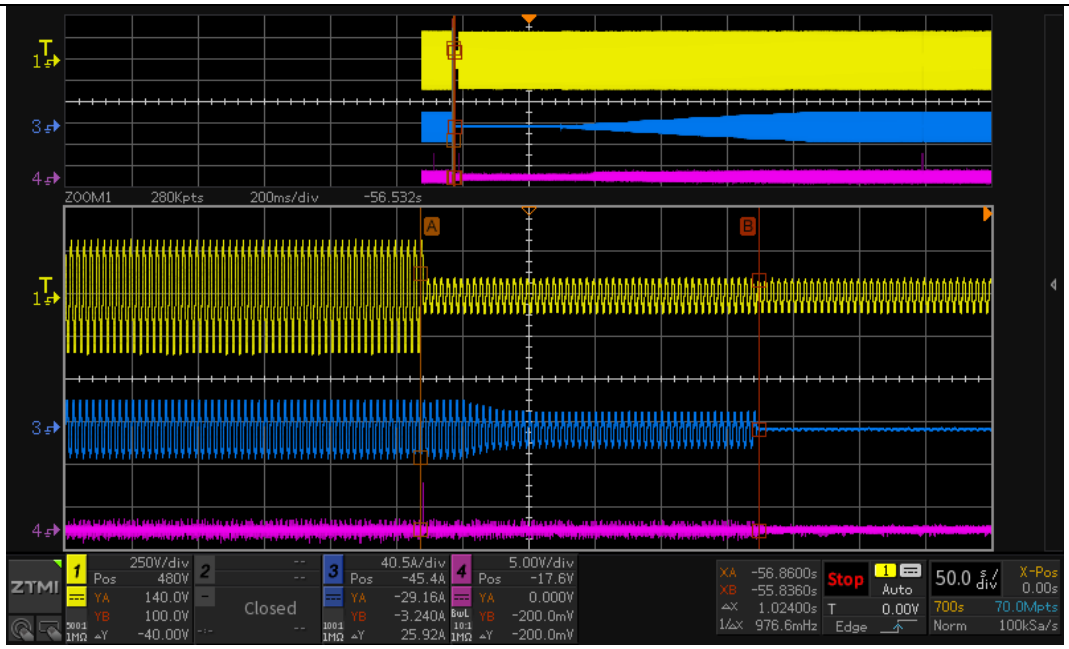


Test 3

Diagram of under-voltage 2 protection: L1 Phase



Test 1



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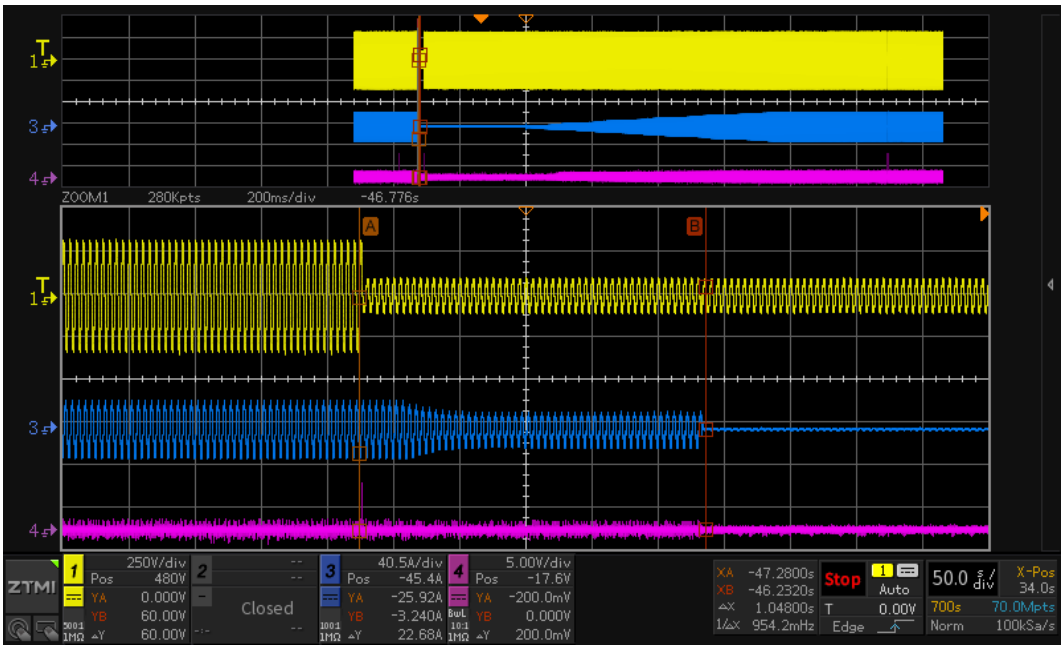
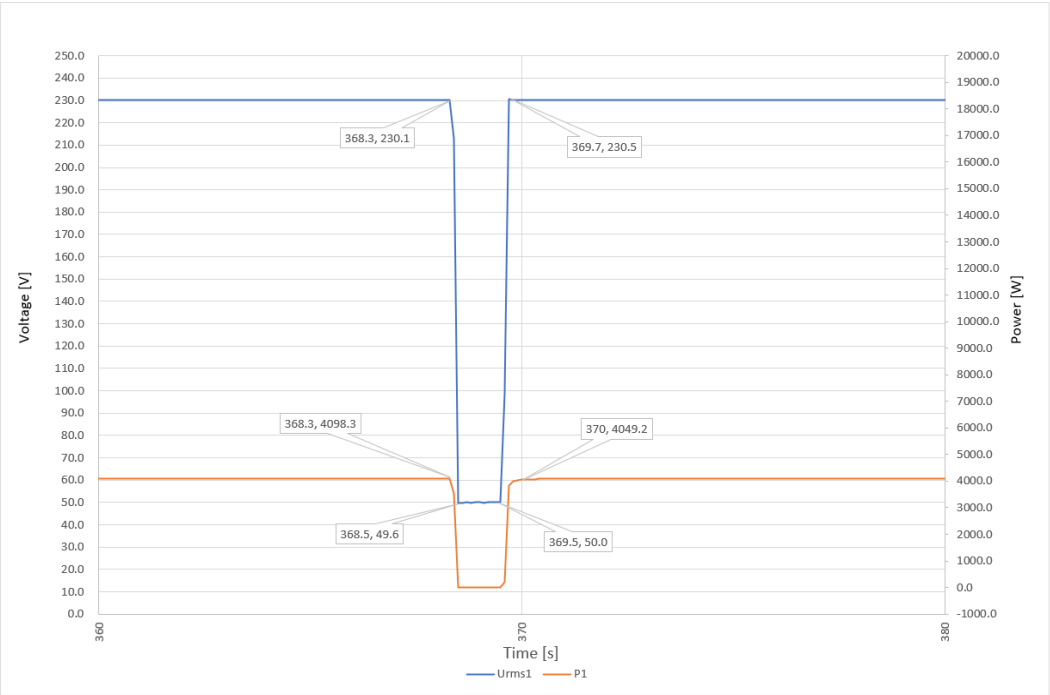


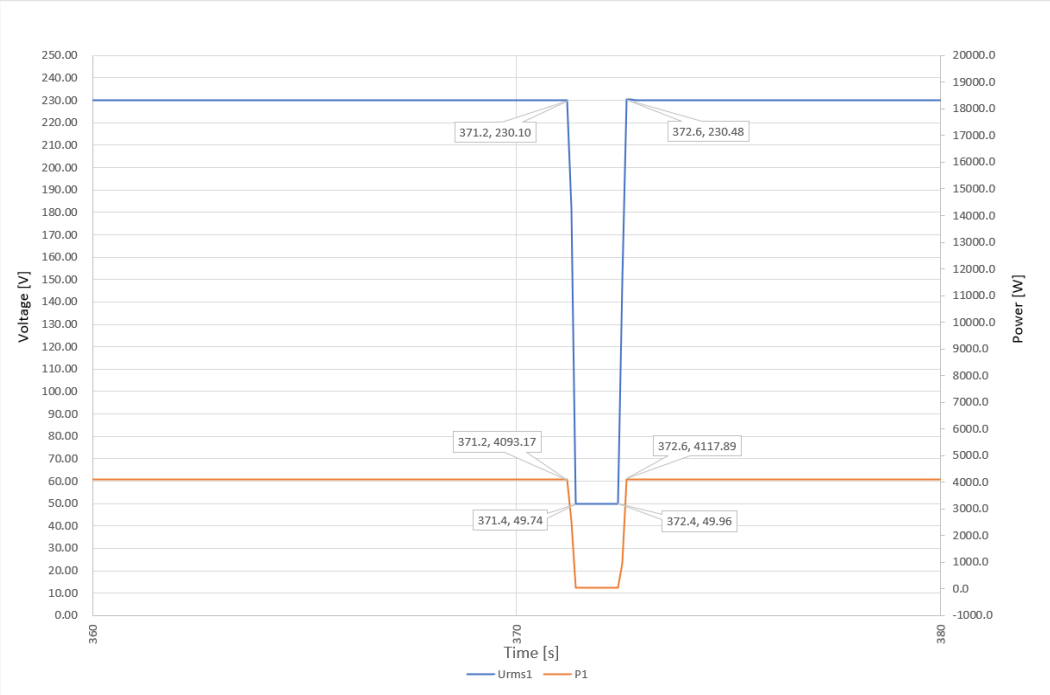
Test 3

Note: 1:Voltage; 3: current; 4: Trig signal

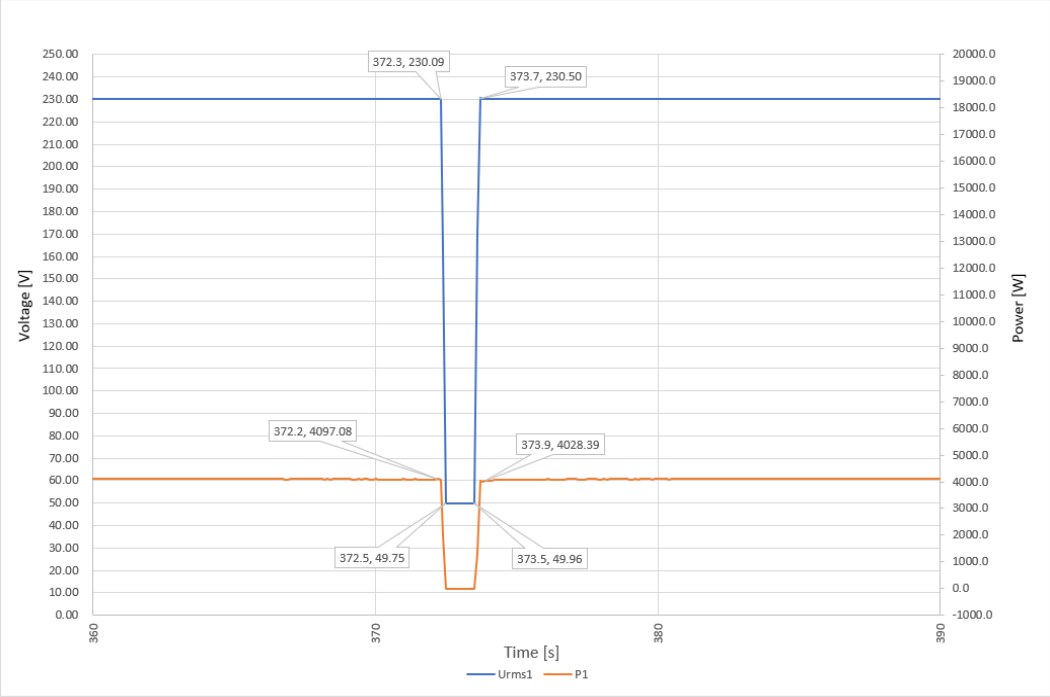
Diagram of step g) and f) : L1 Phase



Test 1

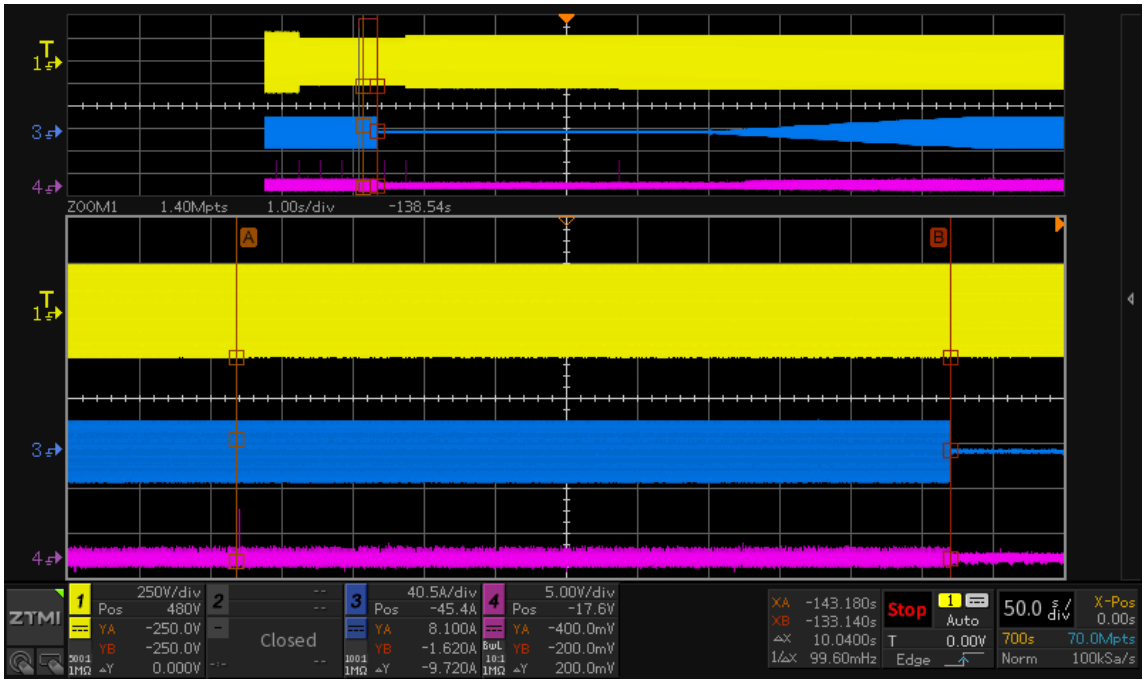


Test 2

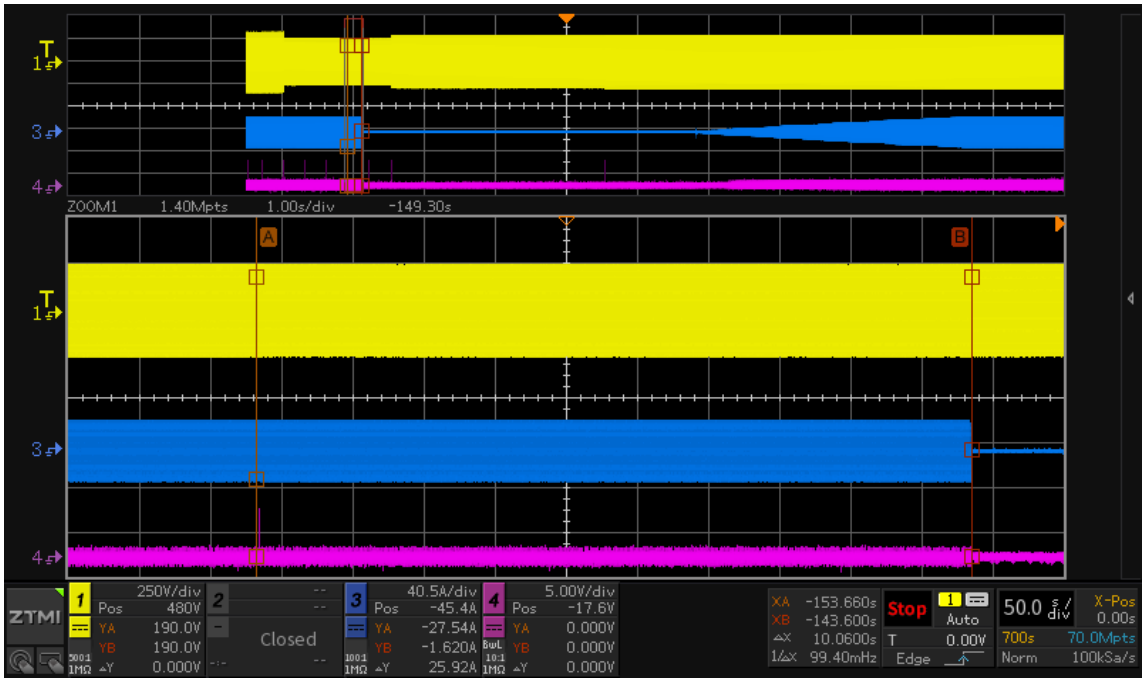


Test 3

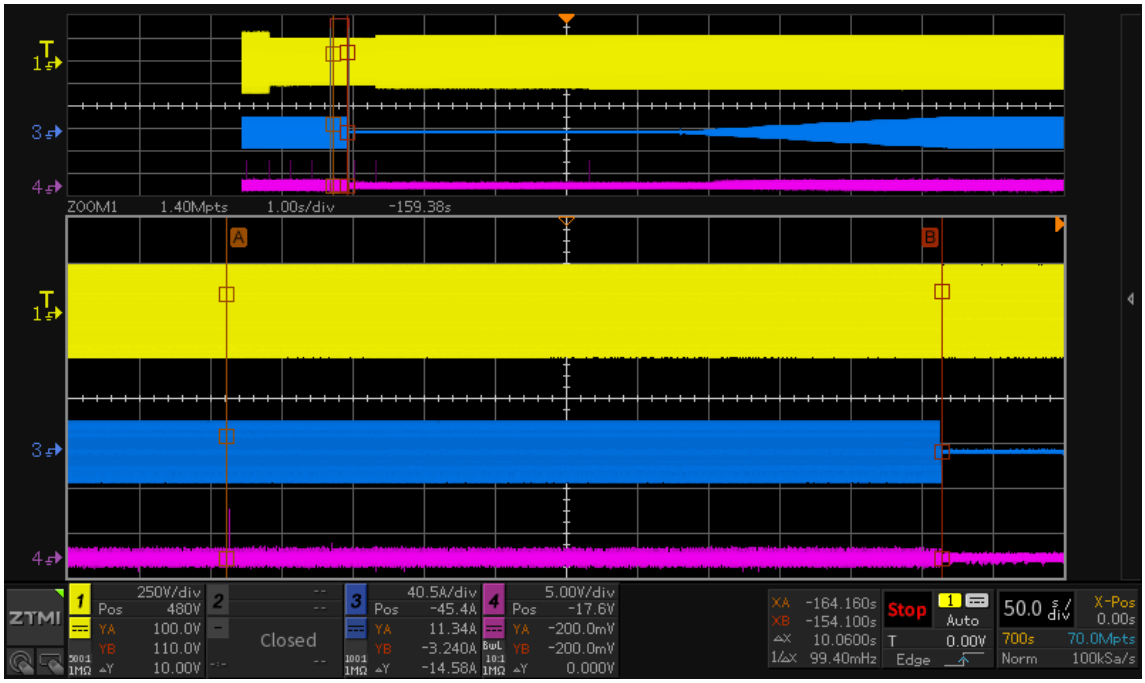
Diagram of under-voltage 1 protection: L1 Phase



Test 1



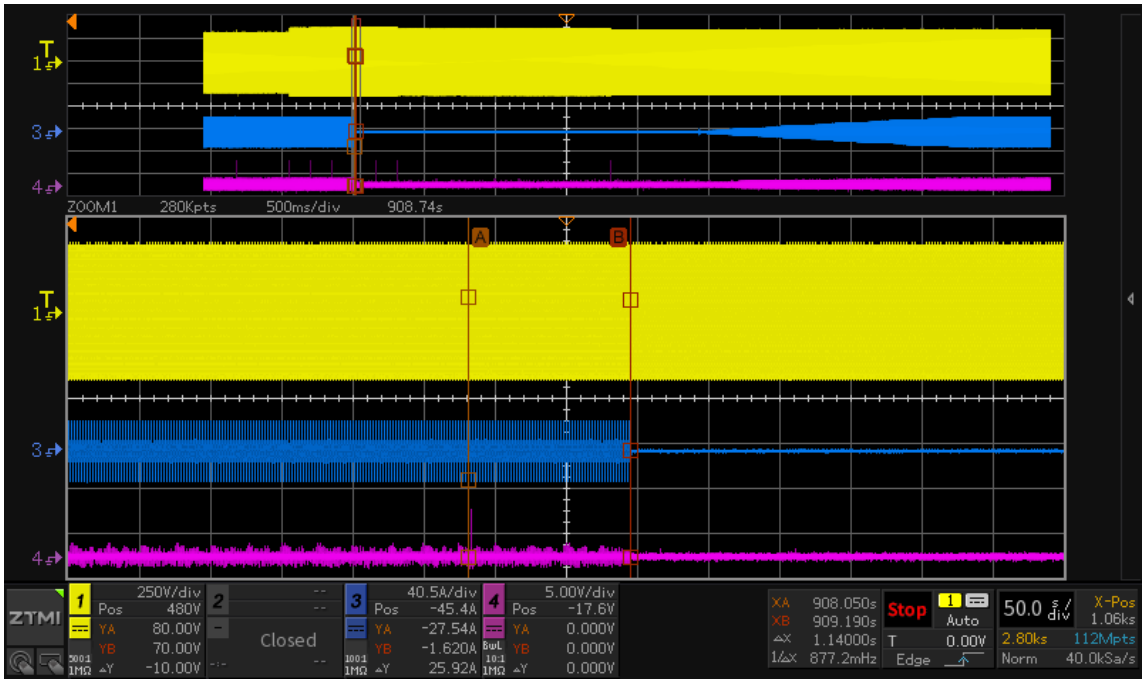
Test 2



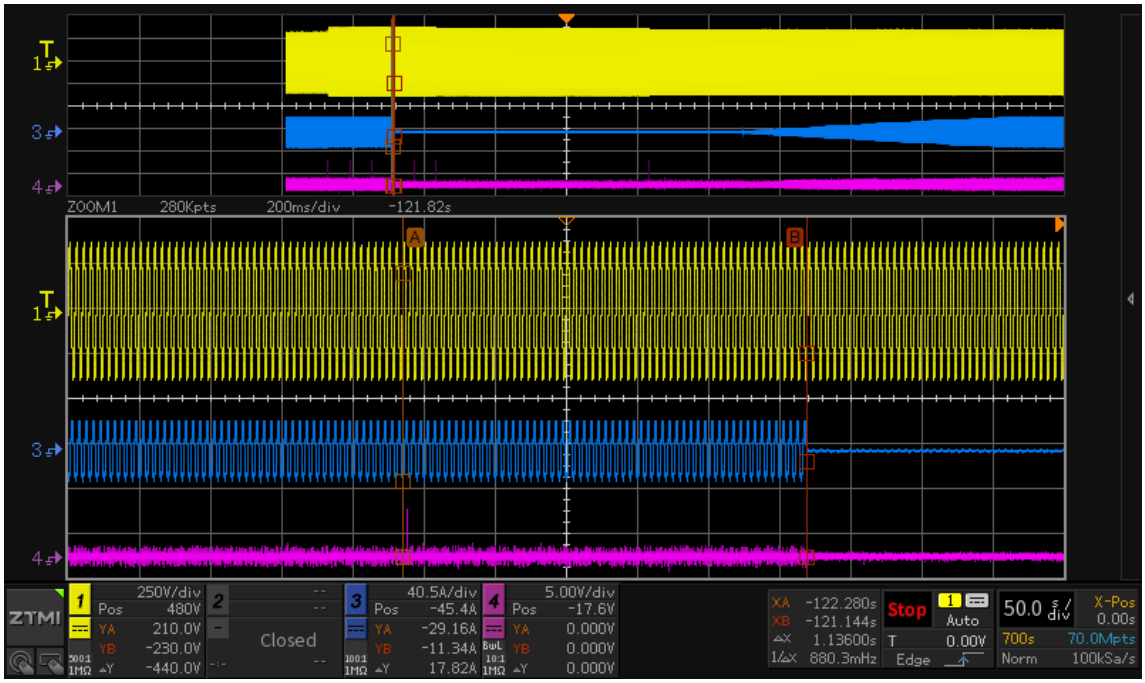
Test 3

Note: 1:Voltage; 3: current; 4: Trig signal

Diagram of over-voltage 1 protection: L1 Phase

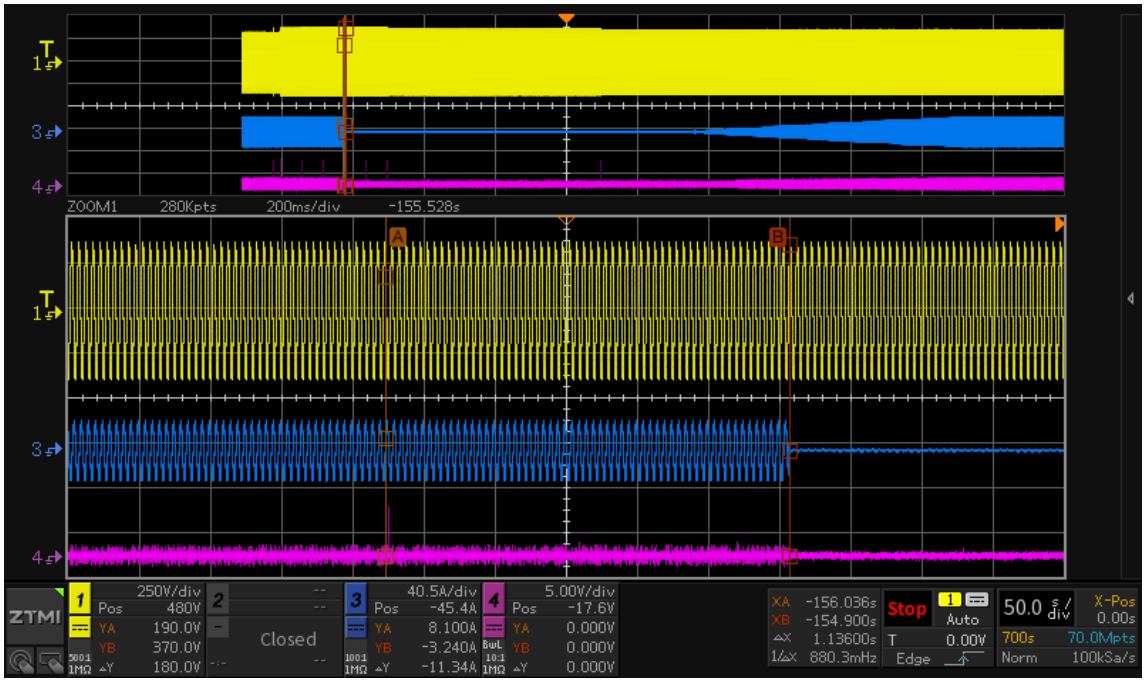


Test 1



Test 2

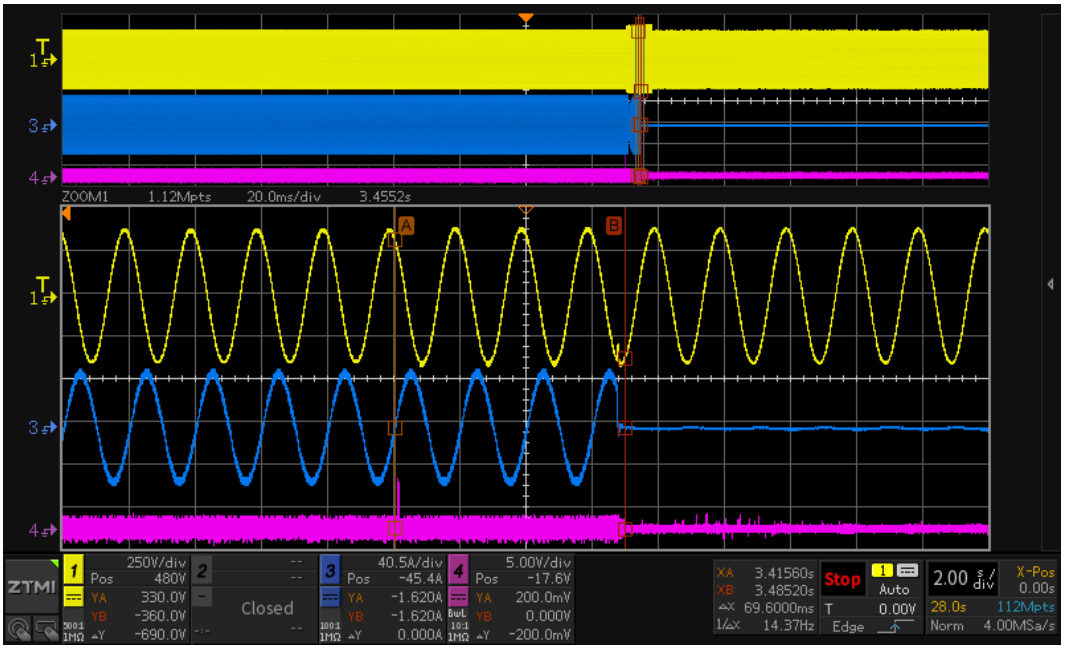
Note: 1:Voltage; 3: current; 4: Trig signal



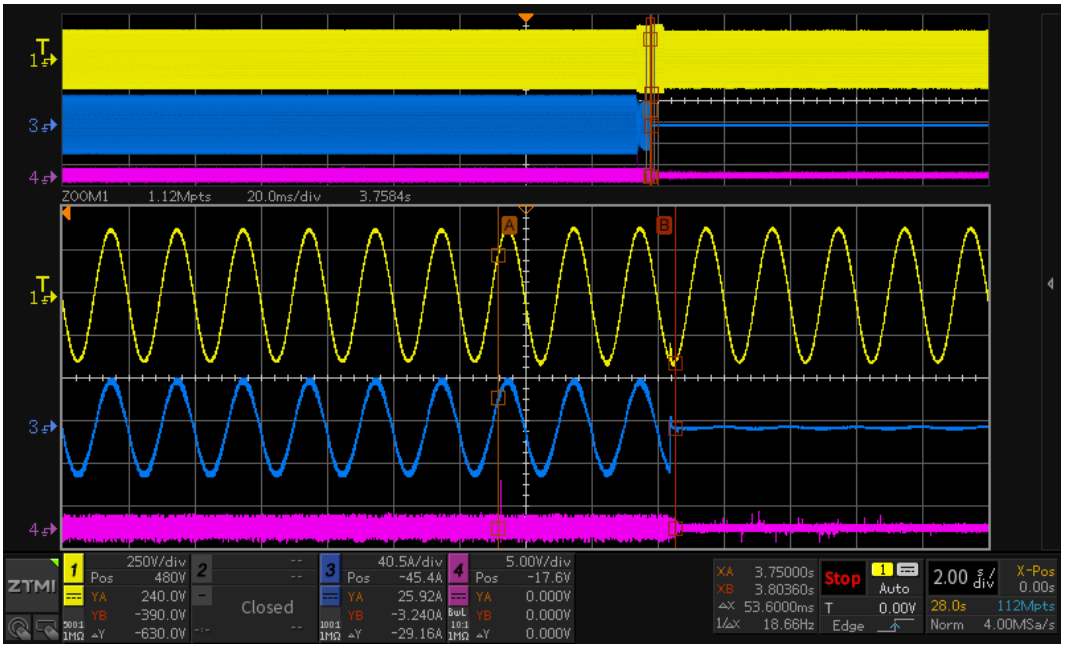
Test 3

Note: 1:Voltage; 3: current; 4: Trig signal

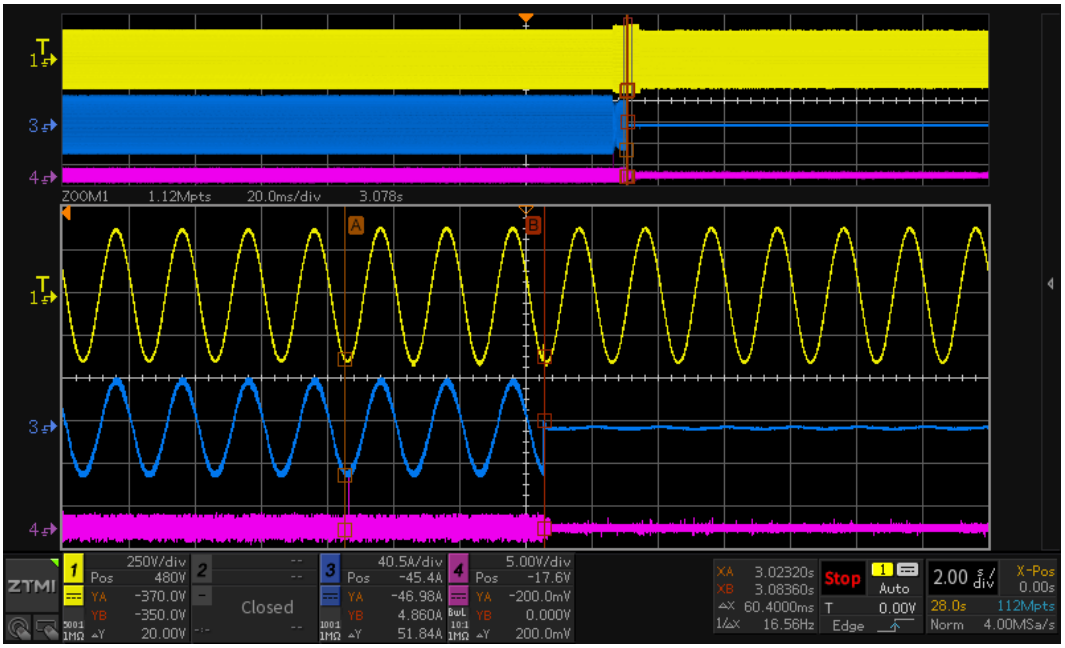
Diagram of over-voltage 2 protection: L2 Phase



Test 1



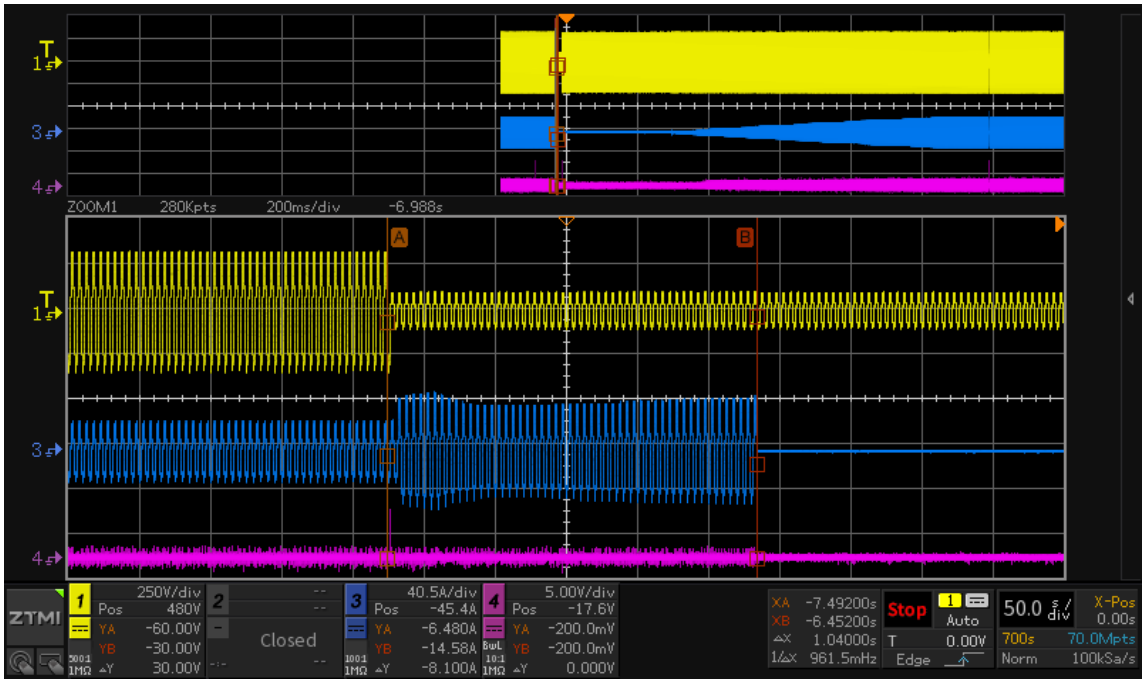
Test 2



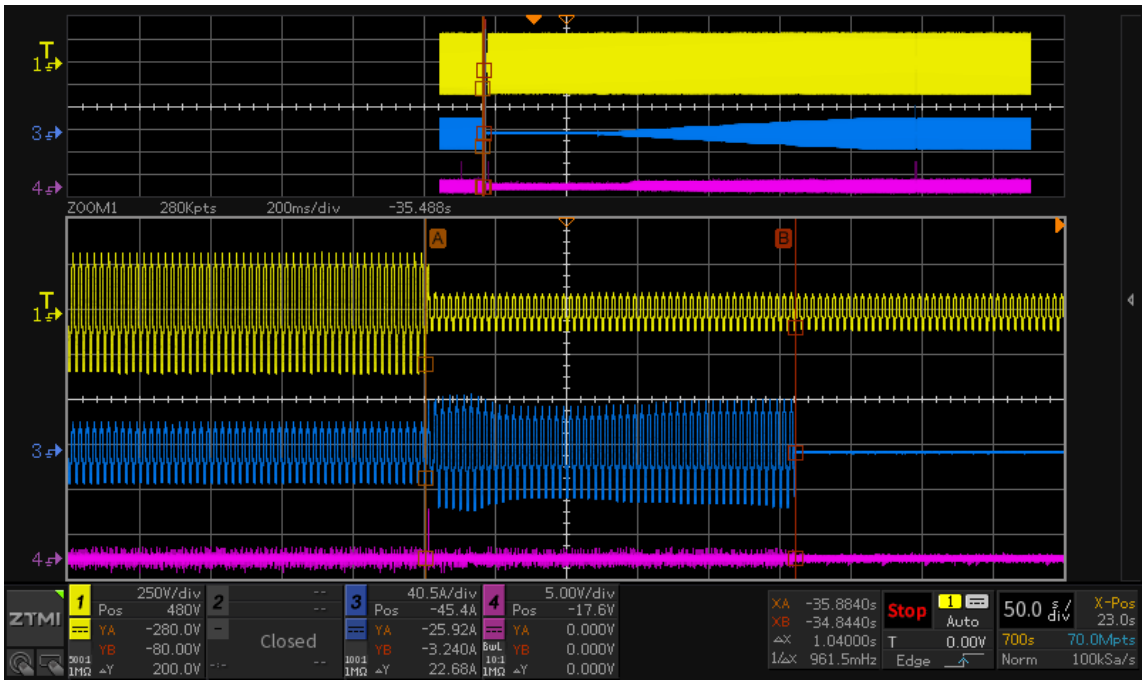
Test 3

Note: 1:Voltage; 3: current; 4: Trig signal

Diagram of under-voltage 2 protection: L2 Phase

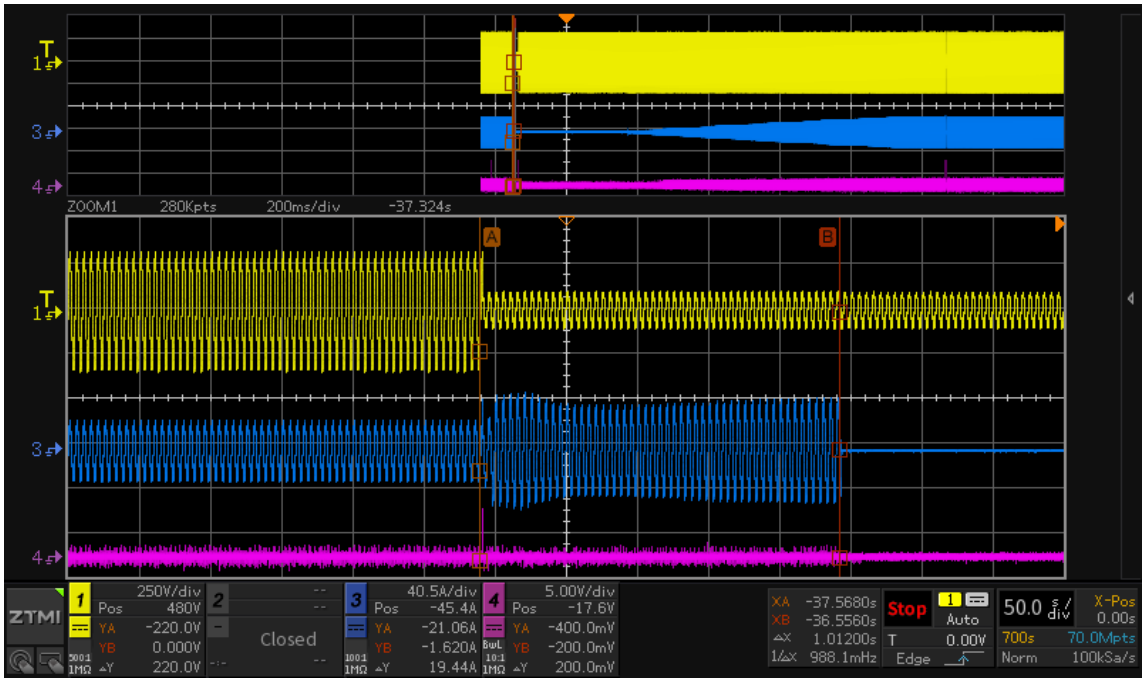


Test 1



Test 2

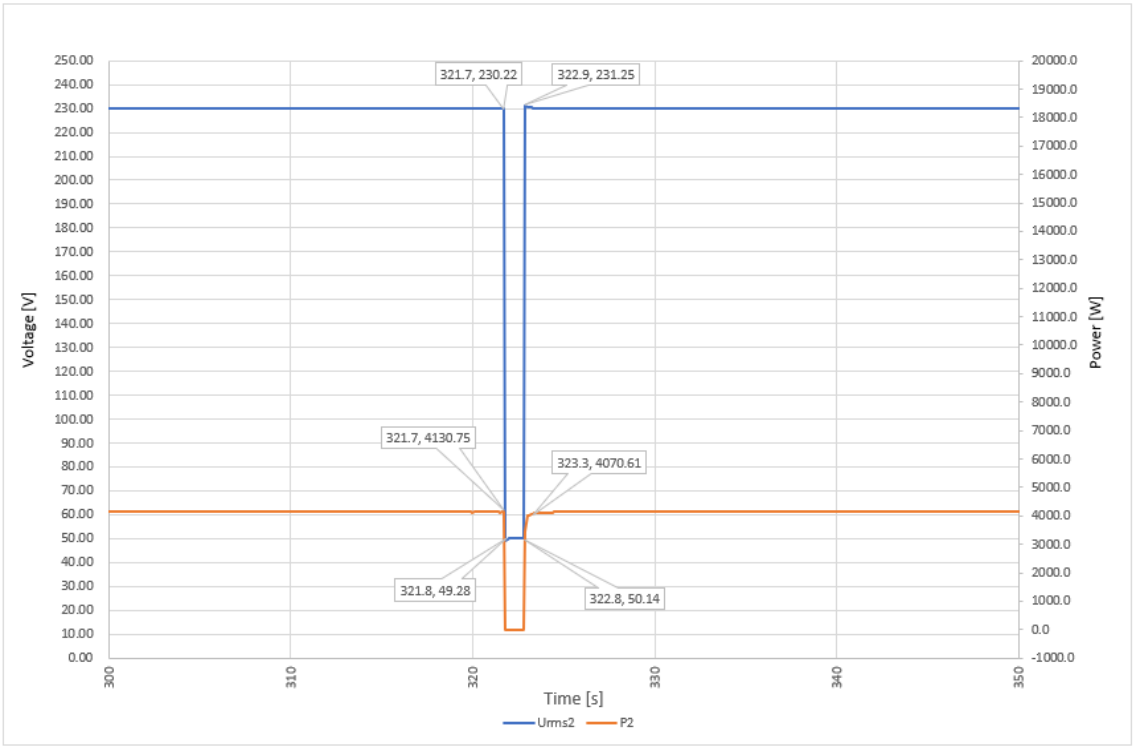
Note: 1:Voltage; 3: current; 4: Trig signal



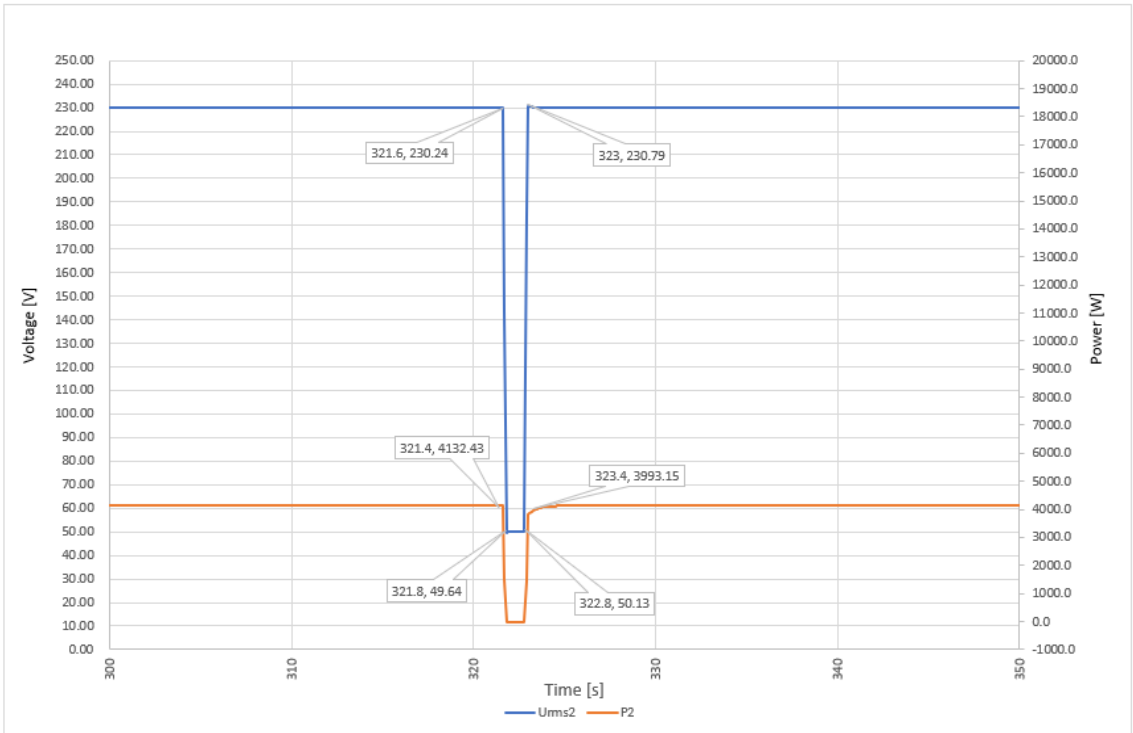
Test 3

Note: 1:Voltage; 3: current; 4: Trig signal

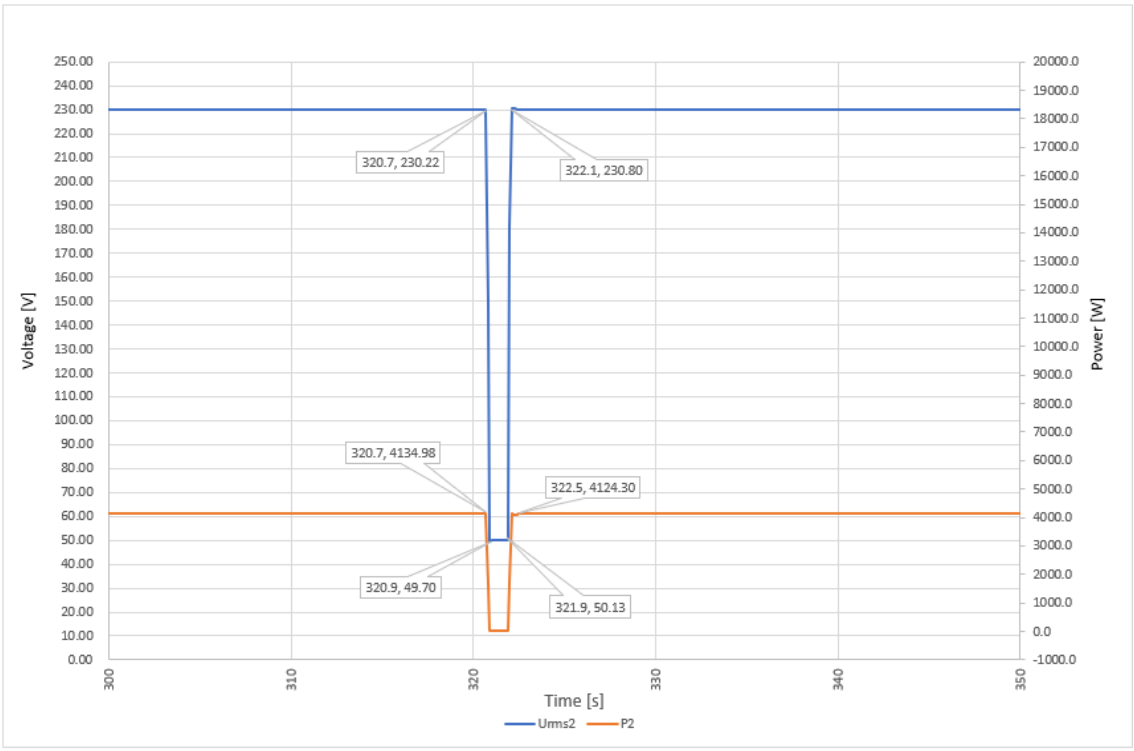
Diagram of step g) and f) : L2 Phase



Test 1

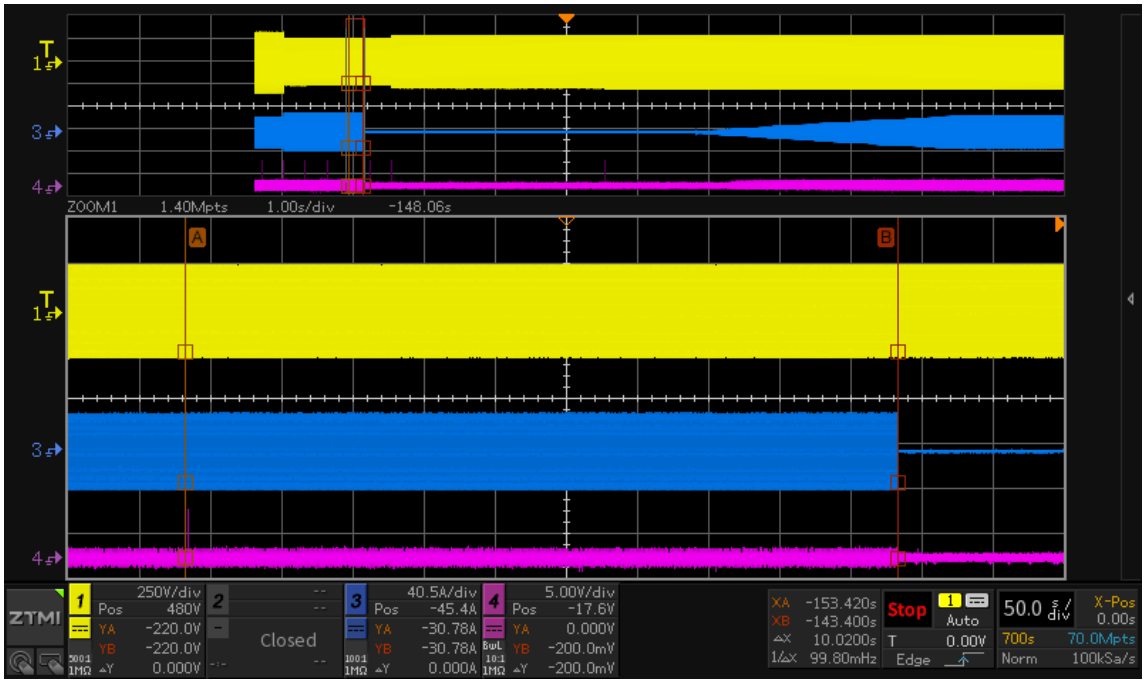


Test 2

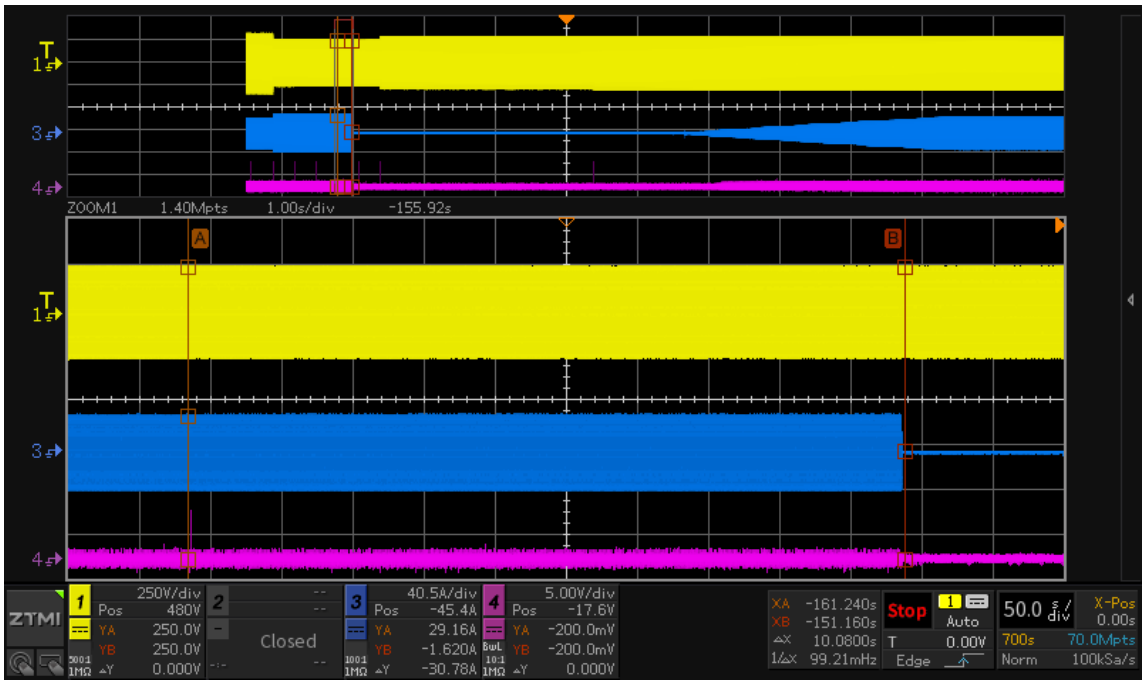

Voltage [V]
Power [W]
Time [s]
320.7, 230.22
322.1, 230.80
320.7, 4134.98
322.5, 4124.30
320.9, 49.70
321.9, 50.13
Umss2
P2

Test 3

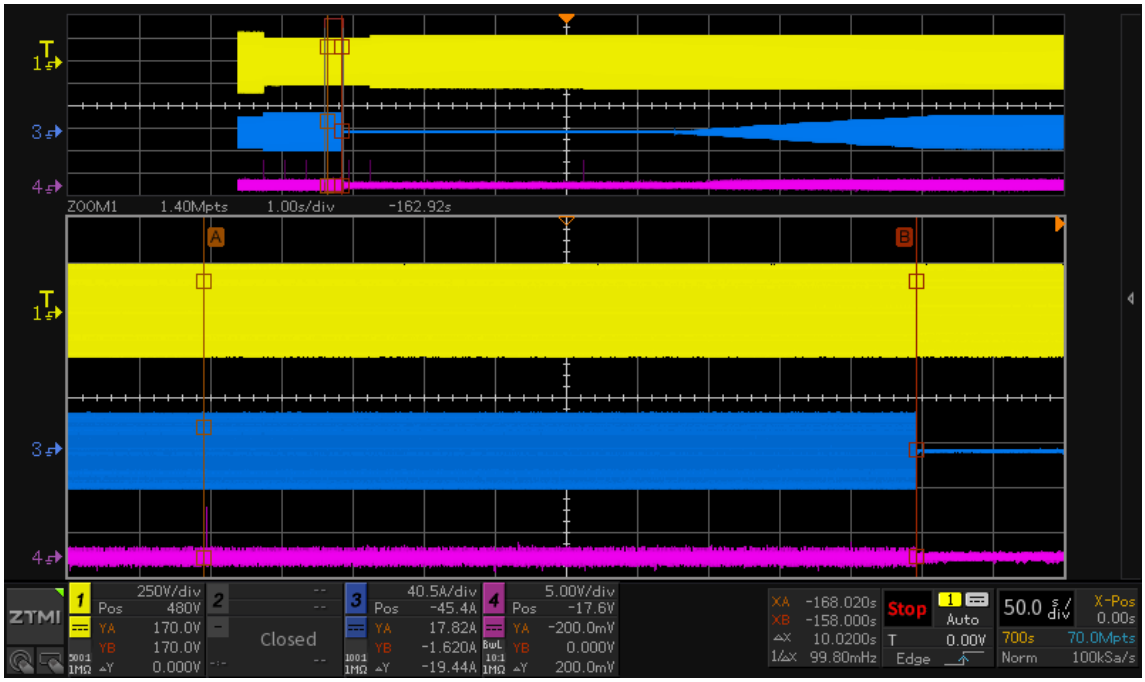
Diagram of under-voltage 1 protection: L2 Phase



Test 1



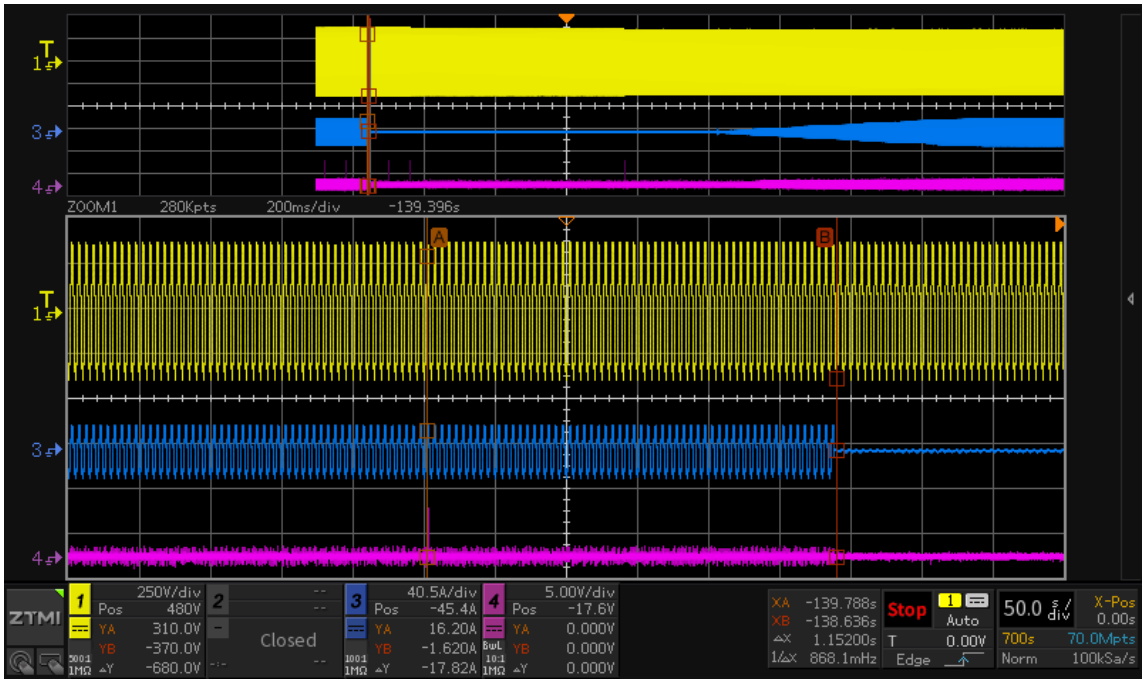
Test 2



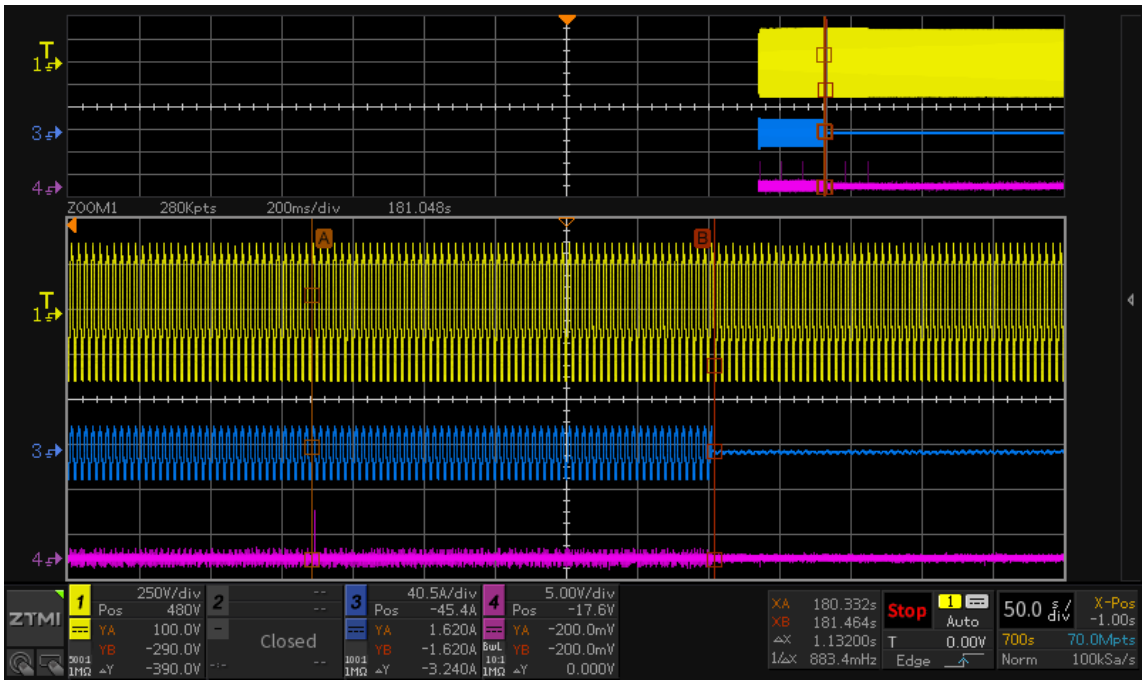
Test 3

Note: 1:Voltage; 3: current; 4: Trig signal

Diagram of over-voltage 1 protection: L2 Phase

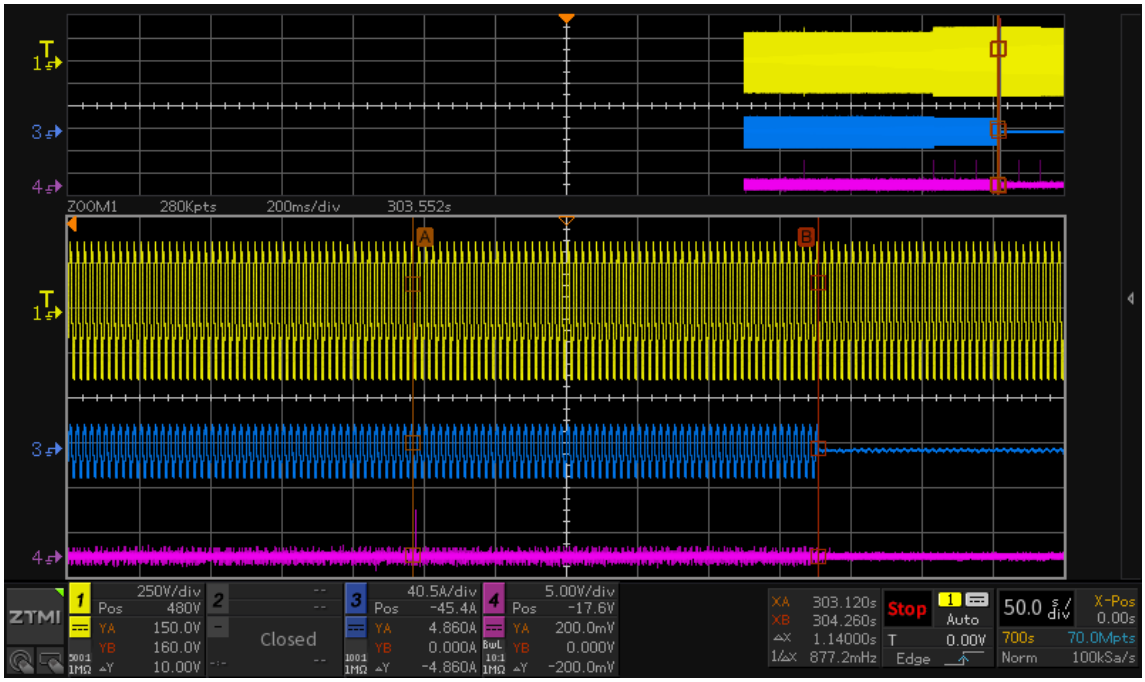


Test 1



Test 2

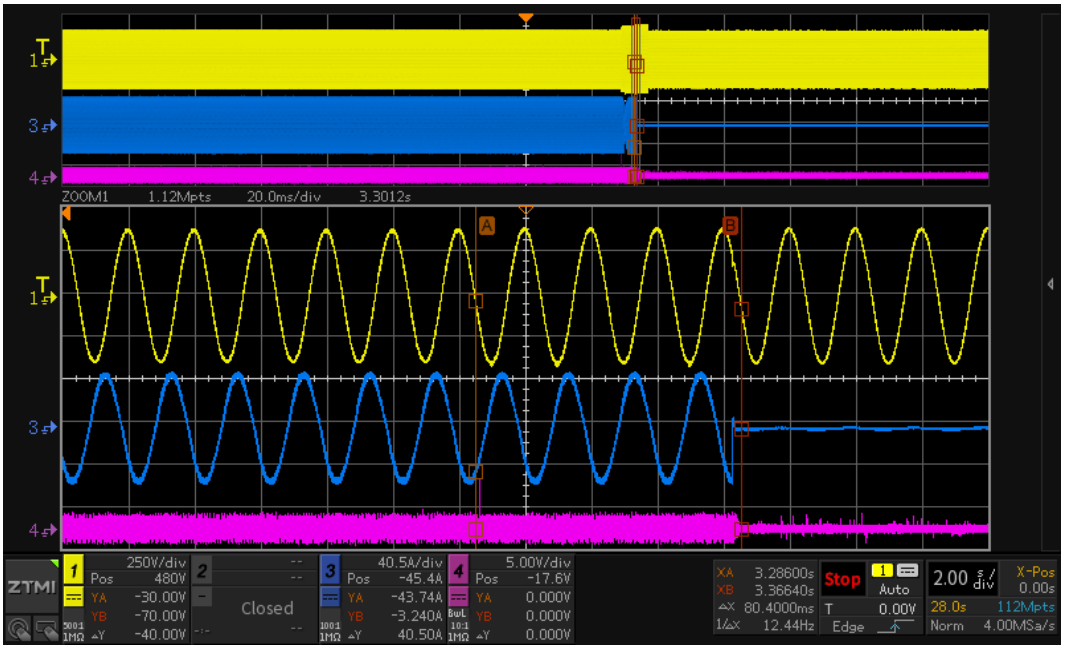
Note: 1:Voltage; 3: current; 4: Trig signal



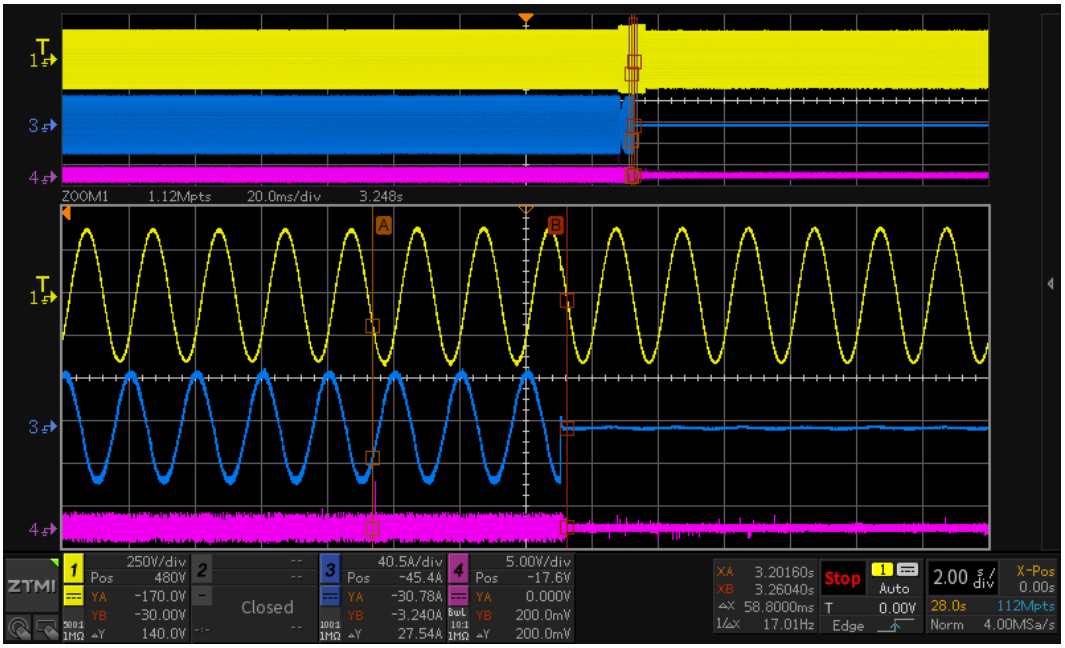
Test 3

Note: 1:Voltage; 3: current; 4: Trig signal

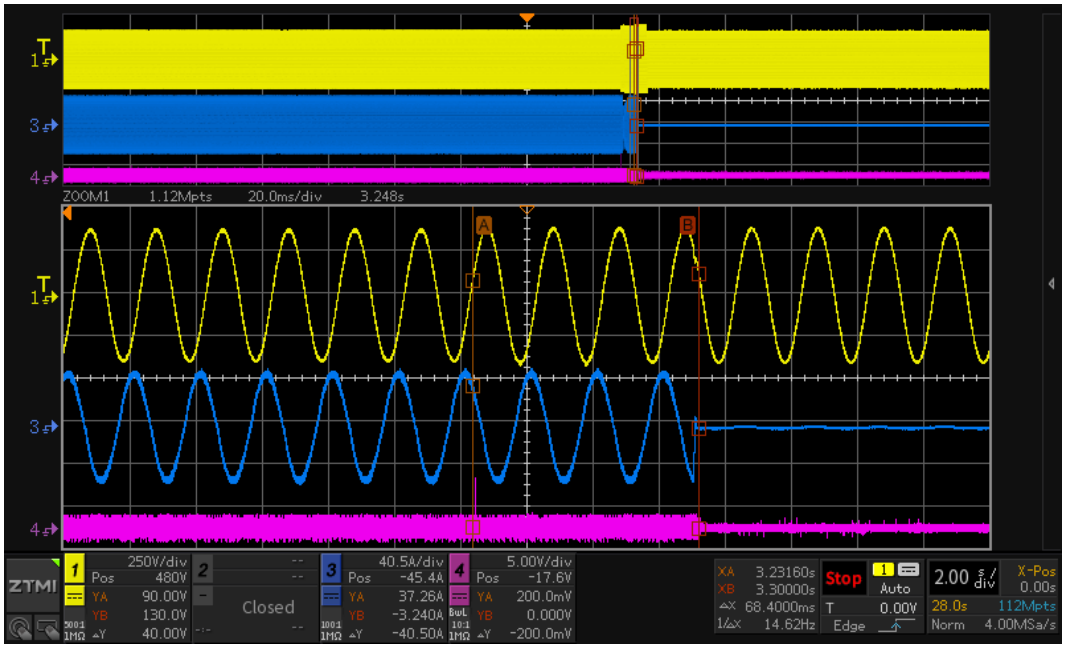
Diagram of over-voltage 2 protection: L3 Phase



Test 1



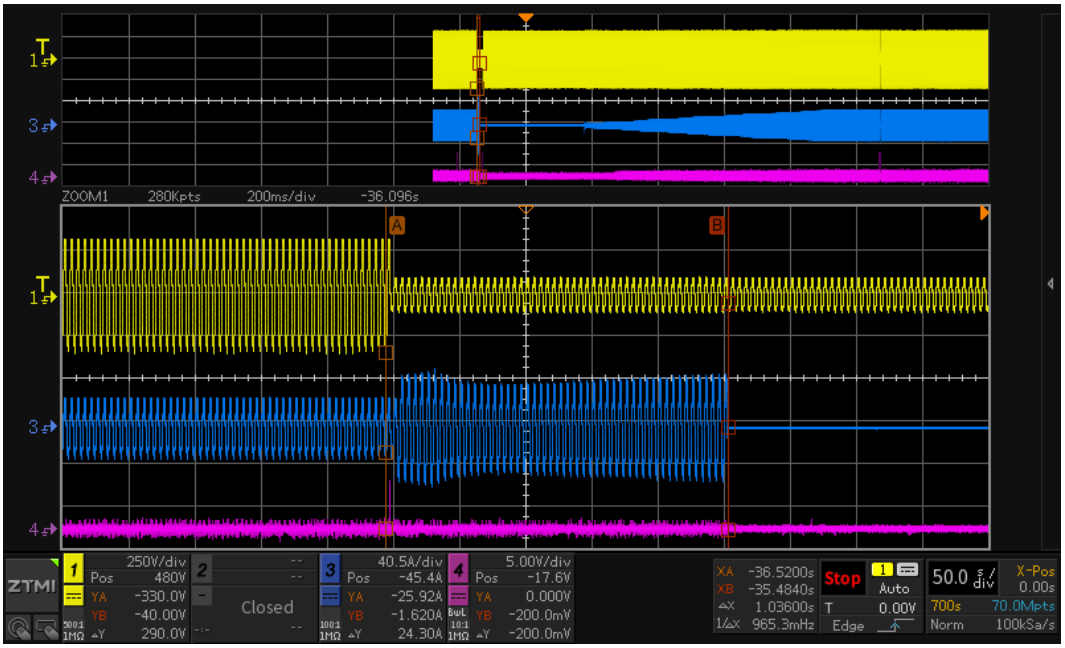
Test 2



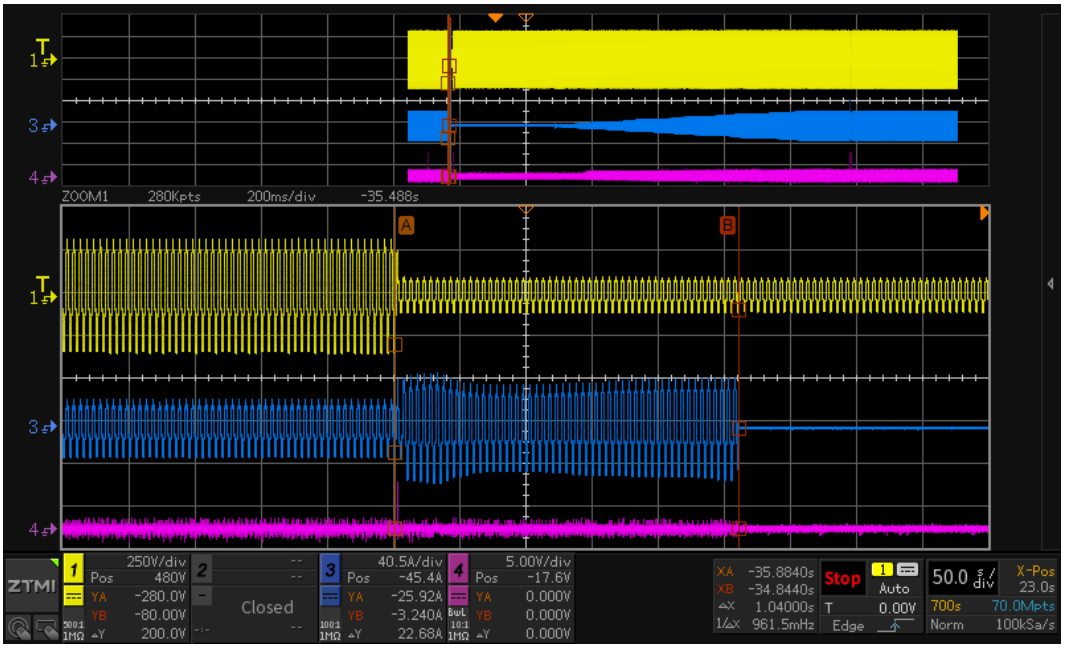
Test 3

Note: 1:Voltage; 3: current; 4: Trig signal

Diagram of under-voltage 2 protection: L3 Phase

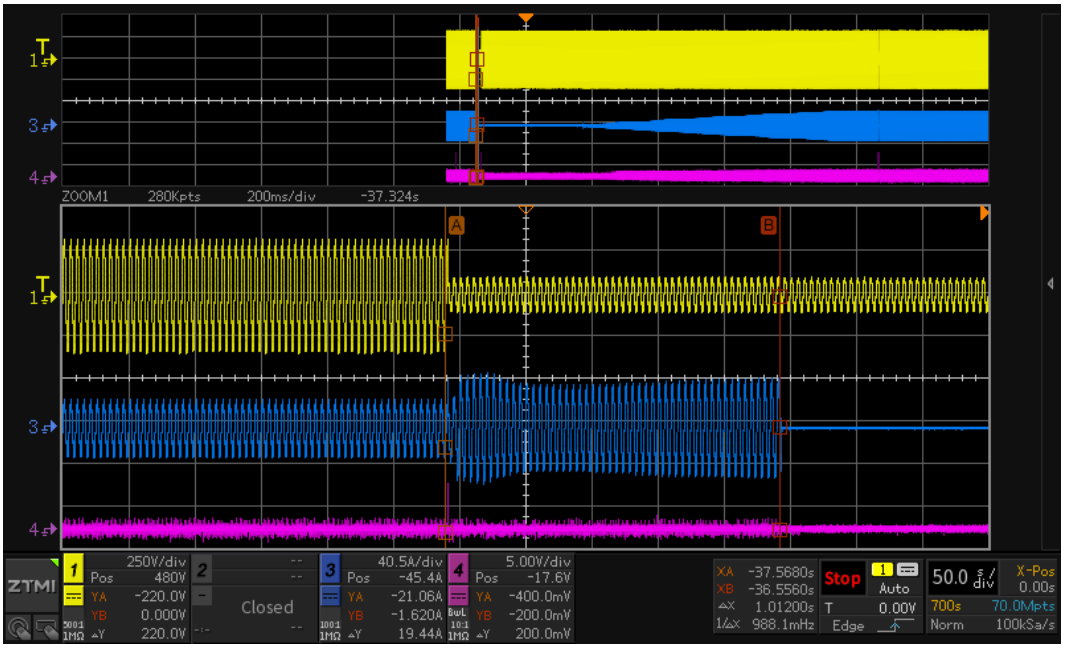


Test 1



Test 2

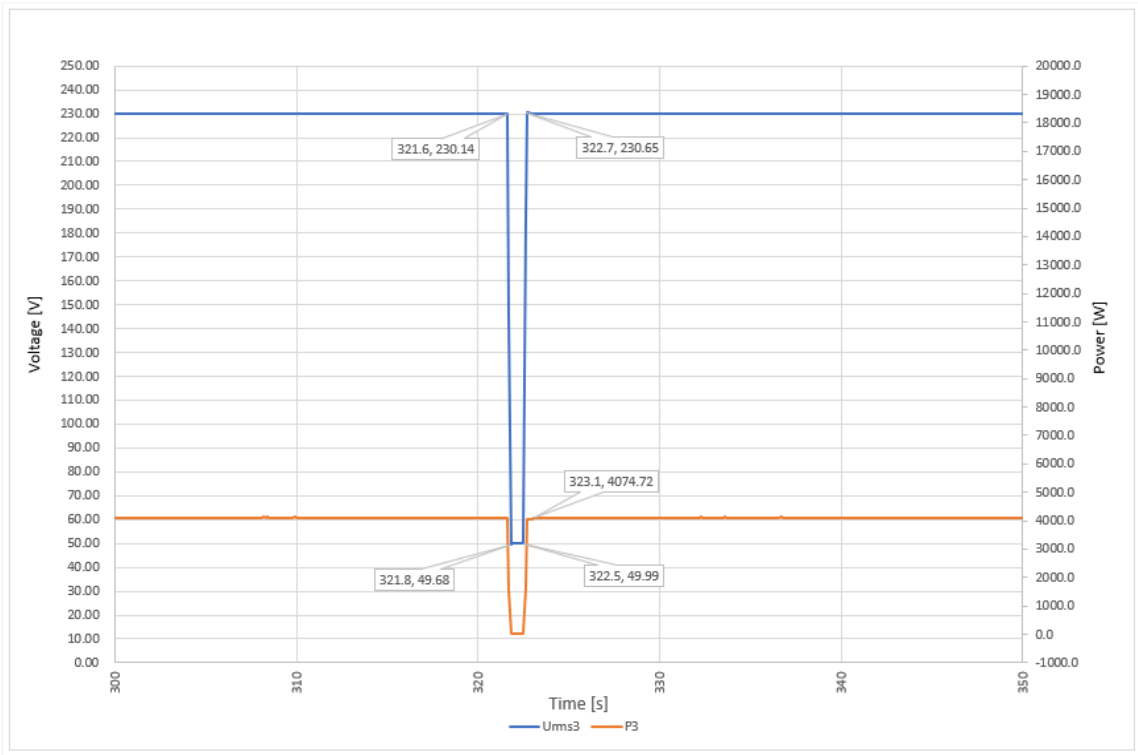
Diagram of under-voltage 2 protection: L3 Phase



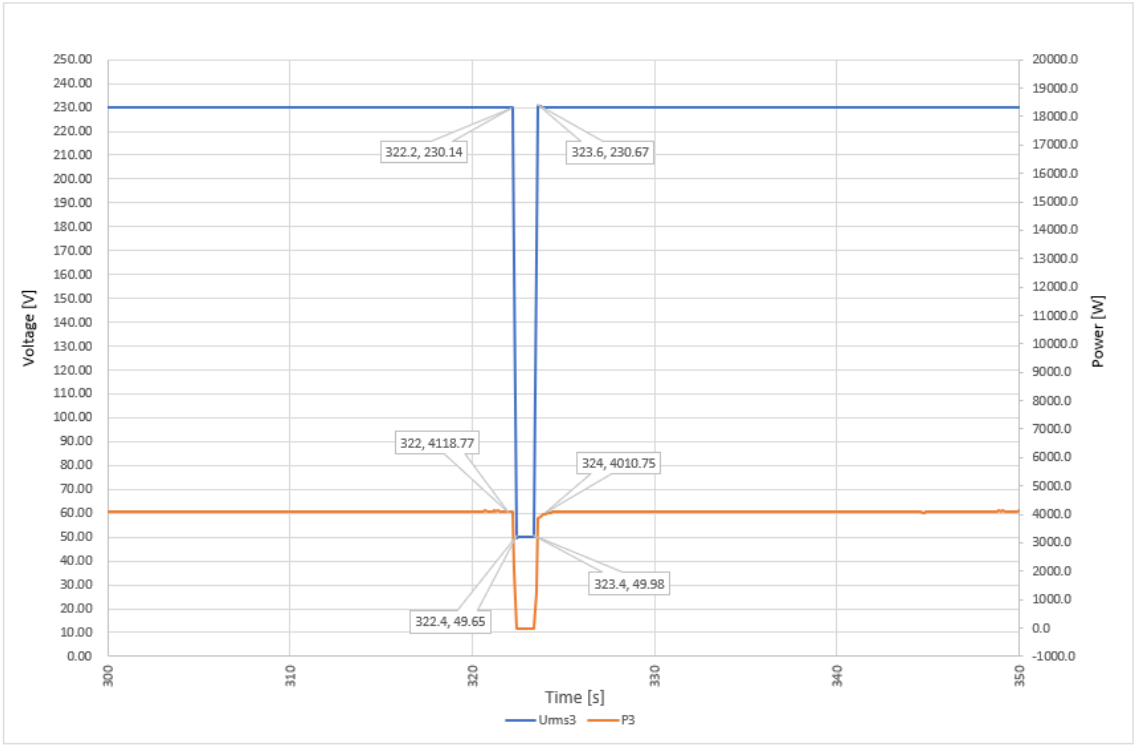
Test 3

Note: 1:Voltage; 3: current; 4: Trig signal

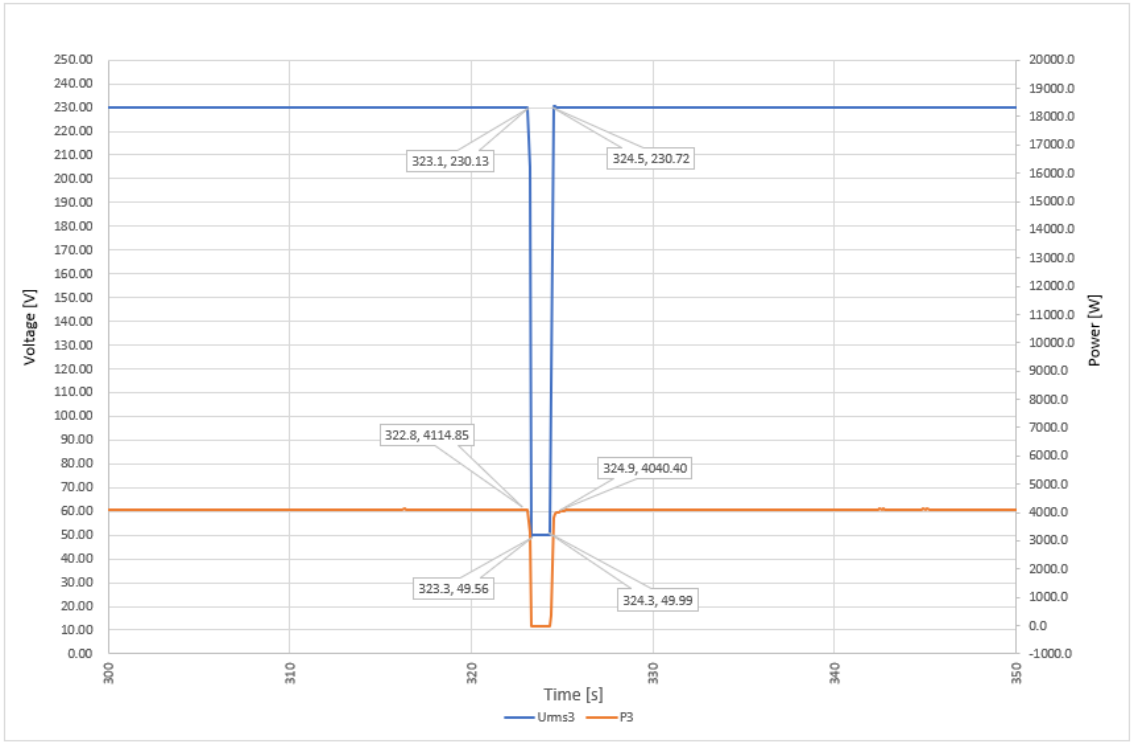
Diagram of step g) and f) : L3 Phase



Test 1

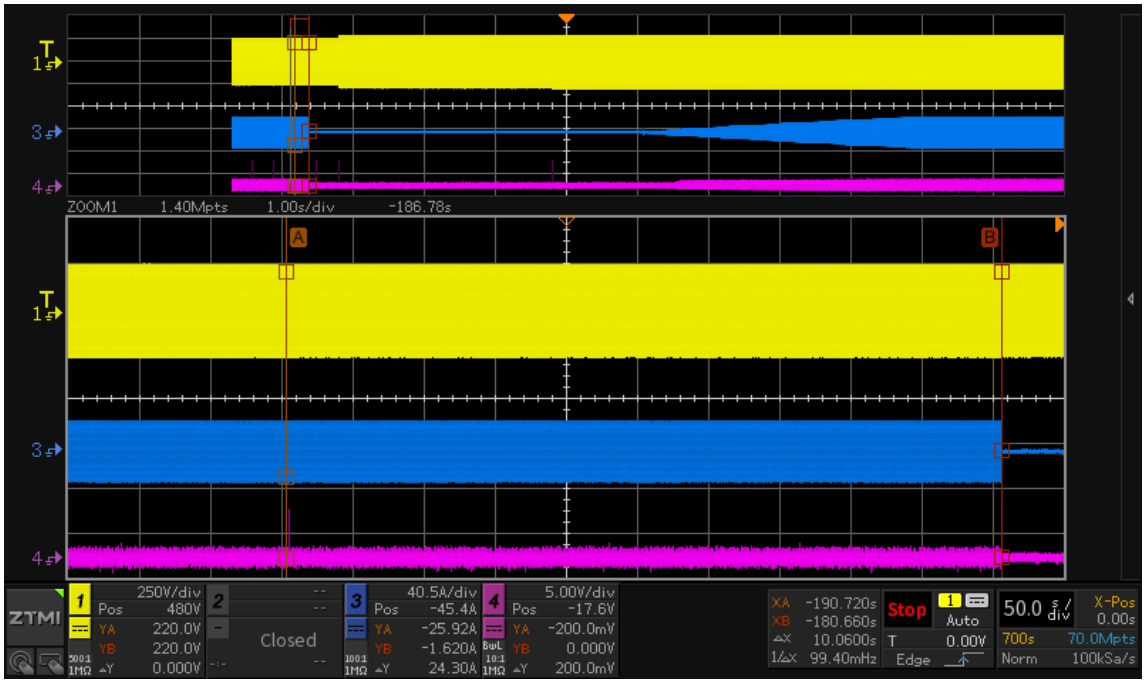


Test 2

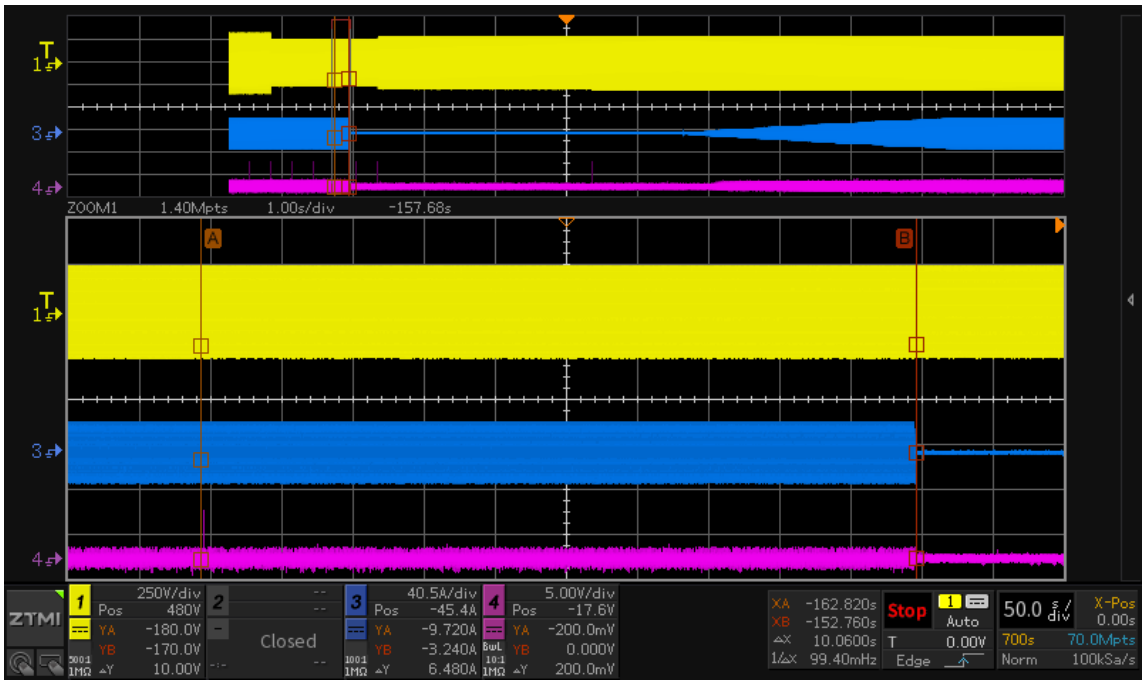

Voltage [V]
Power [W]
Time [s]
323.1, 230.13
324.5, 230.72
322.8, 4114.85
324.9, 4040.40
323.3, 49.56
324.3, 49.99
Urms3
P3

Test 3

Diagram of under-voltage 1 protection: L3 Phase

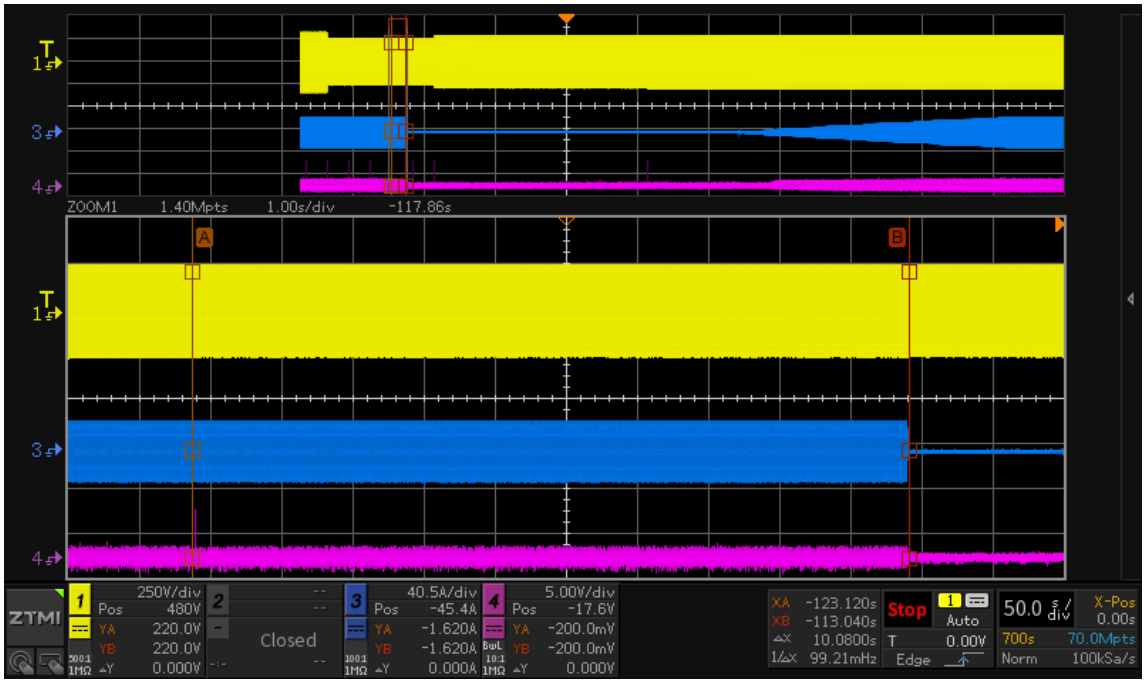


Test 1



Test 2

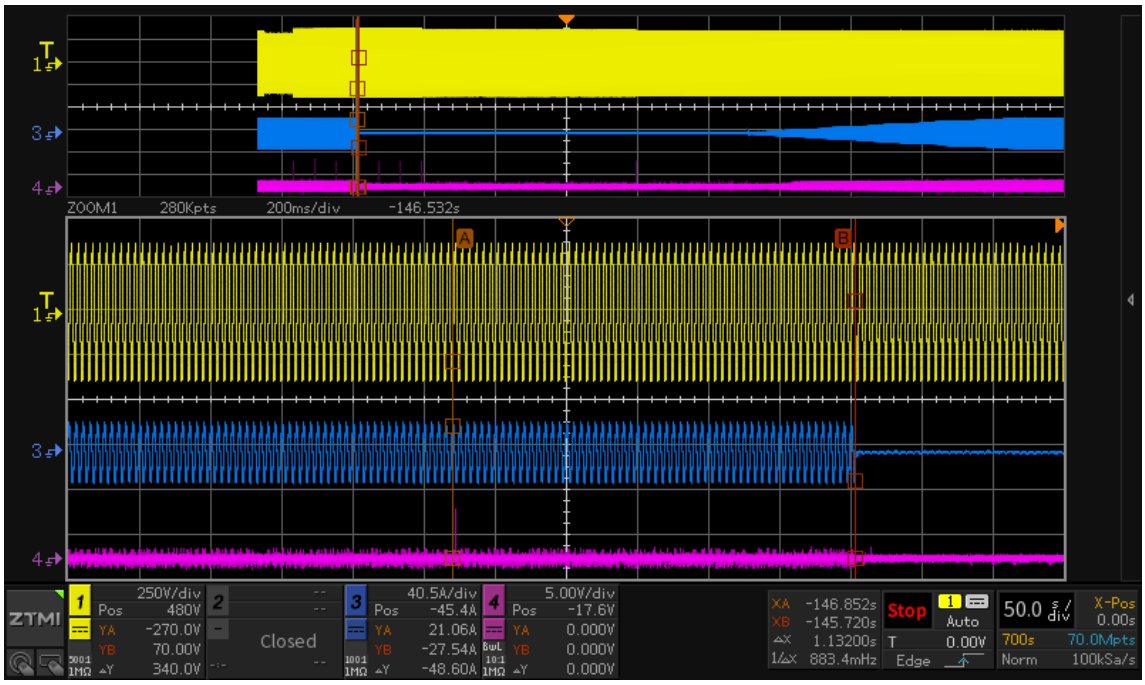
Diagram of under-voltage 1 protection: L3 Phase



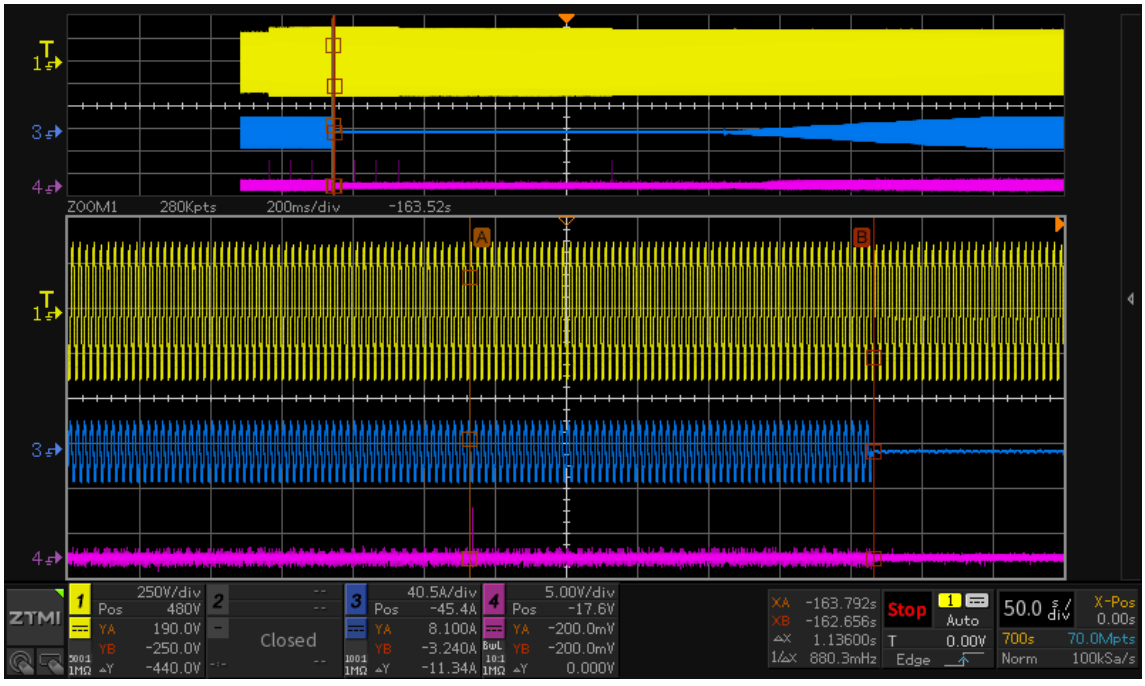
Test 3

Note: 1:Voltage; 3: current; 4: Trig signal

Diagram of over-voltage 1 protection: L3 Phase

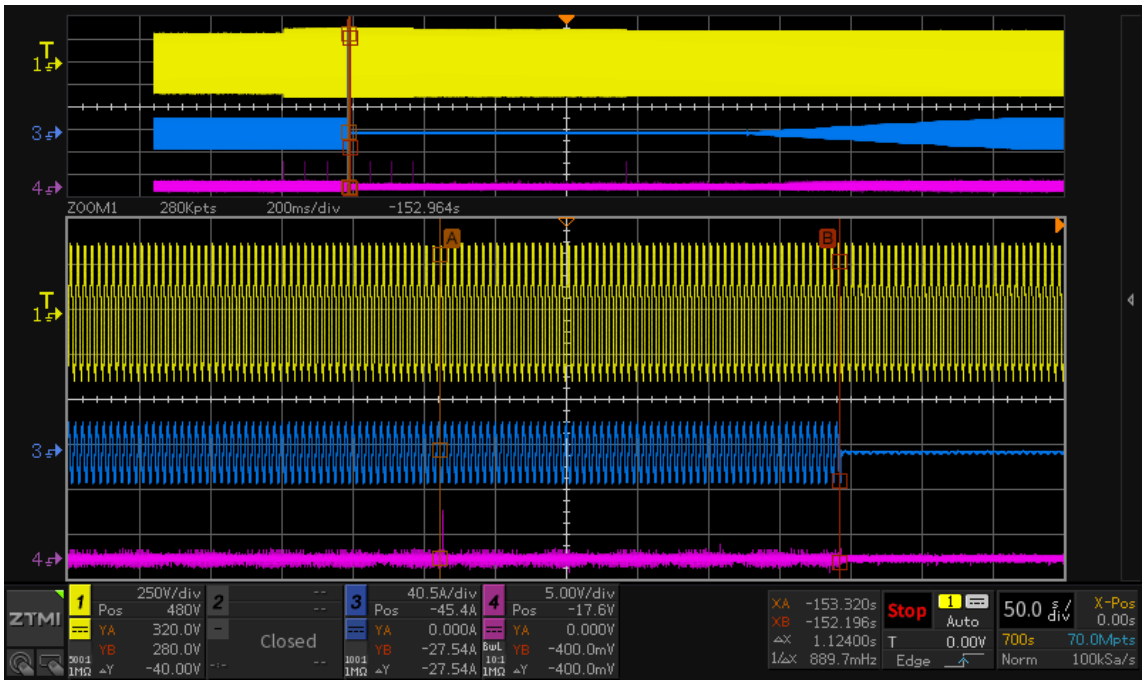


Test 1



Test 2

Diagram of over-voltage 1 protection: L3 Phase



Test 3

Note: 1:Voltage; 3: current; 4: Trig signal

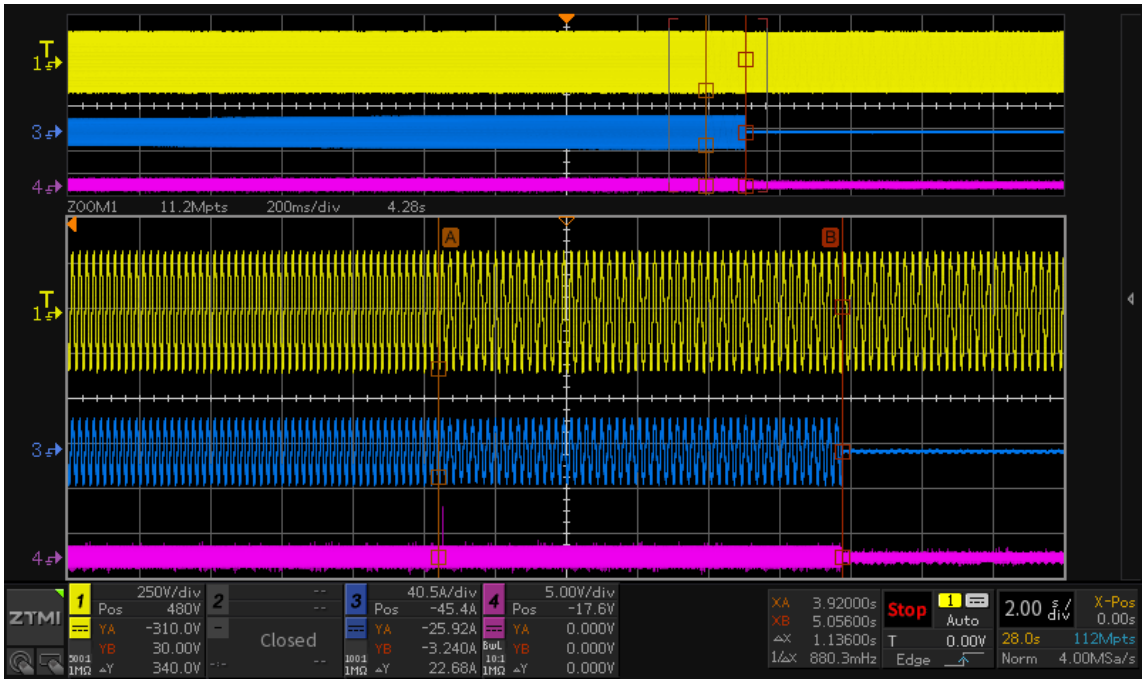
4.4 Voltage and frequency limits (passive anti-islanding protection) Appendix I.2 Under- and over-frequency trip settings and reconnection test (Australia A&B)						**P**
Clause I.4 Test report	Description	Min. value	Max. value	Test resolution		Units
Under-frequency 1 (F<) I.4.2	When decreasing the frequency of the grid source from 50 ± 0.1 Hz, the frequency at which the device under test disconnects [I.4.2 (b)]	Table 4.2	--	1st	47.00	Hz
				2nd	47.00	
				3rd	47.00	
	When increasing the frequency of the grid source to 50 ± 0.1 Hz., the time taken for the device under test to reconnect [I.4.2 (c)]	60.0	--	1st	75.7	s
				2nd	73.6	
				3rd	75.3	
	When the frequency of the grid source is reduced from the under-frequency 1 (F <) limit frequency in Table 4.2 and measured in I.4.2 (b) plus 0.1 Hz by at least the rate of change of frequency (df/dt) as specified in Clause 4.5.6, the time taken from when the frequency measured in I.4.2 (b) is passed through and the device under test disconnecting [I.4.2 (d)]	1	2	1st	1.136	s
				2nd	1.128	
				3rd	1.132	
	When the frequency of the grid source is increased to 47.4 Hz and held for at least twice the time measured in I.4.2 (c), the device under test remains disconnected [I.4.2 (e)]	--	--	Y		Y/N
	When increasing the frequency of the grid source to 48.0 Hz., the time taken for the device under test to reconnect [I.4.2 (f)]	60.0	--	1st	63.8	s
				2nd	64.7	
				3rd	64.2	
Over-frequency 1 (F >) I.4.4	When increasing the frequency of the grid source from 50 ± 0.1 Hz, the frequency at which the device under test disconnects [I.4.3 (b)]	Table 4.2	--	1st	52.10	Hz
				2nd	52.10	
				3rd	52.10	
	When decreasing the frequency of the grid source to 50 ± 0.1 Hz., the time taken for the device under test to reconnect [I.4.3 (c)]	60.0	--	1st	77.8	s
				2nd	77.6	
				3rd	76.9	
	When the frequency of the grid source is increased from the over-frequency 2 (F >>) limit frequency in Table 4.2 measured in I.4.3 (b) minus 0.1 Hz by at least the rate of change of frequency (df/dt) as specified in Clause 4.5.6, the time taken from when the frequency measured in I.4.3 (b) is passed through and the device under test disconnecting [I.4.3 (d)]	0	0.2	1st	0.125	s
				2nd	0.105	
				3rd	0.108	
	When the frequency of the grid source is reduced to 50.2 Hz and held for at least twice the time measured in I.4.3 (c), the device under test remains disconnected [I.4.3 (e)]	--	--	Y		Y/N
	When the frequency of the grid source is	60.0	--	1st	65.0	s

	reduced to 50.1 Hz., the time taken for the device under test to reconnect [I.4.3 (f)]			2nd	65.7	
				3rd	65.6	

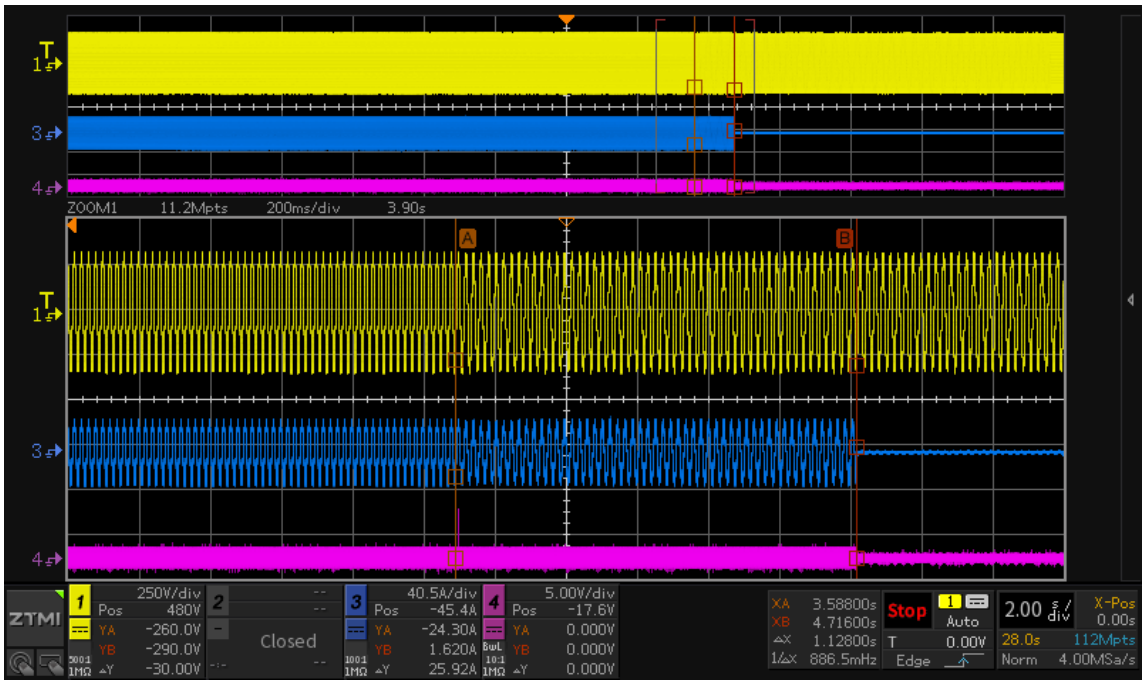
Criteria for acceptance
When tested in accordance with Clause I.4, the device under test shall conform to the following:
(a) The limits specified in Table 4.2.
(b) The measured frequency of each limit shall conform to the measurement accuracy specified in Table 2.5.
(c) The disconnection time shall be greater than the trip delay time and less than the maximum disconnection time of Table 4.2.
(d) The connection or reconnection time and behaviour shall conform to Clause 4.7

Note:
Due to the different duration of power grid fault, the reconnection time of inverter is different.

Diagram of under-frequency protection (for Australia A&B)

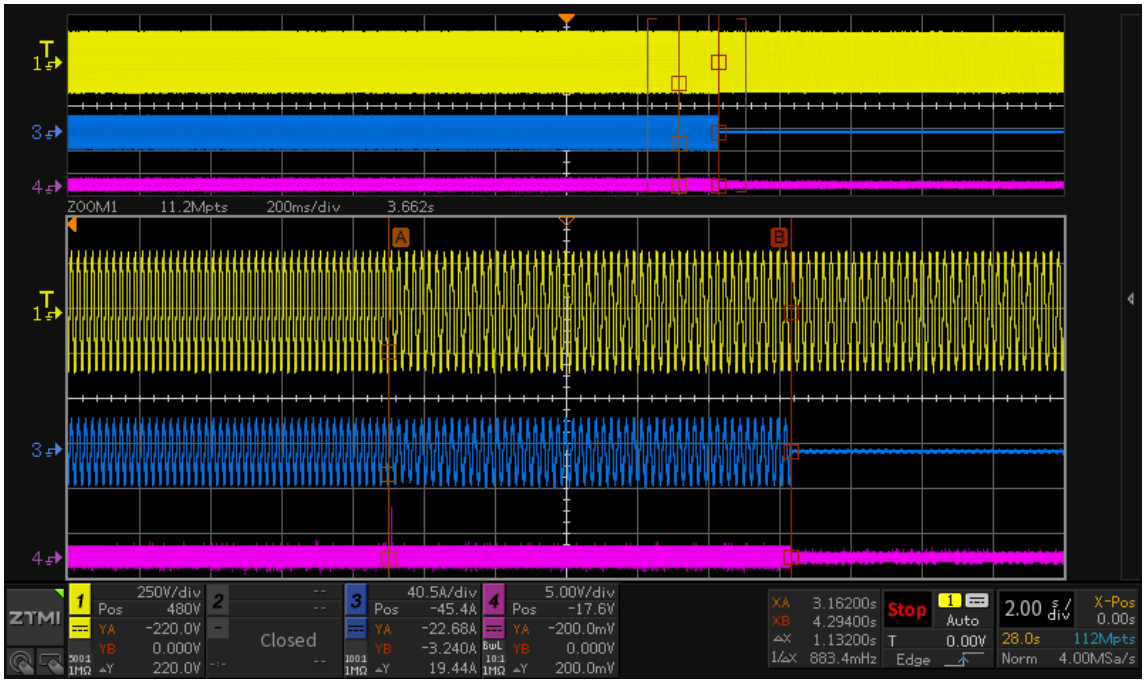


Test 1



Test 2

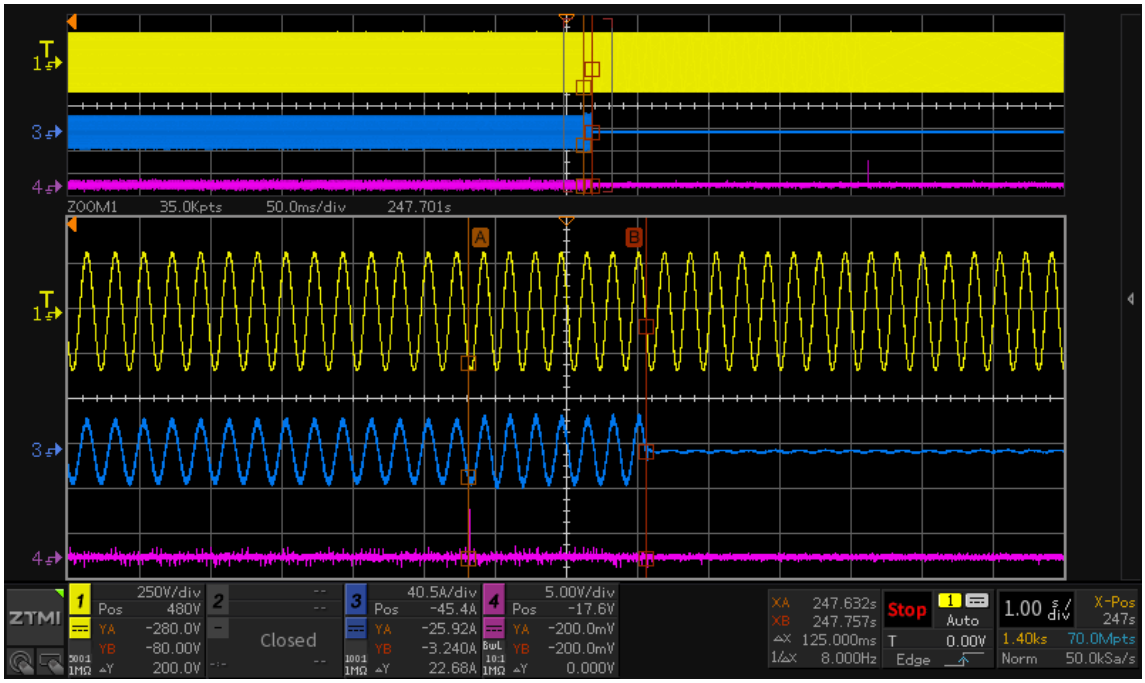
Diagram of under-frequency protection (for Australia A&B)



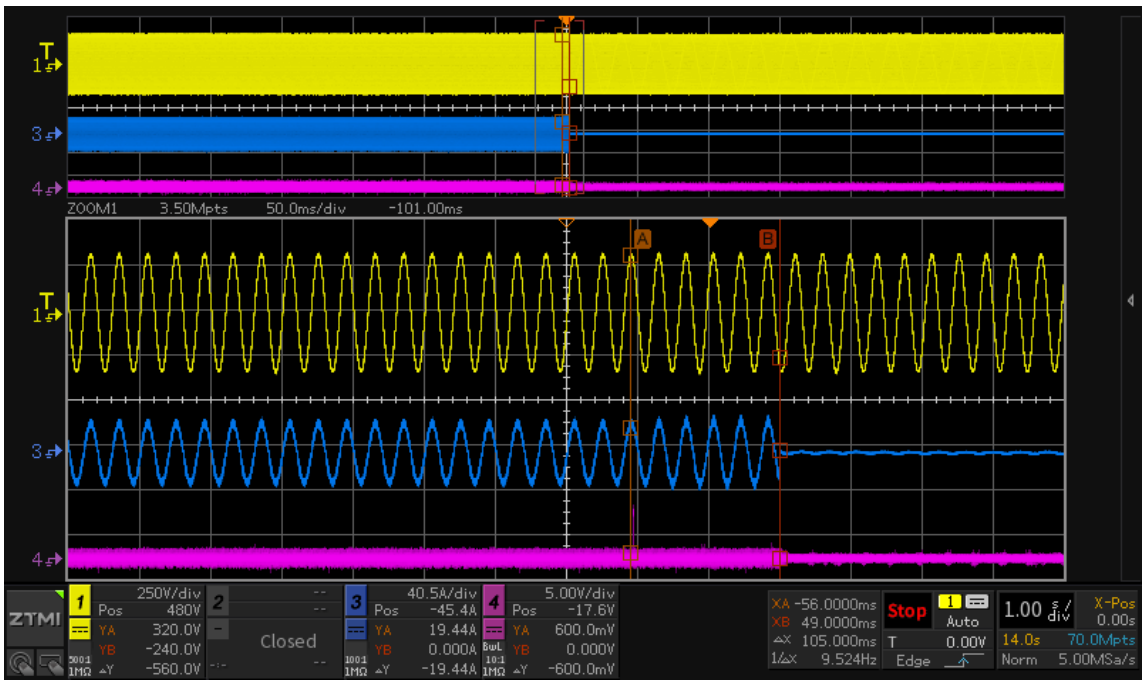
Test 3

Note: 1:Voltage; 3: current; 4: Trig signal

Diagram of over-frequency protection (for Australia A&B)

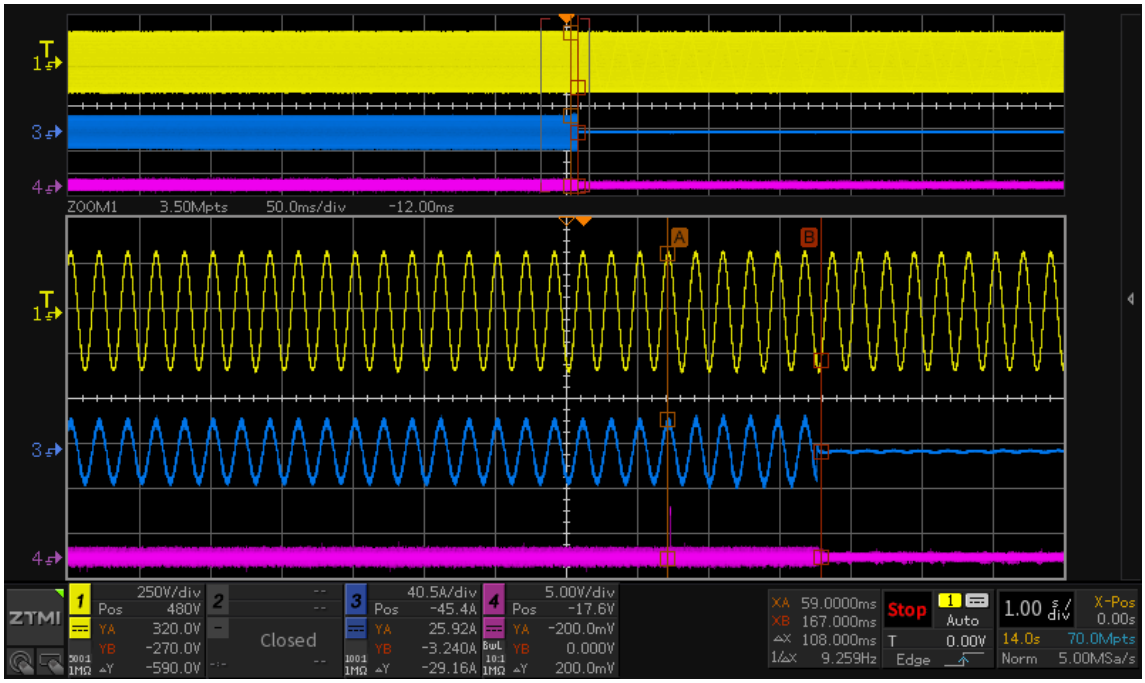


Test 1



Test 2

Diagram of over-frequency protection (for Australia A&B)



Test 3

Note: 1:Voltage; 3: current; 4: Trig signal

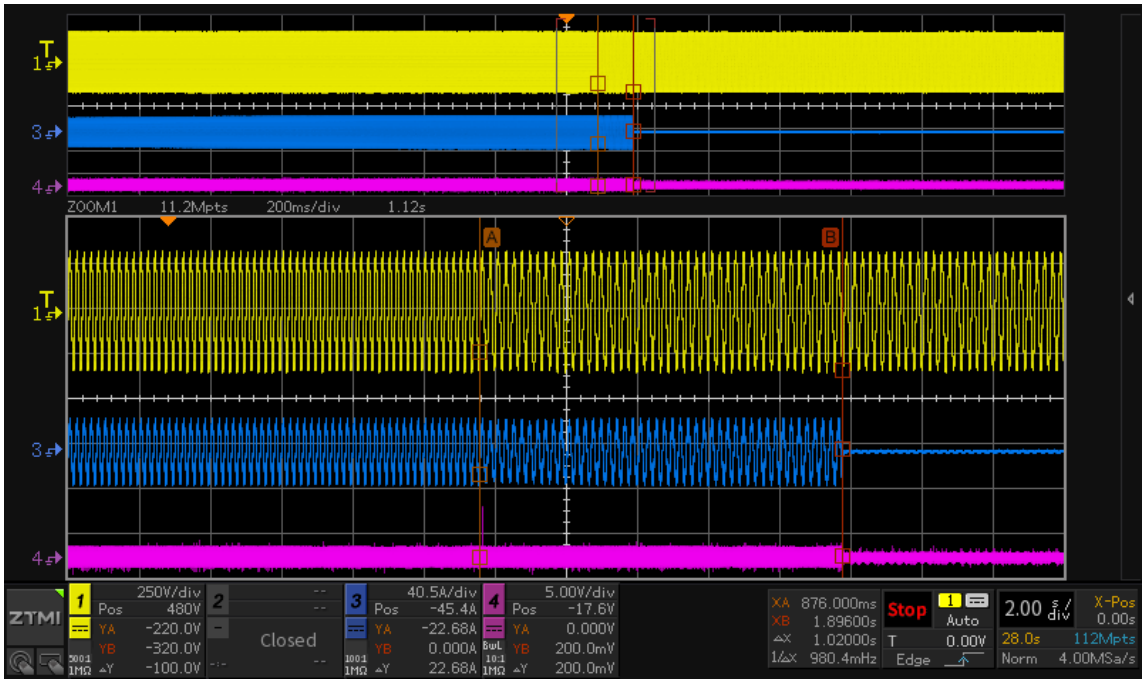
4.4 Voltage and frequency limits (passive anti-islanding protection) Appendix I.2 Under- and over-frequency trip settings and reconnection test (New Zealand)						**P**
Clause I.4 Test report	Description	Min. value	Max. value	Test resolution		Units
Under-frequency 1 (F<) I.4.2	When decreasing the frequency of the grid source from 50 ± 0.1 Hz, the frequency at which the device under test disconnects [I.4.2 (b)]	Table 4.2	--	1st	45.00	Hz
				2nd	45.00	
				3rd	45.00	
	When increasing the frequency of the grid source to 50 ± 0.1 Hz., the time taken for the device under test to reconnect [I.4.2 (c)]	60.0	--	1st	76.1	s
				2nd	73.5	
				3rd	75.5	
	When the frequency of the grid source is reduced from the under-frequency 1 (F <) limit frequency in Table 4.2 and measured in I.4.2 (b) plus 0.1 Hz by at least the rate of change of frequency (df/dt) as specified in Clause 4.5.6, the time taken from when the frequency measured in I.4.2 (b) is passed through and the device under test disconnecting [I.4.2 (d)]	1	2	1st	1.020	s
				2nd	1.024	
				3rd	1.024	
	When the frequency of the grid source is increased to 47.4 Hz and held for at least twice the time measured in I.4.2 (c), the device under test remains disconnected [I.4.2 (e)]	--	--	Y		Y/N
	When increasing the frequency of the grid source to 48.0 Hz., the time taken for the device under test to reconnect [I.4.2 (f)]	60.0	--	1st	64.9	s
				2nd	64.9	
				3rd	64.6	
Over-frequency 1 (F >) I.4.4	When increasing the frequency of the grid source from 50 ± 0.1 Hz, the frequency at which the device under test disconnects [I.4.3 (b)]	Table 4.2	--	1st	55.0	Hz
				2nd	55.0	
				3rd	55.0	
	When decreasing the frequency of the grid source to 50 ± 0.1 Hz., the time taken for the device under test to reconnect [I.4.3 (c)]	60.0	--	1st	85.0	s
				2nd	73.9	
				3rd	74.0	
	When the frequency of the grid source is increased from the over-frequency 2 (F >>) limit frequency in Table 4.2 measured in I.4.3 (b) minus 0.1 Hz by at least the rate of change of frequency (df/dt) as specified in Clause 4.5.6, the time taken from when the frequency measured in I.4.3 (b) is passed through and the device under test disconnecting [I.4.3 (d)]	0	0.2	1st	0.125	s
				2nd	0.134	
				3rd	0.113	
	When the frequency of the grid source is reduced to 50.2 Hz and held for at least twice the time measured in I.4.3 (c), the device under test remains disconnected [I.4.3 (e)]	--	--	Y		Y/N
	When the frequency of the grid source is	60.0	--	1st	68.1	s

	reduced to 50.1 Hz., the time taken for the device under test to reconnect [I.4.3 (f)]			2nd	65.2	
				3rd	65.0	

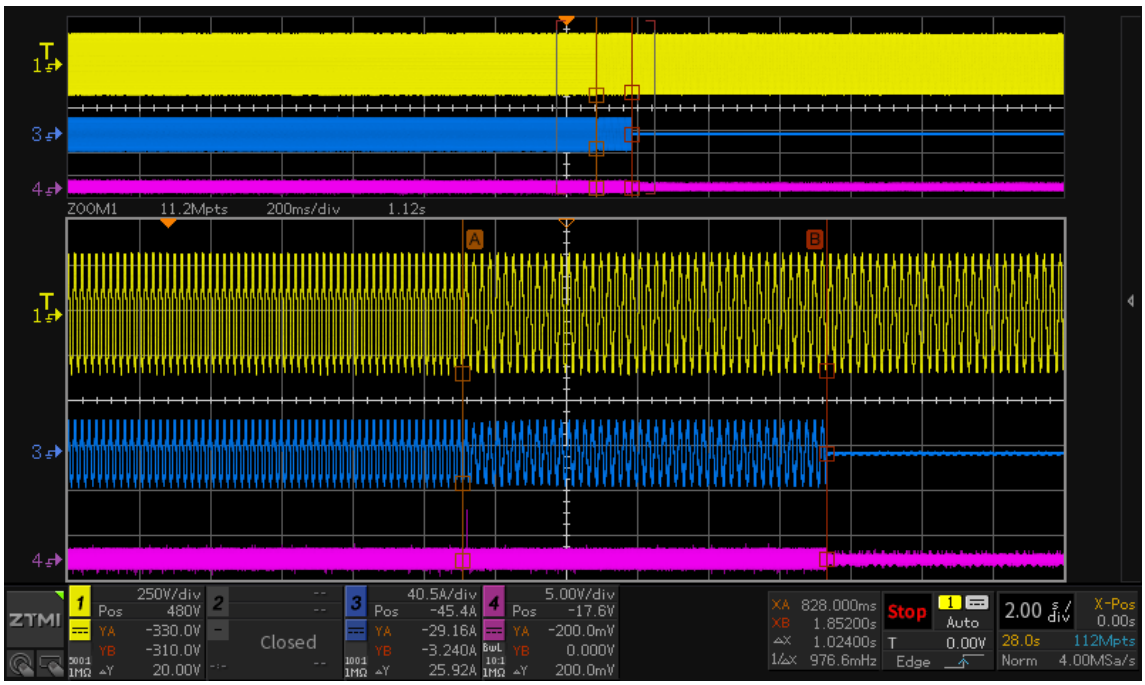
Criteria for acceptance
When tested in accordance with Clause I.4, the device under test shall conform to the following:
(e) The limits specified in Table 4.2.
(f) The measured frequency of each limit shall conform to the measurement accuracy specified in Table 2.5.
(g) The disconnection time shall be greater than the trip delay time and less than the maximum disconnection time of Table 4.2.
(h) The connection or reconnection time and behaviour shall conform to Clause 4.7

Note:
Due to the different duration of power grid fault, the reconnection time of inverter is different.

Diagram of under-frequency protection (for New Zealand)

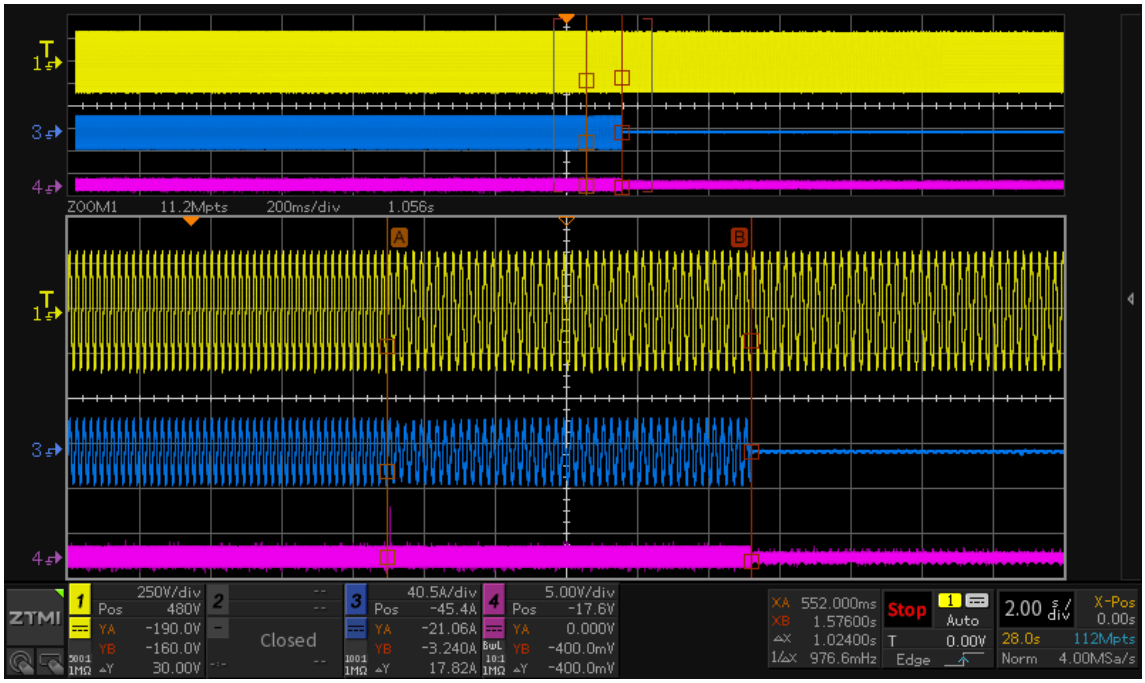


Test 1



Test 2

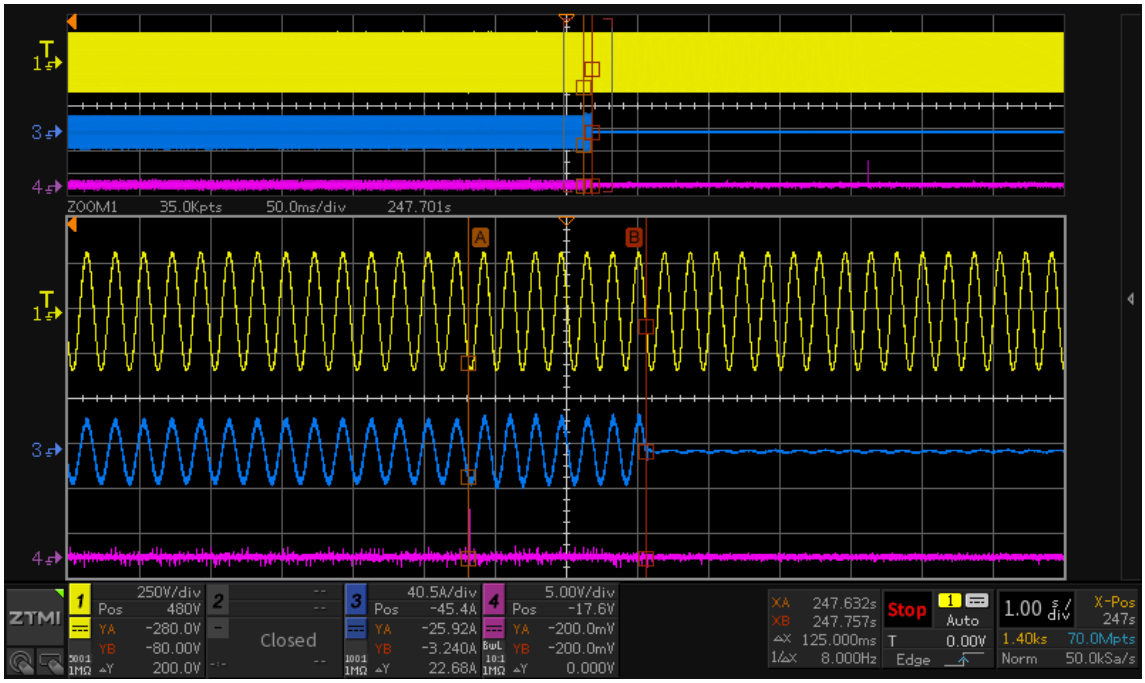
Diagram of under-frequency protection (for New Zealand)



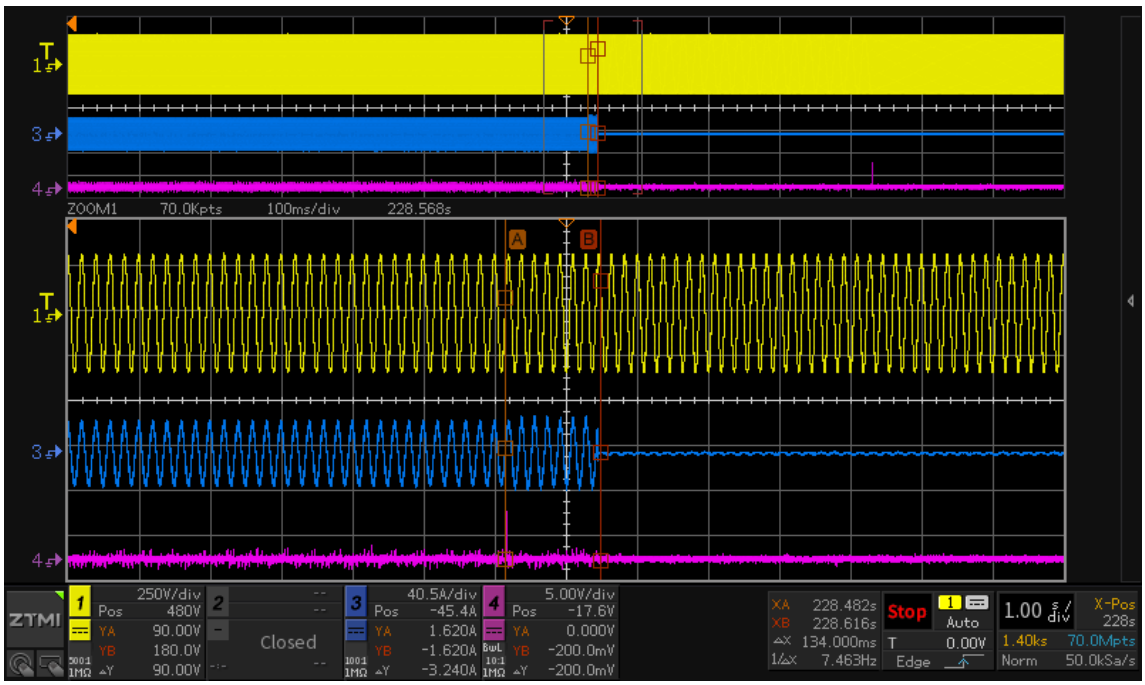
Test 3

Note: 1:Voltage; 3: current; 4: Trig signal

Diagram of over-frequency protection (for New Zealand)

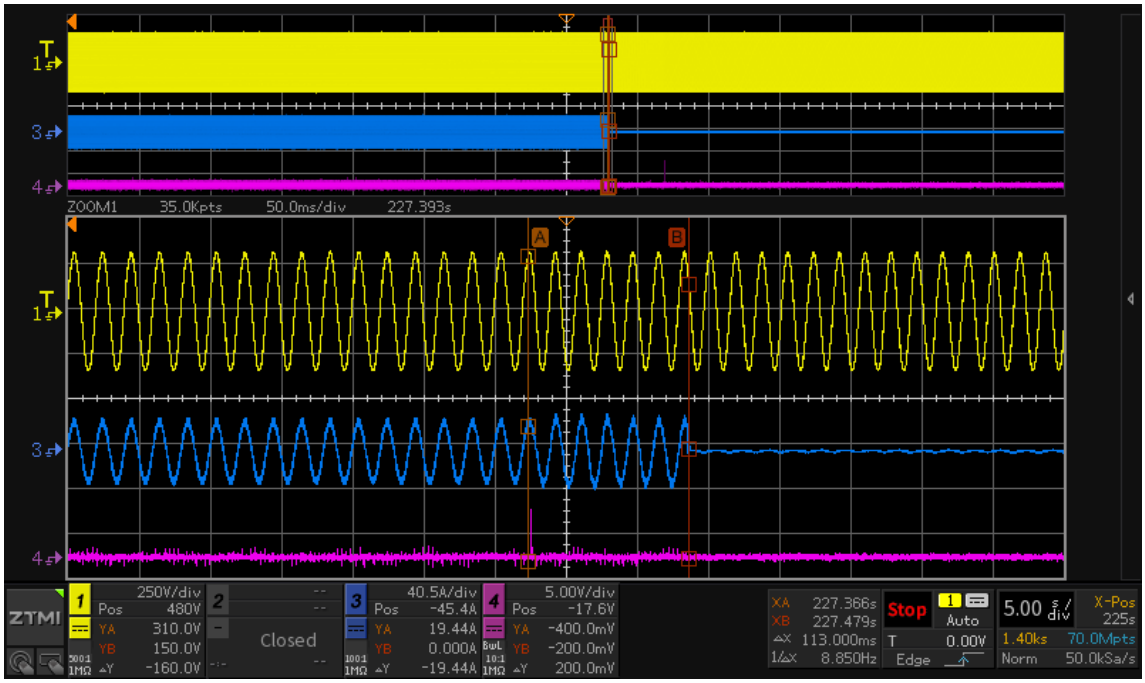


Test 1



Test 2

Diagram of over-frequency protection (for New Zealand)



Test 3

Note: 1:Voltage; 3: current; 4: Trig signal

4.5.2 Sustained operation for voltage variations **Appendix J.2 Sustained operation for voltage variations**	**P**

Settings for $V_{nom\text{-}max}$	
Region	**Default setpoint (V)**
Australia A	258
Australia B	258
Australia C	258
New Zealand	249

Note:
Measurement accuracy:
Voltage: ±1% Vn
Frequency: ±10 mHz

<table>
<tr><td colspan="5">4.5.2 Sustained operation for voltage variations (Australia A/ Australia B/ Australia C)
Appendix J.2 Sustained operation for voltage variations</td><td>P</td></tr>
<tr><td colspan="6">Test: IVGM25KHP3G3</td></tr>
<tr><td colspan="2">Test:</td><td colspan="4">Output power level: 50+/-5% Apparent Power</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td rowspan="12">a)</td><td colspan="5">Step 1. The voltage is set to V_{nom_max} – 1 V. Maintained for 5 min.
Step 2. The voltage increase to V_{nom_max} + 1 V and proceeding 10 min.
Step 3. The 10 min average voltage shall be recorded.</td></tr>
<tr><td colspan="2"></td><td>Average Voltage (V)</td><td colspan="2">Limit</td></tr>
<tr><td rowspan="3">Phase 1</td><td>1st time</td><td>259.02</td><td colspan="2" rowspan="9">1. Disconnection should take place.
2. Voltage within +/1 % of the set-point.</td></tr>
<tr><td>2nd time</td><td>259.13</td></tr>
<tr><td>3rd time</td><td>259.04</td></tr>
<tr><td rowspan="3">Phase 2</td><td>1st time</td><td>259.02</td></tr>
<tr><td>2nd time</td><td>259.13</td></tr>
<tr><td>3rd time</td><td>259.04</td></tr>
<tr><td rowspan="3">Phase 3</td><td>1st time</td><td>259.02</td></tr>
<tr><td>2nd time</td><td>259.13</td></tr>
<tr><td>3rd time</td><td>259.04</td></tr>
<tr><td rowspan="5">b)</td><td colspan="5">Step 1. The voltage is set to V_{nom_max} and maintained for 10 min.
Step 2. Increase 1.5 V to trig the protection.
Step 3. Record the disconnection time.</td></tr>
<tr><td colspan="2"></td><td>Disconnection time (s)</td><td colspan="2">Limit</td></tr>
<tr><td colspan="2">Phase 1</td><td>4.68</td><td colspan="2" rowspan="3">Disconnection time < 30s</td></tr>
<tr><td colspan="2">Phase 2</td><td>2.44</td></tr>
<tr><td colspan="2">Phase 3</td><td>2.44</td></tr>
<tr><td rowspan="5">c)</td><td colspan="5">Step 1. The output voltage of variable a.c. supply decrease the voltage to gird test voltage.
Step 2. Record the reconnection time.</td></tr>
<tr><td colspan="2"></td><td>Reconnection time (s)</td><td colspan="2">Limit</td></tr>
<tr><td colspan="2">Phase 1</td><td>68.6</td><td colspan="2" rowspan="3">Reconnection time > 60s</td></tr>
<tr><td colspan="2">Phase 2</td><td>68.6</td></tr>
<tr><td colspan="2">Phase 3</td><td>71.2</td></tr>
<tr><td colspan="6">Note:
1. The default set-point for Vnom-max shall be as follows:
(a) In Australia: 258 V.
(b) In New Zealand: 248 V.
2. The 10 min average value shall be compared against the limit V_{nom_max} at least every 3 s to determine when to disconnect.
3. The inverter shall operate the automatic disconnection device (see Clause 4.2) within 3 s when the average voltage for a 10 min period exceeds the V_{nom_max}.</td></tr>
</table>

<table>
<tr><td colspan="5">4.5.2 Sustained operation for voltage variations (New Zealand)
Appendix J.2 Sustained operation for voltage variations</td><td>P</td></tr>
<tr><td colspan="6">Test: IVGM25KHP3G3</td></tr>
<tr><td colspan="2">Test:</td><td colspan="4">Output power level: 50+/-5% Apparent Power</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td rowspan="11">a)</td><td colspan="5">Step 1. The voltage is set to V_{nom_max} – 1 V. Maintained for 5 min.
Step 2. The voltage increase to V_{nom_max} + 1 V and proceeding 10 min.
Step 3. The 10 min average voltage shall be recorded.</td></tr>
<tr><td colspan="2"></td><td>Average Voltage (V)</td><td colspan="2">Limit</td></tr>
<tr><td rowspan="3">Phase 1</td><td>1st time</td><td>250.14</td><td colspan="2" rowspan="9">1. Disconnection should take place.
2. Voltage within +/1 % of the set-point.</td></tr>
<tr><td>2nd time</td><td>250.25</td></tr>
<tr><td>3rd time</td><td>250.16</td></tr>
<tr><td rowspan="3">Phase 2</td><td>1st time</td><td>250.03</td></tr>
<tr><td>2nd time</td><td>250.15</td></tr>
<tr><td>3rd time</td><td>250.05</td></tr>
<tr><td rowspan="3">Phase 3</td><td>1st time</td><td>250.03</td></tr>
<tr><td>2nd time</td><td>250.14</td></tr>
<tr><td>3rd time</td><td>250.05</td></tr>
<tr><td rowspan="5">b)</td><td colspan="5">Step 1. The voltage is set to V_{nom_max} and maintained for 10 min.
Step 2. Increase 1.5 V to trig the protection.
Step 3. Record the disconnection time.</td></tr>
<tr><td colspan="2"></td><td>Disconnection time (s)</td><td colspan="2">Limit</td></tr>
<tr><td colspan="2">Phase 1</td><td>0.86</td><td colspan="2" rowspan="3">Disconnection time < 30s</td></tr>
<tr><td colspan="2">Phase 2</td><td>0.79</td></tr>
<tr><td colspan="2">Phase 3</td><td>0.81</td></tr>
<tr><td rowspan="5">c)</td><td colspan="5">Step 1. The output voltage of variable a.c. supply decrease the voltage to gird test voltage.
Step 2. Record the reconnection time.</td></tr>
<tr><td colspan="2"></td><td>Reconnection time (s)</td><td colspan="2">Limit</td></tr>
<tr><td colspan="2">Phase 1</td><td>68.3</td><td colspan="2" rowspan="3">Reconnection time > 60s</td></tr>
<tr><td colspan="2">Phase 2</td><td>69.9</td></tr>
<tr><td colspan="2">Phase 3</td><td>71.6</td></tr>
<tr><td colspan="6">Note:
1. The 10 min average value shall be compared against the limit V_{nom_max} at least every 3 s to determine when to disconnect.
2. The inverter shall operate the automatic disconnection device (see Clause 4.2) within 3 s when the average voltage for a 10 min period exceeds the V_{nom_max}.</td></tr>
</table>

4.5.3 Sustained operation for frequency	P

Frequency variation withstand limits

Inverter response	Decrease in frequency response Lower limit (Hz) (Hz)	Lower limit of continuous operation range (f_{LLCO}) (Hz)	Upper limit of continuous operation range (f_{ULCO}) (Hz)	Increase in frequency response Upper limit (Hz)
Australia A	47	49.75	50.25	52
Australia B	47	49.85	50.15	52
Australia C	45	49.50	50.50	55
New Zealand	45	49.80	50.20	55

Note:
f_{LLCO}: lower limit of continuous operation range for frequency.
f_{ULCO}: upper limit of the continuous operation range for frequency.

Frequency response limits

	Decrease in frequency response limits		Increase in frequency response limits	
Inverter response	Frequency where power output level is maximum (f_{Pmax}) Hz	Frequency where charging power level is zero ($f_{stop-ch}$) Hz	Frequency where discharging power level is zero ($f_{transition}$) Hz	Frequency where power level is minimum (f_{Pmin}) Hz
Australia A	48	49	50.75	52
Australia B	48	49	50.75	52
Australia C	47	48.25	51.75	53
New Zealand	48	49	51	52

Note:
f_{Pmax}: frequency where power output level is maximum.
f_{Pmin}: frequency where power input level is maximum.
$f_{stop-ch}$: frequency where power level is zero.
$f_{transition}$: frequency where power level is zero.

4.5.3 Sustained operation for frequency (Australia A) **Appendix J.3.2 Test procedure for an increase in frequency for inverters without energy storage**	**P**

Test: IVGM25KHP3G3

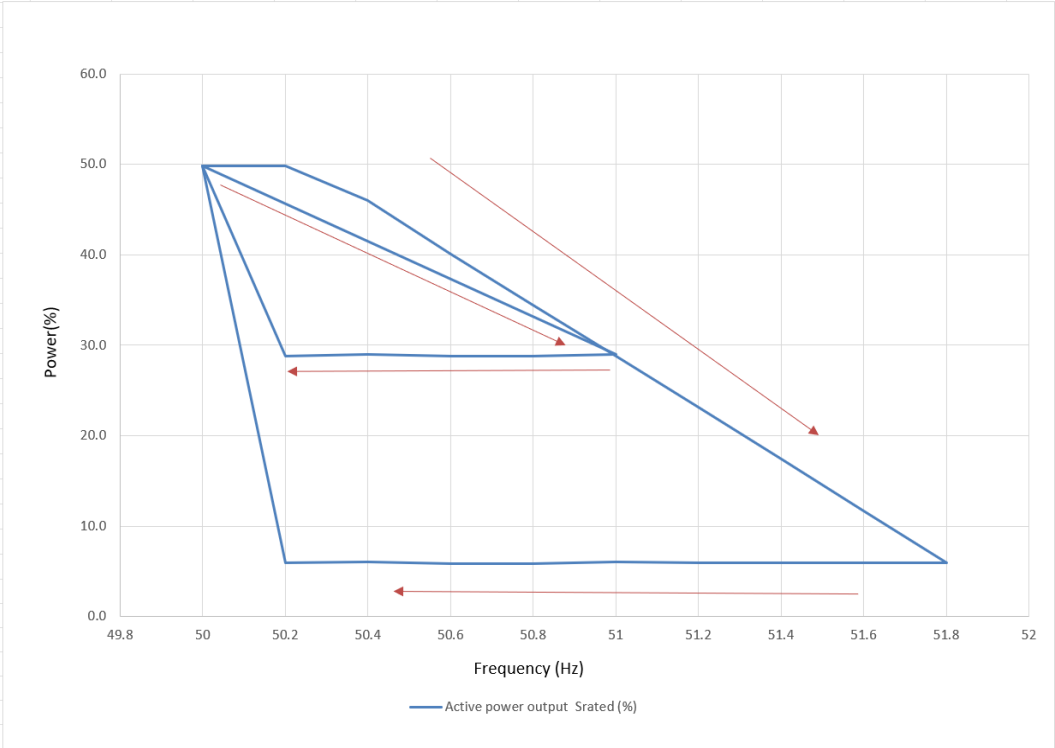
Frequency (Hz)	Time for initial response (s)	Time for output to stabilize (s)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
50.0	—	0.20	49.89	50
50.2	—	0.20	49.88	50
50.4	—	0.20	45.99	46
50.6	—	0.20	40.14	40
50.8	—	0.20	34.43	34
51.0	—	0.40	28.85	29
51.2	—	0.20	23.12	23
51.4	—	0.40	17.39	17
51.6	—	0.20	11.66	11
51.8	—	0.20	5.94	6
51.6	—	—	—	—
...	—	—	—	—
50.4	—	—	—	—
50.2	—	—	5.90	6
50.0	—	—	—	—
...	—	—	—	—
50.0	—	—	49.89	50
51.0	0.20	0.40	29.01	29
50.8	—	—	—	—
50.6	—	—	—	—
50.4	—	—	—	—
50.2	—	—	28.83	29
50.0	—	0.40	49.90	50

Criteria for acceptance:
When tested in accordance with Clause J.3.2, the device under test shall —
(a) respond to the increase in frequency condition linearly and in accordance with Clause 4.5.3;
(b) stabilize the output power level after a frequency disturbance within the response completion time specified in Table 4.6; and
(c) maintain continuous operation for a rate of change of frequency event in accordance with Clause 4.5.6.
The results recorded in J.3.2 shall be graphed on an x-y-axis graph, where the x-axis is frequency and the y-axis is power output.
The results recorded in Steps (i) and (m) shall be graphed with respect to time. The rate of increase in power output shall not exceed the power rate limit (W_{Gra}) and shall conform to the nonlinearity of power

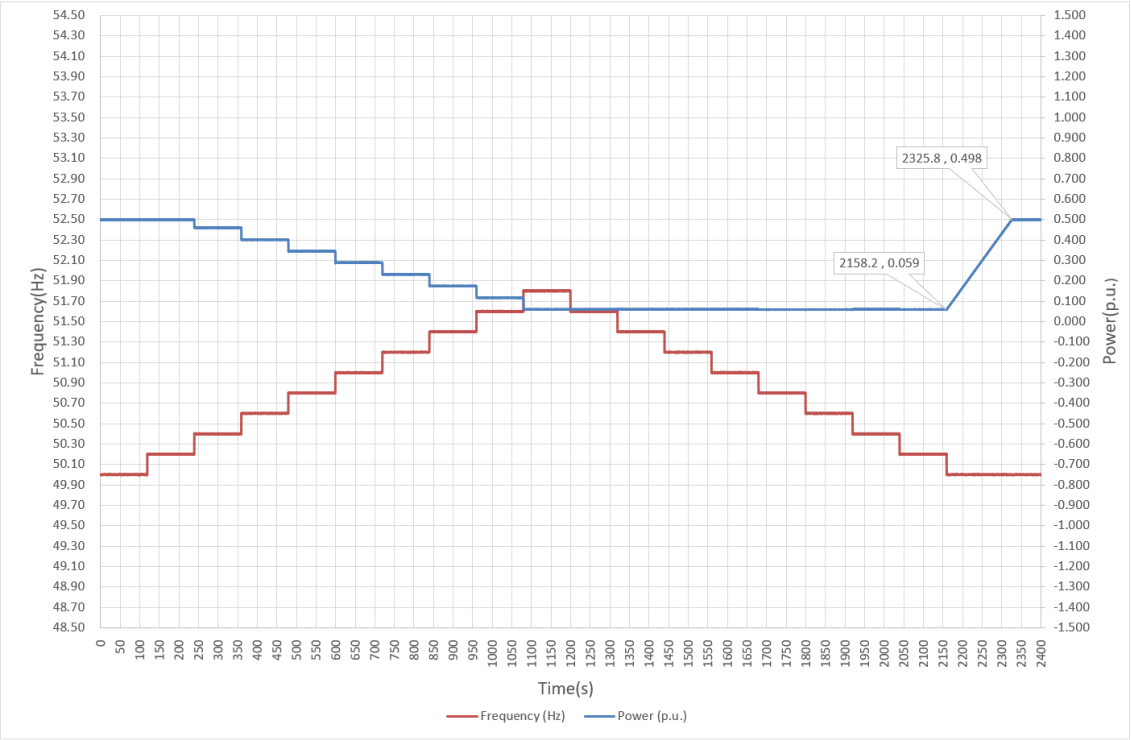
limit changes of Clause 3.3.4.4.
For the test, the $P_{rated-ch}$ is 25kW.

Note:

Graph of the Power-frequency characteristic



Graph: Step a) to i):



Graph: Step j) to m):



4.5.3 Sustained operation for frequency (New Zealand) Appendix J.3.2 Test procedure for an increase in frequency for inverters without energy storage	**P**

Test: IVGM25KHP3G3

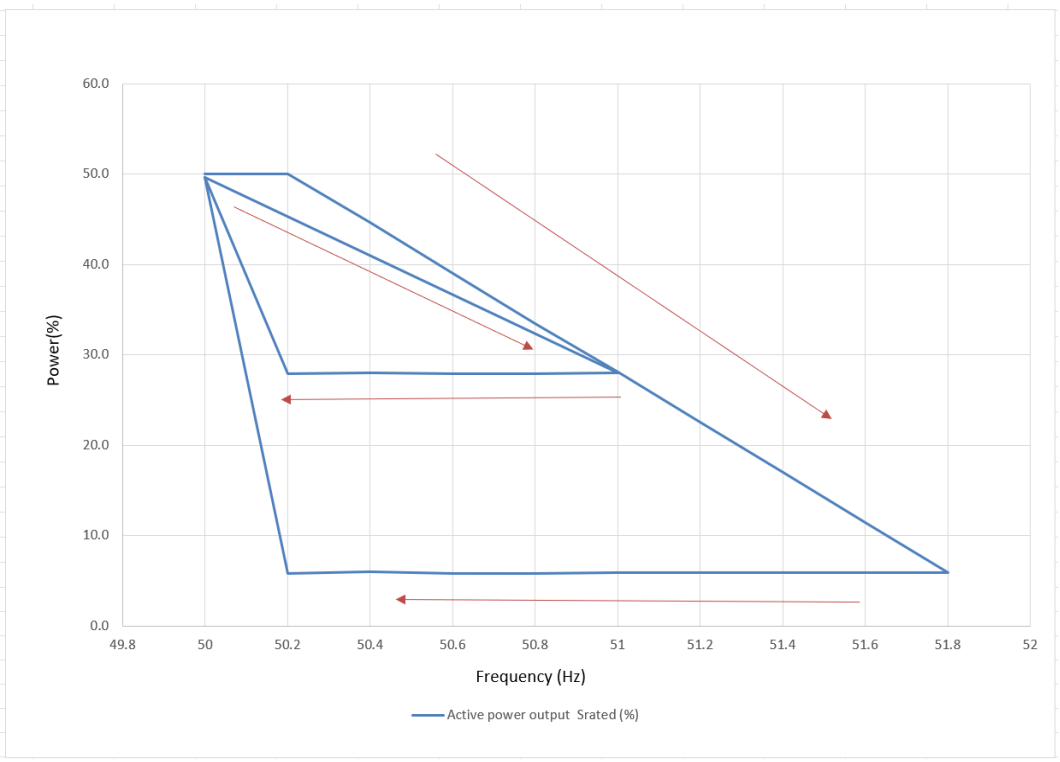
Frequency (Hz)	Time for initial response (s)	Time for output to stabilize (s)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
50.0	—	0.20	50.07	50
50.2	—	0.40	50.06	50
50.4	—	0.40	44.70	44
50.6	—	0.60	39.03	39
50.8	—	0.40	33.50	33
51.0	—	0.20	28.10	28
51.2	—	0.20	22.56	22
51.4	—	0.20	17.00	17
51.6	—	0.20	11.45	11
51.8	—	0.40	5.91	6
51.6	—	—	—	—
...	—	—	—	—
50.4	—	—	—	—
50.2	—	—	5.86	6
50.0	—	—	—	—
...	—	—	—	—
50.0	—	—	49.68	50
51.0	0.20	0.40	28.04	28
50.8	—	—	—	—
50.6	—	—	—	—
50.4	—	—	—	—
50.2	—	—	27.94	28
50.0	—	0.40	49.68	50

Criteria for acceptance:
When tested in accordance with Clause J.3.2, the device under test shall —
(d) respond to the increase in frequency condition linearly and in accordance with Clause 4.5.3;
(e) stabilize the output power level after a frequency disturbance within the response completion time specified in Table 4.6; and
(f) maintain continuous operation for a rate of change of frequency event in accordance with Clause 4.5.6.
The results recorded in J.3.2 shall be graphed on an x-y-axis graph, where the x-axis is frequency and the y-axis is power output.
The results recorded in Steps (i) and (m) shall be graphed with respect to time. The rate of increase in power output shall not exceed the power rate limit (W_{Gra}) and shall conform to the nonlinearity of power

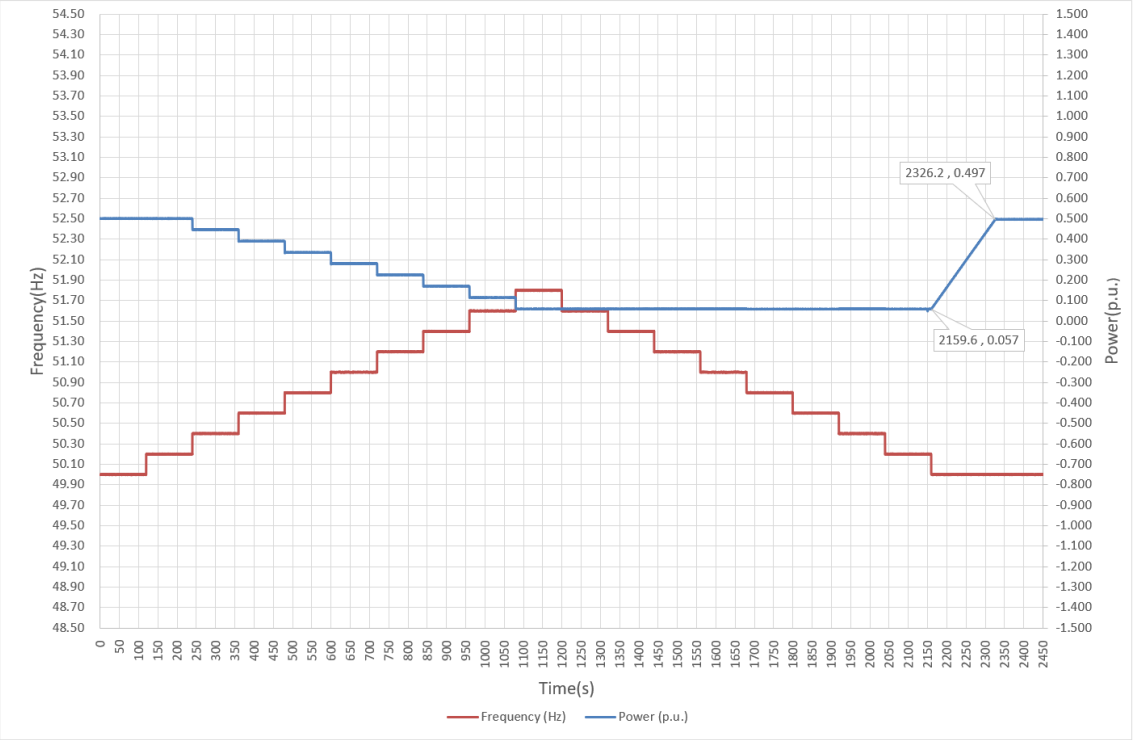
limit changes of Clause 3.3.4.4.
For the test, the $P_{rated-ch}$ is 25kW.

Note:

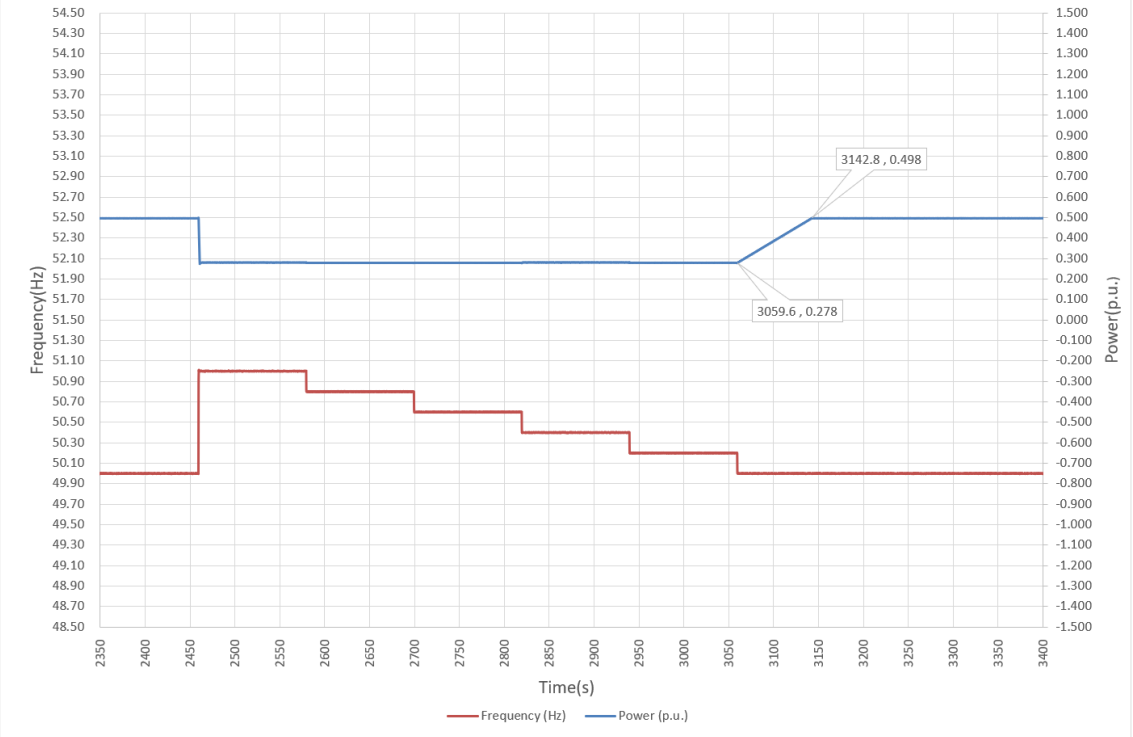
Graph of the Power-frequency characteristic



Graph: Step a) to i):



Graph: Step j) to m):



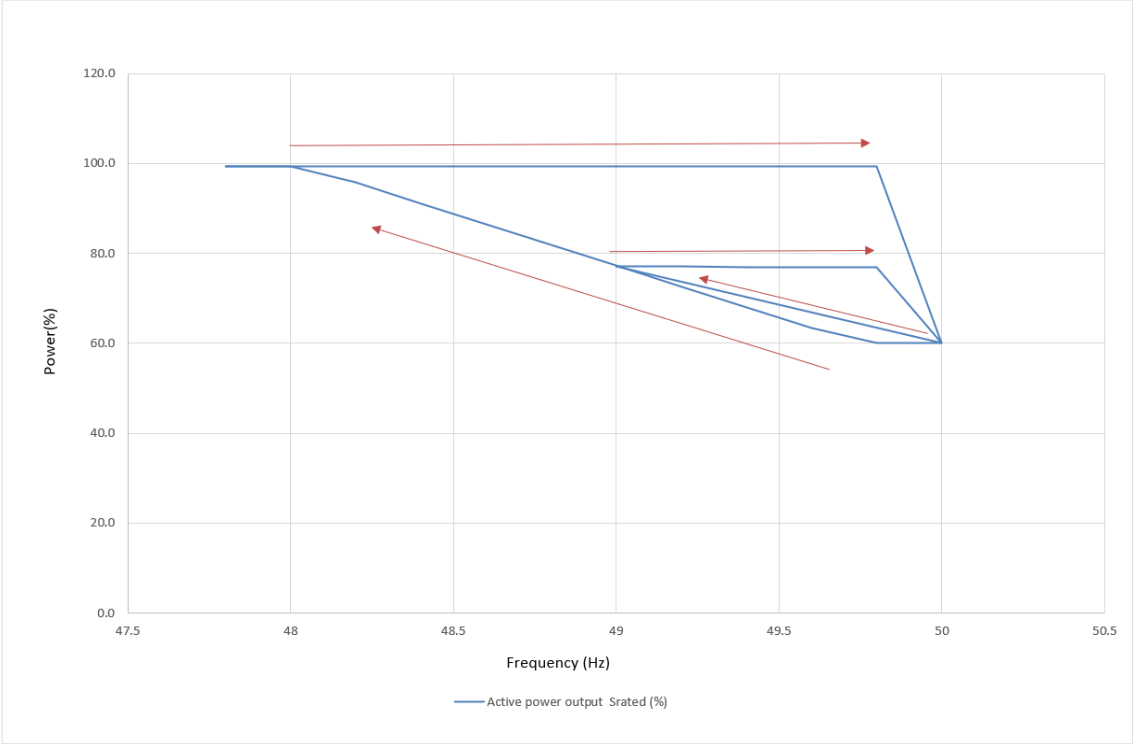
4.5.3 Sustained operation for frequency (Australia A) **Appendix J.3.4 Test procedure for a decrease in frequency for inverters without energy storage**	**P**

Test: IVGM25KHP3G3

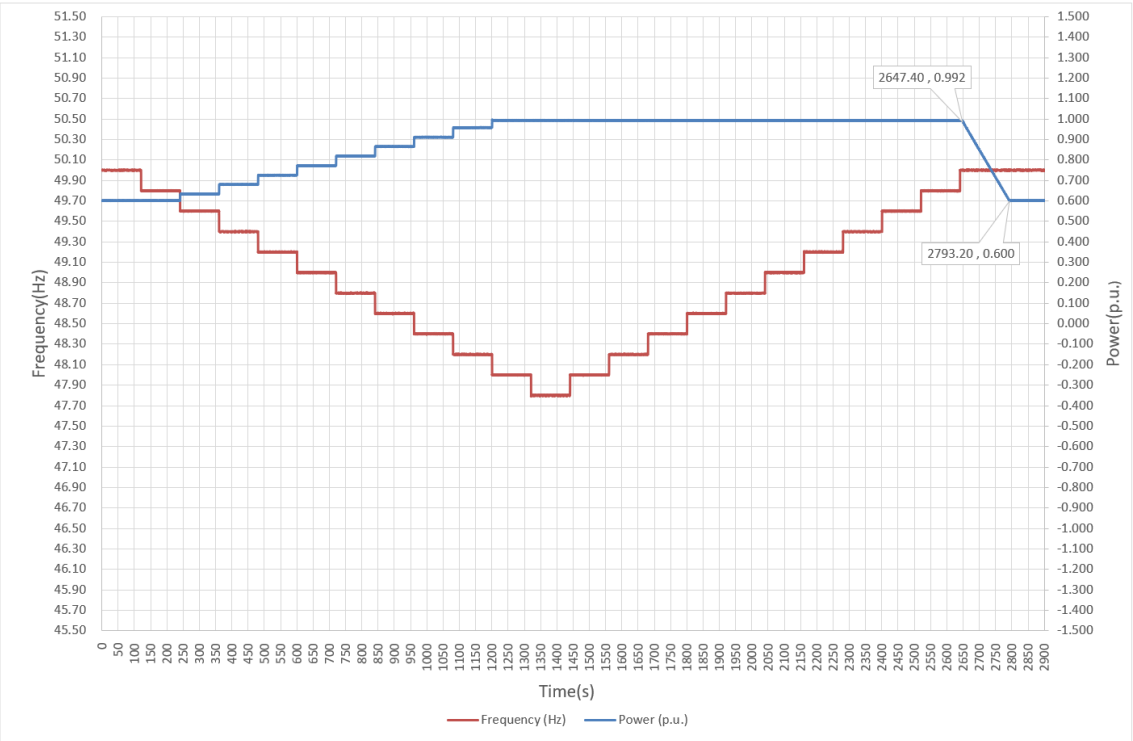
Frequency (Hz)	Time for initial response (s)	Time for output to stabilize (s)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
50.0	—	0.60	60.08	60
49.8	—	0.60	60.09	60
49.6	—	0.40	63.33	63
49.4	—	0.60	67.96	68
49.2	—	0.40	72.58	73
49.0	—	0.20	77.22	77
48.8	—	0.40	81.86	82
48.6	—	0.60	86.49	86
48.4	—	0.60	91.13	91
48.2	—	0.80	95.83	95
48.0	—	0.60	99.37	100
47.8	—	0.80	99.37	100
48.0	—	—	—	—
...	—	—	—	—
49.6	—	—	—	—
49.8	—	0.80	99.31	100
50.0	—	—	—	—
...	—	—	—	—
50.0	—	—	60.10	60
49.0	—	—	77.01	77
49.2	—	—	—	—
49.4	—	—	—	—
49.6	—	—	—	—
49.8	—	—	77.00	77.1
50.0	—	0.60	60.10	60

Note:

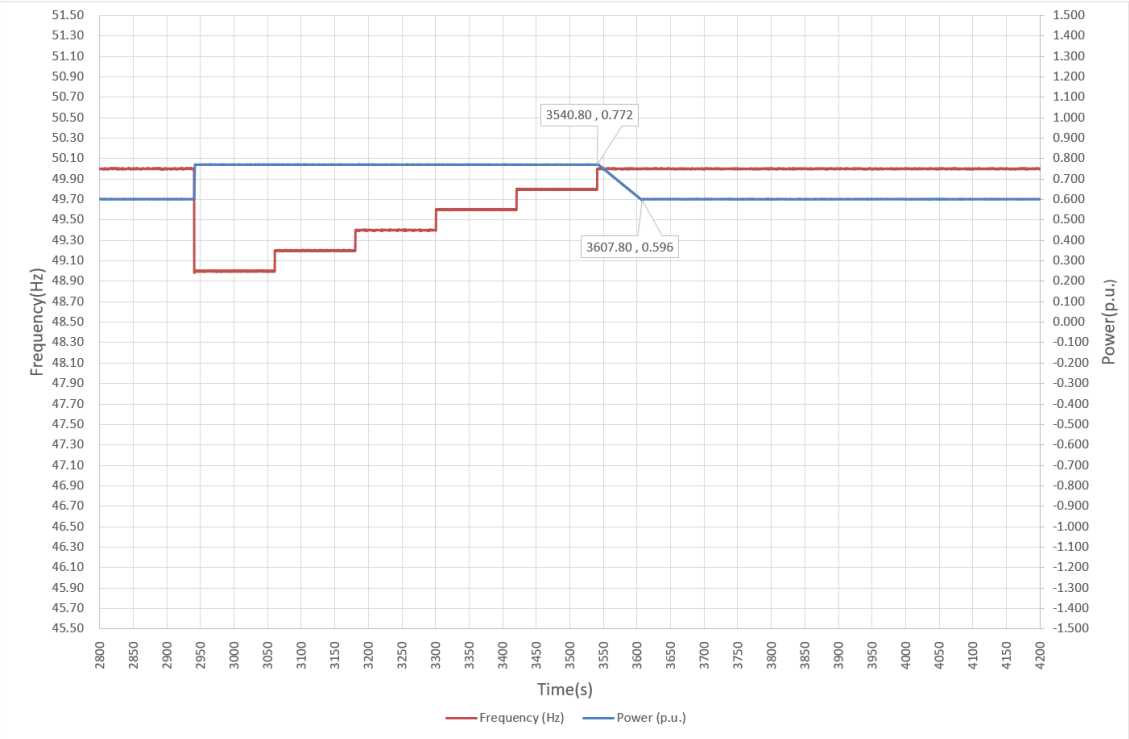
Graph of the Power-frequency characteristic



Graph: Step a) to i):



Graph: Step j) to m):



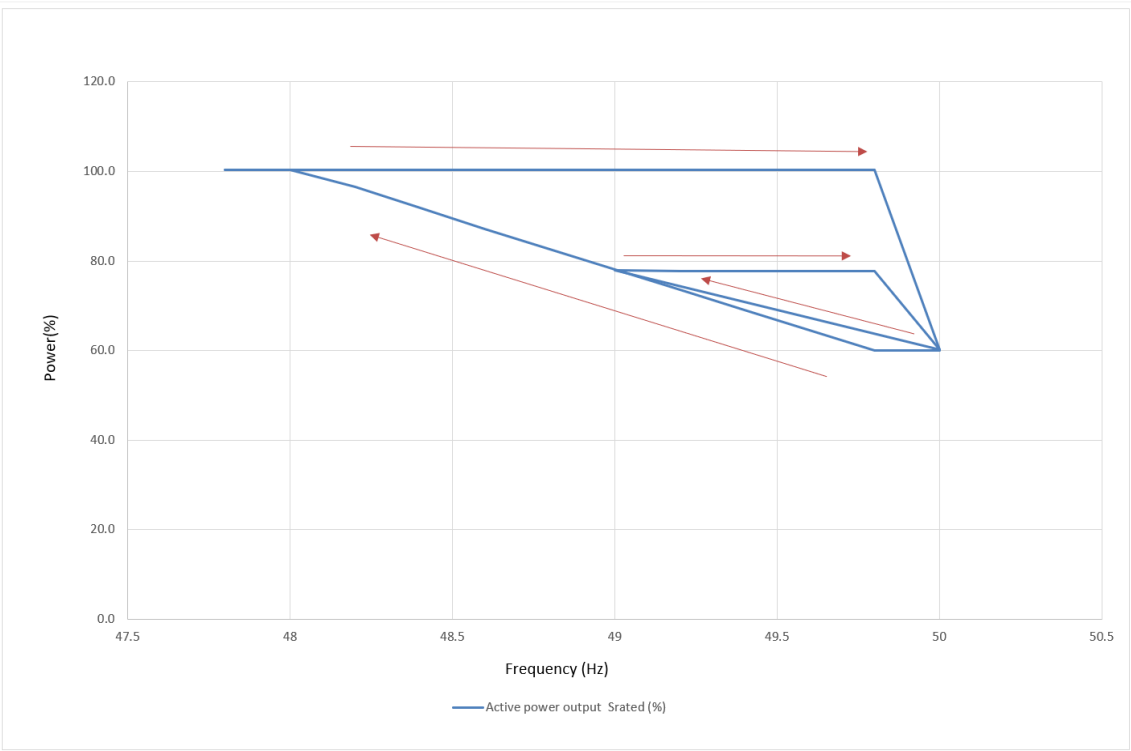
4.5.3 Sustained operation for frequency (New Zealand) **Appendix J.3.4 Test procedure for a decrease in frequency for inverters without energy storage**	**P**

Test: IVGM25KHP3G3

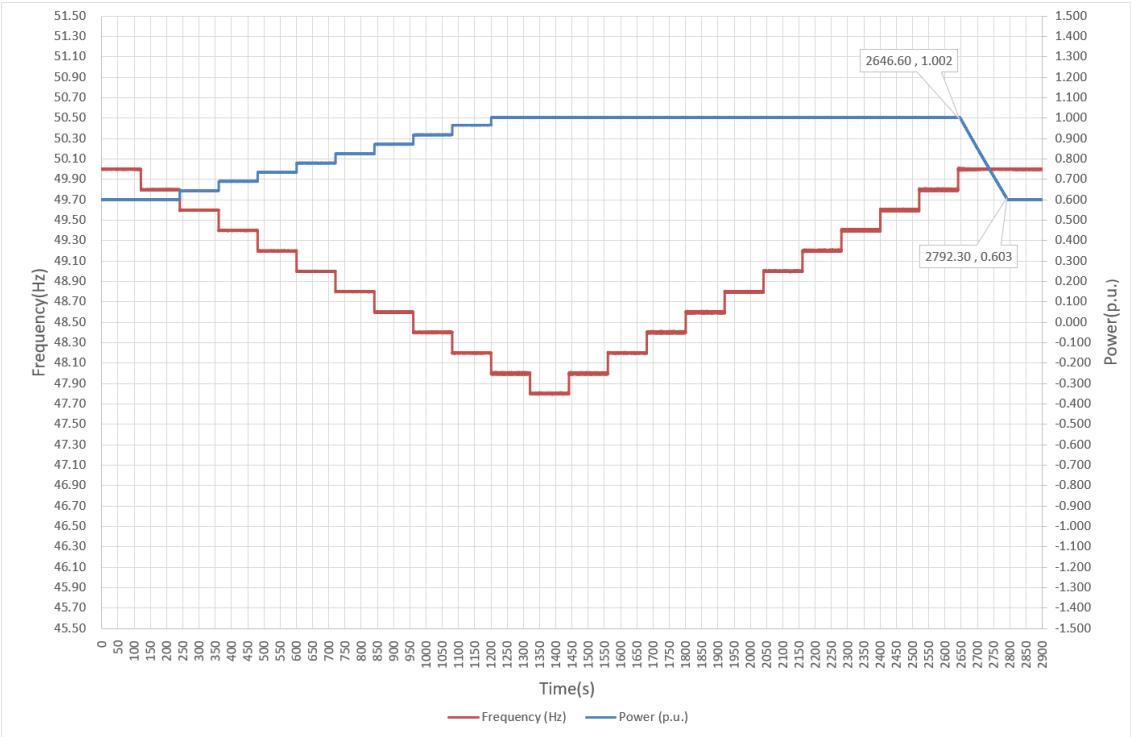
Frequency (Hz)	Time for initial response (s)	Time for output to stabilize (s)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
50.0	—	6.2	60.11	60
49.8	—	6.4	60.05	60
49.6	—	6.6	64.54	64
49.4	—	6.4	69.03	69
49.2	—	7.2	73.53	73
49.0	—	6.0	78.05	78
48.8	—	6.4	82.59	82
48.6	—	6.3	87.20	87
48.4	—	6.4	91.87	91
48.2	—	6.5	96.61	96
48.0	—	6.2	100.39	100
47.8	—	5.8	100.36	100
48.0	—	—	—	—
...	—	—	—	—
49.6	—	—	—	—
49.8	—	6.2	100.38	100
50.0	—	—	—	—
...	—	—	—	—
50.0	—	—	60.14	60
49.0	0.8	6.3	77.86	78
49.2	—	—	—	—
49.4	—	—	—	—
49.6	—	—	—	—
49.8	—	—	77.84	78
50.0	—	5.6	60.14	60

Note:

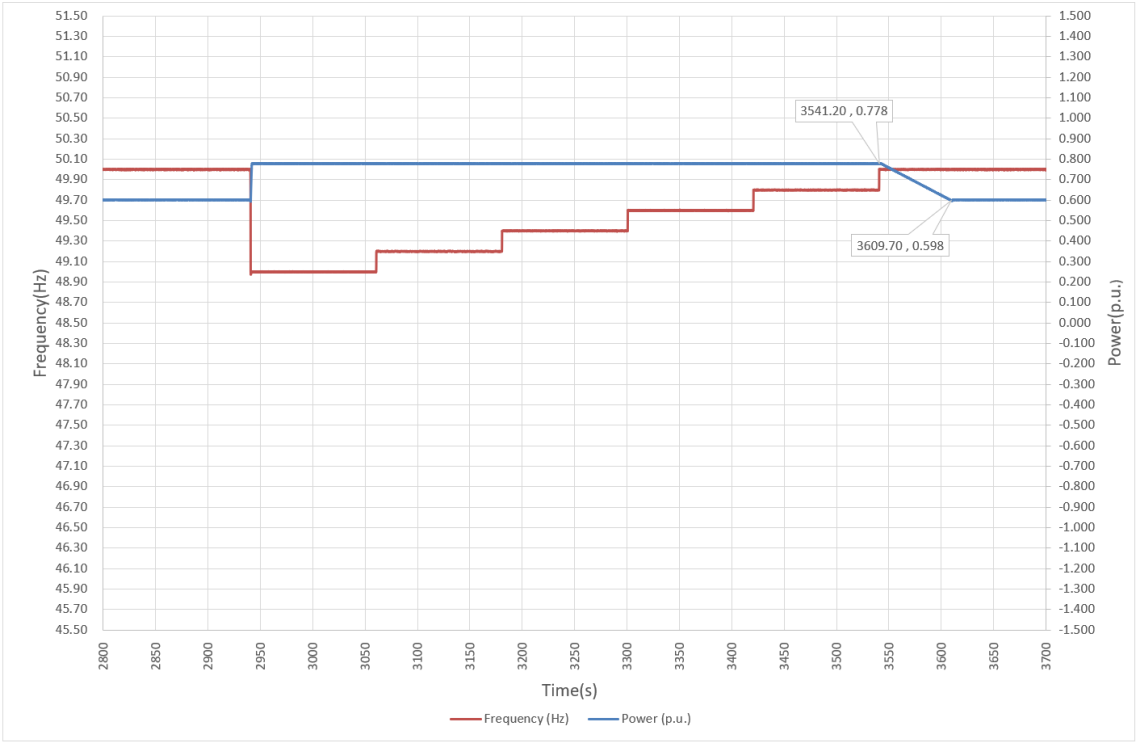
Graph of the Power-frequency characteristic



Graph: Step a) to i):



Graph: Step j) to m):



4.5.3 Sustained operation for frequency (Australia A) **Appendix J.3.6 Test procedure for an increase in frequency for inverters with energy storage**	**P**

Test: IVGM25KHP3G3

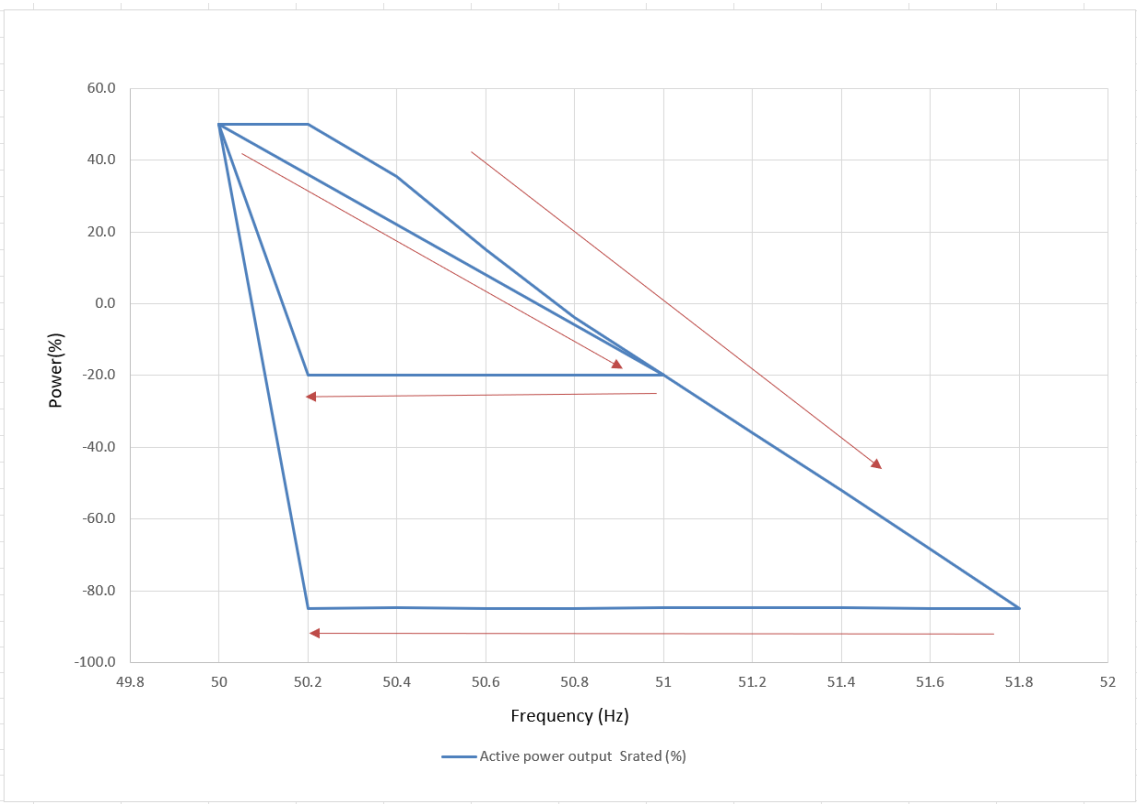
Frequency (Hz)	Time for initial response (s)	Time for output to stabilize (s)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
50.0	—	0.80	50.04	50
50.2	—	0.60	50.04	50
50.4	—	0.80	35.35	35
50.6	—	0.60	15.14	15
50.8	—	0.80	-3.94	-4
51.0	—	0.80	-19.88	-20
51.2	—	0.60	-35.97	-36
51.4	—	0.60	-52.14	-52
51.6	—	0.60	-68.43	-68
51.8	—	0.80	-84.86	-84
51.6	—	—	—	—
...	—	—	—	—
50.4	—	—	—	—
50.2	—	—	-84.91	-84
50.0	—	—	—	—
...	—	—	—	—
50.0	—	—	50.07	50
51.0	0.60	0.80	-19.88	-20
50.8	—	—	—	—
50.6	—	—	—	—
50.4	—	—	—	—
50.2	—	—	-19.98	-20
50.0	—	0.60	50.08	50

Criteria for acceptance:
When tested in accordance with Clause J.3.6, the device under test shall —
(g) respond to the increase in frequency condition linearly and in accordance with Clause 4.5.3;
(h) stabilize the output power level after a frequency disturbance within the response completion time specified in Table 4.6; and
(i) maintain continuous operation for a rate of change of frequency event in accordance with Clause 4.5.6.
The results recorded in J.3.6 shall be graphed on an x-y-axis graph, where the x-axis is frequency and the y-axis is power output.
The results recorded in Steps (i) and (m) shall be graphed with respect to time. The rate of increase in power output shall not exceed the power rate limit (W_{Gra}) and shall conform to the nonlinearity of power

limit changes of Clause 3.3.4.4.
For the test, the $P_{rated-ch}$ is 25kW.

Note:

Graph of the Power-frequency characteristic



Graph: Step a) to i):



Graph: Step j) to m):



4.5.3 Sustained operation for frequency (New Zealand) Appendix J.3.6 Test procedure for an increase in frequency for inverters with energy storage	**P**

Test: IVGM25KHP3G3

Frequency (Hz)	Time for initial response (s)	Time for output to stabilize (s)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
50.0	—	0.80	50.07	50
50.2	—	0.80	50.07	50
50.4	—	0.60	37.71	38
50.6	—	0.80	25.06	25
50.8	—	0.80	12.52	13
51.0	—	0.60	0.16	0
51.2	—	0.40	-19.92	-20
51.4	—	0.60	-40.11	-40
51.6	—	0.60	-60.46	-60
51.8	—	0.40	-80.98	-80
51.6	—	—	—	—
...	—	—	—	—
50.4	—	—	—	—
50.2	—	—	-81.03	-80
50.0	—	—	—	—
...	—	—	—	—
50.0	—	—	50.07	50
51.0	0.20	1.20	0.17	0
50.8	—	—	—	—
50.6	—	—	—	—
50.4	—	—	—	—
50.2	—	—	0.07	0
50.0	—	0.60	50.08	50

Criteria for acceptance:

When tested in accordance with Clause J.3.6, the device under test shall —

(j) respond to the increase in frequency condition linearly and in accordance with Clause 4.5.3;

(k) stabilize the output power level after a frequency disturbance within the response completion time specified in Table 4.6; and

(l) maintain continuous operation for a rate of change of frequency event in accordance with Clause 4.5.6.

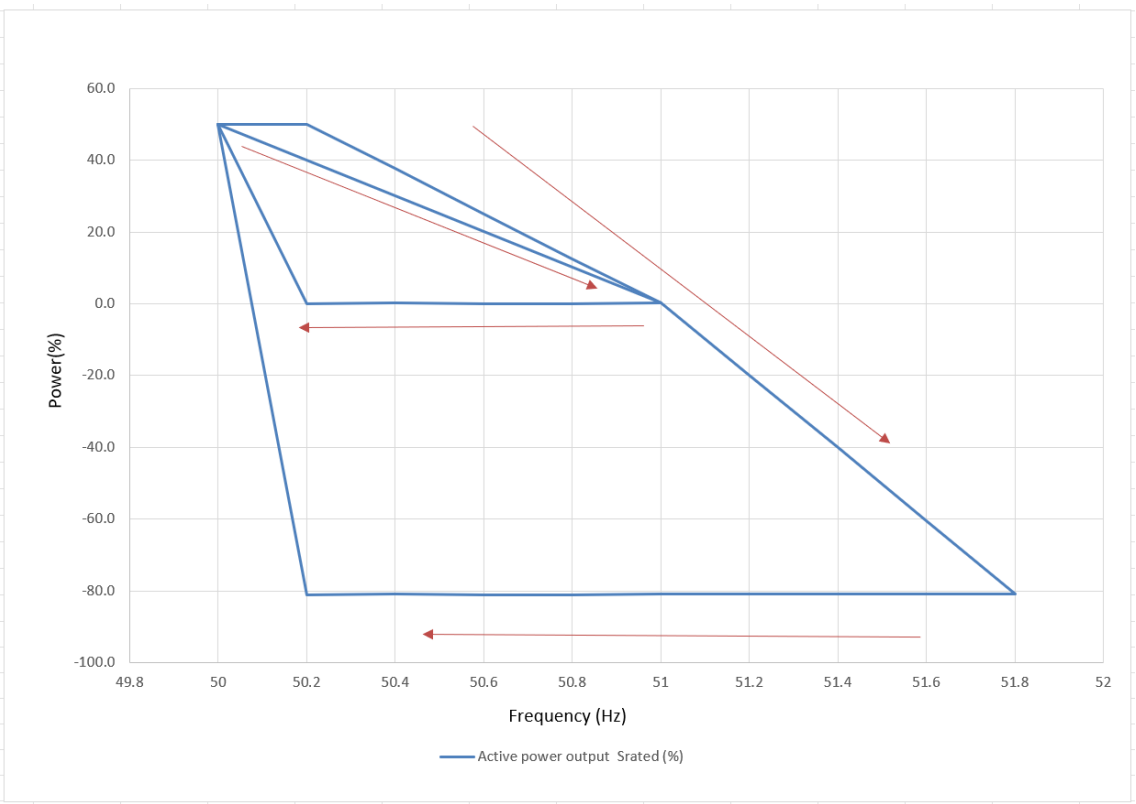
The results recorded in J.3.6 shall be graphed on an x-y-axis graph, where the x-axis is frequency and the y-axis is power output.

The results recorded in Steps (i) and (m) shall be graphed with respect to time. The rate of increase in power output shall not exceed the power rate limit (W_{Gra}) and shall conform to the nonlinearity of power limit changes of Clause 3.3.4.4.

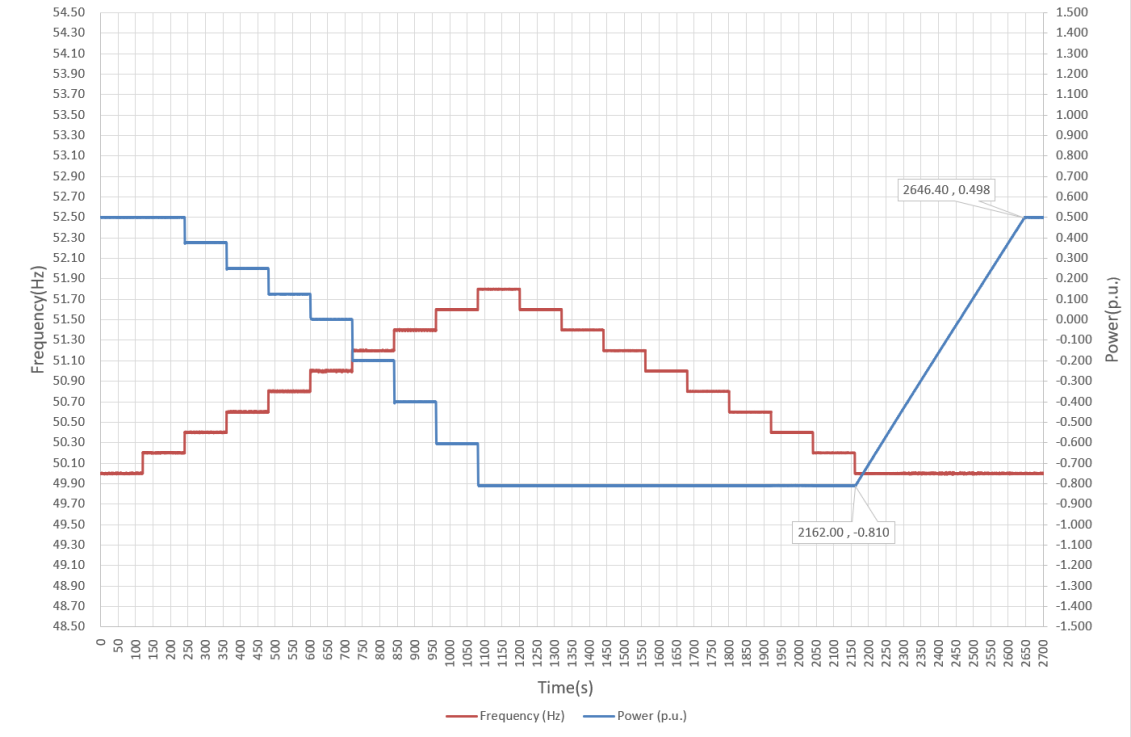
For the test, the $P_{rated-ch}$ is 25kW.

Note:

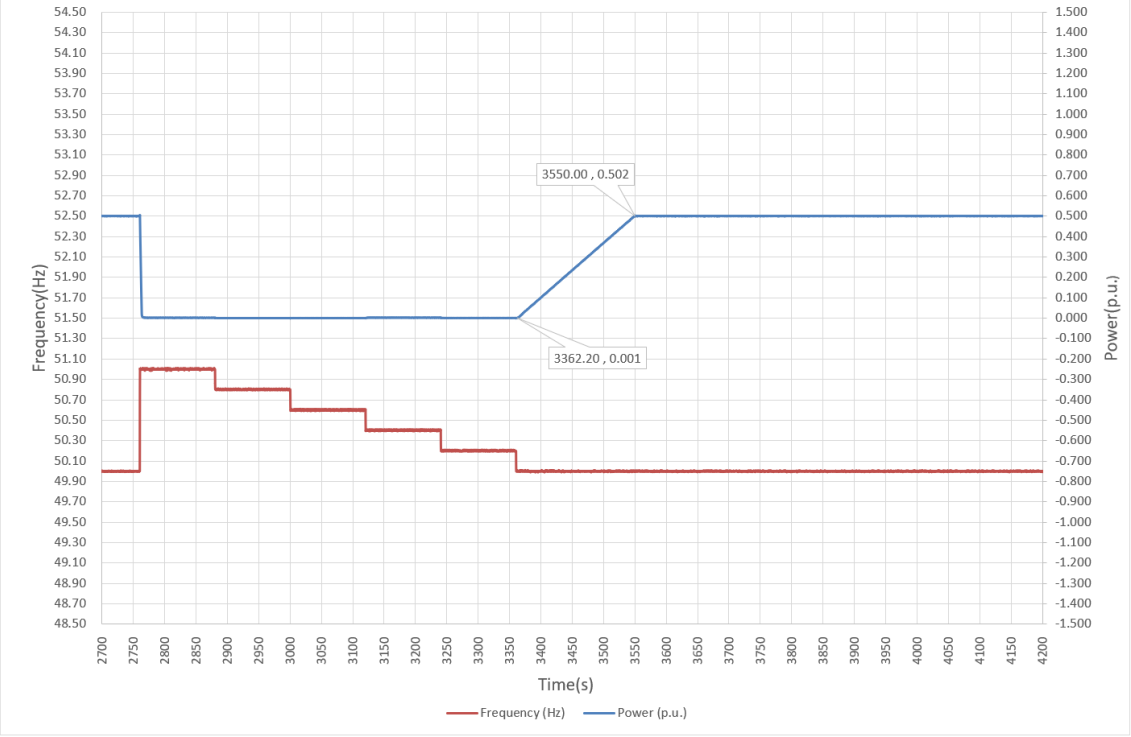
Graph of the Power-frequency characteristic



Graph: Step a) to i):



Graph: Step j) to m):



4.5.3 Sustained operation for frequency (Australia A) **Appendix J.3.8 Test procedure for a decrease in frequency for inverters with energy storage**	**P**

Test: IVGM25KHP3G3

Frequency (Hz)	Time for initial response (s)	Time for output to stabilize (s)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
50.0	—	0.60	-50.29	-50
49.8	—	0.80	-50.29	-50
49.6	—	0.80	-39.83	-40
49.4	—	0.60	-26.51	-26
49.2	—	0.80	-13.21	-13
49.0	—	0.60	0.21	0
48.8	—	0.60	20.23	20
48.6	—	0.40	40.26	40
48.4	—	0.60	60.30	60
48.2	—	0.80	80.36	80
48.0	—	0.60	99.51	100
47.8	—	0.60	99.49	100
48.0	—	—	—	—
...	—	—	—	—
49.6	—	—	—	—
49.8	—	0.40	99.39	100
50.0	—	—	—	—
...	—	—	—	—
50.0	—	—	-50.35	-50
49.2	0.40	0.60	-13.20	-13
49.4	—	—	—	—
49.6	—	—	—	—
49.8	—	—	-13.21	-13
50.0	—	0.60	-50.36	-50

Criteria for acceptance:

When tested in accordance with Clause J.3.8, the device under test shall —

(a) respond to the decrease in frequency condition linearly and in accordance with Clause 4.5.3;

(b) stabilize the output power level after a frequency disturbance within the response completion time specified in Table 4.6; and

(c) maintain continuous operation for a rate of change of frequency event in accordance with Clause 4.5.6.

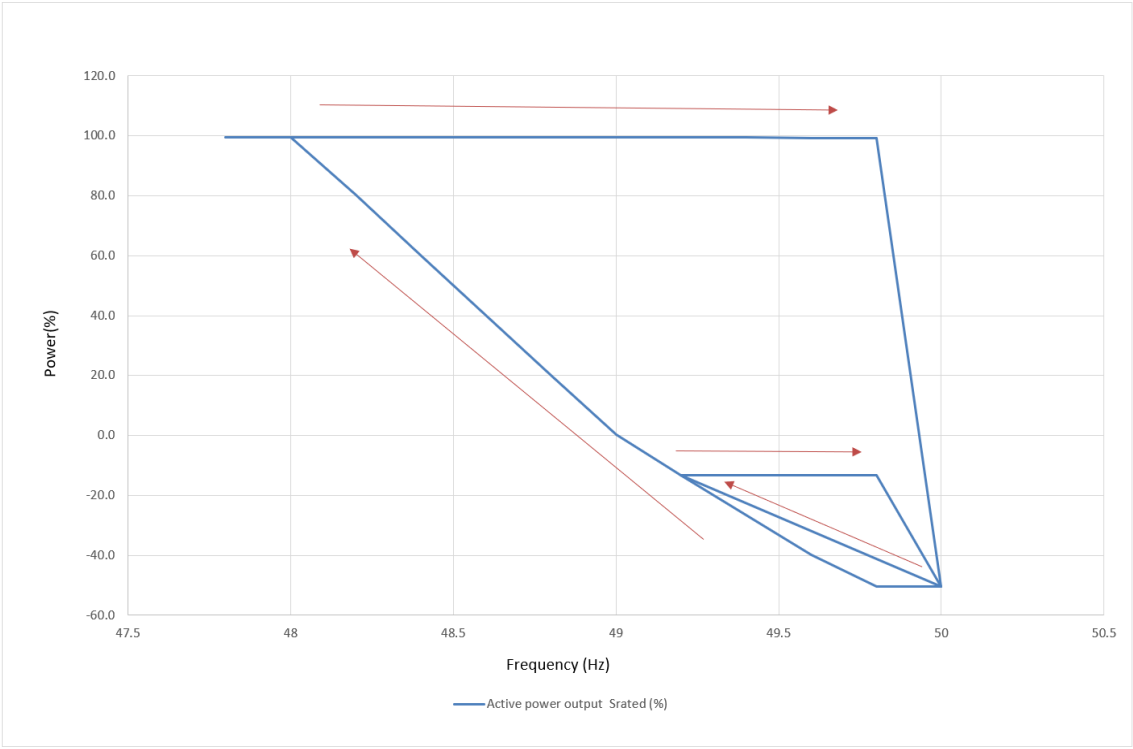
The results recorded in J.3.8 shall be graphed on an x-y-axis graph, where the x-axis is frequency and the y-axis is power output.

The results recorded in Steps (j) and (n) shall be graphed with respect to time. The rate of increase in power output shall not exceed the power rate limit (W_{Gra}).

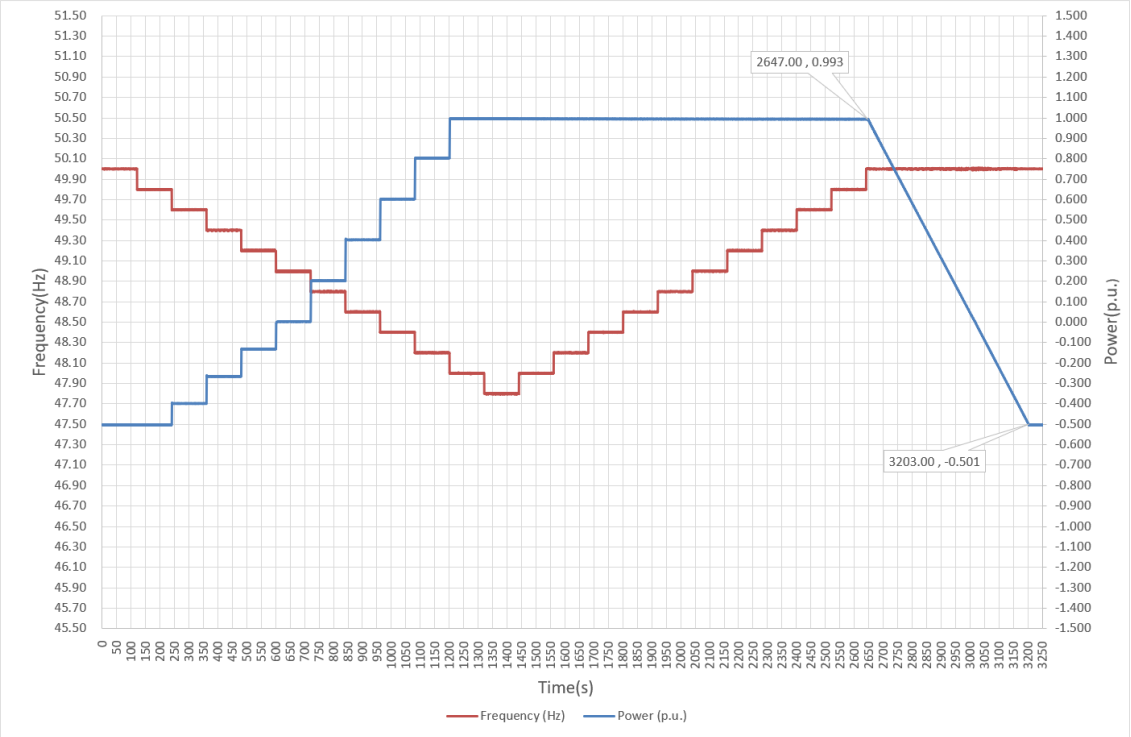
For the test, the $P_{rated-ch}$ is 25kW.

Note:

Graph of the Power-frequency characteristic:



Graph: Step a) to i):



Graph: Step j) to m):



4.5.3 Sustained operation for frequency (New Zealand) **Appendix J.3.8 Test procedure for an decrease in frequency for inverters with energy storage**	**P**

Test: IVGM25KHP3G3

Frequency (Hz)	Time for initial response (s)	Time for output to stabilize (s)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
50.0	—	0.60	-50.35	-50
49.8	—	0.80	-49.97	-50
49.6	—	0.60	-37.40	-38
49.4	—	0.60	-24.90	-25
49.2	—	0.80	-12.41	-13
49.0	—	0.60	0.20	0
48.8	—	0.60	20.24	20
48.6	—	0.40	40.29	40
48.4	—	0.60	60.35	60
48.2	—	0.40	80.41	80
48.0	—	0.80	99.41	100
47.8	—	0.60	99.41	100
48.0	—	—	—	—
...	—	—	—	—
49.6	—	—	—	—
49.8	—	0.40	99.34	100
50.0	—	—	—	—
...	—	—	—	—
50.0	—	—	-50.36	-50
49.2	0.40	0.80	-12.38	-13
49.4	—	—	—	—
49.6	—	—	—	—
49.8	—	—	-12.39	-13
50.0	—	0.40	-50.37	-50

Criteria for acceptance:

When tested in accordance with Clause J.3.8, the device under test shall —

(d) respond to the decrease in frequency condition linearly and in accordance with Clause 4.5.3;

(e) stabilize the output power level after a frequency disturbance within the response completion time specified in Table 4.8; and

(f) maintain continuous operation for a rate of change of frequency event in accordance with Clause 4.5.6.

The results recorded in J.3.4 shall be graphed on an x-y-axis graph, where the x-axis is frequency and

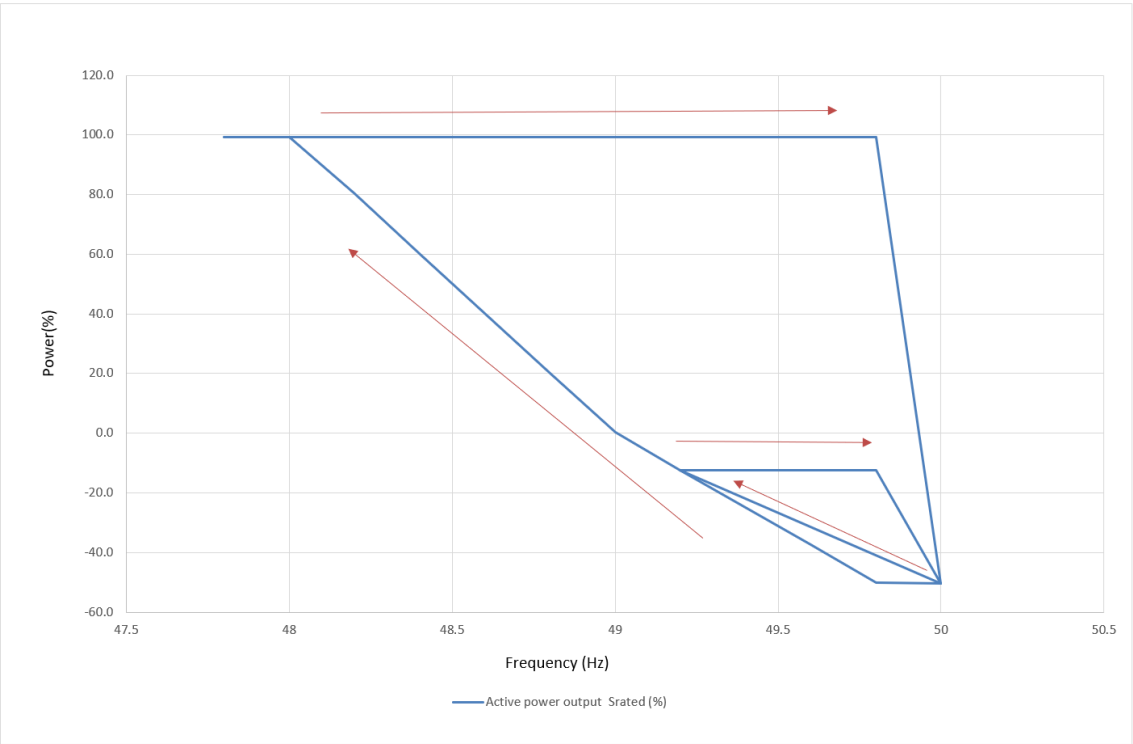
the y-axis is power output.

The results recorded in Steps (j) and (n) shall be graphed with respect to time. The rate of increase in power output shall not exceed the power rate limit (W_{Gra}).

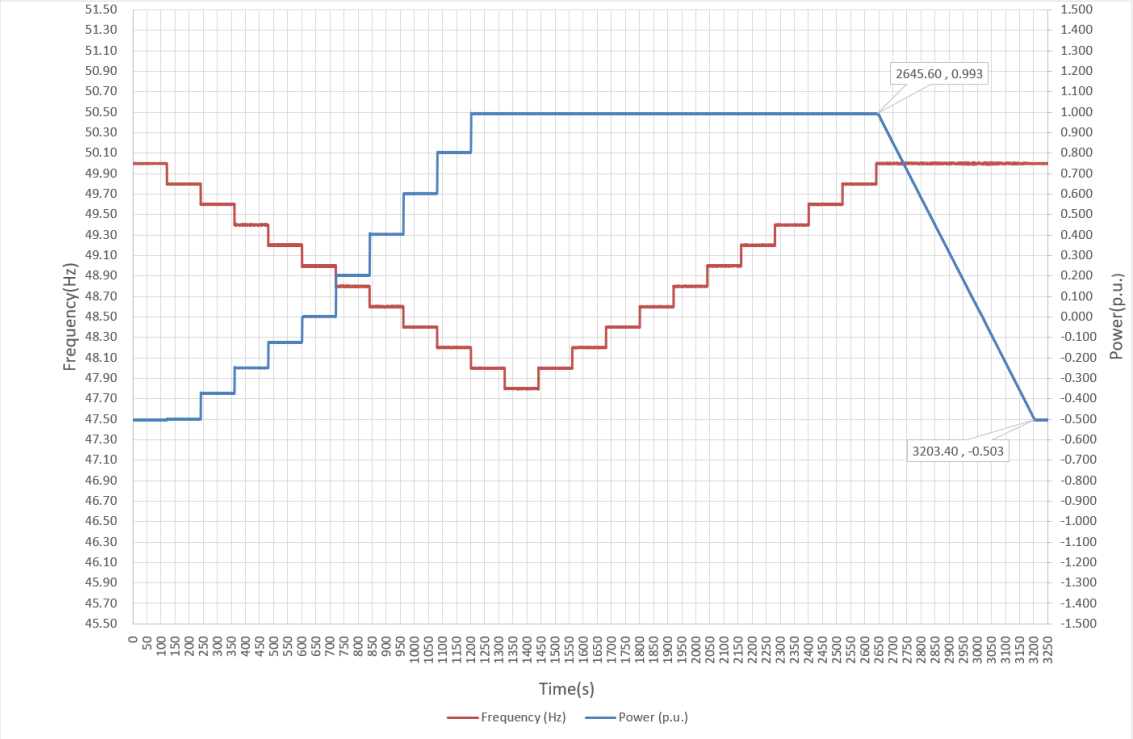
For the test, the $P_{rated-ch}$ is 25kW. the S_{rated} is 25kW.

Note:

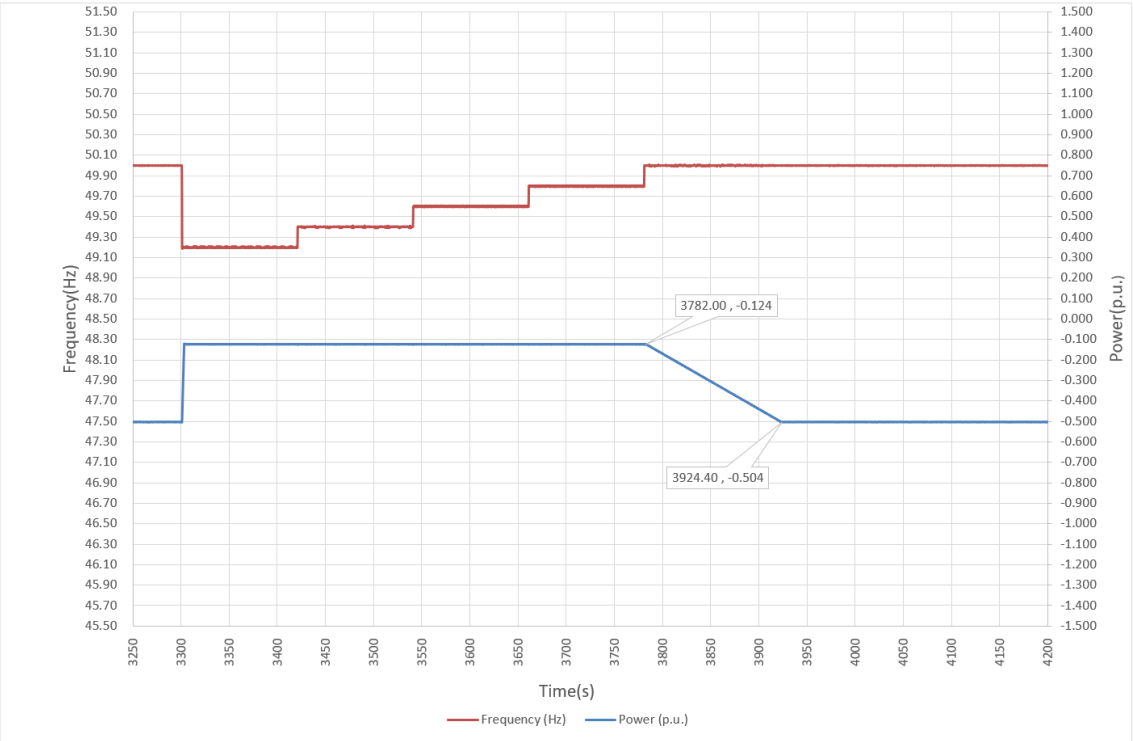
Graph of the Power-frequency characteristic:



Graph: Step a) to i):



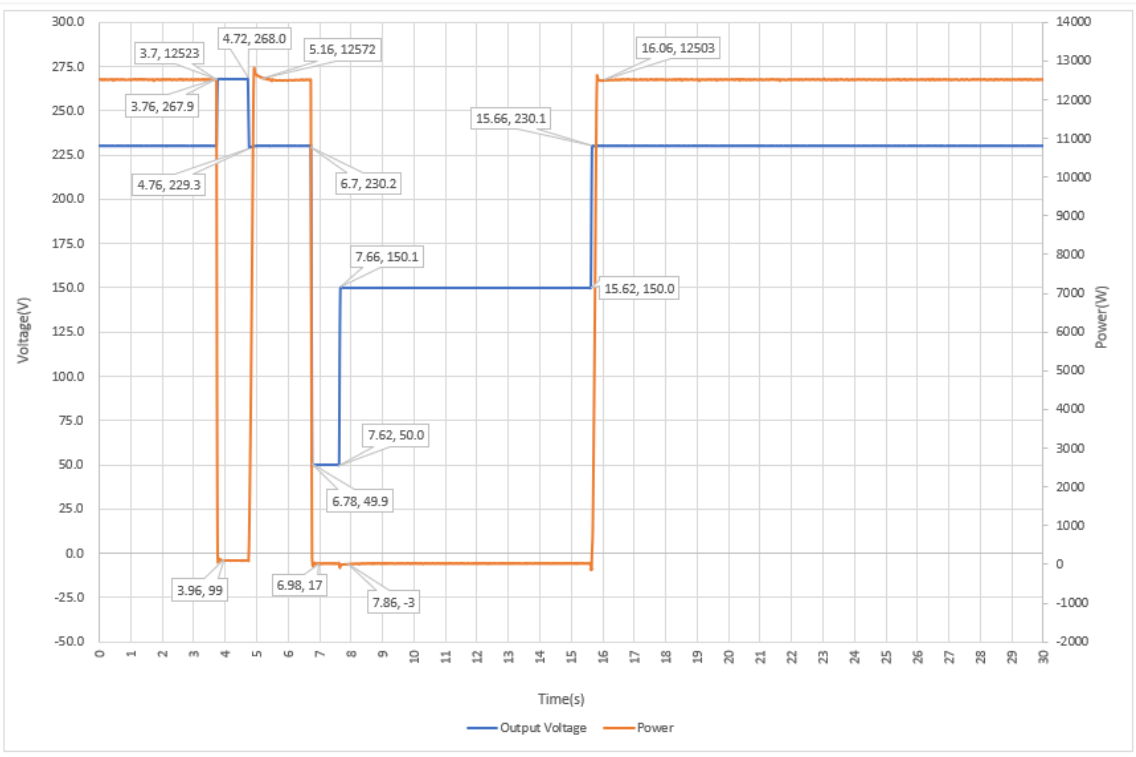
Graph: Step j) to m):



4.5.4 Voltage disturbance withstand **Appendix I.3 Voltage disturbance withstand tests**					**P**
Clause I.3 Test report	Description	Min. value	Max. value	Test resolution	Units
Cease power generation and multiple voltage disturbance test I.3.1	The active power level after the device under test has been set to (50 ± 5) % of its rated apparent power [I.3.1(b)]	--	--	L1:12523 L2:12515 L3:12518	W
	When the grid source voltage is raised from grid test voltage to 267.5 V [2 ms — I.2.5(c)], record the power level 200 ms after the voltage step change [I.3.1(d)]	--	--	L1: 99 L2: 98 L3: 101	W
	When after < 1 s the grid source voltage is decreased to the grid test voltage (2 ms), record the stabilized power level 400 ms after the voltage step change [I.3.1(f)]	--	--	L1:12572 L2:12581 L3:12581	W
	When after 2 s the grid source voltage is decreased to the 50 V (2 ms), record the stabilized power level 200 ms after the voltage step change [I.3.1(h)]	--	--	L1: 17 L2: -31 L3: 36	W
	When after < 1 s the grid source voltage is increased to 150 V (2 ms), record the stabilized power level 200 ms after the voltage step change [I.3.1(j)]	--	--	L1: -3 L2: 89 L3: -256	W
	When after 8 s the grid source voltage is increased to the grid test voltage (2 ms), record the stabilized power level 400 ms after the voltage step change [I.3.1(l)]	--	--	L1:12503 L2:12501 L3:12532	W
	When after > 15 s the grid source voltage is decreased to the 50 V (2 ms), record the stabilized power level 200 ms after the voltage step change [I.3.1(n)]	--	--	L1: 53 L2: 1 L3: -120	W
	When after 0.5 s the grid source voltage is increased to the grid test voltage (2 ms), record the stabilized power level 400 ms after the voltage step change [I.3.1(p)]	--	--	L1:12518 L2:12509 L3:12518	W
	When after 2 s the grid source voltage is decreased to the 100 V (2 ms), record the stabilized power level 200 ms after the voltage step change [I.3.1(r)]	--	--	L1: 94 L2: 20 L3: 174	W
	When after 4.5 s the grid source voltage is decreased from 100 V to the 50 V (2 ms), record the stabilized power level 200 ms after the voltage step change [I.3.1(t)]	--	--	L1: 22 L2: 21 L3: 23	W
	When after 0.5 s the grid source voltage is increased to the grid test voltage (2 ms), record the stabilized power level 400 ms	--	--	L1:12510 L2:12536	W

	after the voltage step change [I.3.1(t)]			L3:12524	
	When after 2 s the grid source voltage is decreased to the 100 V (2 ms), record the stabilized power level 200 ms after the voltage step change [I.3.1(t)]	--	--	L1: -48 L2: -153 L3: 37	W
	When after 4.5 s the grid source voltage is increased to the grid test voltage (2 ms), record the stabilized power level 400 ms after the voltage step change [I.3.1(v)]	--	--	L1:12539 L2:12511 L3:12531	W
Criteria for acceptance The device under test shall — (a) remain connected for the duration of the test; and (b) conform to the voltage disturbance withstand behavior of Clause 4.5.4.1.					
Note:					

Diagram of L1 phase



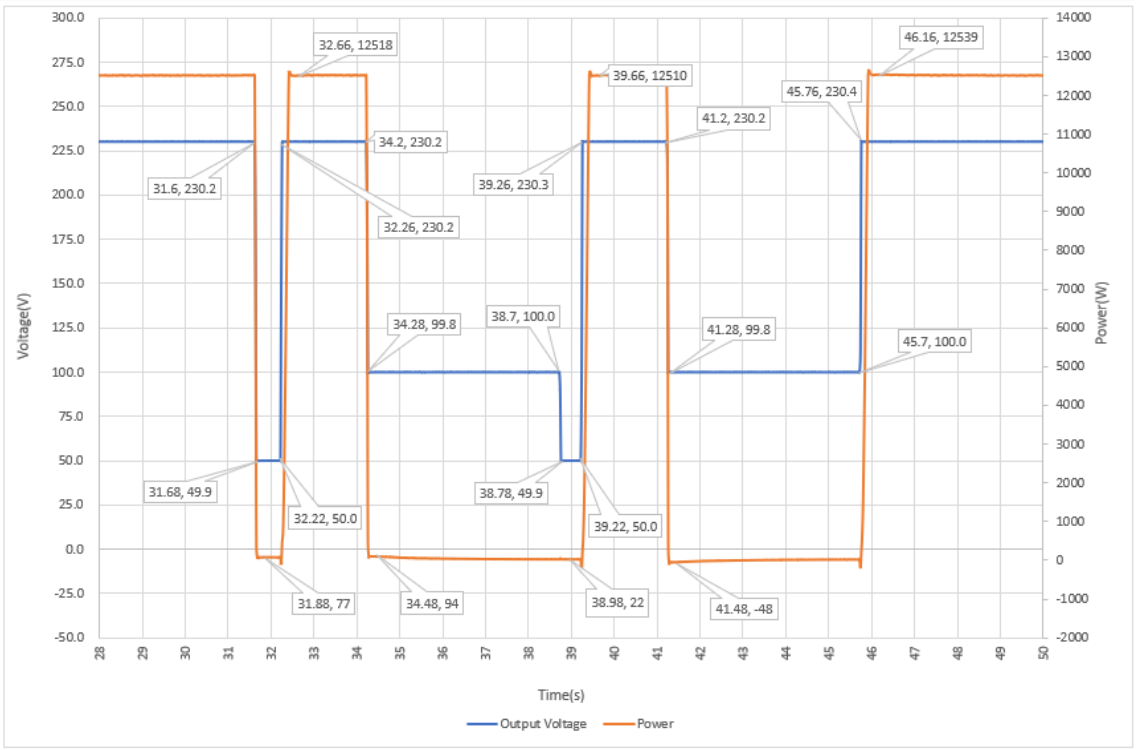
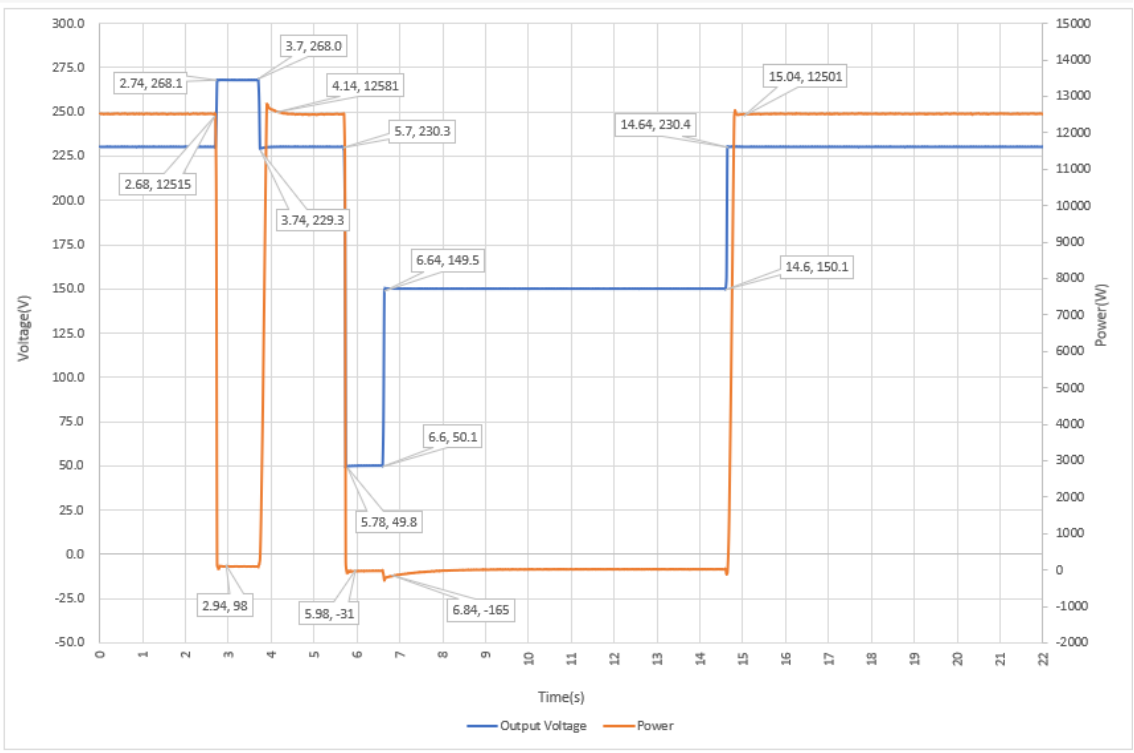


Diagram of L2 phase



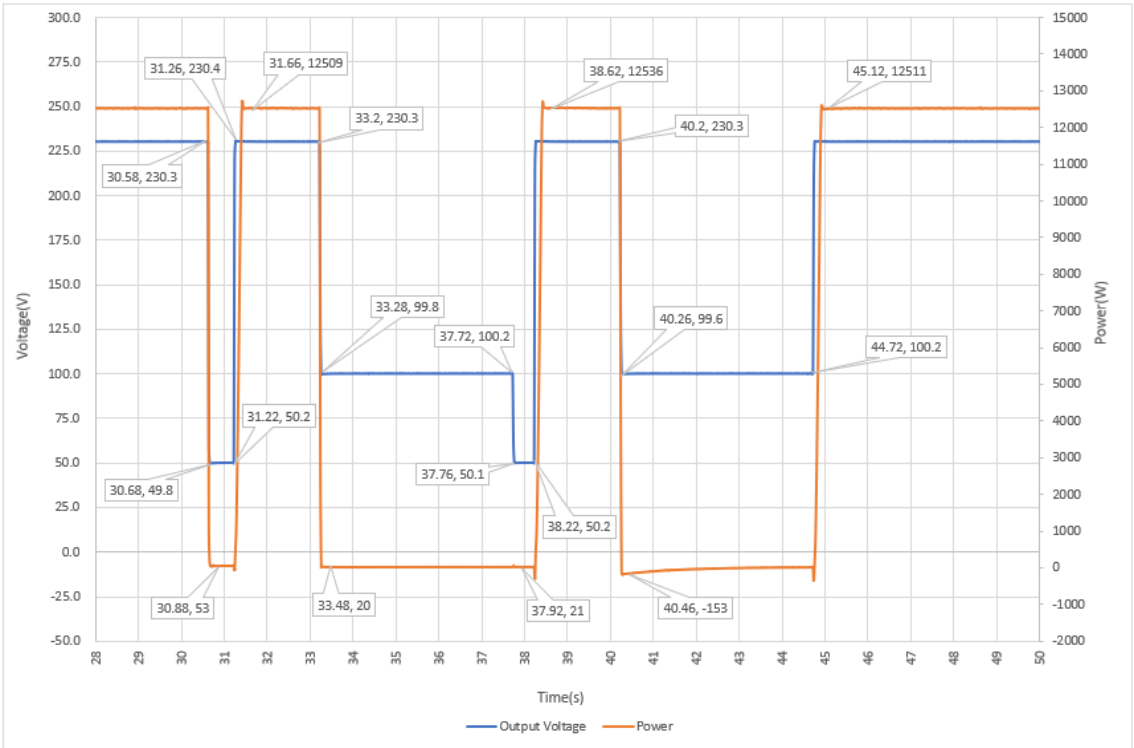
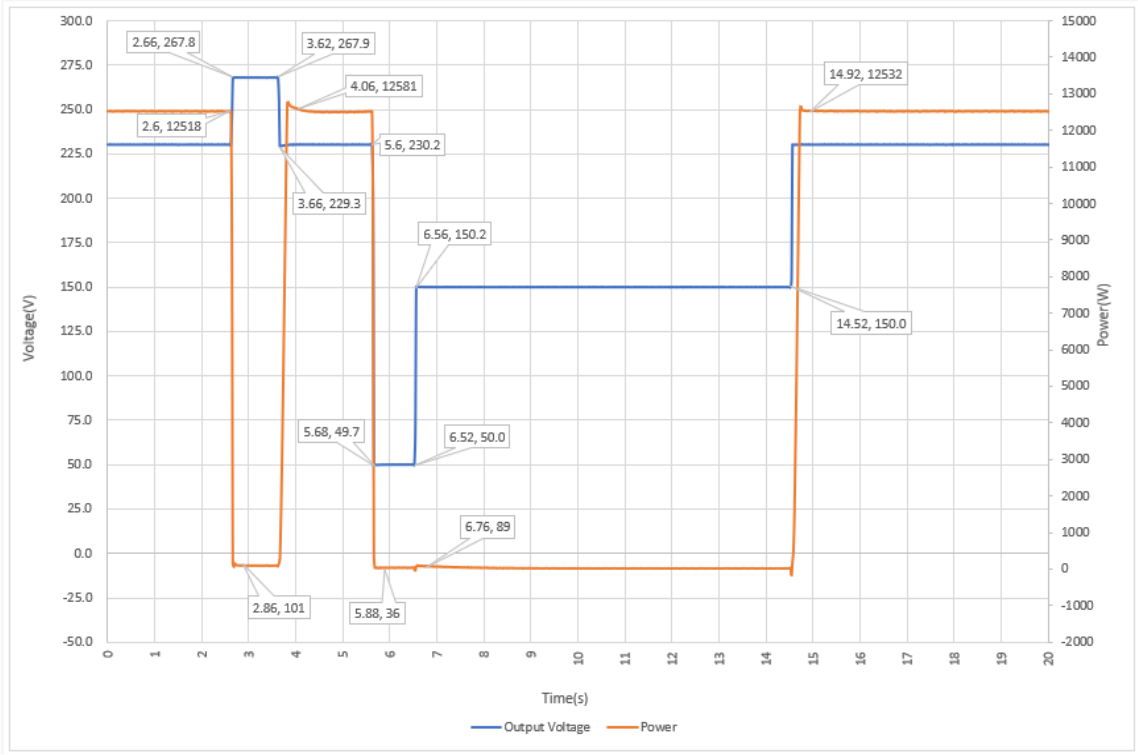
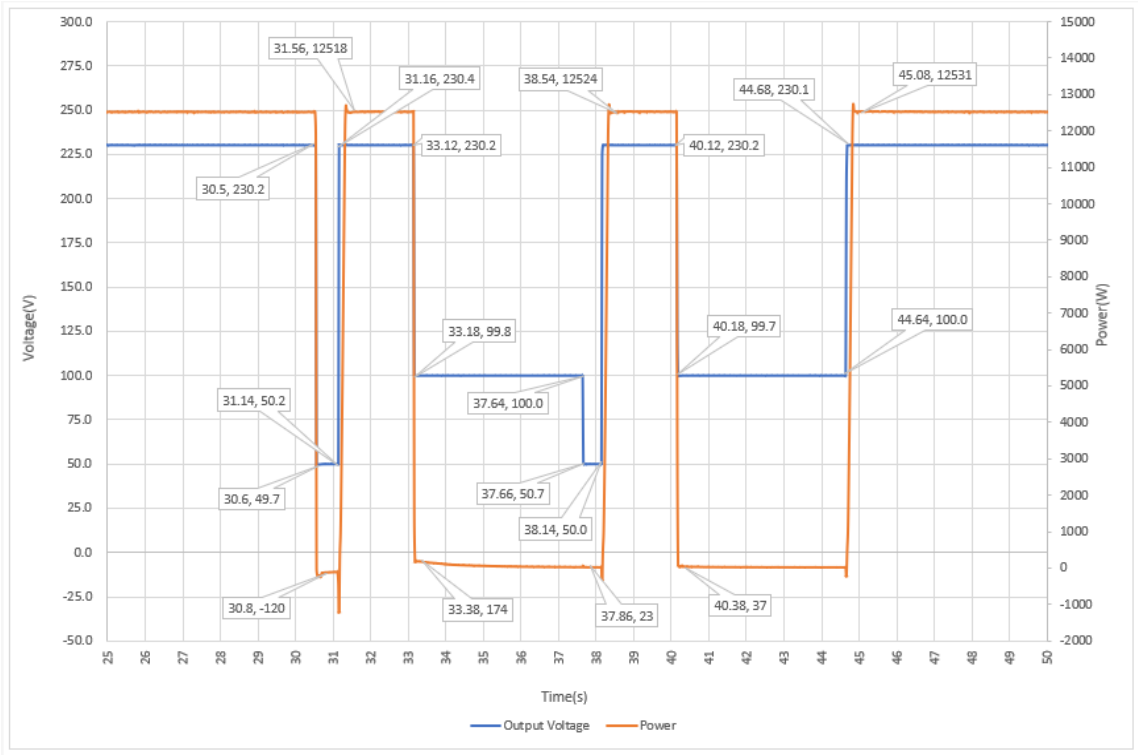


Diagram of L3 phase





4.5.5 Voltage phase angle shift withstand **Appendix I.5 Voltage phase angle shift test**					**P**
Clause I.5 Test report	Description	Min. value	Max. value	Test resolution	Units
Voltage phase angle shift test	The active power level after the device under test has been set to 50 ± 5 % of its rated current output [I.5.2 (b)]	--	--	12697	W
	The active power level 400 ms after the relative angle of phase-a has been shifted by 60 ± 3° and been restored [I.5.2 (e)]	I.5.2(b) -4%	I.5.2(b)+4 %	12648	W
	The active power level 400 ms after the relative angle of phase-b has been shifted by 60 ± 3° and been restored [I.5.2 (e)]	I.5.2(b) -4%	I.5.2(b)+4 %	12707	W
	The active power level 400 ms after the relative angle of phase-c has been shifted by 60 ± 3° and been restored [I.5.2 (e)]	I.5.2(b) -4%	I.5.2(b)+4 %	12702	W
	The active power level 400 ms after the voltage angles of all three phases have been shifted by 20 ± 3° and been restored [I.5.2 (i)]	I.5.2(b) -4%	I.5.2(b)+4 %	12697	W
Criteria for acceptance: When tested in accordance with Clause I.5.2, the device under test shall conform to the following: (a) The device under test shall remain connected for the duration of this test. (b) The active power output recorded at Step (m) shall be equal to that at Step (b)±4%.					

Diagram of single phase-a shift 60 ± 3°

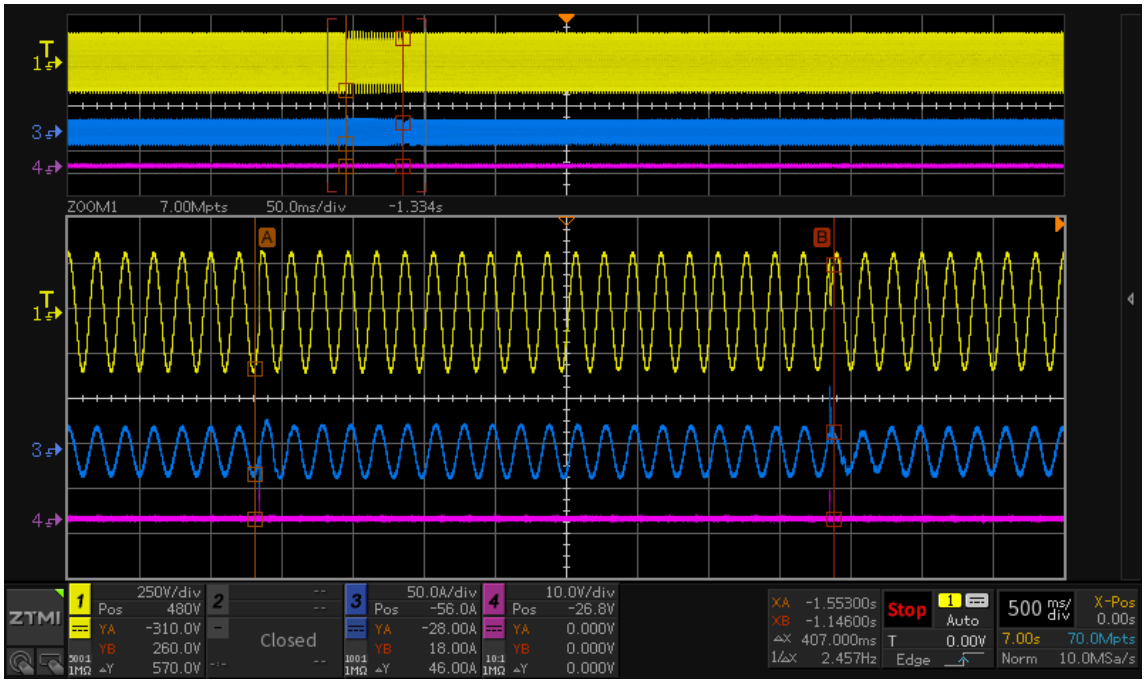


Diagram of single phase-b shift 60 ± 3°

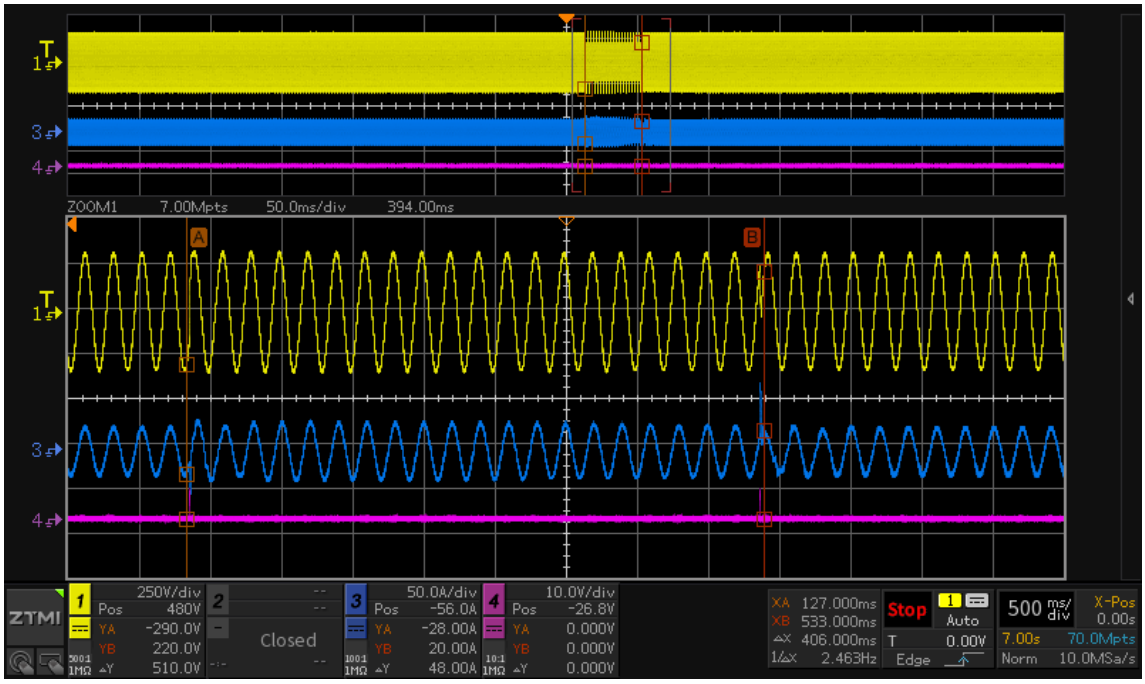


Diagram of single phase-c shift 60 ± 3°

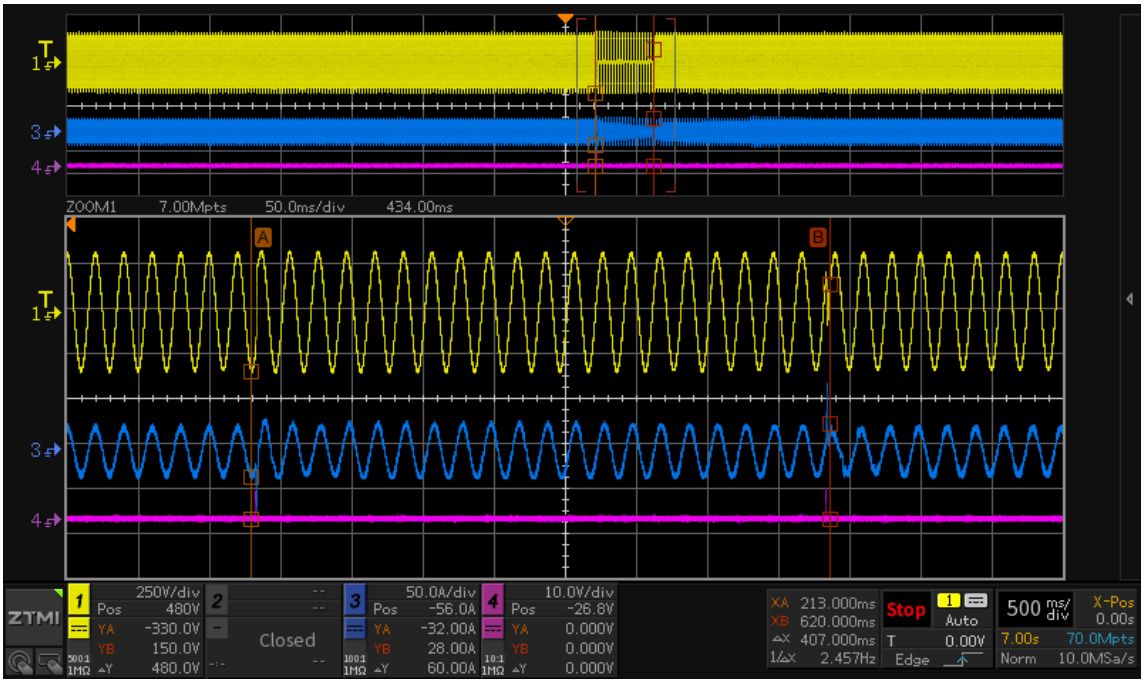
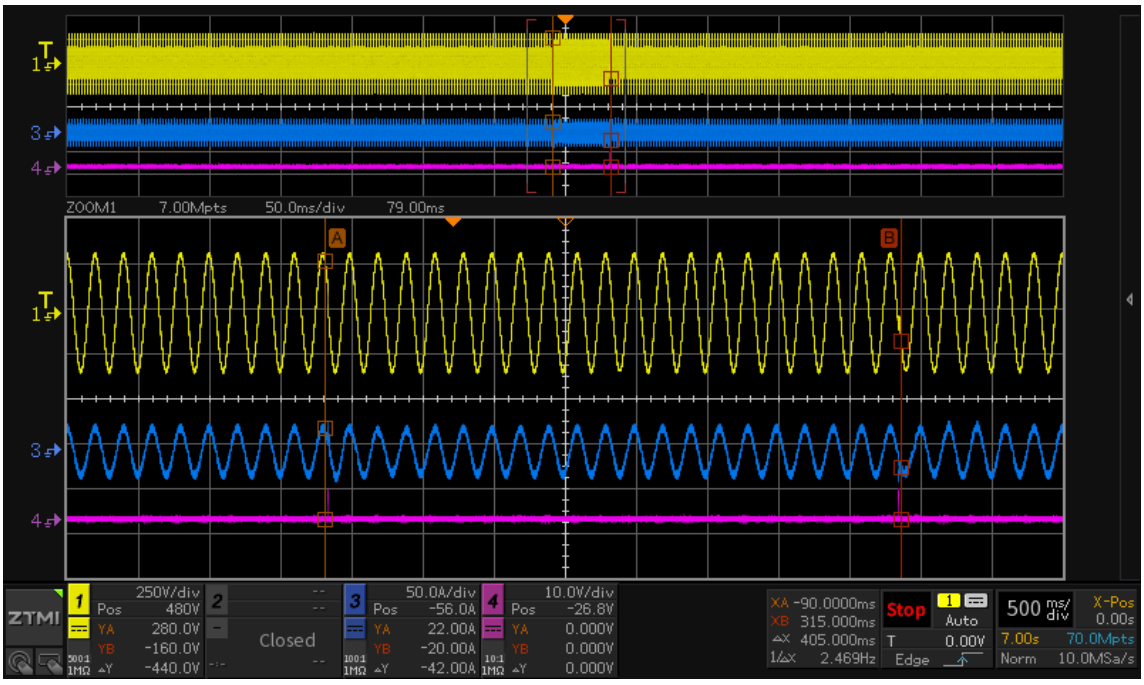


Diagram of three phase shift 20 ± 3°



Note:

6.2 Generation limit control **Appendix L.4.2.3 Multiple inverter generation limit control**					**P**
Clause L.4.4 Test report	Description	Minimum value	Maximum value	Test result	Units
Generation limit control with hard and soft limit set to 100%[L.4.2.3]	When the secondary a.c. source is set to 25 % and the energy source is varied until the a.c. output of the device under test is maximized, after 20 s the time taken for the active power output level to stabilize to less than or equal to the generation limit [L.4.2.3(e)]	--	15s	2.2	s
	When the secondary a.c. source is set to 25 % and the energy source is varied until the a.c. output of the device under test is maximized, after 20 s the power to the grid source [L.4.2.3(e)]	Active power	Units	Reactive power	Units
		25010	W	40	var
	When the secondary a.c. source is adjusted to 75 % rated apparent power output of the device under test, after 20s the time taken for the active power output level to stabilize to less than or equal to the generation limit [L.4.2.3(g)]	--	15s	12.2	s
	When the secondary a.c. source is adjusted to 75 % rated apparent power output of the device under test, after 20s the power to the grid source [L.4.2.3 (g)]	Active power	Units	Reactive power	Units
		25040	W	77	var
	When the secondary a.c. source is adjusted to 95 % rated apparent power output of the device under test, after 20 s the time taken for the active power output level to stabilize to less than or equal to the generation limit [L.4.2.3(i)]	--	15s	8.5	s
	When the secondary a.c. source is adjusted to 95 % rated apparent power output of the device under test, after 20s the power to the grid source [L.4.2.3(i)]	Active power	Units	Reactive power	Units
		25050	W	91	var
	When the active power output of secondary a.c. source is increased from 95% in steps≤2.5% of the rated apparent power of the device under test with a dwell time of 30 s, the power output to the grid source after the automatic disconnection device operates [L.4.2.2(k)]	Active power	Units	Reactive power	Units
		25055	W	71	var
		25057	W	98	var
	When the active power output of secondary a.c. source is increased from 95% in steps≤2.5% of the rated apparent power of the device under test with a	Record time for each	--	3.8	s

	dwell time of 30 s, the time taken for the active power output level to stabilize to less than or equal to the generation limit [L.4.2.2(k)]	step			
	When the active power output of secondary a.c. source is increased from 95% in steps≤2.5% of the rated apparent power of the device under test with a dwell time of 30 s, the time taken from the last dwell step and the device under test disconnecting from the grid source [L.4.2.2(l)] When the active power output of secondary a.c. source is increased from 95% in steps≤2.5% of the rated apparent power of the device under test with a dwell time of 30 s, the power output to the grid source after the automatic disconnection device operates [L.4.2.2(l)]	15s	20s	16.5	s
	When the active power output of secondary a.c. source is increased from 95% in steps≤2.5% of the rated apparent power of the device under test with a dwell time of 30 s, the time taken for the active power output level to stabilize to less than or equal to the generation limit [L.4.2.2(k)]	Active power	Units	Reactive power	Units
		25053	W	33	var
	When the secondary a.c. source active power is set to 25 % of the rated apparent output power of the device under test, the time taken for the device under test to reconnect to the grid source [L.4.2.3(n)]	60s	--	86.7	s
	When the secondary a.c. source active power is set to 25 % of the rated apparent output power of the device under test, the ramp rate obtained by measuring active power output at intervals ≤15s until active power output has stabilized at (100 ± 4) % of rated apparent power [L.4.2.3(o)]	Min. value	Max. value	Test resolution	
		According to Figure 3.3	According to Figure 3.3	16.11	%/min
	When the communication path is disconnected or disabled between the inverter and the external measurement device, the time taken for the device under test to disconnect from the grid source [L.4.2.3(p)]	--	5s	1.1	s
	When the communication path is reconnected or re-enabled between the inverter and the external measurement device, the time taken for the device under test to reconnect from the grid source [L.4.2.3(q)]	60s	--	81.6	s
Criteria for acceptance					

When tested in accordance with Clauses L.4.2.1 and L.4.2.2, the response to exported active power shall be in accordance with Clause 6.3. When tested in accordance with Clauses L.4.2.3, the response to generated apparent power shall be in accordance with Clause 6.2. In addition, the disconnection and reconnection associated with a loss of signal from the external measurement device shall be in accordance Clause 6.1.
Note:

Appendix L.4.2.3 (s) – Clause G.2.2 Volt-var and volt-watt response modes test (Australia A Setting)	**P**

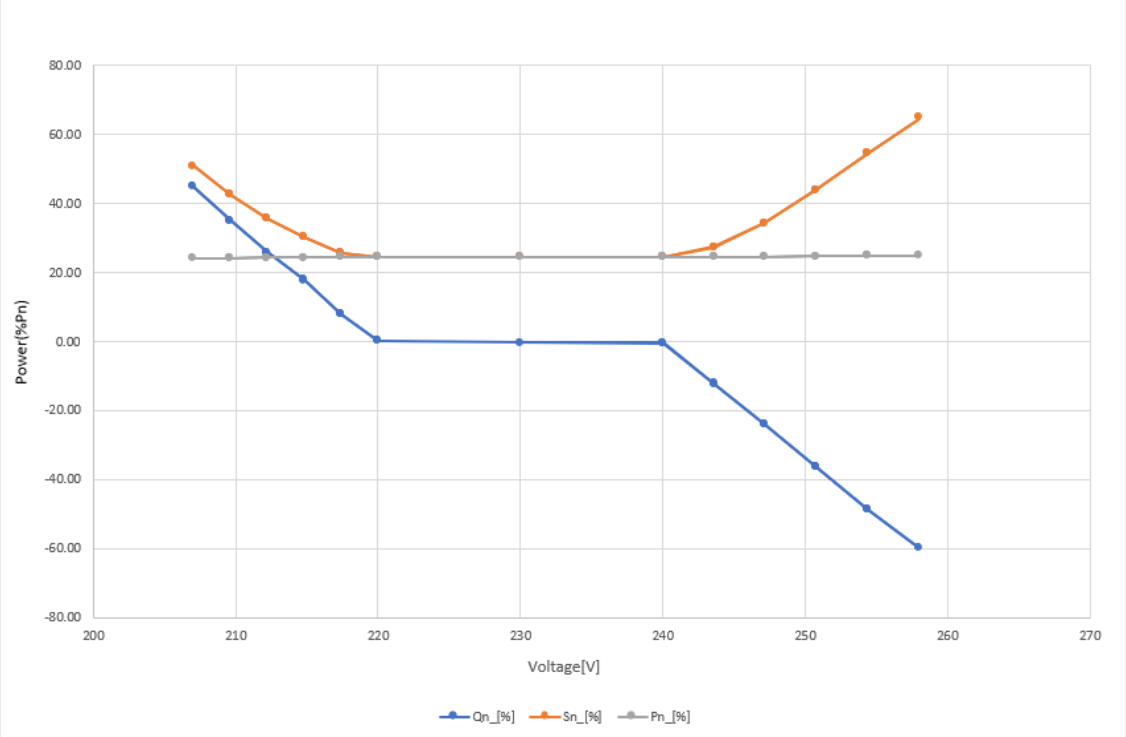
Test: IVGM25KHP3G3 (Secondary AC source set to 75%)

Voltage (V)	Time for output to stabilize (s)	Stable reactive power output $\%S_{rated}$ (%)	Typical reactive power level $\%S_{rated}$ (%)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
240.0	--	-0.36	0	24.49	25
243.6	8.2	-12.01	-12	24.56	25
247.2	8.4	-24.01	-24	24.63	25
250.8	8.0	-36.33	-36	24.70	25
254.4	8.3	-48.70	-48	24.87	25
258.0	9.0	-59.68	-60	24.94	25
254.4	8.7	-48.71	-48	24.87	25
250.8	8.8	-36.35	-36	24.69	25
247.2	8.7	-24.05	-24	24.63	25
243.6	9.0	-12.08	-12	24.56	25
240.0	8.5	-0.46	0	24.49	25
220.0	--	0.34	0	24.48	25
217.4	8.4	8.09	9	24.43	25
214.8	8.5	17.78	18	24.38	25
212.2	8.7	25.89	26	24.33	25
209.6	8.2	35.15	35	24.20	25
207.0	8.5	44.95	44	24.13	25
209.6	8.3	35.17	35	24.20	25
212.2	8.5	25.87	26	24.33	25
214.8	8.9	17.73	18	24.38	25
217.4	8.5	8.09	9	24.43	25
220.0	8.4	0.34	0	24.48	25
259.0	8.2	-59.80	-60	24.94	25

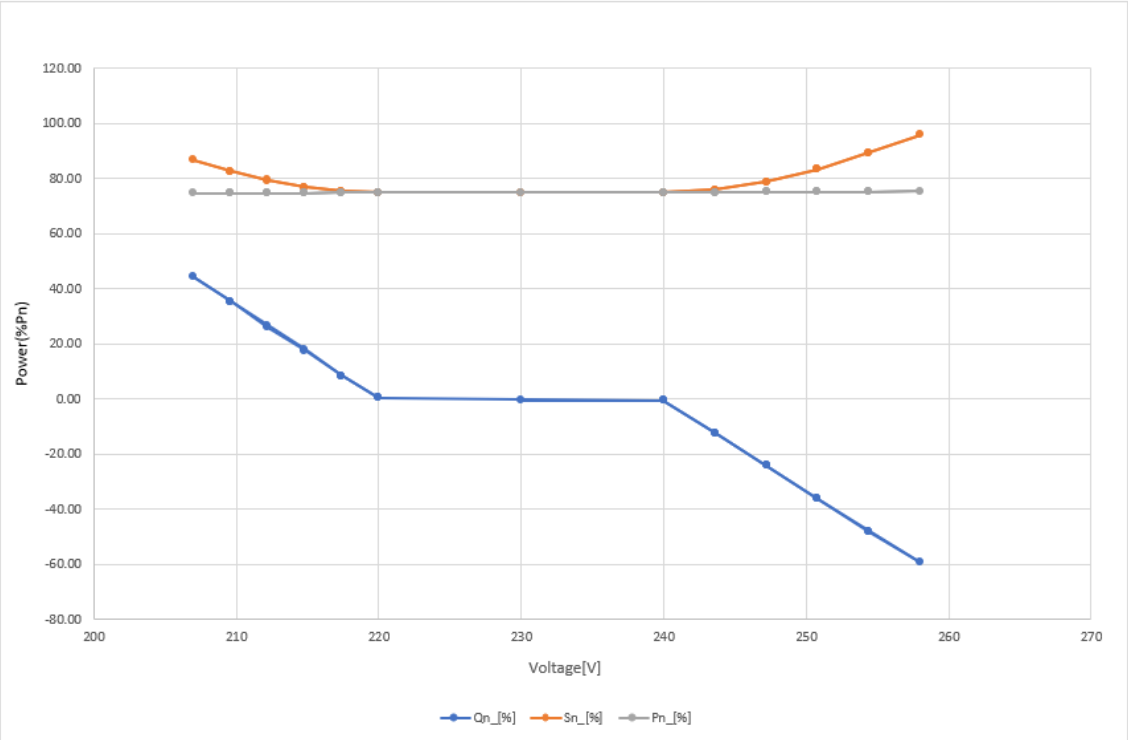
Test: IVGM25KHP3G3 (Secondary ac source set to 25%)

Voltage (V)	Time for output to stabilize (s)	Stable reactive power output $\%S_{rated}$ (%)	Typical reactive power level $\%S_{rated}$ (%)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
240.0	--	-0.42	0	74.92	75
243.6	8.6	-12.16	-12	75.01	75
247.2	8.5	-24.10	-24	75.09	75
250.8	8.4	-36.19	-36	75.18	75

254.4	8.5	-48.06	-48	75.27	75
258.0	8.4	-59.18	-60	75.36	75
254.4	8.7	-48.05	-48	75.27	75
250.8	8.6	-36.19	-36	75.18	75
247.2	8.9	-24.10	-24	75.09	75
243.6	9.1	-12.16	-12	75.01	75
240.0	8.5	-0.42	0	74.92	75
220.0	--	0.48	0	74.94	75
217.4	8.4	8.55	9	74.88	75
214.8	8.3	17.72	18	74.82	75
212.2	8.5	26.12	26	74.77	75
209.6	8.5	35.35	35	74.73	75
207.0	8.2	44.31	44	74.71	75
209.6	8.3	35.44	35	74.73	75
212.2	8.8	26.80	26	74.77	75
214.8	9.0	18.13	18	74.82	75
217.4	8.7	8.38	9	74.88	75
220.0	8.6	0.48	0	74.93	75
259.0	8.2	-59.93	-60	75.39	75



Expected active power output 25%



Expected active power output 75%

Note:
* The active power is limited due to the current limitation.

Appendix L.4.2.3 (s)– Clause G.2.2 Volt-var and volt-watt response modes test (New Zealand Setting)	**P**

Test: IVGM25KHP3G3 (Secondary AC source set to 75%)

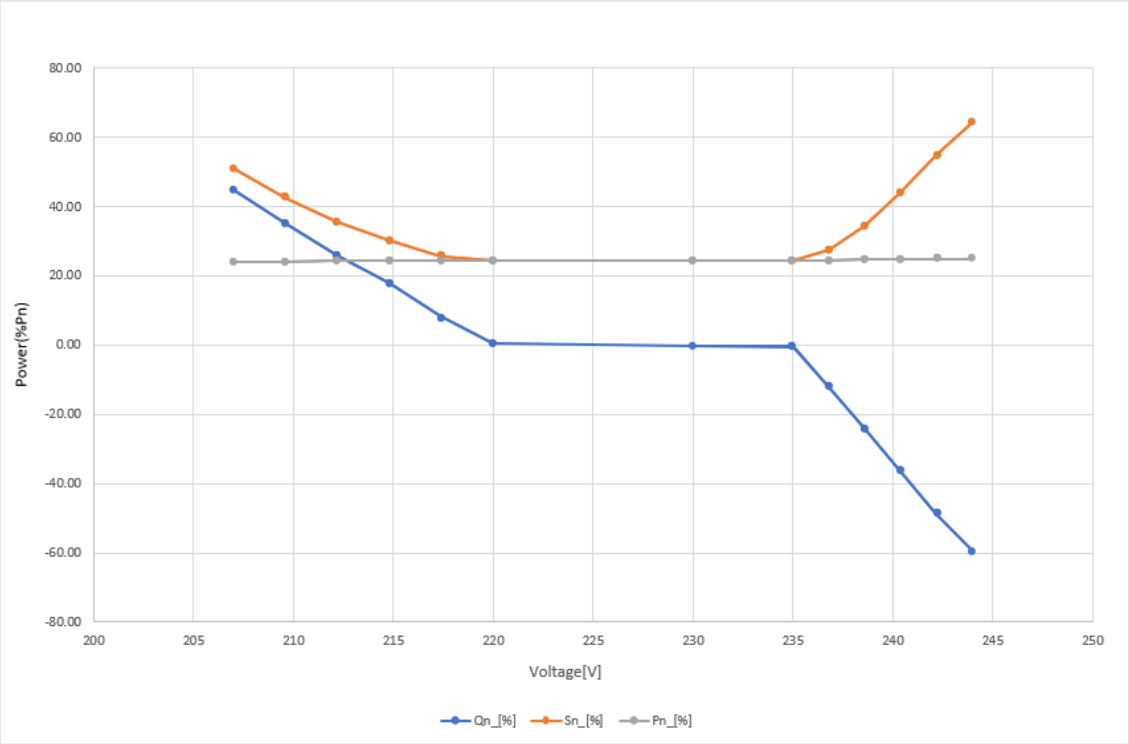
Voltage (V)	Time for output to stabilize (s)	Stable reactive power output $\%S_{rated}$ (%)	Typical reactive power level $\%S_{rated}$ (%)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
235	8.4	-0.36	0	24.49	25
236.8	8.5	-12.01	-12	24.56	25
238.6	8.3	-24.01	-24	24.63	25
240.4	8.0	-36.33	-36	24.70	25
242.2	8.2	-48.70	-48	24.87	25
244	8.3	-59.68	-60	24.94	25
242.2	8.4	-48.71	-48	24.87	25
240.4	8.4	-36.35	-36	24.69	25
238.6	8.3	-24.05	-24	24.63	25
236.8	8.2	-12.08	-12	24.56	25
235	8.4	-0.46	0	24.49	25
220.0	--	0.34	0	24.48	25
217.4	8.2	8.09	9	24.43	25
214.8	8.4	17.78	18	24.38	25
212.2	8.5	25.89	26	24.33	25
209.6	8.3	35.15	35	24.20	25
207.0	8.4	44.95	44	24.13	25
209.6	8.3	35.17	35	24.20	25
212.2	8.2	25.87	26	24.33	25
214.8	8.5	17.73	18	24.38	25
217.4	8.2	8.09	9	24.43	25
220.0	8.1	0.34	0	24.48	25
249.0	8.1	-59.80	-60	24.94	25

Test: IVGM25KHP3G3 (Secondary AC source set to 25%)

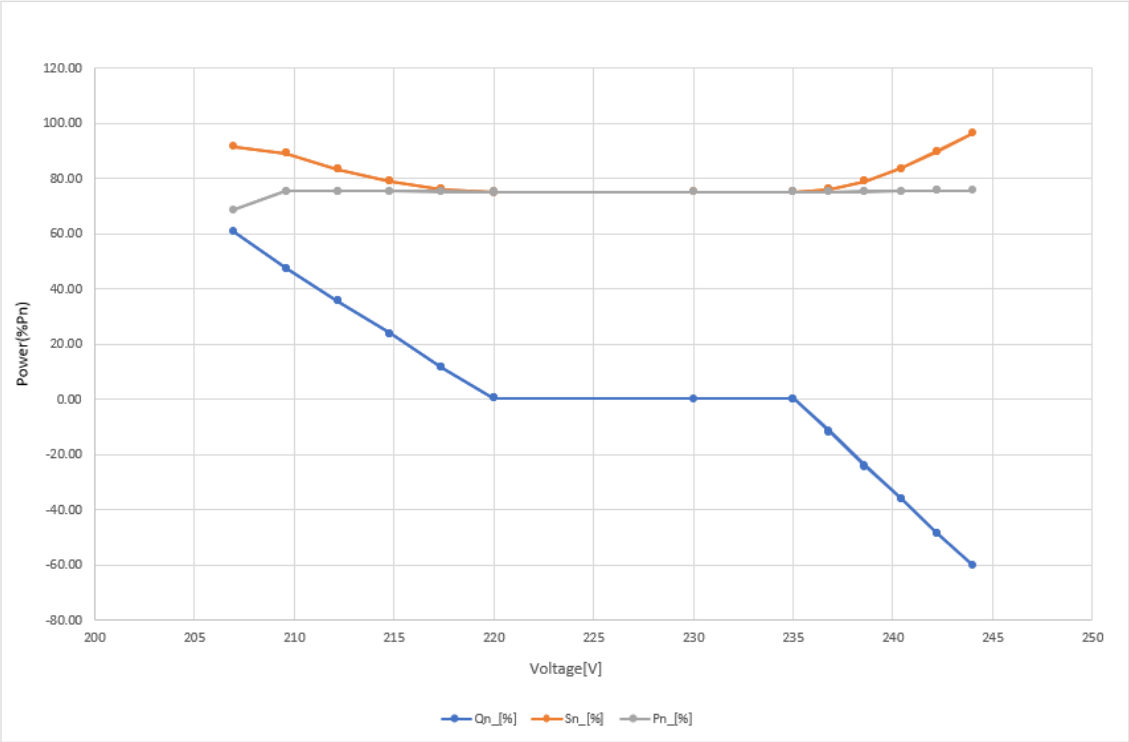
Voltage (V)	Time for output to stabilize (s)	Stable reactive power output $\%S_{rated}$ (%)	Typical reactive power level $\%S_{rated}$ (%)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
235	8.2	0.35	0	75.12	75
236.8	8.3	-11.90	-12	75.18	75
238.6	7.9	-24.36	-24	75.27	75
240.4	8.0	-35.76	-36	75.47	75

242.2	8.1	-48.45	-48	75.56	75
244	8.4	-59.95	-60	75.63	75
242.2	8.5	-48.48	-48	75.56	75
240.4	8.4	-35.79	-36	75.47	75
238.6	8.2	-23.85	-24	75.38	75
236.8	8.1	-11.34	-12	75.31	75
235	8.1	0.34	0	75.27	75
220.0	--	0.48	0	75.28	75
217.4	8.2	11.62	12	75.30	75
214.8	7.9	23.90	24	75.32	75
212.2	8.2	35.68	36	75.38	75
209.6	8.3	47.44	48	75.45	75
207.0	8.2	60.68	60	68.69 *	75
209.6	8.4	47.41	48	75.44	75
212.2	8.2	35.65	36	75.38	75
214.8	8.3	23.87	24	75.33	75
217.4	8.2	11.60	12	75.31	75
220.0	8.1	0.48	0	75.00	75
249.0	8.2	-60.98	-60	75.50	75

Note:
* The active power is limited due to the current limitation.



Expected active power output 25%



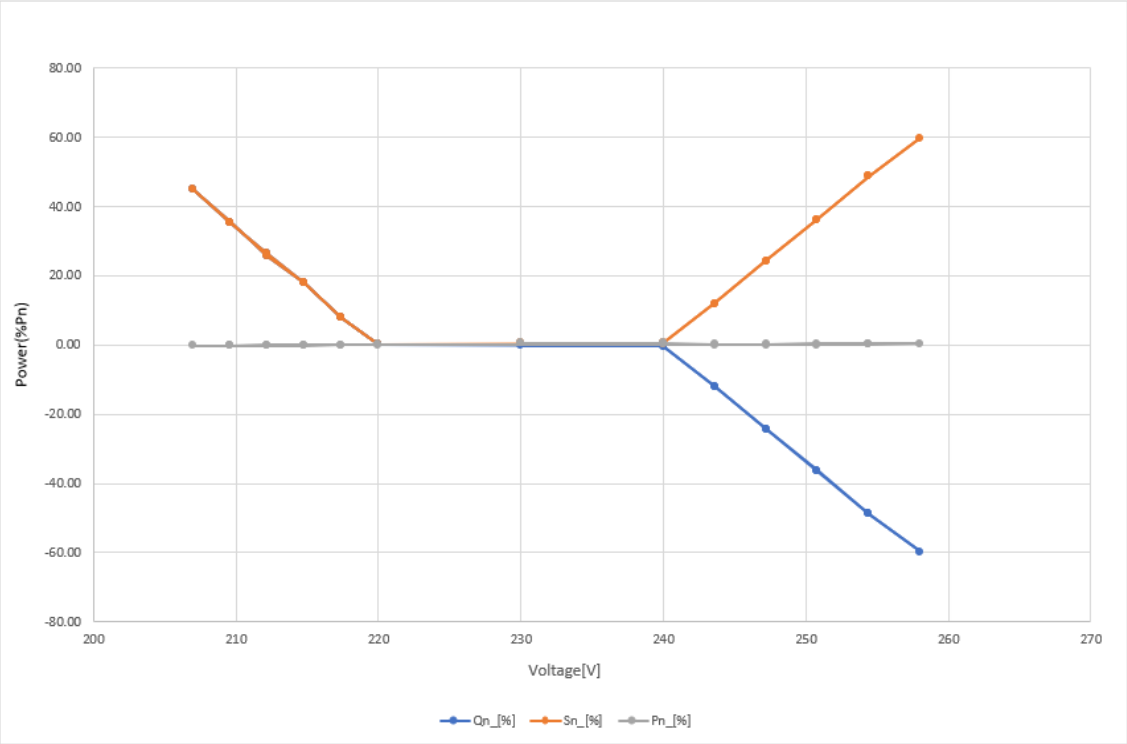
Expected active power output 75%

6.2 Generation limit control **Appendix L.4.2.4 Single inverter generation limit control**					**P**
Clause L.4.2.4 test report	Description	Minimum value	Maximum value	Test result	Units
Generation limit control with hard and soft limits set to 100 % [L.4.2.4]	When the energy source is varied until the a.c. output of the device under test equals (100 ± 5) % of its rated apparent power output, after 20 s the time taken for the active power output level to stabilize to less than or equal to the generation limit [L.4.2.4(d)]	--	15s	3.2	s
	When the energy source is varied until the a.c. output of the device under test equals (100 ± 5) % of its rated apparent power output, after 20 s the power to the grid source [L.4.2.4(d)]	Active power	Units	Reactive power	Units
		25127	W	141	var
	When the generation limit is adjusted to 75 % rated apparent power output of the device under test, after 20 s the time taken for the active power output level to stabilize to less than or equal to the generation limit [L.4.2.4(f)]	--	15s	2.6	s
	When the generation limit is adjusted to 75 % rated apparent power output of the device under test, after 20 s the power to the grid source [L.4.2.4 (f)]	Active power	Units	Reactive power	Units
		18695	W	152	var
	When the generation limit is adjusted to the minimum manufacturer declared capability of the device under test, after 20 s the time taken for the active power output level to stabilize to less than or equal to the generation limit [L.4.2.4(h)]	--	15s	7.3	s
	When the generation limit is adjusted to the minimum manufacturer declared capability of the device under test, after 20 s the power to the grid source [L.4.2.4(h)]	Active power	Units	Reactive power	Units
		80	W	41	var

Appendix L.4.2.4 (j) – Clause G.2.2 Volt-var and volt-watt response modes test (Australia A Setting)	**P**

Test: IVGM25KHP3G3 (Generation limit set to minimum capability)

Voltage (V)	Time for output to stabilize (s)	Stable reactive power output $\%S_{rated}$ (%)	Typical reactive power level $\%S_{rated}$ (%)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
240.0	--	-0.27	0	0.54	0
243.6	8.6	-11.97	-12	-0.08	0
247.2	8.6	-24.31	-24	0.01	0
250.8	8.8	-36.33	-36	0.08	0
254.4	8.7	-48.71	-48	0.15	0
258.0	8.5	-59.81	-60	0.35	0
254.4	8.6	-48.69	-48	0.33	0
250.8	8.0	-36.30	-36	0.31	0
247.2	8.1	-24.32	-24	0.27	0
243.6	8.6	-12.01	-12	0.24	0
240.0	8.5	-0.32	0	0.13	0
220.0	--	0.24	0	0.12	0
217.4	8.4	7.94	9	0.06	0
214.8	8.6	17.96	18	-0.03	0
212.2	8.7	26.45	26	-0.06	0
209.6	8.6	35.34	35	-0.09	0
207.0	8.2	44.85	44	-0.22	0
209.6	8.0	35.38	35	-0.20	0
212.2	8.3	25.72	26	-0.17	0
214.8	8.4	17.98	18	-0.15	0
217.4	8.0	7.93	9	-0.05	0
220.0	8.3	0.24	0	-0.05	0
259.0	8.6	-59.83	-60	0.35	0

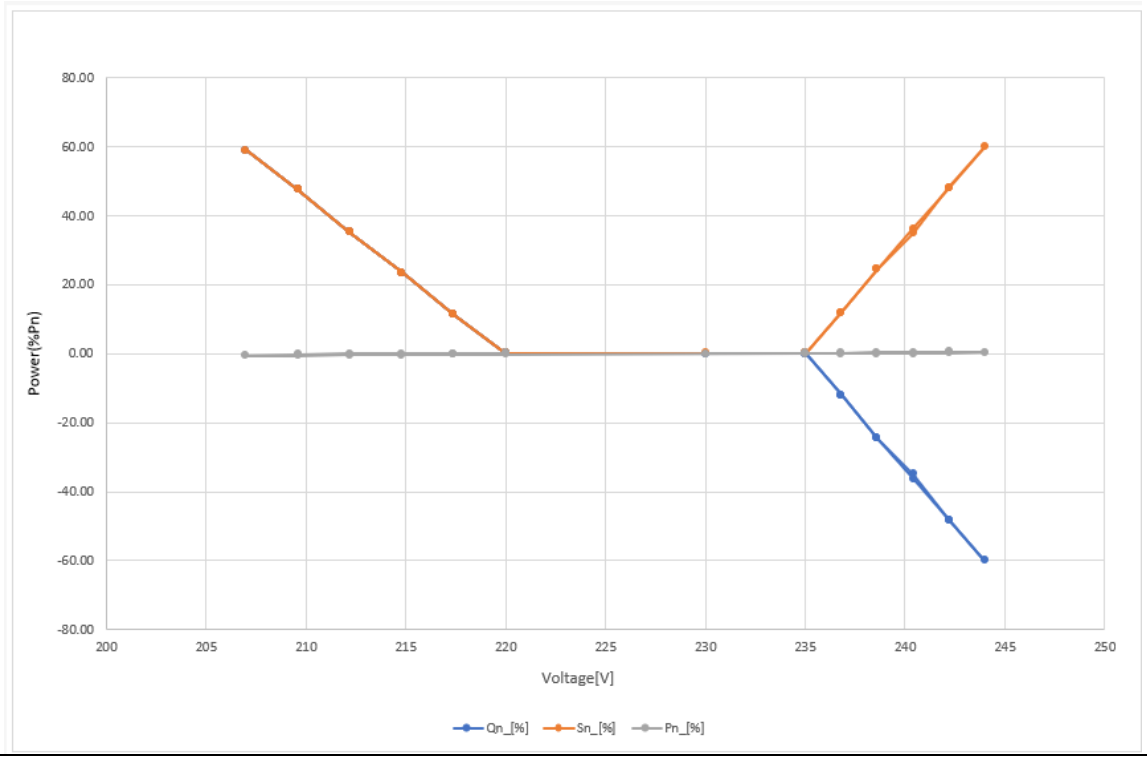


Note: The minimum power generation limit declared by the manufacturer is zero power.

Appendix L.4.2.4 (j) – Clause G.2.2 Volt-var and volt-watt response modes test (New Zealand Setting)	**P**

Test: IVGM25KHP3G3 (Generation limit set to minimum capability)

Voltage (V)	Time for output to stabilize (s)	Stable reactive power output $\%S_{rated}$ (%)	Typical reactive power level $\%S_{rated}$ (%)	Stable active power output $\%S_{rated}$ (%)	Expected active power output $\%S_{rated}$ (%)
235	8.2	0.10	0	0.10	0
236.8	8.5	-11.92	-12	-0.08	0
238.6	8.4	-24.42	-24	0.01	0
240.4	8.3	-36.24	-36	0.08	0
242.2	8.2	-48.10	-48	0.26	0
244	8.0	-60.00	-60	0.35	0
242.2	7.9	-48.14	-48	0.52	0
240.4	8.1	-34.96	-36	0.35	0
238.6	8.2	-24.47	-24	0.31	0
236.8	8.6	-11.92	-12	0.25	0
235	8.5	0.10	0	0.13	0
220.0	--	0.23	0	-0.11	0
217.4	8.8	11.36	12	-0.24	0
214.8	8.5	23.56	24	-0.31	0
212.2	8.2	35.28	36	-0.34	0
209.6	8.6	47.53	48	-0.49	0
207.0	8.6	59.08	60	-0.56	0
209.6	8.2	47.56	48	-0.23	0
212.2	8.0	35.24	36	-0.05	0
214.8	8.4	23.53	24	0.00	0
217.4	8.2	11.34	12	0.07	0
220.0	8.3	0.24	0	0.14	0
249.0	8.1	-60.78	-60	0.35	0



Note: The minimum power generation limit declared by the manufacturer is zero power.

6.3 Export limit control **Appendix L.4.2.1 Soft export limit control**					**P**
Clause L.4.4 Test report	Description	Min. value	Max. value	Test resolution	Units
Soft export limit control with limit set to 25% [L.4.2.1]	The stabilized active power output to the grid source with the soft export limit set to 25 % after Steps [L.4.2.1(a) to (e)]	--	--	35	W
	The stabilized reactive power output to the grid source [L.4.2.1(f)]	--	--	-4855	Var
	When the test load resistive element has been reduced to 50 % of the rated apparent power of the device under test, the time taken for the active power to stabilize [L.4.2.1(h)]	--	15s	5.0	s
	When the test load resistive element has been reduced to 50 % of the rated apparent power of the device under test, after 20 s the stable active power output to the grid source [L.4.2.1(h)]	--	--	6285	W
	When the test load resistive element has been reduced to 50 % of the rated apparent power of the device under test, after 20 s the stable reactive power output to the grid source [L.4.2.1(h)]	--	--	-4902	Var
	When the test load resistive element has been disconnected so the test load is solely inductive, the time taken for the active power to stabilize [L.4.2.1(j)]	--	15s	6.4	s
	When the test load resistive element has been disconnected so the test load is solely inductive, after 20 s the stable active power output to the grid source [L.4.2.1(j)]	--	--	6283	W
	When the test load resistive element has been disconnected so the test load is solely inductive, after 20 s the stable reactive power output to the grid source [L.4.2.1(j)]	--	--	-4951	Var
	When the test load is connected to a resistive load equal to the apparent rated power output of the device under test, the time taken for the active power to stabilize [L.4.2.1(l)]	--	15s	8.4	s
	When the test load is connected to a	--	--	-107	W

	resistive load equal to the apparent rated power output of the device under test, after 20 s the stable active power output to the grid source [L.4.2.1(l)]				
	When the test load is connected to a resistive load equal to the apparent rated power output of the device under test, after 20 s the stable reactive power output to the grid source [L.4.2.1(l)]	--	--	-4855	Var
	When the communication path is disconnected or disabled between the inverter and the external measurement device, the time taken for the active power to stabilize [L.4.2.1(n)]	--	15s	6.0	s
	When the communication path is disconnected or disabled between the inverter and the external measurement device, after 20 s the stable active power output to the grid source [L.4.2.1(n)]	--	--	-18710	W
	When the communication path is disconnected or disabled between the inverter and the external measurement device, after 20 s the stable reactive power output to the grid source [L.4.2.1(n)]	--	--	-4867	Var
	When the communication path is reconnected or re-enabled between the inverter and the external measurement device, the ramp rate obtained by measuring active power output at intervals≤15s unit active power output has stabilized at (100 ± 4) % of rated apparent power [L.4.2.1(p)]	According to Figure 3.4	According to Figure 3.4	15.88	%/min
Soft export limit control with limit set to 0% [L.4.2.1]	The stabilized active power output to the grid source with the soft export limit set to 0 % after Steps [L.4.2.1(q), (b) to (e)]	--	--	74	W
	The stabilized reactive power output to the grid source [L.4.2.1(f)]	--	--	-4880	Var
	When the test load resistive element has been reduced to 50 % of the rated apparent power of the device under test, the time taken for the active power to stabilize [L.4.2.1(h)]	--	15s	8.5	s
	When the test load resistive element has been reduced to 50 % of the rated apparent	--	--	80	W

	power of the device under test, after 20 s the stable active power output to the grid source [L.4.2.1(h)]				
	When the test load resistive element has been reduced to 50 % of the rated apparent power of the device under test, after 20 s the stable reactive power output to the grid source [L.4.2.1(h)]	--	--	-4927	Var
	When the test load resistive element has been disconnected so the test load is solely inductive, the time taken for the active power to stabilize [L.4.2.1(j)]	--	15s	8.24	s
	When the test load resistive element has been disconnected so the test load is solely inductive, after 20 s the stable active power output to the grid source [L.4.2.1(j)]	--	--	83	W
	When the test load resistive element has been disconnected so the test load is solely inductive, after 20 s the stable reactive power output to the grid source [L.4.2.1(j)]	--	--	-4920	Var
	When the test load is connected to a resistive load equal to the apparent rated power output of the device under test, the time taken for the active power to stabilize [L.4.2.1(l)]	--	15s	9.6	s
	When the test load is connected to a resistive load equal to the apparent rated power output of the device under test, after 20 s the stable active power output to the grid source [L.4.2.1(l)]	--	--	-90	W
	When the test load is connected to a resistive load equal to the apparent rated power output of the device under test, after 20 s the stable reactive power output to the grid source [L.4.2.1(l)]	--	--	-4820	Var
Criteria for acceptance When tested in accordance with Clauses L.4.2.1 and L.4.2.2, the response to exported active power shall be in accordance with Clause 6.3. When tested in accordance with Clauses L.4.2.3, the response to generated apparent power shall be in accordance with Clause 6.2. In addition, the disconnection and reconnection associated with a loss of signal from the external measurement device shall be in accordance Clause 6.1.					

6.3 Export limit control **Appendix L.4.2.2 Hard export limit control**	**P**

Clause L.4.4 Test report	Description	Min. value	Max. value	Test resolution	Units
Hard export limit control with limit set to 50% [L.4.2.2]	When the energy source is varied until the a.c. output of the device under test equals (100 ± 5) % of its rated apparent power output, the active power to the grid source [L.4.2.2(d)]	--	0±5% of S_{rated}	82	W
	When a capacitive element equal to 20 % of the rating of the device under test is added to the load, after 20 s the stable active power output to the grid source [L.4.2.2(f)]	--	--	80	W
	When a capacitive element equal to 20 % of the rating of the device under test is added to the load, after 20 s the stable reactive power output to the grid source [L.4.2.2(f)]	--	--	4992	Var
	When the test load resistive element has been reduced to 55 % of the rated apparent power of the device under test, after 20 s the stable active power output to the grid source [L.4.2.2(h)]	--	--	11318	W
	When the test load resistive element has been reduced to 55 % of the rated apparent power of the device under test, after 20 s the stable reactive power output to the grid source [L.4.2.2(h)]	--	--	4996	Var
	When the test load resistive element is reduced in steps ≤2.5% of the rated apparend power of the device under apparent power of the device under test with a dwell time of 20 s, the time taken from the last dwell step and the device under test disconnecting from the grid source [L.4.2.2(j)]	--	5s	2.2	s
	When the test load resistive element is reduced in steps ≤2.5% of the rated apparent power of the device under test with a dwell time of 20 s, the active power output to the grid source after the automatic disconnection device operates	--	--	-11820	W

	[L.4.2.2(j)]				
	When the test load resistive element is reduced in steps ≤2.5% of the rated apparent power of the device under test with a dwell time of 20 s, the reactive power output to the grid source after the automatic disconnection device operates [L.4.2.2(j)]	--	--	4992	Var
	When the test load resistive element is increased to 100 % of the rated apparent power of the device under test, the time taken for the device under test to reconnect the grid source [L.4.2.2(l)]	60s	--	64.7	s
	When the test load resistive element is increased to 100 % of the rated apparent power of the device under test, the ramp rate obtained by measuring active power output at intervals ≤15s until active power output has stabilized at (100 ± 4) % of rated apparent power [L.4.2.1(p)]	According to Figure 3.4	According to Figure 3.4	16.11	%/min
	When the communication path is disconnected or disabled between the inverter and the external measurement device, the time taken for the device under test to disconnect from the grid source [L.4.2.2(n)]	--	5s	3.5	s
	When the communication path is reconnected or re-enabled between the inverter and the external measurement device, the time taken for the device under test to reconnect from the grid source [L.4.2.2(o)]	--	60s	82.1	s
Hard export limit control with limit set to 5% [L.4.2.2(p)]	After adjusting the hard export limit to 5 %, the test load resistive element is reduced in steps ≤2.5% of the rated apparent power of the device under test with a dwell time of 20 s, the time taken from the last dwell step and the device under test disconnecting from the grid source [L.4.2.2(p)]	--	5s	2.4	s
	After adjusting the hard export limit to 5 %, the test load resistive element is reduced in steps ≤2.5% of the rated apparent power of the device under test with a dwell time of 20 s, the active power output to the grid source after the automatic disconnection	--	--	-24844	W

	device operates [L.4.2.2(p)]				
	After adjusting the hard export limit to 5 %, the test load resistive element is reduced in steps ≤2.5% of the rated apparent power of the device under test with a dwell time of 20 s, the reactive power output to the grid source after the automatic disconnection device operates [L.4.2.2(p)]	--	--	4915	Var
Criteria for acceptance When tested in accordance with Clauses L.4.2.1 and L.4.2.2, the response to exported active power shall be in accordance with Clause 6.3. When tested in accordance with Clauses L.4.2.3, the response to generated apparent power shall be in accordance with Clause 6.2. In addition, the disconnection and reconnection associated with a loss of signal from the external measurement device shall be in accordance Clause 6.1.					
Note:					

External view

External view

External view



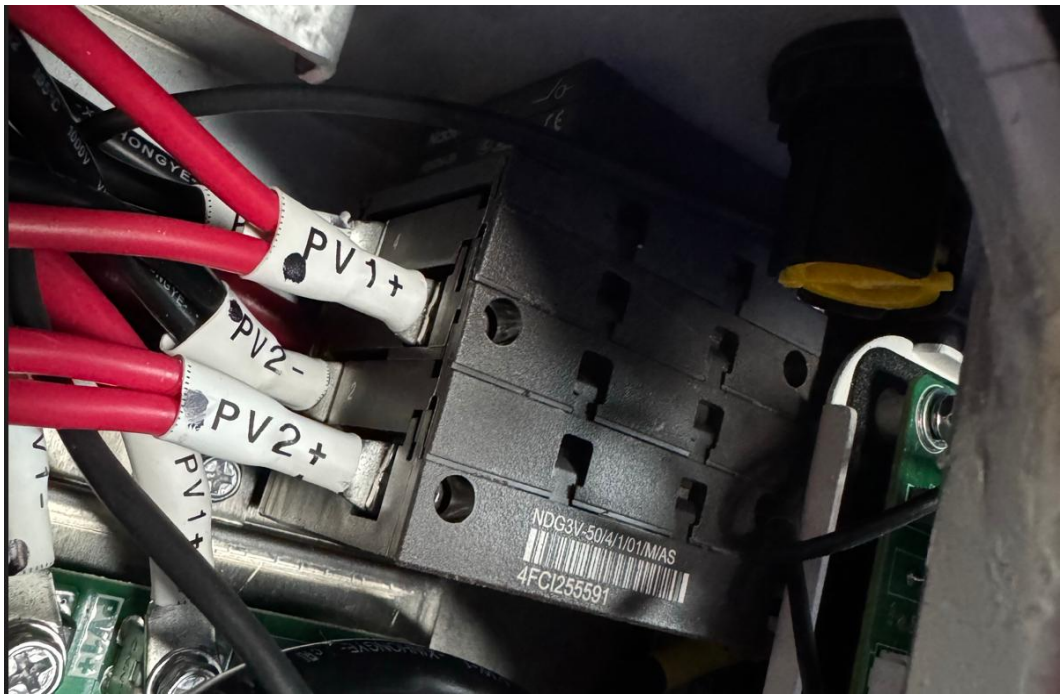
External view



External view

External view


Inside view

PV switch


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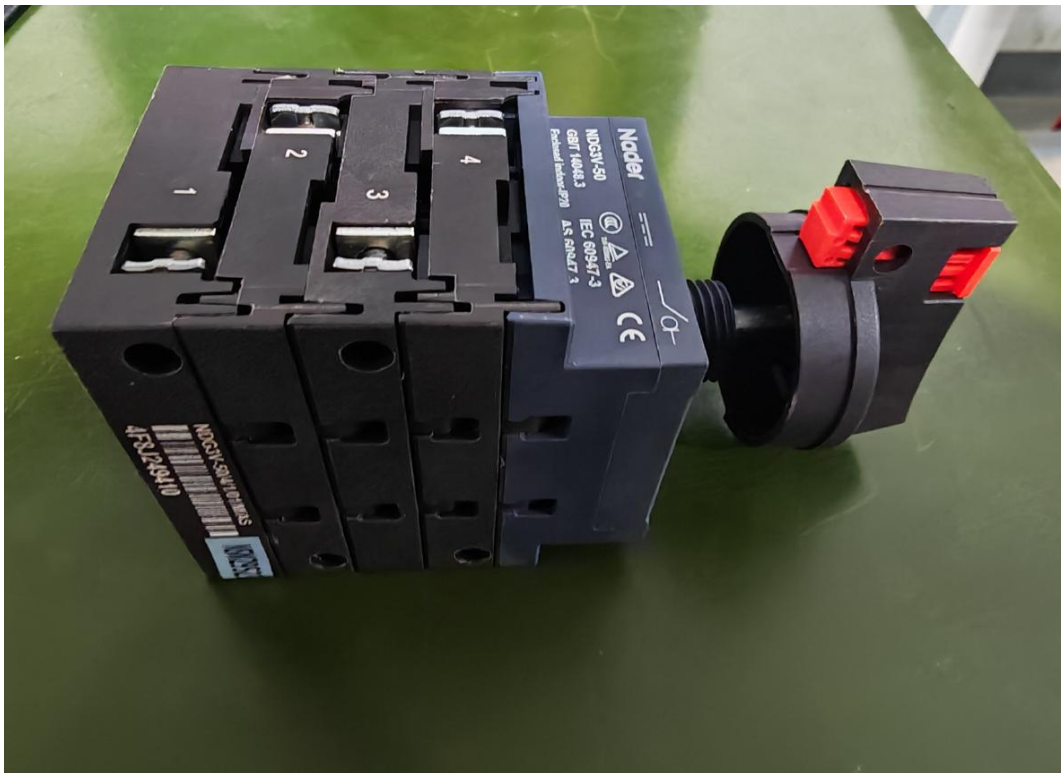
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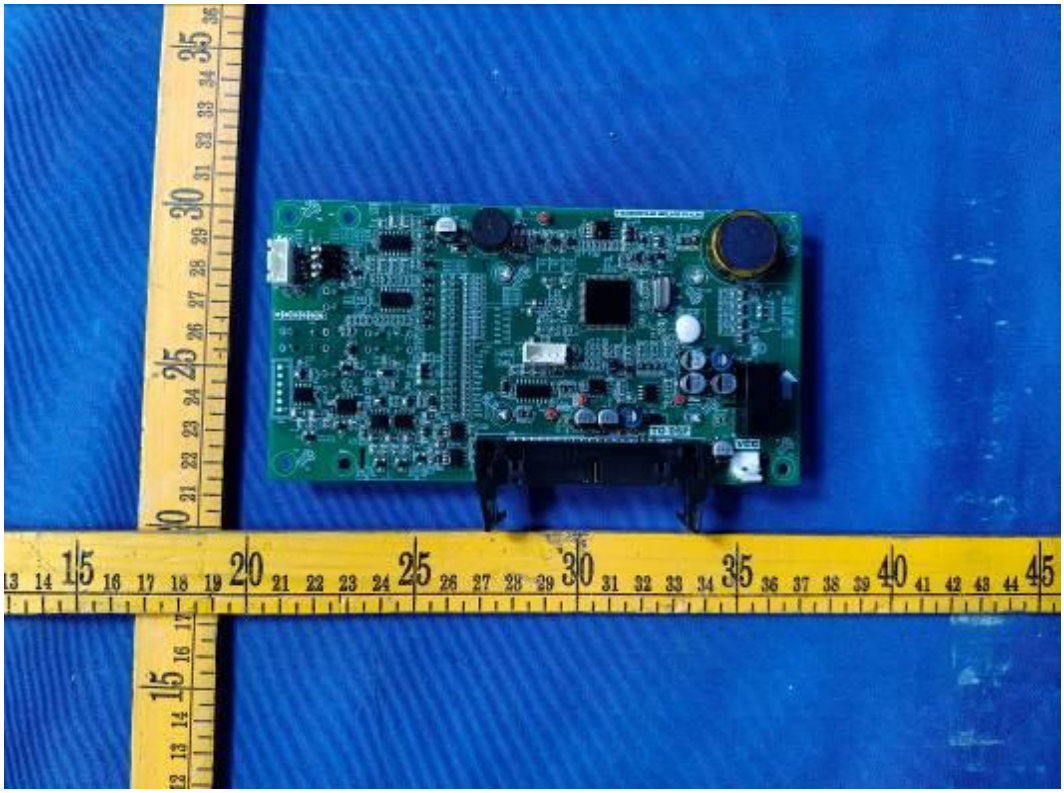

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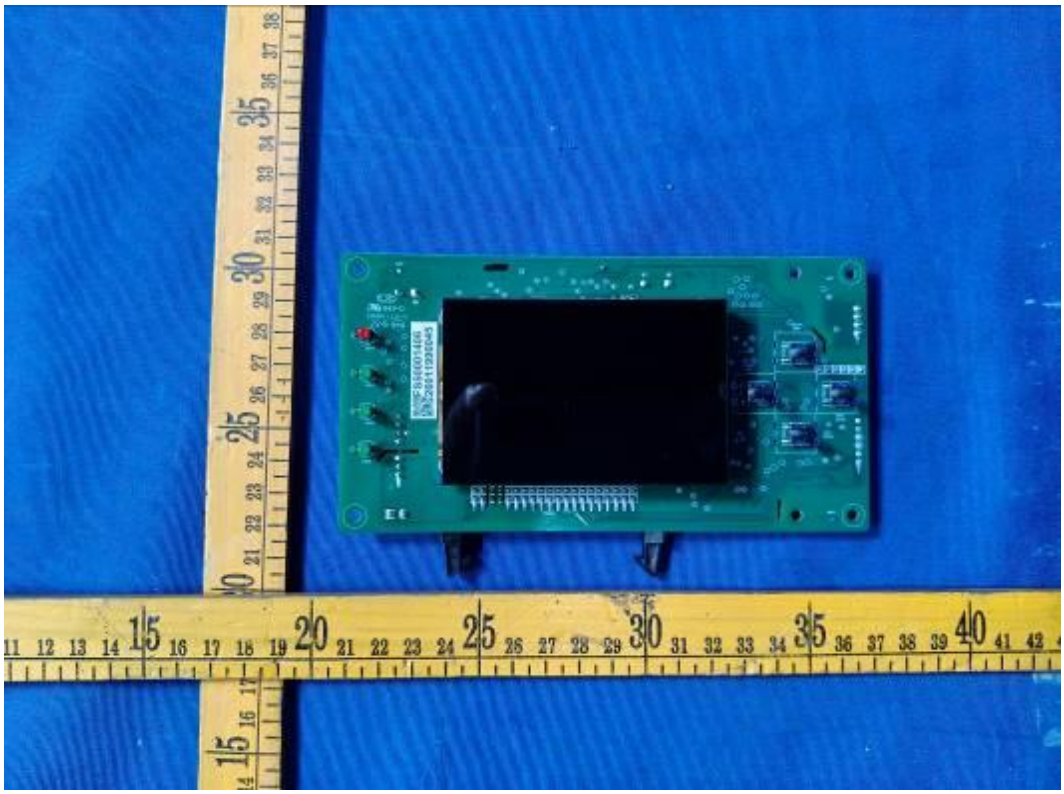
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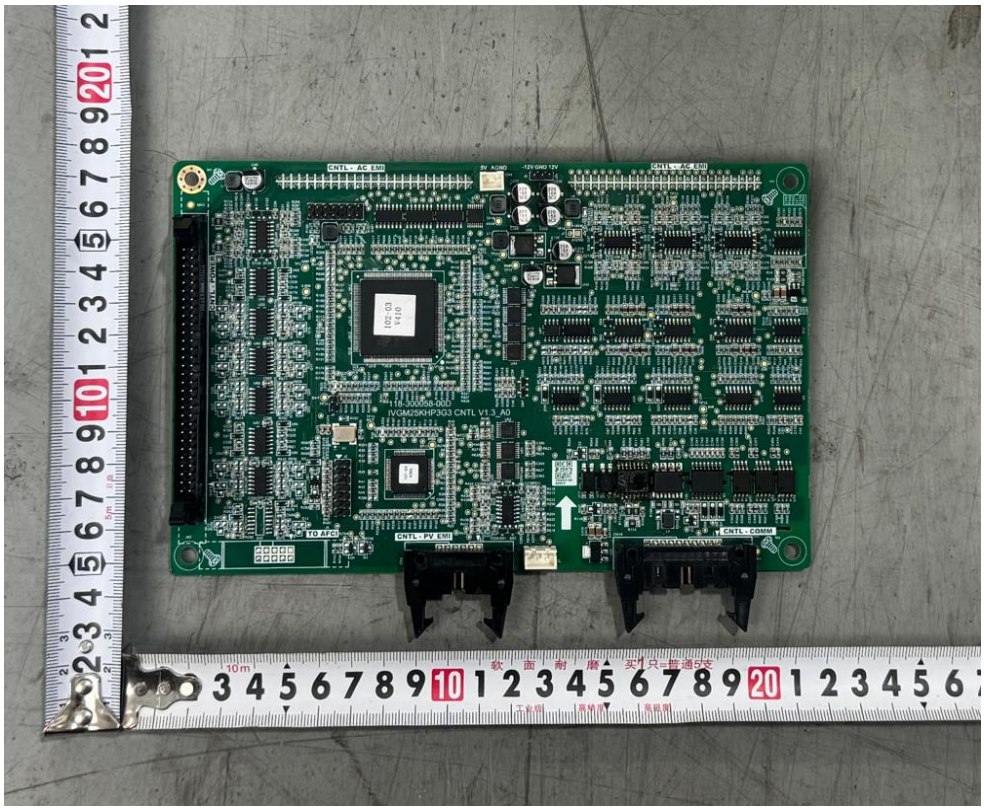

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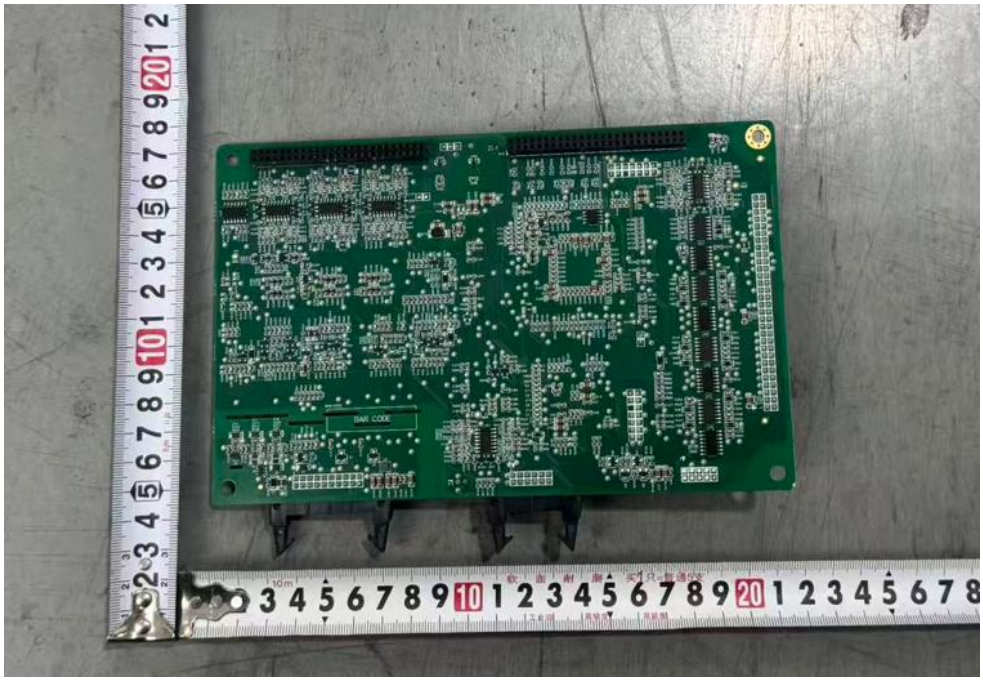
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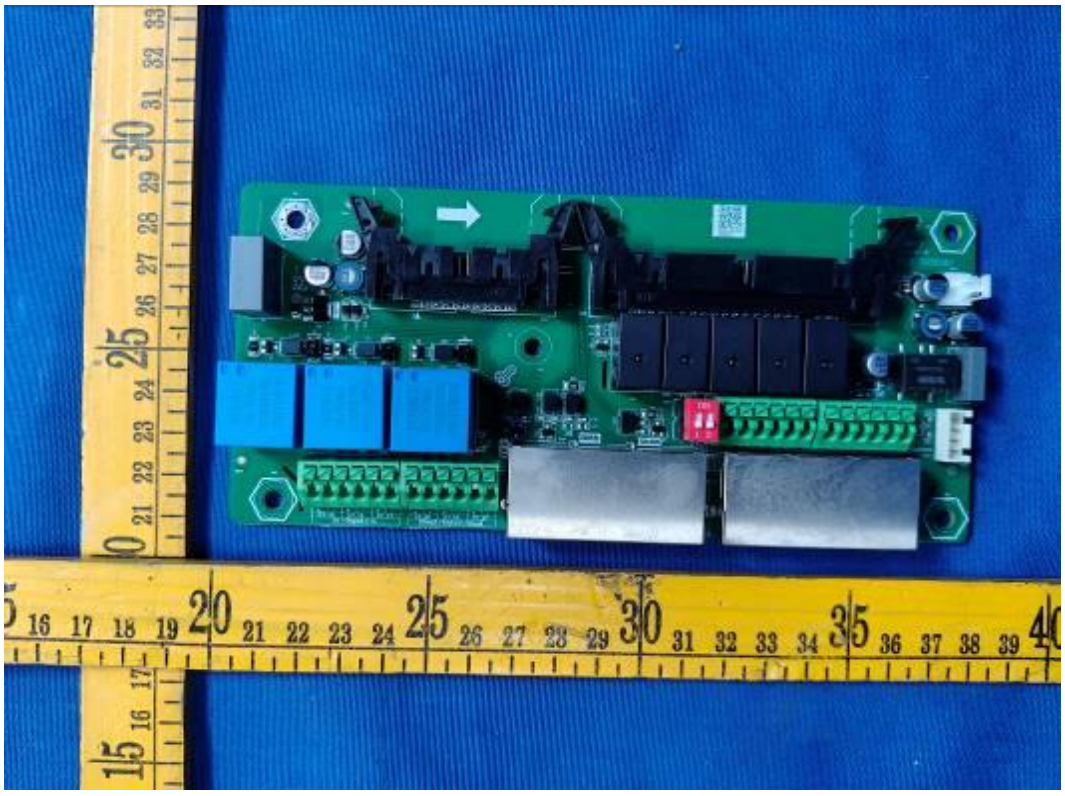

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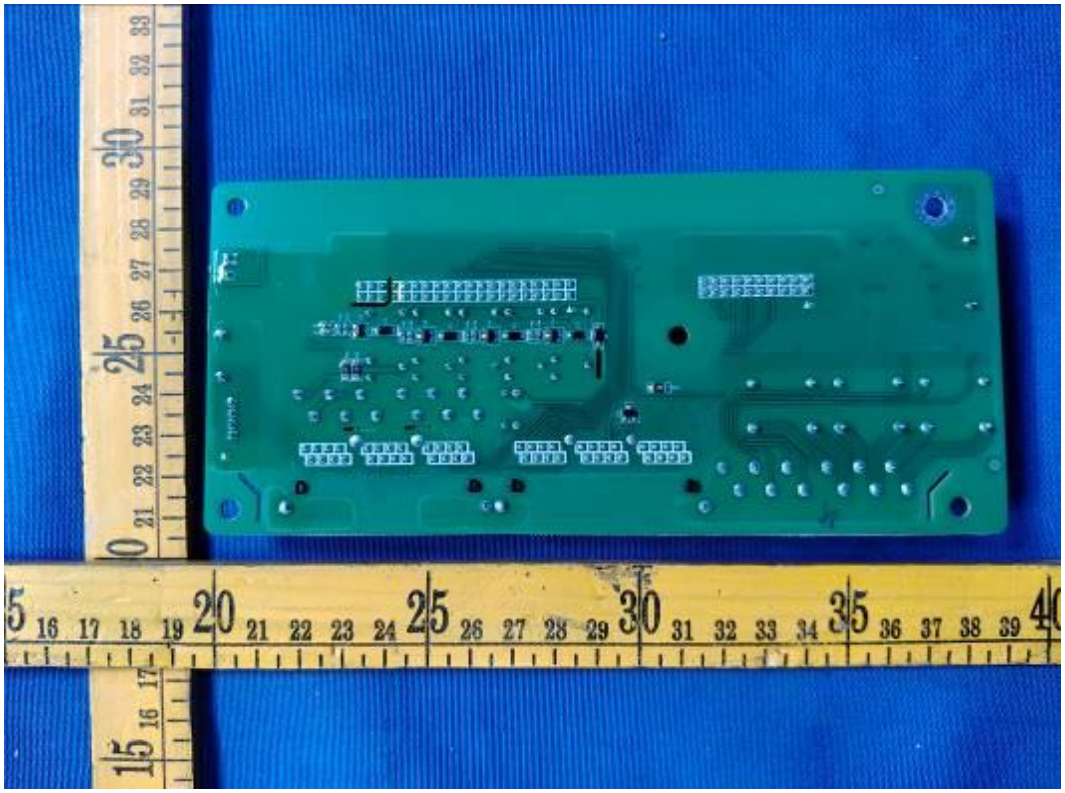
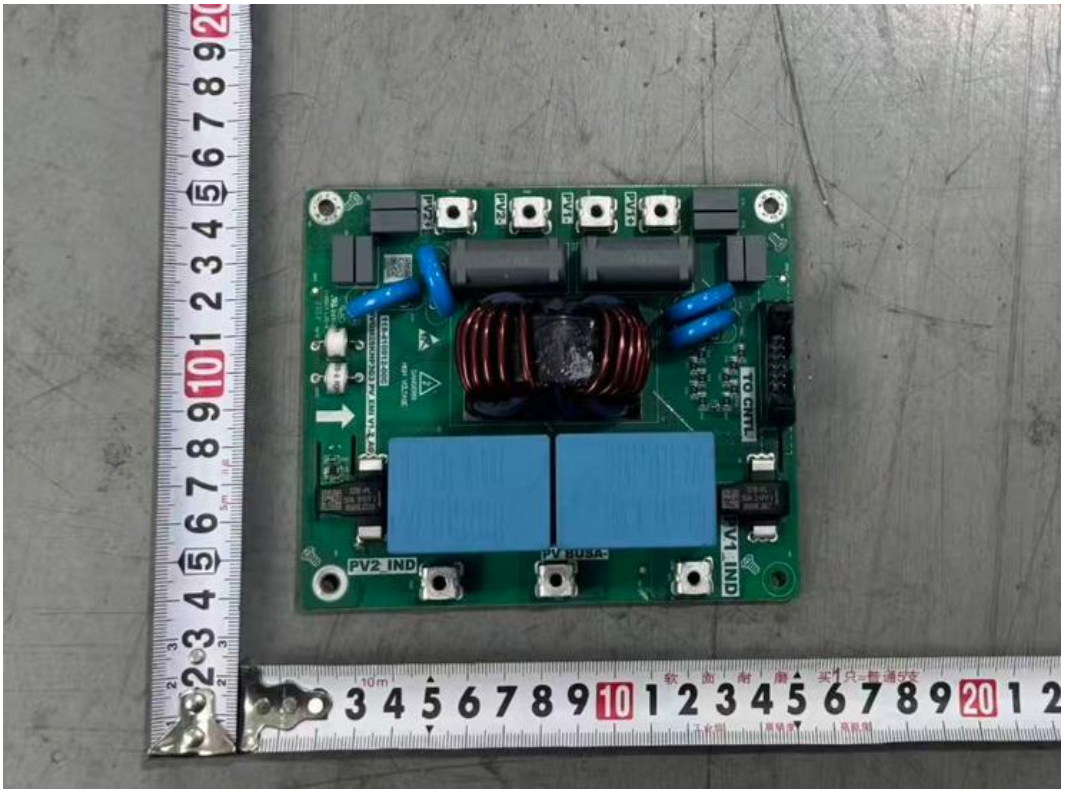

IVGM25KHP3G3 PV_EMI V1.2 board


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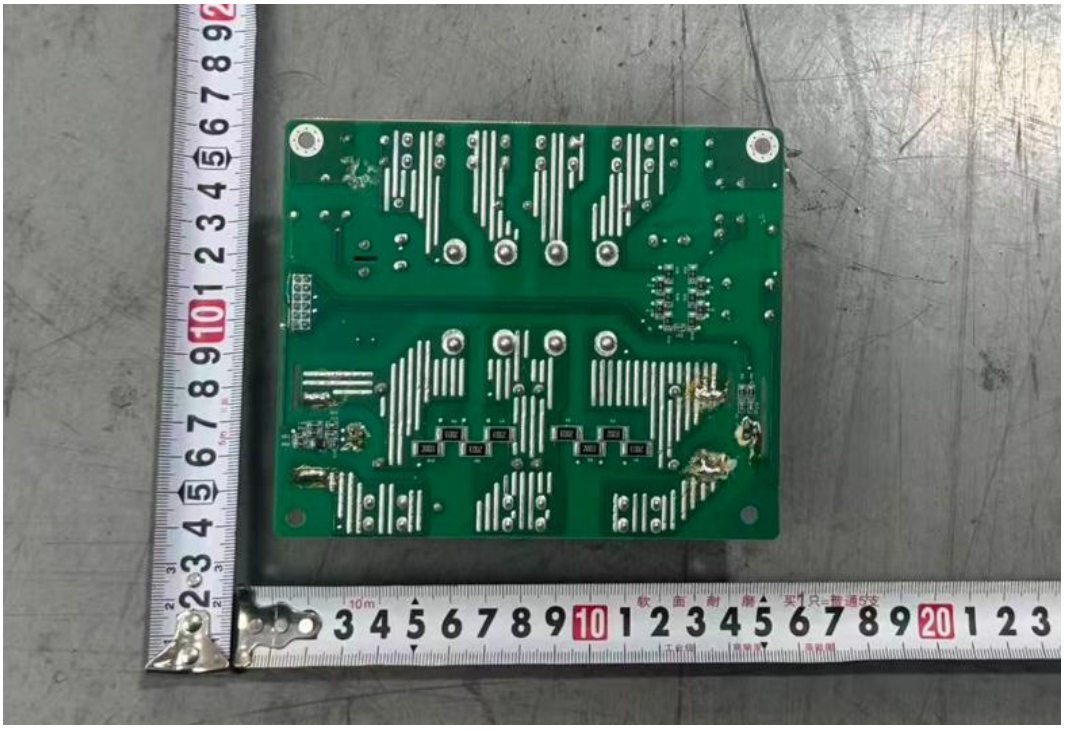
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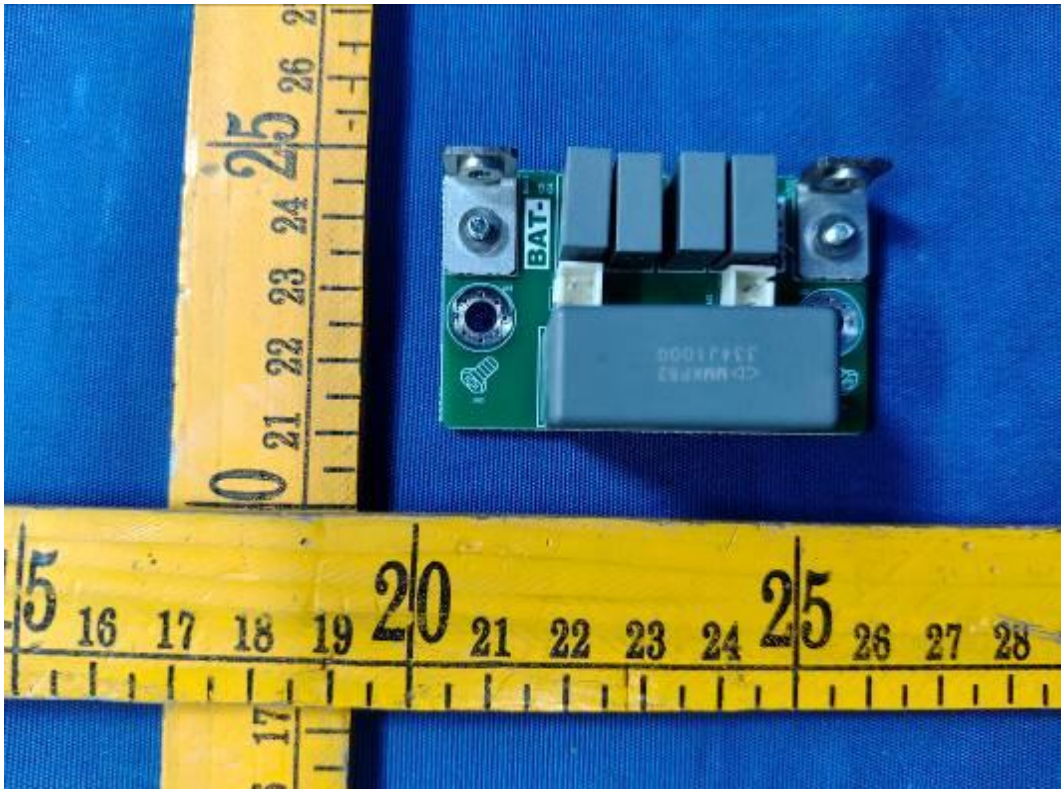

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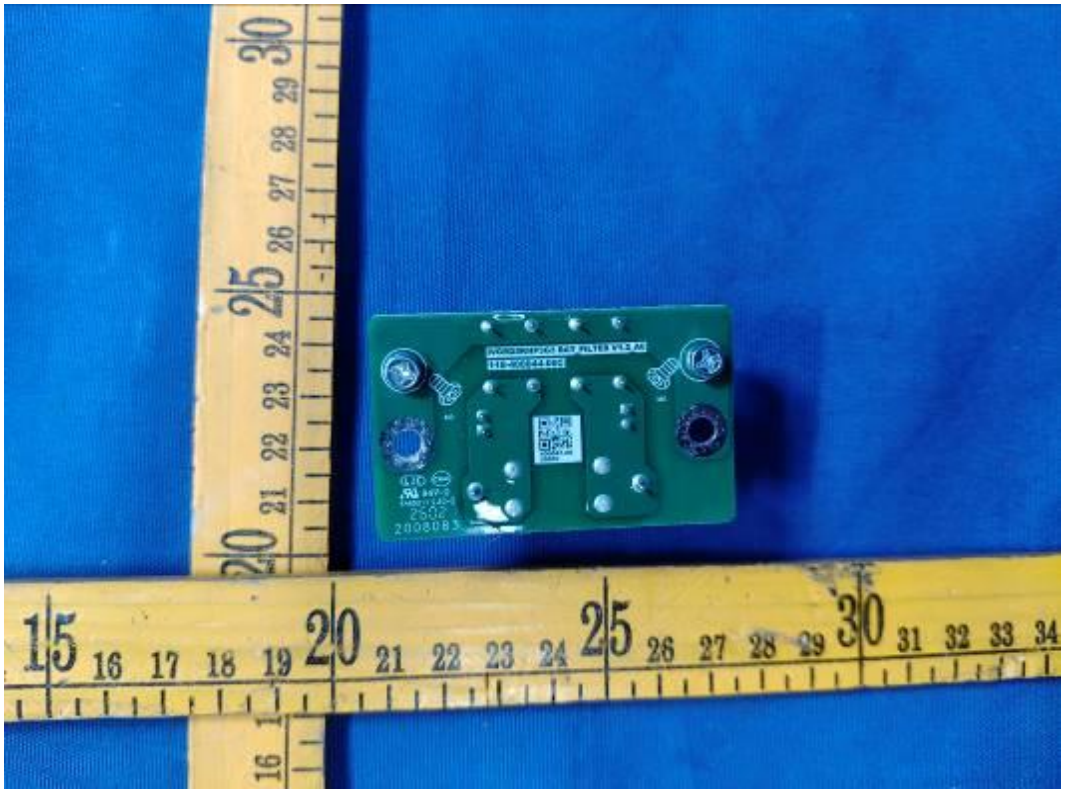
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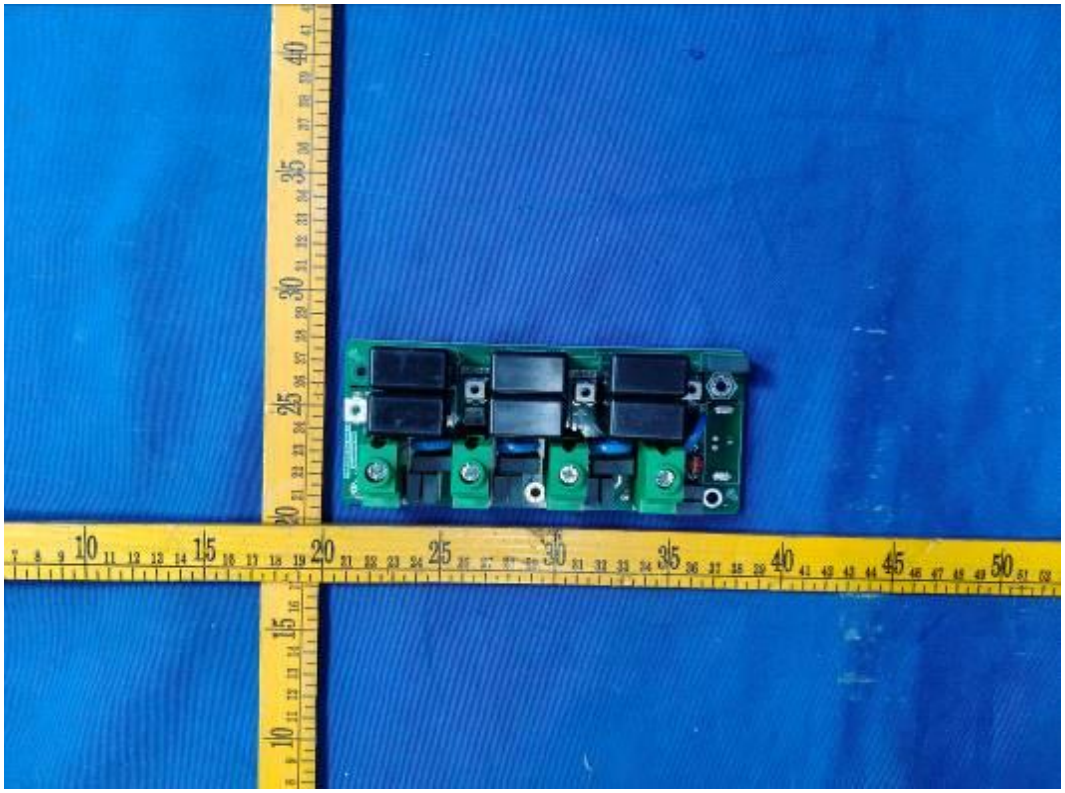
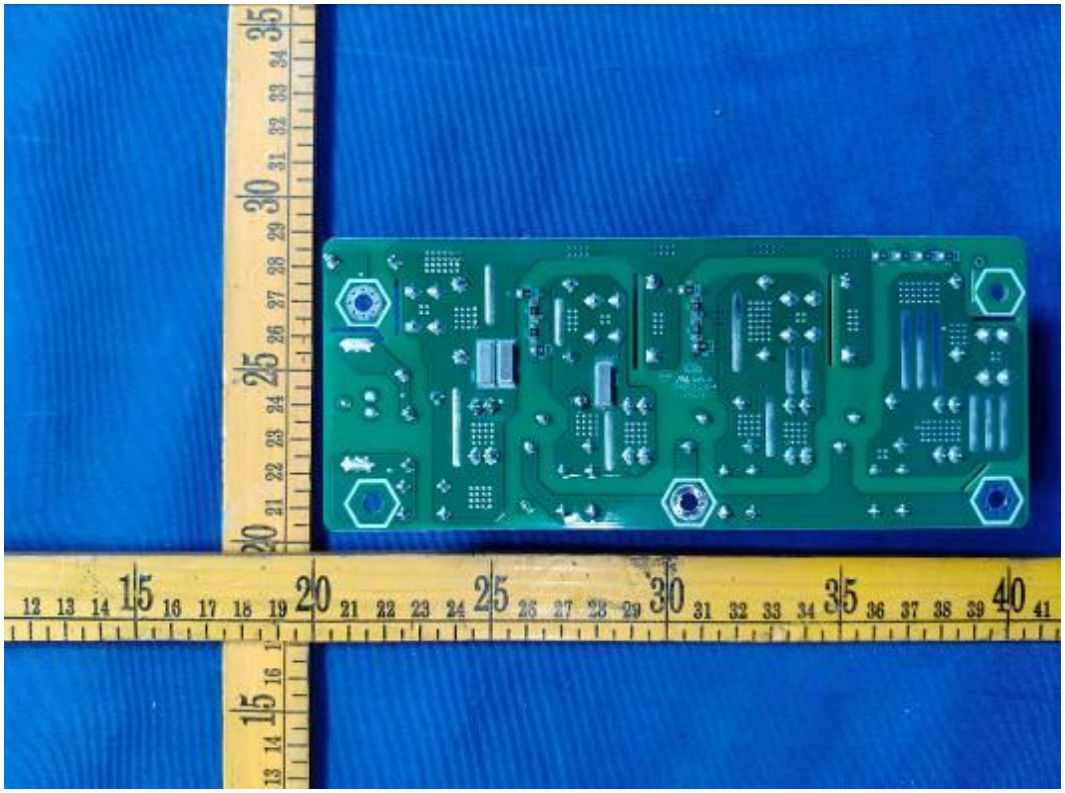
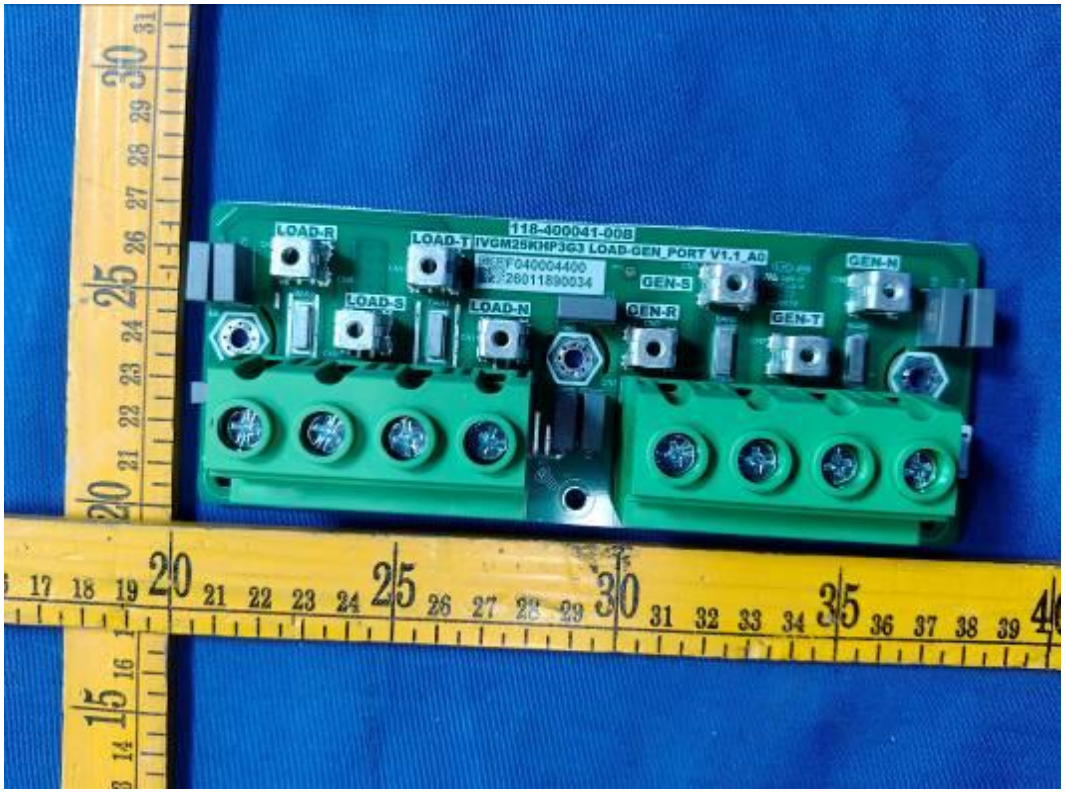
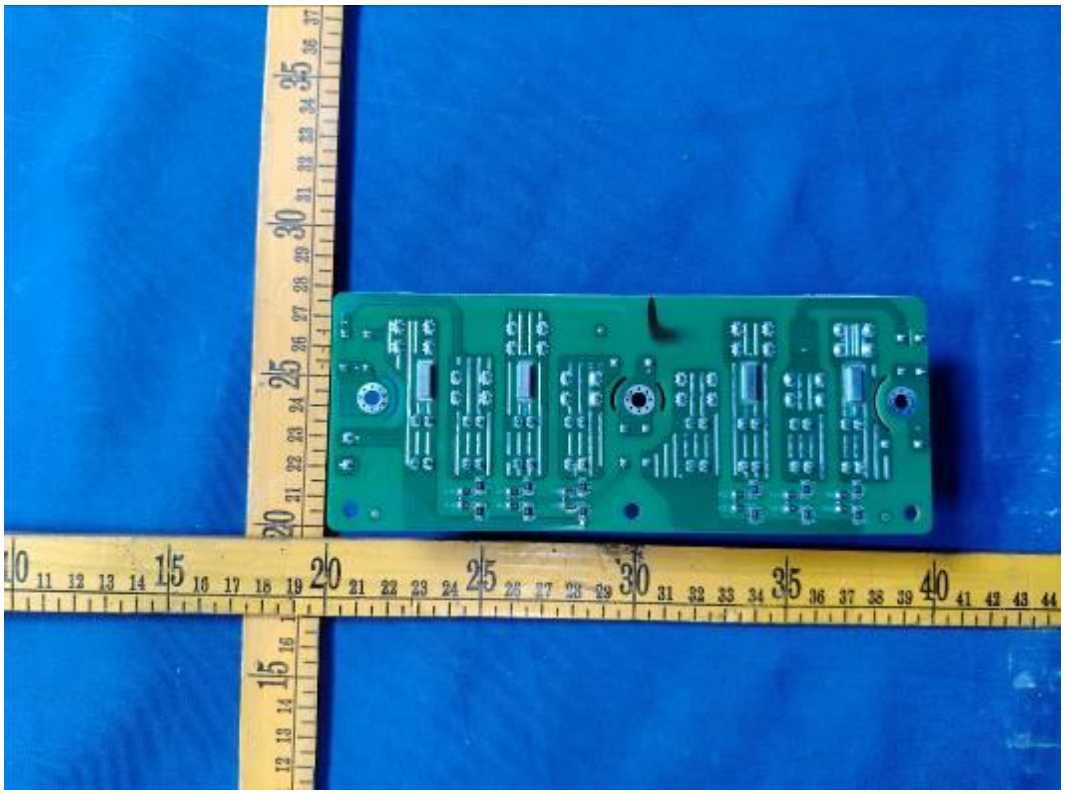


IVGM25KHP3G3 GRID_PORT V1.2 board



IVGM25KHP3G3 LOAD-GEN_PORT V1.1 board



IVGM25KHP3G3 LOAD-GEN_PORT V1.1 board

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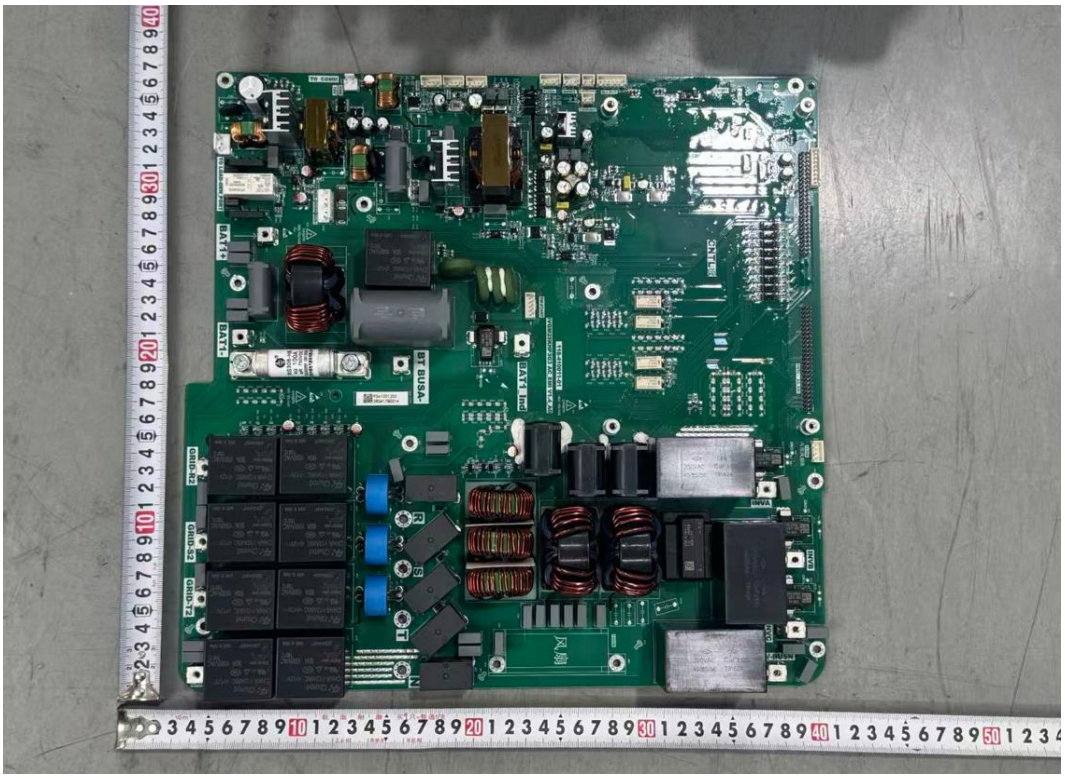

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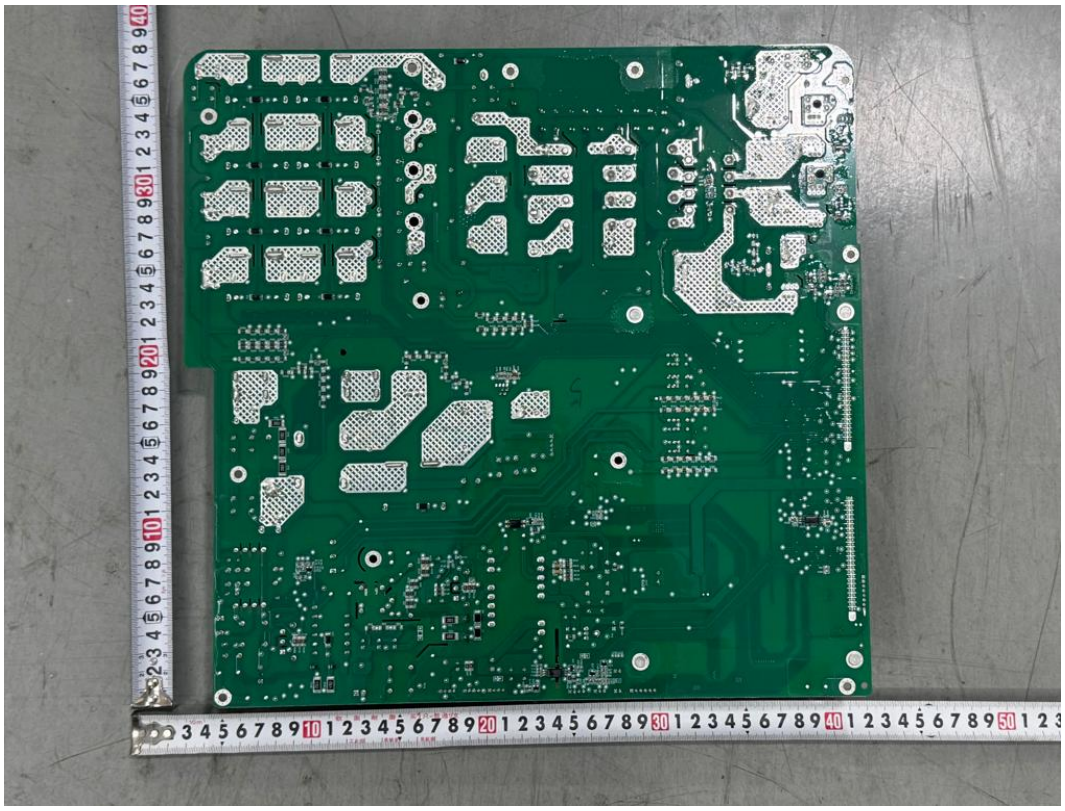
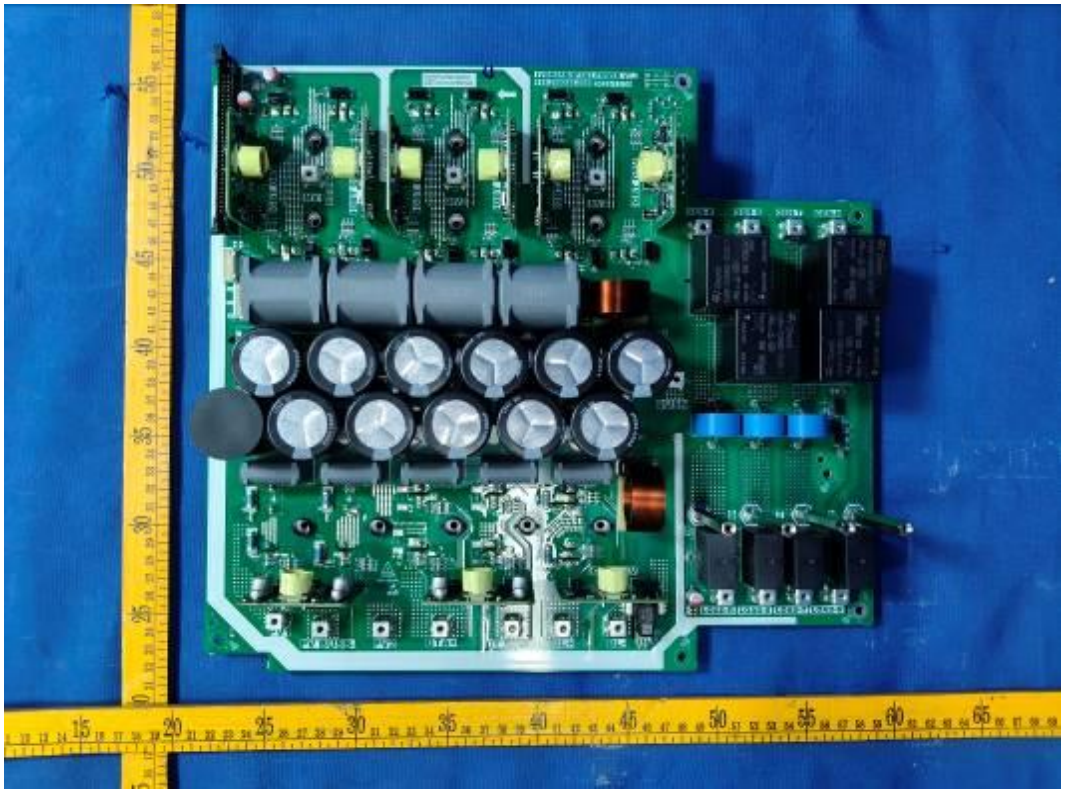
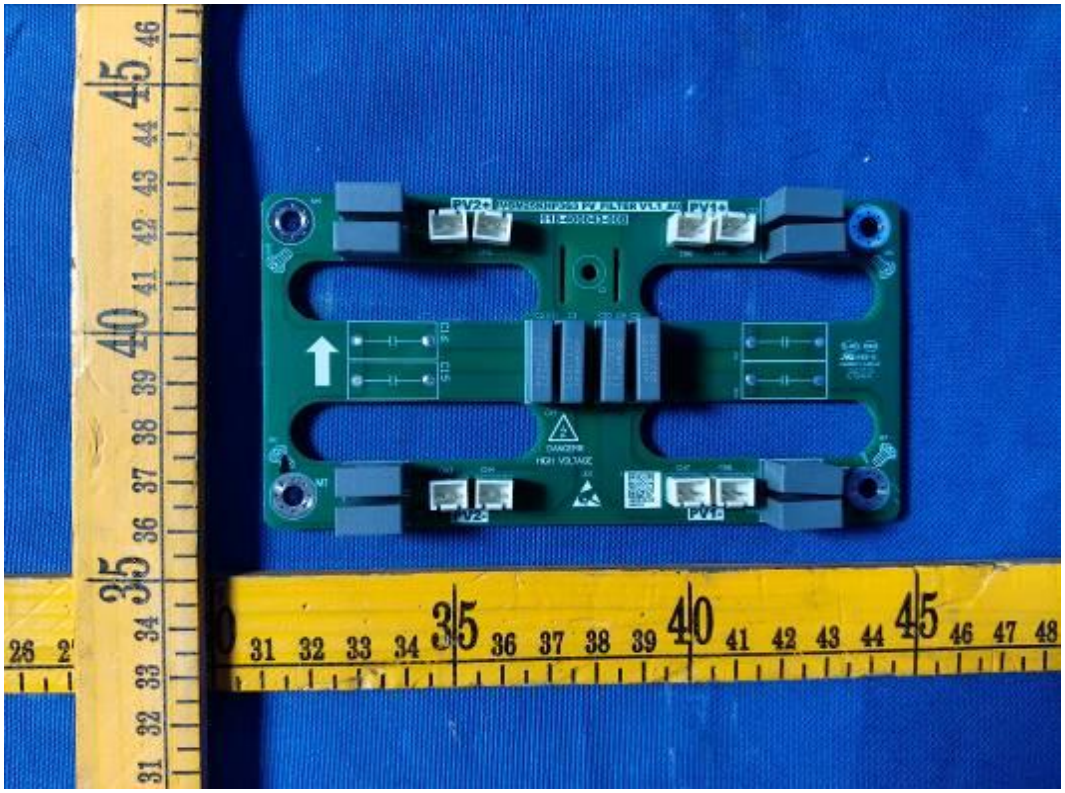
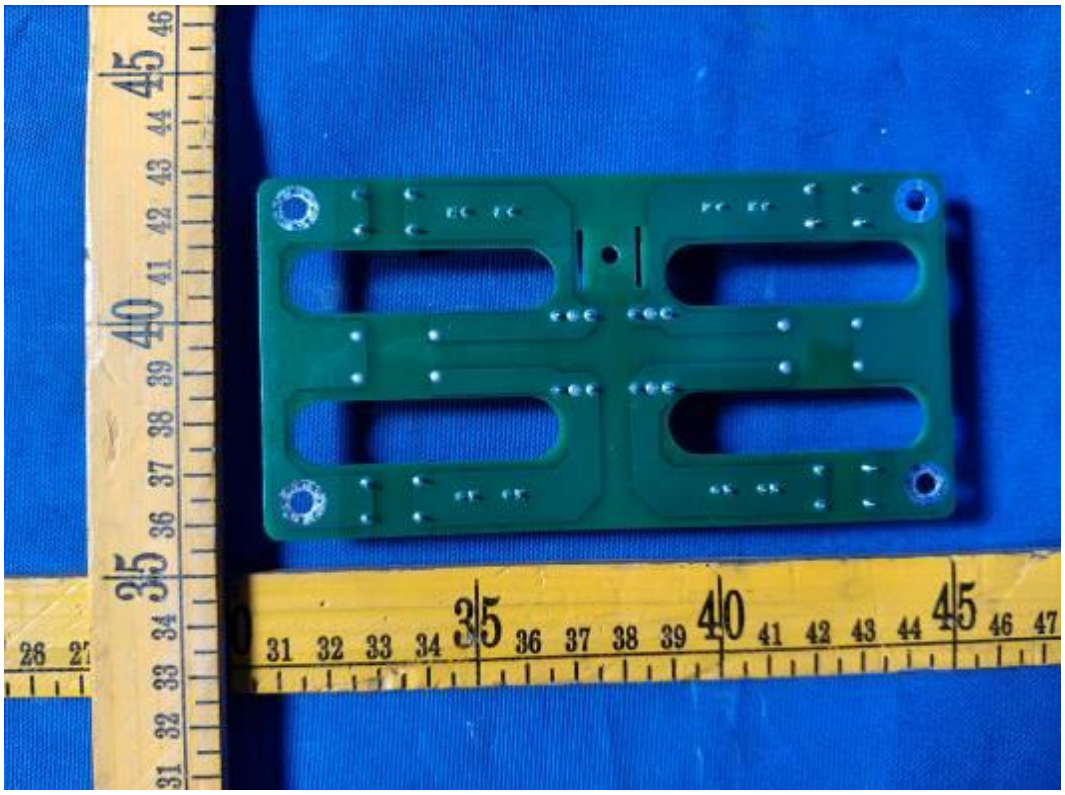

IVGM25KHP3G3 POWER V1.2 board


IVGM25KHP3G3 POWER V1.2 board

IVGM25KHP3G3 PV_FILTER V1.1 board


IVGM25KHP3G3 PV_FILTER V1.1 board

Serial Number

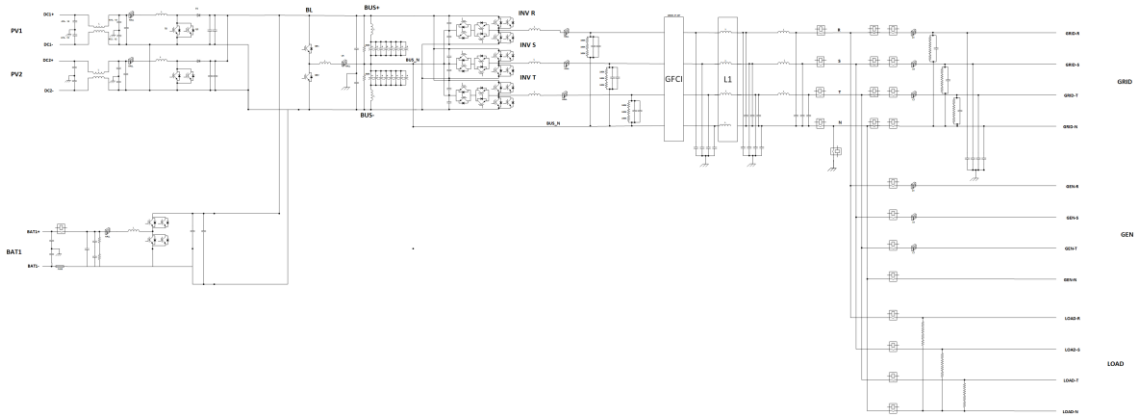

Software and Hardware Version

Basic data

SN: 130300025026050002	Model:IVGM25KHP3G3
Rated Power:25kW	Parallel status:Stand-alone
Operating mode:Off-grid mode	Meter communication status:Disconnected
Control version:411	Battery Mode:Use Batt V
Slave version:307	BMS Communication:Disconnected
Hardware version:100	BMS2 Communication:Disconnected
Newsletter version:213	Grid connection regulations:General_Standard_50Hz
Firmware version:100	Power station:50K-II Lab

Software and Hardware Version: 100
Software and Hardware Version: 100

Electrical Scheme



TEST EQUIPMENT LIST

No.	EQUIPMENT	TRADEMARK/MODEL	S/N	CALIBRATION PERIOD
1	Power Analyzer	DEWTRON/TRIONet	SUZE600302	2025/07/15 to 2026/07/14
2	Current probe	CYBERTEK/CP1000A	SUZE600801	2025/07/15 to 2026/07/14
3	Current probe	CYBERTEK/CP1000A	SUZE600802	2025/07/15 to 2026/07/14
4	Current probe	CYBERTEK/CP1000A	SUZE600803	2025/07/15 to 2026/07/14
5	Current probe	CYBERTEK/CP1000A	SUZE600804	2025/07/15 to 2026/07/14
6	Oscilloscope	MSO46 4-BW-500	SUZE600702	2025/03/13 to 2026/03/12
7	Temperature & Humidity meter	Testo/175-H1	SUZE601701	2025/03/13 to 2026/03/12
8	Multimeter	FLUKE/175C	SUZE600601	2025/03/13 to 2026/03/12
9	AC source	WAGO / WLPA-330150kVA-D-W	SUZE600101	/
10	DC source	EA/PSI 11500-60	SUZE600201	/
11	RLC load	KAIXIANG / AC400V-450.99kVA-RLC	SUZE660101	/

----------End of report----------