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

Report Reference No. ....:	190411091GZU-003
Tested by (name + signature) ....:	Jason Fu Technical Team Leader
Approved by (name + signature) ......:	Tommy Zhong Technical Manager
Date of issue...................................:	18 Jun., 2019
Contents ……………………………...:	66 pages
Testing Laboratory ....:	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch
Address...:	Block E, No.7-2 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GliETDD, Guangzhou, China
Testing location / procedure ....:	TL ☒ SMT ☐ TMP ☐
Testing location / address.................:	The same as testing laboratory
Applicant's name ....:	Shenzhen SOFAR SOLAR Co., Ltd.
Address...:	401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, China
Test specification:	
Standard ....:	AS/NZS 4777.2: 2015
Test procedure.................................:	SAA
Non-standard test method…………..:	N/A
Test Report Form/blank test report	
Test Report Form No.......................:	TTRF_AS/NZS _4777.2B
TRF Originator ....:	Intertek Guangzhou
Master TRF......................................:	Dated 2015-11

Test item description ....:	Solar Grid-tied Inverter
Trade Mark ....:	SOFAR SOLAR
Manufacturer....................................:	Same as applicant
Model/Type reference.......................:	SOFAR 10000TL-G2, SOFAR 12000TL-G2, SOFAR 15000TL-G2

Ratings...:	Model	SOFAR 10000TL-G2	SOFAR 12000TL-G2	SOFAR 15000TL-G2
	Max.PV voltage	1000 d.c.V		
	PV MPPT voltage range	160-960 d.c.V		
	Max.input current	21 /11 d.c.A		
	PV Isc	30/15 d.c.A		
	Max.output power	10000W	12000W	15000W
	Max.apparent power	11000VA	13200VA	16500VA
	Nominal output voltage	3/N/PE, 230 /400 a.cV		
	Max.output current	3×16.5 a.c.A	3×20.0 a.c.A	3×24.0 a.c.A
	Nominal output Frequency	50 Hz		
	Power factor range	0.8Leading – 0.8 lagging		
	Inverter technology	Non-isolated		
	Safety level	Class I		
	Ingress Protection	IP 65		
	Operation Ambient Temperature	-25℃ - +60℃		
	Software Version	V0.21		

Test item particulars ....:	
Classification of installation and use ....:	Mounting on wall and outdoor used
Supply Connection ....:	Permanent connection
Possible test case verdicts:	
- test case does not apply to the test object ....:	N/A
- test object does meet the requirement ....:	P(Pass)
- test object does not meet the requirement ....:	F(Fail)
Testing ....:	
Date of receipt of test item ....:	11 April., 2019
Date (s) of performance of tests ....:	11 April., 2019 – 13 Jun., 2019

General remarks:

The test results presented in this report relate only to the object tested.
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"(see Enclosure #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.
Throughout this report a comma is used as the decimal separator.

When determining for test conclusion, measurement uncertainty of tests has been considered.
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The test results presented in this report relate only to the item tested. The results indicate that the specimen complies with standard” AS/NZS 4777.2: 2015”.

Factory: same as applicant

This report shall be used together with report No. 190411091GZU-001 and 190411091GZU-002.

General product information:

The unit is a three-phases non-isolated PV Grid-tied inverter, it can convert the high PV voltage to Grid voltage and feed into Grid network.

The unit is providing EMI filtering at the PV side and AC side. It does provide basic insulation from PV side to Grid.

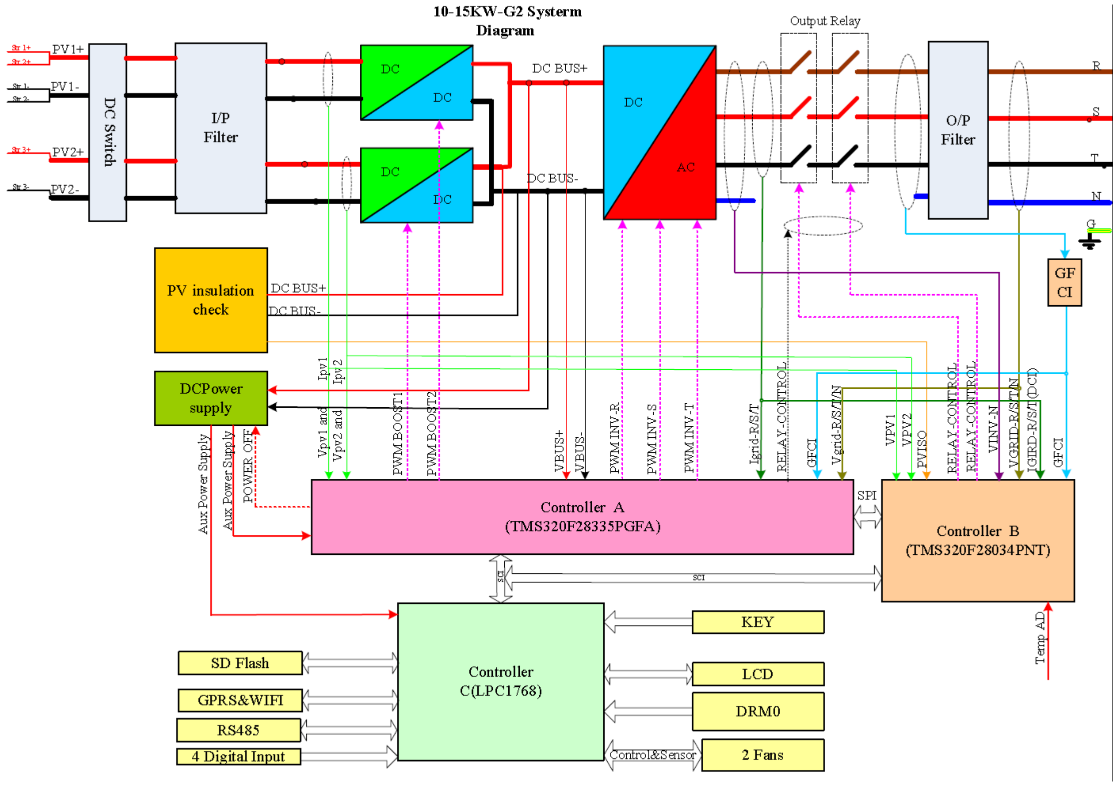
The unit has two controllers. The master controller A monitor the invert statue; measure the PV voltage and current, bus voltage, AC voltage, current, GFCI and frequency, also communicate with the slave controller B

The slave controller B monitor AC voltage, current, frequency, GFCI and communicate with the master controller A

The relays are designed to redundant structure that controlled by separately.

The master controller and slave controller are used together to control relay open or close, if the single fault on one controller, the other controller can be capable to open the relay, so that still providing safety means.

The topology diagram as following:



Model differences:

The model SOFAR 10000TL-G2, SOFAR 12000TL-G2 and SOFAR 15000TL-G2 are completely identical, except output power derating in software.

The only differences on hardware between the models SOFAR 10000TL-G2, SOFAR 12000TL-G2 and SOFAR 15000TL-G2 are below:

1.The main output inductor is NPS226060*2+NPF226060*2, 2.0Φ*2P /37Ts L=756ųH for model SOFAR 15000TL-G2 while it's NPS226060*2+NPF226060*1, 2.0Φ*2P*42Ts L=0.73mH for model SOFAR 10000TL-G2, SOFAR 12000TL-G2

Other than special notes, typical model SOFAR 15000TL-G2 is used as representative for testing in this report

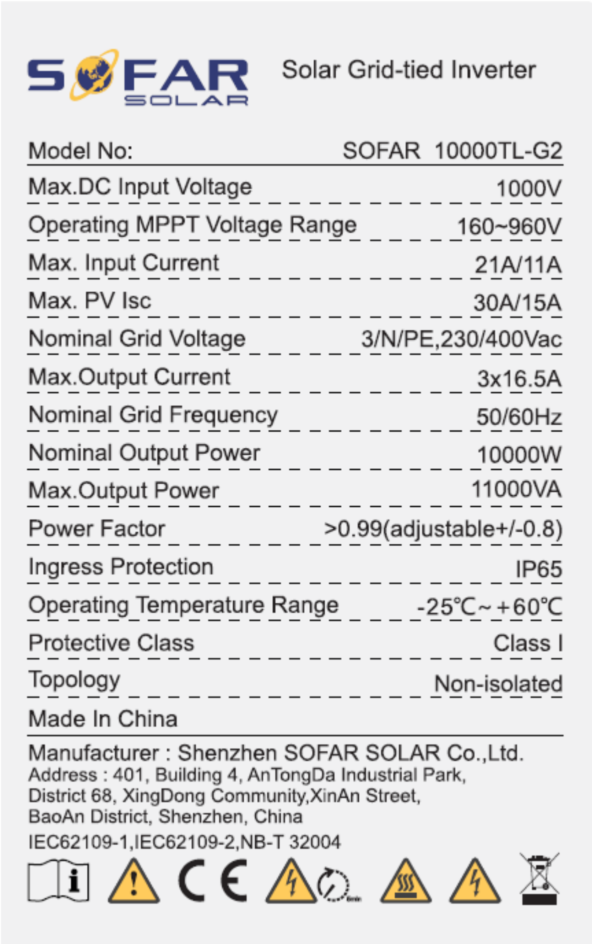
Version of software: V0.21

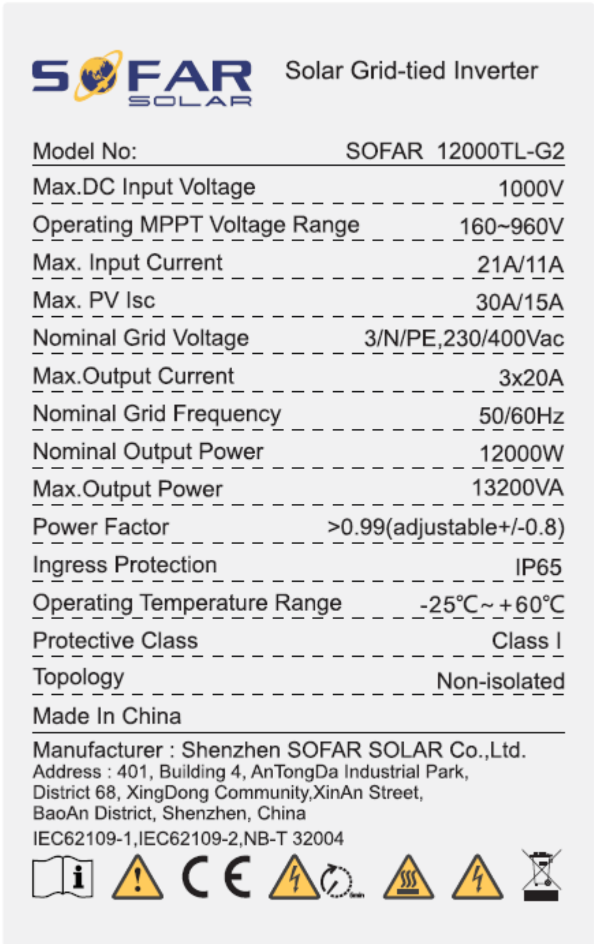
Version of hardware: V1.00

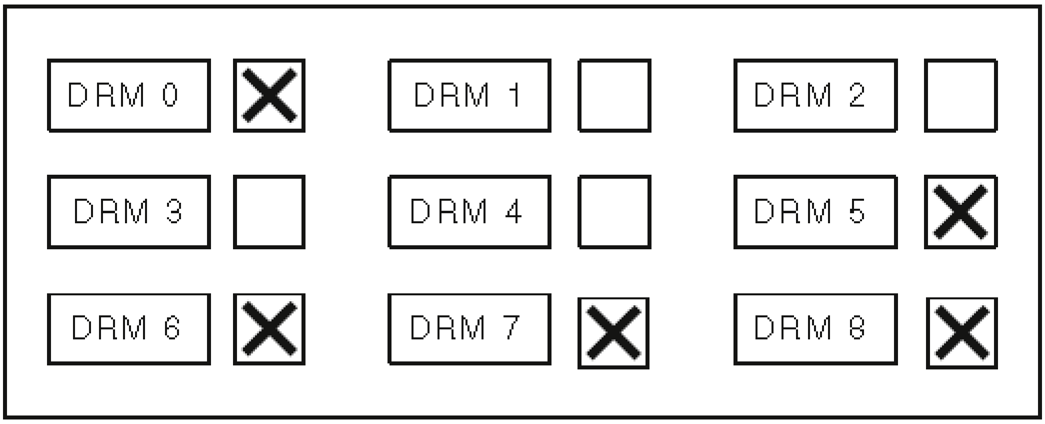
The type of grid source: simulated test grid

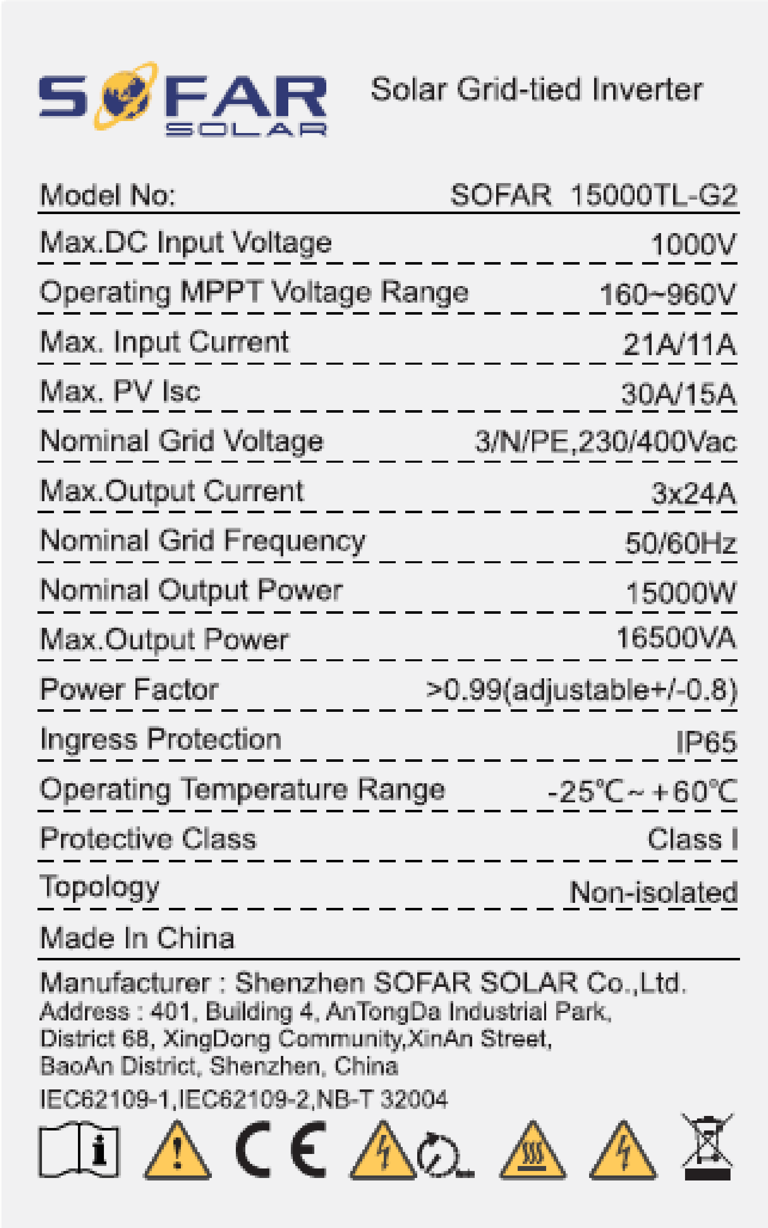
The impedance of the grid source:0.1Ω

Copy of marking plate(representative):









SOFAR SOLAR Solar Grid-tied Inverter

Model No:	SOFAR 15000TL-G2
Max.DC Input Voltage	1000V
Operating MPPT Voltage Range	160~960V
Max. Input Current	21A/11A
Max. PV Isc	30A/15A
Nominal Grid Voltage	3/N/PE,230/400Vac
Max.Output Current	3x24A
Nominal Grid Frequency	50/60Hz
Nominal Output Power	15000W
Max.Output Power	16500VA
Power Factor	>0.99(adjustable+/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-25℃~+60℃
Protective Class	Class I
Topology	Non-isolated

Made In China

Manufacturer : Shenzhen SOFAR SOLAR Co.,Ltd.
Address : 401, Building 4, AnTongDa Industrial Park,
District 68, XingDong Community,XinAn Street,
BaoAn District, Shenzhen, China
IEC62109-1,IEC62109-2,NB-T 32004

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

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

5	**GENERAL REQUIREMENTS**		P
5.1	**Electrical safety**		P
	Inverters for use in inverter energy systems with photovoltaic (PV) arrays shall comply with the appropriate electrical safety requirements of IEC 62109-1 and IEC 62109-2, and the requirements within this Standard.	Considered	P
	Inverters for use in inverter energy systems that have energy storage (batteries) as the only possible energy source shall comply with the electrical safety requirements of AS 62040.1.1, and the requirements within this Standard.		N/A
	Inverters for use in inverter energy systems that incorporate energy sources other than photovoltaic (PV) arrays or batteries shall comply with the applicable electrical safety requirements of IEC 62109-1 and IEC 62109-2, and the requirements within this Standard. However, for energy source inputs other than PV arrays or batteries, the requirements of IEC 62109-1 and IEC 62109-2 shall be applied with consideration of the inverter topology, the energy source voltage, installation requirements and potential faults which could present a hazard.	Considered	P
5.2	Provision for external connections		P
	Inverters shall be used and installed as fixed equipment only. Inverters shall not be used as portable equipment.		P
	Inverter provisions for external connection—		P
	(a) shall be for fixed equipment only; and	Fixed equipment only	P
	(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 ports (except communications ports) shall incorporate connection types for either—		P
	(i) permanently connected equipment; or		P
	(ii) pluggable type B equipment.		N/A
	Inverter source or load connections shall not incorporate connection types for pluggable type A equipment.		P
	Permanently connected inverters shall have suitable terminals for connection to fixed installation wiring.		P

AS/NZS 4777.2			
Clause	Requirement - Test	Result - Remark	Verdict
	Pluggable type B equipment shall have one of the following means of connection:		N/A
	(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.		N/A
	Pluggable type B equipment shall not incorporate—		N/A
	(1) a connection by a connector or inlet complying with any of the dimensional sheets of AS/NZS 60320.1;		N/A
	(2) a connection by a plug conforming to AS/NZS 3112; or		N/A
	(3) a connection by a connector or inlet where hazardous voltages are accessible by the standard test finger.		N/A
5.3	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.	Earth fault detection and RCD are equipped.	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 Clause 9.	Internal RCD	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.		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—		N/A
	(a) open circuit the functional earth connection to the PV array;		N/A
	(b) measure the resistance to earth of each conductor of the PV array;		N/A
	I if the earth resistance is above the resistance limit (R_{iso} limit) threshold specified in Table 1, the system shall reconnect the functional earth and shall be allowed to start; and		N/A
	(d) if the earth resistance is equal to or less than the resistance limit (R_{iso} limit) threshold specified in Table 1, the inverter shall shut down and initiate an earth fault alarm in accordance with the requirements of IEC 62109-2.		N/A

AS/NZS 4777.2			
Clause	Requirement - Test	Result - Remark	Verdict
5.4	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 60038 (for Australia), or IEC 60038 (for New Zealand).		P
5.5	Power factor		P
	The displacement power factor of the inverter, considered as a load from the perspective of the grid, shall, for all current outputs from 25% to 100% of rated current, operate at unity power factor within the range 0.95 leading to 0.95 lagging.	See appended table	P
	NOTE: For all inverter current outputs below 25% of rated current, it is acceptable for the displacement power factor to be controlled such that the vars supplied or drawn are less than the amount of vars supplied or drawn at 25% current output.		P
	Operation at power factor other than unity is acceptable where the inverter operates in power quality response modes. Additional requirements for displacement power factor control apply for inverters that are capable of operating in power quality response modes. See Clause 6.3.		P
	Compliance shall be determined by type testing in accordance with the power factor test specified in Appendix B.	See appended table	P
5.6	Harmonic currents		P
	The harmonic currents of the inverter shall not exceed the limits specified in Tables 2 and 3 and the total harmonic current distortion (ITHD) to the 50th harmonic shall be less than 5%.		P
	Compliance shall be determined by type testing in accordance with the harmonic current limit test specified in Appendix C.	See appended table	P
5.7	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

AS/NZS 4777.2			
Clause	Requirement - Test	Result - Remark	Verdict
	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
	Compliance shall be determined by testing in accordance with the appropriate Standard. The inverter shall remain connected throughout the test and the automatic disconnection device shall not operate.	See appended table	P
5.8	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 4.		P
	Compliance shall be determined by type testing in accordance with the transient voltage limit test specified in Appendix D. The voltage-duration curve is derived from the measurements taken at the grid-interactive port of the inverter.	See appended table	P
5.9	Direct 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 and/or stand-alone port shall not exceed 0.5% of the inverter's rated current or 5 mA, whichever is the greater.		P
	In the case of a three-phase inverter, the d.c. output current of the inverter at any a.c. port, including the grid-interactive and/or stand-alone 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.		P

<table>
<tr><td colspan="4">AS/NZS 4777.2</td></tr>
<tr><td>Clause</td><td>Requirement - Test</td><td>Result - Remark</td><td>Verdict</td></tr>
<tr><td></td><td>If the inverter does not incorporate a mains frequency isolating transformer or is not used with a dedicated external isolation transformer, it shall be type tested to ensure the d.c. output current at any a.c. port of the inverter is below the limits specified above at all output current levels.</td><td></td><td>P</td></tr>
<tr><td></td><td>Compliance shall be determined by type testing in accordance with the d.c. current injection test specified in Appendix E.</td><td>See appended table</td><td>P</td></tr>
<tr><td>5.10</td><td colspan="2">Current balance for three-phase inverters</td><td>P</td></tr>
<tr><td></td><td>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.</td><td></td><td>P</td></tr>
<tr><td></td><td>Compliance shall be determined by type testing in accordance with the following requirement. 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.</td><td><table><tr><td></td><td>Rated current</td><td>Measured</td><td>%</td><td>Limit</td></tr><tr><td>Phase R</td><td>21.7</td><td>22.06</td><td>1.66</td><td>5%</td></tr><tr><td>Phase S</td><td>21.7</td><td>22.13</td><td>1.98</td><td>5%</td></tr><tr><td>Phase T</td><td>21.7</td><td>22.07</td><td>1.71</td><td>5%</td></tr></table></td><td>P</td></tr>
<tr><td></td><td>Inverters which can be used in a voltage balance mode, as defined in Clause 6.3.2.4, are allowed to generate unbalanced currents.</td><td></td><td>N/A</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>6</td><td colspan="2">OPERATIONAL MODES AND MULTIPLE MODE INVERTERS</td><td>P</td></tr>
<tr><td>6.1</td><td colspan="2">General</td><td>P</td></tr>
<tr><td></td><td>Unless otherwise stated, the modes in the following Clauses are for the grid-interactive port of the inverter.</td><td></td><td>P</td></tr>
</table>

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

6.2	Inverter demand response modes (DRMs)		P
6.2.1	General		P
	The inverter shall support the demand response mode DRM 0 of Table 5. The inverter should support the other demand response modes of Table 5.		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.		P
	The inverter shall comply with the relevant requirements of Clause 5 and this Clause (6), and with all of the requirements of Clause 7, while any demand response mode is asserted.		P
	Compliance shall be determined by testing as specified in Appendix I.	See appended table	P
6.2.2	Interaction with demand response enabling device (DRED)		P
	The inverter shall have a means of connecting to a DRED. This means of connection shall include a terminal block or RJ45 socket. The terminal block or RJ45 socket shall comply with the minimum electrical specifications in Table 6. The terminal block or RJ45 socket may be physically mounted in the inverter or in a separate device that remotely communicates with the inverter.	Terminal block used	P
	The DRED asserts demand response modes by shorting together terminals or pins as specified in Table 7. In detecting the state of the DRED, the inverter shall comply with the following requirements:		P
	(a) The inverter shall not inject more than 30 mA (d.c. or a.c.) into—	<30mA	P
	(i) terminals ‘DRM1/5’, ‘DRM2/6’, ‘DRM3/7’ or ‘DRM4/8’, where a terminal block is used; or		P
	(ii) pins 1, 2, 3 or 4, where an RJ45 socket is used.		N/A
	(b) The inverter shall allow for a drop of up to 1.6 V across the DRED and associated wiring when nominally shorted.	<1.6V	P
	I The inverter shall not supply more than 34.5 V (d.c. or a.c.) to any terminal of the terminal block or RJ45 socket.		P
	(d) If the impedance between pins 5 and 6 is detected to be above 20 kΩ, the inverter shall fail-safe to DRM 0 asserted.		P

AS/NZS 4777.2			
Clause	Requirement - Test	Result - Remark	Verdict
	The DRED may assert more than one DRM at a time, in which case the requirements of every active DRM that is supported by the inverter shall be simultaneously satisfied.	DRM0	P
	The inverter shall detect the assertion of any combination of DRMs which result in terminal 5 and 6 being shorted simultaneously as assertion of DRM 0.		P
	Where DRM 3 or DRM 7 are supported, the reactive power set-point shall be set by default to operate at unity power factor. The reactive power set-point should be adjustable up to a minimum of 60% of the inverter's kVA rating.		P
	The inverter may optionally provide a power supply for use by the DRED. If included this shall be d.c. and of a voltage less than 34.5 V.	No power supply provide	N/A
	Where an RJ45 socket is used, pins 7 and 8 may be utilized as positive and negative DRED power supply pins respectively. The power supply shall be capable of delivering at least 0.5 A at a minimum of 6 V d.c., otherwise the inverter shall short pins 7 and 8 together.		N/A
	Where a terminal block is used, only those terminals needed for the supported DRMs are required.		P
6.3	Inverter power quality response modes		P
6.3.1	General		P
	The inverter may have the capability of operating in modes which will—		P
	(a) contribute to maintaining the power quality at the point of connection with the customer installation; or		P
	(b) provide characteristics which are outside the typical operation of an inverter for the purpose of providing support to a grid.		P
	These various operating modes may be enabled or disabled in an inverter and may include the following:		P
	(i) Volt response modes.		P
	(ii) Fixed power factor or reactive power mode.		P
	(iii) Power response mode.		P
	(iv) Power rate limit.		P
	If these power quality response modes are available in the inverter, the inverter shall comply with the relevant requirements of this Clause (6) and Clause 5, and all of the requirements of Clauses 7 and 8, when these modes are enabled or disabled.		P
	Compliance shall be determined by type testing as specified in Appendix I with the applicable modes disabled and enabled.		P

AS/NZS 4777.2			
Clause	Requirement - Test	Result - Remark	Verdict
	If these power quality response modes of operation are controlled by an external device, the external device shall not interfere with the inverter complying with the relevant requirements of this Clause (6) and Clause 5, and all of the requirements of Clauses 7 and 8, when the external device is controlling these modes.		N/A
6.3.2	Volt response modes		P
6.3.2.1	General		P
	The intent of including the volt response modes, which respond to voltage changes at the inverter terminals, is to increase the number of systems which can be connected at a point on the grid without adversely affecting the voltage within an electrical installation.		P
	The volt – watt and volt – var response modes specified in Clause 6.3.2.2 and Clause 6.3.2.3 shall use the volt response reference values specified in Table 9. Each volt response mode may have volt response reference values which are independent of other volt response modes. This is to allow different volt response curves for different volt response modes.		P
6.3.2.2	Volt – watt response mode		P
	The volt – watt response mode varies the output power of the inverter in response to the voltage at its terminal. The inverter should have the volt – watt response mode. If this mode is available, it shall be enabled by default.	See appended table	P
	The response curve required for the volt – watt response mode is defined by the volt response reference values in Table 9 and corresponding power levels. The default values are listed in Table 10 and example response modes are shown in Figure 2(A) for Australia and Figure 2(B) for New Zealand.		P
6.3.2.3	Volt – var response mode		P
	The volt – var response mode varies the reactive power output of the inverter in response to the voltage at its grid-interactive port. The inverter should have the volt – var response capability. If this mode is available, it shall be disabled by default.	See appended table	P
	The response curve required for the volt – var response is defined by the volt response reference values specified in Table 9 and corresponding var levels. The default values are listed in Table 11 and shown in Figure 3.		P
6.3.2.4	Voltage balance modes		N/A
	If the voltage balance mode is available, the following requirements apply:		N/A

AS/NZS 4777.2			
Clause	Requirement - Test	Result - Remark	Verdict
	(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 8.2 apply.		N/A
	I The voltage balancing mode shall be able to—		N/A
	(i) operate correctly with a single fault applied;		N/A
	(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		N/A
	(iii) detect the fault or loss of operability and disconnect the inverter from the electrical installation.		N/A
6.3.3	Fixed power factor mode and reactive power mode		P
	The fixed power factor mode and the reactive power mode may be required in some situations by the electrical distributor to meet local grid requirements. These modes shall be disabled by default.	See appended table	P
	If the inverter is capable of operating with reactive power mode, the maximum ratio of reactive power (vars) to rated apparent power should be 100%. The reactive power modes may be required to be fixed at a constant reactive power by the electrical distributor.		P
	If the inverter is capable of operating with fixed power factor mode, the minimum range of settings should be 0.8 leading to 0.8 lagging. The fixed power factor mode is for control of the displacement power factor over the range of inverter power output.		P
6.3.4	Characteristic power factor curve for cos ϕ (P) (Power response)		P
	The characteristic power factor curve for cos ϕ (P) (Power response) mode varies the displacement power factor of the output of the inverter in response to changes in the output power of the inverter, i.e. cos ϕ (P) modes. If this mode is available, it shall be disabled by default.	See appended table	P
	The response curve required for the cos ϕ (P) response should be defined within displacement power factor range of 0.9 leading to 0.9 lagging. One possible cos ϕ (P) curve is shown in Figure 4.		P
6.3.5	Power rate limit		P
6.3.5.1	General		P

AS/NZS 4777.2			
Clause	Requirement - Test	Result - Remark	Verdict
	The power rate limit for an inverter is a power quality response mode. The inverter shall have the capability to rate limit changes in power generation 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).	See appended table	P
	The power rate limit only applies to the changes specified in Clause 6.3.5.3.		P
	The power rate limit does not apply when the inverter disconnection device is required to operate (i.e. to disconnect).		P
6.3.5.2	Gradient of power rate limit		P
	The power rate limit (W_{Gra}) is the ramp rate of real power output in response to changes in power and is defined as a percentage of rated power per minute. The nominal ramp time (Tn) is the nominal time for a 100% change in output power with a power rate limit of W_{Gra}. An inverter shall have an adjustable power rate limit (W_{Gra}) which limits the change in power output to the set power rate limit. 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.		P
	The power rate limit (W_{Gra}) shall be adjustable within the range 5% to 100% of rated power per minute. It is acceptable to have two separate power rate limits for increase and decrease in output power, as follows:		P
	(a) To rate limit an increase in power (W_{Gra}+).		P
	(b) To rate limit a decrease in power (W_{Gra}−).		P
6.3.5.3	Power rate limit modes		P
6.3.5.3.1	General		P
	The inverter power rate limit (W_{Gra}) is applicable to operate in the following modes:		P
	(a) Soft ramp up after connect or reconnect.		P
	(b) Changes in a.c. operation and control.		P
	(c) Changes in energy source operation.		N/A
6.3.5.3.2	Soft ramp up after connect or reconnect		P
	All inverters shall have this mode. This mode shall be enabled as per Clause 7.7 and for the increase in power required by Clause 7.5.3 after frequency decreased to the required limit.		P
6.3.5.3.3	Changes in a.c. operation and control		P

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Clause	Requirement - Test	Result - Remark	Verdict
	If available, this mode shall be enabled for a change in a demand response mode of Clause 6.2 (except for DRM 0). When a demand response mode of Clause 6.2 (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 output levels.		P
	The power rate limit for changes in a.c. operation and control does not apply to those inverters that are correcting for sags and swells of less than 1 min.		P
6.3.5.3.4	Changes in energy source operation	The inverter is not equipped with energy source	N/A
	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. For this mode the power rate limit (W_{Gra}) should apply to the increase or decrease in power generation or consumption, and to the transitions between power output levels. For this mode, the power rate limit (W_{Gra}) should be able to be enabled or disabled. The power rate limit shall be disabled by default. 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). 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
6.3.5.4	Nonlinearity of power rate limit changes		P
	The nonlinearity (NL) of the power rate limit (Wgra) 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%.		P
6.4	Multiple mode inverter operation		N/A
6.4.1	General		N/A
	The requirements in this Clause for multiple mode inverters are in addition to the requirements for inverters.		N/A
	When the multiple mode inverter is disconnected from the grid any stand-alone port shall ensure that all active conductors are also isolated from the grid-interactive port.		N/A
	Multiple mode inverters shall be arranged 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 stand-alone port.		N/A
	Multiple mode inverters shall be arranged such that only the allowed installation methods of AS/NZS 3000 and AS/NZS 4777.1 can be used.		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	When the multiple mode inverter is providing the stand-alone function and is disconnected from the grid, the stand-alone port shall comply with the requirements for d.c. current injection (refer to Clause 5.9) into the connected load circuits. The type of RCD compatible with and for use on the stand-alone function outputs shall be declared.	No such port	N/A
6.4.2	Sinusoidal output in stand-alone mode		N/A
	The a.c. output voltage waveform of a stand-alone port of a multiple mode inverter operating in stand-alone mode, shall comply with the requirements of this Clause (6.4.2). The a.c. output voltage waveform of a stand-alone mode shall have a voltage total harmonic distortion (THD) not exceeding of 5% and no individual harmonic at a level exceeding 5%.		N/A
	Compliance shall be checked by measuring the THD and the individual harmonic voltages with the inverter delivering 5% power or the lowest continuous available output power greater than 5%, and 50% and 100% of its continuous rated power, into a resistive load, with the inverter supplied with nominal d.c. input voltage. The THD measuring instrument shall measure the sum of the harmonics from n = 2 to n = 50 as a percentage of the fundamental (n = 1) component at each load level.		N/A
6.4.3	Volt‑watt response mode for charging of energy storage		N/A
	The volt‑watt response mode for charging of energy storage varies the power input of the inverter from the grid in response to the voltage at its grid-interactive port. A multiple mode inverter with energy storage which can be charged from the grid shall have this volt‑watt response mode. This volt‑watt response mode is only active when power from the grid is required to charge the energy storage.		N/A
	The response curve required for the volt‑watt response is defined by the volt response reference values in Table 9 and corresponding power consumption from the grid through the grid-interactive port for charging energy storage. The default values are listed in Table 12 and shown in Figure 6.		N/A
6.5	Security of operational settings		P
	The internal settings of the demand response or power quality response modes of the inverter shall be secured against inadvertent or unauthorized tampering. Changes to the internal settings shall require the use of a tool and special instructions not provided to unauthorized personnel.		P
	The installer-accessible settings shall be capable of being adjusted within the values specified in this Clause (6).		P

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Clause	Requirement - Test	Result - Remark	Verdict
	Compliance shall be determined by inspection.		P
7	PROTECTIVE FUNCTIONS FOR CONNECTION TO ELECTRICAL INSTALLATIONS AND THE GRID		P
7.1	General		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 is disrupted from the grid.	two relays in serial used as automatic disconnection means	P
7.2	Automatic disconnection device		P
	The automatic disconnection device shall prevent power (both a.c. and d.c.) from entering the grid when the automatic disconnection device operates.		P
	The automatic disconnection device shall provide isolation in all live conductors.		P
	Automatic disconnection devices for isolation shall comply with the following requirements:		P
	(a) They shall be capable of withstanding an impulse voltage likely to occur at the point of installation, or have an appropriate contact gap.	There are two relays in serial used as automatic disconnection means. Contact gap is >1.5 mm for each relay	P
	(b) They shall not be able to falsely indicate that the contacts are open.		P
	(c) They shall be designed and installed so as to prevent unintentional closure, such as might be caused by impact, vibration or the like.	Self-check before the inverter work	P
	(d) They shall be devices that disconnect all live conductors (active and neutral) of the inverter from the grid-interactive port.		P
	(e) They shall be such that with a single fault applied to the automatic disconnection device or to any other location in the inverter, at least basic insulation or simple separation is maintained between the energy source port and the grid-interactive port when the means of disconnection is intended to be in the open state.	There are two relays in serial used as automatic disconnection means.	P
	(f) They shall be such that with a single fault applied to the automatic disconnection device or to any other location in the inverter, power is prevented from entering the grid.	the inverter shutdown and disconnect from grid	P
	The automatic disconnection device shall be capable of interrupting at least the rated current.		P
	The settings of the automatic disconnection device shall not exceed the capability of the inverter.		P
	A semiconductor (solid-state) device shall not be used for isolation purposes.	Not solid-state device	P

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Clause	Requirement - Test	Result - Remark	Verdict
7.3	Active anti-islanding protection		P
	The automatic disconnection device shall incorporate at least one method of active anti-islanding protection.		P
	The method used to provide active anti-islanding protection shall be declared.	frequency shift method used	P
	To prevent islanding, the active anti-islanding protection system shall operate the automatic disconnection device (see Clause 7.2) within 2 s of disruption to the power supply from the grid.		P
	Compliance shall be determined by type testing in accordance with the active anti-islanding tests specified in Appendix F or IEC 62116.	See appended table in accordance with IEC 62116	P
7.4	Voltage and frequency limits (passive anti-islanding protection)		P
	The automatic disconnection device shall incorporate the following forms of passive anti-islanding protection:		P
	(a) Undervoltage and overvoltage protection.		P
	(b) Under-frequency and over-frequency protection.		P
	For sustained variation of the voltage and frequency beyond each limit specified in Table 13, the automatic disconnection device (see Clause 7.2) shall operate no sooner than the required trip delay time and before the maximum disconnection time.		P
	This requires the inverter to remain in continuous, uninterrupted operation for voltage variations with a duration shorter than the trip delay time specified in Table 13.		P
	Each protective function limit shall be preset and secured against change.		P
	Compliance shall be determined by type testing in accordance with the voltage and frequency limits tests specified in Appendix G.	See appended table	P
7.5	Limits for sustained operation		P
7.5.1	General		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 5.4.		P
7.5.2	Sustained operation for voltage variations		P
	The inverter shall operate the automatic disconnection device (see Clause 7.2) within 30 s when the average voltage for a 10 min period exceeds the V_{nom_max}, where $V_{nom-max}$ lies in the range 244 – 258 V.		P
	The sustained operation for voltage variations shall not interfere with the active and passive anti-islanding requirements of Clauses 7.3 and 7.4.		P

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Clause	Requirement - Test	Result - Remark	Verdict
	The limit $V_{nom-max}$, shall be preset to the default set-point and may be programmable up to the maximum 258 V. The default set-point for $V_{nom-max}$ shall be as follows:		P
	(a) In Australia: 255 V.		P
	(b) In New Zealand: 248 V.		P
	The 10 min average value shall be compared against the limit $V_{nom-max}$ at least every 3 s to determine when to disconnect.		P
	Compliance shall be determined by type testing in accordance with the sustained operation for voltage variations test specified in Appendix H.	See appended table	P
7.5.3	Sustained operation for frequency variations		P
7.5.3.1	Response to an increase in frequency		P
	The inverter shall be capable of supplying rated power between 47 Hz and 50.25 Hz for Australia.		P
	The inverter shall be capable of supplying rated power between 45 Hz and 50.25 Hz for New Zealand.		P
	When a grid frequency disturbance results in an increase in grid frequency which exceeds 50.25 Hz, the inverter shall reduce the power output linearly with an increase of frequency until f_{stop} is reached, where f_{stop} lies in the range 51 – 52 Hz.		P
	The power level present at the time the frequency reaches or exceeds 50.25 Hz shall be held as the reference power level used to calculate the required response to the increasing frequency.		P
	When the frequency exceeds f_{stop} the inverter power output shall be ceased (i.e. 0 W). The default set-point for f_{stop} shall be 52 Hz.		P
	The output power shall remain at or below the lowest power level reached in response to an over-frequency event between 50.25 Hz and f_{stop}. This is to provide hysteresis in the control of the inverter. When the grid frequency has decreased back to 50.15 Hz or less for at least 60 s, the power level shall be increased at a rate no greater than the power rate limit (W_{Gra}) of Clause 6.3.5 until the available energy source power is reached. Figure 7(A) shows this.		P
	Unconstrained power operation may recommence 6 min after the frequency returns to and remains at less than 50.15 Hz.		P
	Compliance shall be determined by type testing in accordance with the sustained operation for frequency variations test specified in Appendix H.	See appended table	P
7.5.3.2	Response to a decrease in grid frequency		N/A
	This requirement applies only to inverters with energy storage.		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	The inverter shall be capable of charging the energy storage between 49.75 Hz and 52.0 Hz.		N/A
	When a grid frequency disturbance results in a decrease in grid frequency which falls below 49.75 Hz, an inverter with energy storage which is charging from the grid port should reduce the power input for charging linearly with a decrease of frequency until $f_{stop-CH}$ is reached, where $f_{stop-CH}$ lies in the range 47 – 49 Hz.		N/A
	The power input level for charging present at the time the frequency reaches or falls below 49.75 Hz shall be held as the reference charge rate used to calculate the required response to the decreasing frequency.		N/A
	When the frequency falls below $f_{stop-CH}$, the inverter should have ceased charging the storage element (i.e. 0 W). The default set-point for $f_{stop-CH}$ should be 49 Hz.		N/A
	The power input level for charging of the storage element shall remain at or below the lowest charge rate reached in response to a low-frequency event between $f_{stop-CH}$ and 49.75 Hz. This is to provide hysteresis in the control of the inverter.		N/A
	When the grid frequency has increased back to 49.85 Hz or more for at least 60 s, the charge rate of the storage element may be increased at a rate no greater than the power rate limit (W_{Gra}) of Clause 6.3.5 until the charge rate present at the time of the frequency disturbance is reached. Figure 7(B) shows this.		N/A
	Unconstrained charging of the storage element may recommence 6 min after the frequency returns to and remains above than 49.85 Hz.		N/A
	Compliance shall be determined by type testing in accordance with the sustained operation for frequency variations test specified in Appendix H.		N/A
7.6	Disconnection on external signal		P
	The automatic disconnection device shall incorporate the ability to disconnect on an external signal.		P
	If an external signal or demand response 'DRM 0' condition is asserted, the automatic disconnection device shall operate within 2 s.		P
	Compliance shall be determined by type testing as specified in Appendix I.	See appended table	P
7.7	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—		P
	(a) the voltage of the grid has been maintained within the limits of AS 60038 (for Australia) or IEC 60038 (for New Zealand) for at least 60 s;		P

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Clause	Requirement - Test	Result - Remark	Verdict
	(b) the frequency of the grid has been maintained within the range 47.5 Hz to 50.15 Hz for at least 60 s;		P
	(c) the inverter and the grid are synchronized and in-phase with each other; and		P
	(d) no external signal is present or DRM 0 asserted requiring the system to be disconnected.		P
	After the automatic disconnection device operates to connect or reconnect the inverter the output shall rate limit increase in power generation to the set power rate limit (W_{Gra}) for increase in power of Clause 6.3.5. Unconstrained power operation may recommence after the automatic disconnection device operates to connect or reconnect the inverter, when either the rated power output is reached or the required output power level of the inverter exceeds the available energy source.		P
	Compliance shall be determined by type testing in accordance with the tests as specified in Appendix F and Appendix G.	See appended table	P
7.8	Security of protection settings		P
	The internal settings of the automatic disconnection device shall be secured against inadvertent or unauthorized tampering. Changes to the internal settings shall require the use of a tool and special instructions not provided to unauthorized personnel.		P
	The installer-accessible settings of the automatic disconnection device shall be capable of being adjusted within the limits specified in Clause 7.5.		P
	The manufacturer settings of the automatic disconnection device, specified in Clause 7.4, shall be secured against changes.		P
	Compliance shall be determined by inspection.		P
8	MULTIPLE INVERTER COMBINATIONS		N/A
8.1	General		N/A
	There are installations where multiple inverter energy systems are used and the electrical installation connects at a single point of supply to the grid. Inverter energy systems are often comprised of multiple inverters used in combination to provide the desired inverter energy system capacity or to ensure that voltage balance is maintained in multiple phase connections to the grid.	No in such used	N/A
	This Clause (8) specifies the requirements and tests for inverter energy systems used in such combinations. 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.		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	Possible combinations are single-phase inverters used in parallel, single-phase inverters used in multiple phase installations and three-phase inverters used in parallel.		N/A
8.2	Inverter current balance across multiple phases		N/A
	In a three-phase inverter system comprised of individual single-phase inverters the a.c. output current should be generated and injected into the three-phase electrical installation as a three-phase balanced current. The maximum current imbalance in a three-phase inverter system comprised of individual single-phase inverters shall be no more than 21.7 A.		N/A
8.3	Grid disconnection		N/A
	When any inverter within the inverter energy system disconnects as required by Clause 7, all inverters within the inverter energy system shall disconnect within 2 s of the first inverter disconnecting. This applies to all inverters used in combination for single-phase or multiple phases.		N/A
8.4	Grid connection and reconnection		N/A
	When multiple inverters are used together in a multiple phase combination, only after all the conditions of Clause 7.7 have been met on all connected phases shall the automatic disconnection device operate to connect or reconnect any inverter of the multiple phase combination to the grid.		N/A
	Where any inverter used in a multiple phase combination has a rated current exceeding 21.7 A per phase, the requirement of Clause 8.2 shall be met when connecting or reconnecting.		N/A
8.5	Testing combinations		N/A
8.5.1	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.		N/A
	To determine the number of inverters to be tested, the following equation shall be used: $N = 6/I_{rated}$		N/A
	If $N \geqslant 2$, 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.		N/A
8.5.2	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 8(a)].		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 8(b)].		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
8.5.3	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-phase inverter which is to be used as part of a multiple inverter combination shall be tested in combination as specified in Clauses 8.5.1 and 8.5.2.		N/A
	The tests specified in Table 14 for multiple inverter combinations shall be performed.		N/A
	Compliance shall be determined by type testing as specified in Appendix J.		N/A
8.5.4	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 8.5.1 and 8.5.2 or with the automatic disconnection device configured with the number of inverters specified by the manufacturer ‘s instructions.		N/A
	Compliance shall be determined by performing all of the type tests specified in Clause 5.		N/A
9	INVERTER MARKING AND DOCUMENTATION		P
9.1	General		P
	The inverter shall comply with the marking and documentation requirements of IEC 62109-1 and IEC 62109-2, as varied by this Clause (9).		P
	All markings and documentation shall be in the English language.		P
9.2	Marking		P
9.2.1	General		P
	The following variations apply to the marking requirements of IEC 62109-1 and IEC 62109-2:		P
	(a) Inverters that are designated for use in inverter energy systems incorporating energy sources other than PV arrays or batteries shall bear additional or alternative markings appropriate to the energy source.		N/A
	(b) Inverters that are designated for use in closed electrical operating areas shall be marked with a warning stating that they are not suitable for installation in households or areas of a similar type or use (i.e. domestic).		N/A
9.2.2	Equipment ratings		P

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Clause	Requirement - Test	Result - Remark	Verdict
	The inverter shall be marked with its ratings and the ratings of each port, as specified in Table 15. Only those ratings that are applicable to the type of inverter are required. The ratings shall be plainly and permanently marked on the inverter, in a location that is clearly visible after installation.		P
9.2.3	Ports		P
	Each port shall be marked with its classification and indicate whether a.c or d.c. voltage as appropriate.		P
	Typical classifications include the following:		P
	(a) PV (photovoltaic).		P
	(b) Wind turbine.		N/A
	(c) Energy storage.		N/A
	(d) Battery.		N/A
	(e) Generator.		N/A
	(f) Grid-interactive.		P
	(g) Stand-alone.		N/A
	(h) Communications (type).		P
	(i) DRM.		P
	(j) Load.		N/A
9.2.4	External and ancillary equipment		N/A
	If the inverter requires external or ancillary equipment for compliance with this Standard, the requirement for any such equipment shall be marked on the inverter along with the following or an equivalent statement: ‘Refer to the installation instructions for type and ratings’ or symbol.		N/A
	Any external or ancillary equipment shall be marked in accordance with this Clause (9).		N/A
9.2.5	Residual current devices (RCDs)		P
	Inverter energy systems used with PV array systems require residual current detection in accordance with IEC 62109-1 and IEC 62109-2. The requirements can be met by the installation of a suitably rated RCD external to the inverter or by an RCMU integral to the inverter.	Internal RCMU	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:		N/A
	WARNING: AN RCD IS REQUIRED ON THE [NAME] PORTS OF THE INVERTER		N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	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:		N/A
	WARNING: A TYPE B RCD IS REQUIRED ON THE [NAME] PORTS OF THE INVERTER		N/A
9.2.6	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.		P
	Figure 9 illustrates an acceptable form of marking. If this form of marking is used, each box shall contain a tick or a cross (if the inverter has that capability) or remain blank (if it does not have that capability). Alternatively, only the modes supported may be marked.		P
	If the physical interface is a terminal block, then—		P
	(a) the terminals shall be engraved or otherwise durably marked; or		P
	(b) a permanent label with ‘DRM Port’ shall be affixed near the terminal block.		P
	The marking shall indicate which terminal corresponds to which demand response mode.		P
	The range of markings is indicated against Pins 1 to 6 in Table 7.		P
9.3	Documentation		P
9.3.1	General		P
	The documentation supplied with the inverter shall provide all information necessary for the correct installation, operation and use of the system and any required external devices including information specified in Clause 9.2.		P
	All inverters, including those intended for use in systems incorporating energy sources other than PV arrays or batteries, shall comply with the documentation requirements of IEC 62109-1 and IEC 62109-2.		P
9.3.2	Equipment ratings		P
	The documentation supplied with the inverter shall state the ratings of the inverter and the ratings for each port, as specified in Table 16. Only those ratings that are applicable to the type of inverter are required.		P
	For equipment with rated current greater than 16 A per phase, additional documentation requirements apply. See Clause 5.7.		P
9.3.3	Ports		P

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Clause	Requirement - Test	Result - Remark	Verdict
	In addition to the requirements of Clause 9.3.2, the documentation supplied with the inverter shall state the following for each port, as a minimum:		P
	(a) Means of connection.		P
	(b) For pluggable equipment type B, the type of matching connectors to be used.		N/A
	(c) External controls and protection requirements.		P
	(d) Explanation of terminals or pins used for connection including polarity and voltage.		P
	(e) Tightening torque to be applied to terminals.		N/A
	(f) Instructions for protective earthing.		P
	(g) Instructions for connection of loads and installation of RCD protection to stand-alone ports.		N/A
	(h) The decisive voltage class (DVC).		P
9.3.4	External and ancillary equipment		N/A
	Where an inverter or multiple inverter combinations requires external or ancillary equipment for compliance with this Standard, the documentation shall—		N/A
	(a) state the requirement for any such equipment;		N/A
	(b) provide sufficient information to identify the external or ancillary equipment, either by manufacturer and part number or by type and rating; and		N/A
	(c) specify assembly, location, mounting and connection requirements.		N/A
9.3.5	RCDs		N/A
	Where an external RCD is required, the following or an equivalent statement shall be included in the documentation: ‘External RCD Required’. The documentation shall also state the rating and type of RCD required and provide instructions for the installation of the RCD.		N/A
9.3.6	Multiple mode inverters		N/A
	Where the inverter is capable of multiple mode operation, the documentation shall include the following:		N/A
	(a) Ratings and means of connection to each source of supply to the inverter or output from the inverter.		N/A
	(b) Any requirements related to wiring and external controls, including the method of maintaining neutral continuity within the electrical installation to any stand-alone ports as required.		N/A
	(c) Disconnection means and isolation means.		N/A
	(d) Overcurrent protection needed.		N/A
9.3.7	Multiple inverter combinations	No in such used	N/A

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Clause	Requirement - Test	Result - Remark	Verdict
	Where an inverter has been tested for use in a multiple inverter combination as per Clause 8, the documentation shall include the following:		N/A
	(a) Valid combinations of inverters.		N/A
	(b) Installation instructions for correct operation as a multiple inverter combination.		N/A
APPENDIX A	GENERAL TEST AND REPORTING REQUIREMENTS		P
APPENDIX B	POWER FACTOR TEST		P
APPENDIX C	HARMONIC CURRENT LIMIT TEST		P
APPENDIX D	TRANSIENT VOLTAGE LIMIT TEST		P
APPENDIX E	D.C. INJECTION TEST		P
APPENDIX F	ACTIVE ANTI-ISLANDING TEST		P
APPENDIX G	VOLTAGE AND FREQUENCY LIMITS (PASSIVE ANTI-ISLANDING PROTECTION) TESTS		P
APPENDIX H	LIMITS FOR SUSTAINED OPERATION		P
APPENDIX I	DEMAND AND POWER QUALITY RESPONSE MODE TESTING INCLUDING DISCONNECTION ON EXTERNAL SIGNAL		P
APPENDIX J	MULTIPLE INVERTER TESTING		N/A
APPENDIX K	RELATED DOCUMENTS		Info.

Appendix Table:

5.5	TABLE: Power factor test						P
Model	SOFAR 15000TL-G2						
Mode		Measurement	15%	25%	50%	75%	100%
Unity		Power (KW)	2.2796	3.9094	7.7276	11.7056	15.1350
		Reactive power (Var)	-178.13	-207.06	-115.93	-105.45	-92.84
		PF	0.9970	0.9986	0.9999	0.9999	0.9999
		Lead/lag	Lag	Lag	Lag	Lag	Lag
Model	SOFAR 10000TL-G2						
Mode		Measurement	15%	25%	50%	75%	100%
Unity		Power (W)	1500.79	2693.34	5244.64	7497.81	9855.28
		Reactive power (Var)	-158.34	-158.18	-132.39	-116.61	453.20
		PF	0.9943	0.9983	0.9997	0.9999	0.9989
		Lead/lag	Lag	Lag	Lag	Lag	Lead

5.6	TABLE: Harmonic current limit test						P
Background voltage harmonics (R phase)							
Component	Limit of fundamental	Value V	% of fundamental	Component	Limit of fundamental	Value V	% of fundamental
1	--	229.9538	100.00	26	0.1%	0.0030	0.0013
2	0.2%	0.0151	0.0065	27	0.1%	0.0030	0.0013
3	0.9%	0.0325	0.0142	28	0.1%	0.0030	0.0013
4	0.2%	0.0038	0.0016	29	0.1%	0.0030	0.0013
5	0.4%	0.0414	0.0180	30	0.1%	0.0029	0.0013
6	0.2%	0.0022	0.0010	31	0.1%	0.0029	0.0013
7	0.3%	0.0175	0.0076	32	0.1%	0.0030	0.0013
8	0.2%	0.0021	0.0009	33	0.1%	0.0030	0.0013
9	0.2%	0.0077	0.0034	34	0.1%	0.0032	0.0014
10	0.1%	0.0024	0.0011	35	0.1%	0.0028	0.0012
11	0.1%	0.0026	0.0011	36	0.1%	0.0029	0.0012
12	0.1%	0.0025	0.0011	37	0.1%	0.0029	0.0012
13	0.1%	0.0026	0.0011	38	0.1%	0.0029	0.0013
14	0.1%	0.0027	0.0012	39	0.1%	0.0030	0.0013
15	0.1%	0.0026	0.0011	40	0.1%	0.0029	0.0013
16	0.1%	0.0028	0.0012	41	0.1%	0.0031	0.0014
17	0.1%	0.0027	0.0011	42	0.1%	0.0030	0.0013
18	0.1%	0.0027	0.0012	43	0.1%	0.0030	0.0013

19	0.1%	0.0028	0.0012	44	0.1%	0.0030	0.0013
20	0.1%	0.0027	0.0012	45	0.1%	0.0034	0.0015
21	0.1%	0.003	0.0013	46	0.1%	0.0141	0.0061
22	0.1%	0.0027	0.0012	47	0.1%	0.0032	0.0014
23	0.1%	0.0028	0.0012	48	0.1%	0.0139	0.0061
24	0.1%	0.0028	0.0012	49	0.1%	0.0034	0.0015
25	0.1%	0.0029	0.0012	50	0.1%	0.0033	0.0014
Total harmonic distortion (to 50th component)	5%	0.0330%					
Background voltage harmonics (S phase)							
Component	Limit of fundamental	Value V	% of fundamental	Component	Limit of fundamental	Value V	% of fundamental
1	--	230.0221	100	26	0.1%	0.0025	0.0011
2	0.2%	0.0156	0.0068	27	0.1%	0.003	0.0013
3	0.9%	0.0325	0.0141	28	0.1%	0.0029	0.0013
4	0.2%	0.0029	0.0013	29	0.1%	0.0028	0.0012
5	0.4%	0.0449	0.0195	30	0.1%	0.0029	0.0013
6	0.2%	0.0021	0.0009	31	0.1%	0.0029	0.0012
7	0.3%	0.0204	0.0089	32	0.1%	0.0028	0.0012
8	0.2%	0.0022	0.0009	33	0.1%	0.0028	0.0012
9	0.2%	0.0043	0.0018	34	0.1%	0.0028	0.0012
10	0.1%	0.0022	0.001	35	0.1%	0.0027	0.0012
11	0.1%	0.0037	0.0016	36	0.1%	0.003	0.0013
12	0.1%	0.0024	0.0011	37	0.1%	0.003	0.0013
13	0.1%	0.004	0.0018	38	0.1%	0.0029	0.0013
14	0.1%	0.0025	0.0011	39	0.1%	0.0028	0.0012
15	0.1%	0.0029	0.0013	40	0.1%	0.0029	0.0012
16	0.1%	0.0025	0.0011	41	0.1%	0.0031	0.0014
17	0.1%	0.0031	0.0014	42	0.1%	0.003	0.0013
18	0.1%	0.0025	0.0011	43	0.1%	0.0031	0.0013
19	0.1%	0.0028	0.0012	44	0.1%	0.0031	0.0013
20	0.1%	0.0026	0.0011	45	0.1%	0.0029	0.0013
21	0.1%	0.0027	0.0012	46	0.1%	0.0237	0.0103
22	0.1%	0.0028	0.0012	47	0.1%	0.0039	0.0017
23	0.1%	0.0025	0.0011	48	0.1%	0.0252	0.0109

24	0.1%	0.0027	0.0012	49	0.1%	0.0033	0.0015
25	0.1%	0.0027	0.0012	50	0.1%	0.0031	0.0014
Total harmonic distortion (to 50th component)	5%	0.0350%					

Background voltage harmonics (T phase)

Component	Limit of fundamental	Value V	% of fundamental	Component	Limit of fundamental	Value V	% of fundamental
1	--	230.0084	100	26	0.1%	0.0028	0.0013
2	0.2%	0.0147	0.0064	27	0.1%	0.0030	0.0013
3	0.9%	0.0343	0.0149	28	0.1%	0.0028	0.0012
4	0.2%	0.0034	0.0014	29	0.1%	0.0029	0.0013
5	0.4%	0.0443	0.0193	30	0.1%	0.0028	0.0013
6	0.2%	0.0022	0.0009	31	0.1%	0.0030	0.0013
7	0.3%	0.0198	0.0086	32	0.1%	0.0028	0.0012
8	0.2%	0.0022	0.001	33	0.1%	0.0028	0.0012
9	0.2%	0.0042	0.0018	34	0.1%	0.0030	0.0013
10	0.1%	0.0022	0.001	35	0.1%	0.0028	0.0012
11	0.1%	0.0037	0.0017	36	0.1%	0.0031	0.0013
12	0.1%	0.0024	0.001	37	0.1%	0.0030	0.0013
13	0.1%	0.0036	0.0016	38	0.1%	0.0029	0.0013
14	0.1%	0.0026	0.0012	39	0.1%	0.0030	0.0013
15	0.1%	0.0029	0.0013	40	0.1%	0.0028	0.0012
16	0.1%	0.0024	0.001	41	0.1%	0.003	0.0013
17	0.1%	0.0030	0.0013	42	0.1%	0.0029	0.0012
18	0.1%	0.0026	0.0011	43	0.1%	0.0033	0.0014
19	0.1%	0.0030	0.0013	44	0.1%	0.0030	0.0013
20	0.1%	0.0027	0.0012	45	0.1%	0.0033	0.0014
21	0.1%	0.0029	0.0012	46	0.1%	0.0144	0.0063
22	0.1%	0.0027	0.0011	47	0.1%	0.0031	0.0014
23	0.1%	0.0026	0.0011	48	0.1%	0.0140	0.0061
24	0.1%	0.0027	0.0012	49	0.1%	0.0033	0.0015
25	0.1%	0.0027	0.0012	50	0.1%	0.0030	0.0013
Total harmonic distortion (to 50th component)	5%	0.0330%					

Harmonic current limit test

Model: SOFAR 15000TL-G2 (R phase)

Component	Limit of fundamental	50% of rated current Value A	50% of rated current Angle degrees	50% of rated current % of fundamental	100% of rated current Value A	100% of rated current Angle degrees	100% of rated current % of fundamental
1	100%	12.0029	0	100.00	22.971	0	100.00
2	1%	0.0248	0	0.2070	0.0303	0	0.132
3	4%	0.0275	0	0.2291	0.0468	0	0.2036
4	1%	0.0247	0	0.2055	0.0248	0	0.1081
5	4%	0.0278	0	0.2314	0.0675	0	0.2937
6	1%	0.0231	0	0.1924	0.0226	0	0.0986
7	4%	0.0250	0	0.2084	0.0918	0	0.3995
8	1%	0.0235	0	0.1962	0.0244	0	0.1060
9	2%	0.0244	0	0.2036	0.0299	0	0.1302
10	0.5%	0.0225	0	0.1876	0.0252	0	0.1096
11	2%	0.0219	0	0.1826	0.0434	0	0.1890
12	0.5%	0.0225	0	0.1874	0.0218	0	0.0948
13	2%	0.0214	0	0.1785	0.0295	0	0.1283
14	0.5%	0.0216	0	0.1796	0.0234	0	0.1020
15	1%	0.0220	0	0.1830	0.0243	0	0.1058
16	0.5%	0.0213	0	0.1776	0.0223	0	0.0969
17	1%	0.0263	0	0.2188	0.0455	0	0.1979
18	0.5%	0.0206	0	0.1719	0.0215	0	0.0935
19	1%	0.0263	0	0.2192	0.0465	0	0.2025
20	0.5%	0.0214	0	0.1787	0.0217	0	0.0945
21	0.6%	0.0215	0	0.1791	0.0212	0	0.0921
22	0.5%	0.0223	0	0.1856	0.0209	0	0.0911
23	0.6%	0.0256	0	0.2132	0.0353	0	0.1535
24	0.5%	0.0207	0	0.1725	0.021	0	0.0914
25	0.6%	0.0240	0	0.1999	0.0304	0	0.1325
26	0.5%	0.0212	0	0.1765	0.0214	0	0.0930
27	0.6%	0.0222	0	0.1851	0.02	0	0.0872
28	0.5%	0.0212	0	0.1765	0.0203	0	0.0885
29	0.6%	0.0246	0	0.2051	0.0276	0	0.1200
30	0.5%	0.0212	0	0.1769	0.0213	0	0.0925
31	0.6%	0.0240	0	0.2003	0.0258	0	0.1123
32	0.5%	0.0221	0	0.1845	0.021	0	0.0915

33	0.6%	0.0221	0	0.1842	0.0232	0	0.1010
Total harmonic distortion (to 50th component)	5%	2.1410			1.2790		

Harmonic current limit test

Model	SOFAR 15000TL-G2 (S phase)						
Component	Limit	50% of rated current			100% of rated current		
	% of fundamental	Value A	Angle degrees	% of fundamental	Value A	Angle degrees	% of fundamental
1	100%	11.9968	120	100.00	22.9946	120	100.00
2	1%	0.0269	120	0.2244	0.0364	120	0.1581
3	4%	0.0253	120	0.2112	0.0314	120	0.1367
4	1%	0.0255	120	0.2130	0.023	120	0.1002
5	4%	0.0288	120	0.2398	0.0724	120	0.3149
6	1%	0.0222	120	0.1852	0.0215	120	0.0935
7	4%	0.0232	120	0.1933	0.0719	120	0.3127
8	1%	0.0225	120	0.1874	0.0235	120	0.1021
9	2%	0.0216	120	0.1803	0.0245	120	0.1065
10	0.5%	0.0234	120	0.1949	0.0282	120	0.1225
11	2%	0.0243	120	0.2025	0.0334	120	0.1452
12	0.5%	0.0221	120	0.1843	0.0233	120	0.1014
13	2%	0.0231	120	0.1922	0.0374	120	0.1624
14	0.5%	0.0239	120	0.1988	0.0243	120	0.1057
15	1%	0.0216	120	0.1801	0.0230	120	0.1001
16	0.5%	0.0219	120	0.1824	0.0250	120	0.1086
17	1%	0.0256	120	0.2131	0.0509	120	0.2215
18	0.5%	0.0229	120	0.1906	0.0209	120	0.0910
19	1%	0.0264	120	0.2203	0.0469	120	0.2041
20	0.5%	0.0223	120	0.1857	0.0220	120	0.0956
21	0.6%	0.0208	120	0.1735	0.0218	120	0.0946
22	0.5%	0.0218	120	0.1814	0.0218	120	0.0950
23	0.6%	0.0262	120	0.2180	0.0350	120	0.1524
24	0.5%	0.0213	120	0.1776	0.0216	120	0.0941
25	0.6%	0.0246	120	0.2052	0.0374	120	0.1628
26	0.5%	0.0218	120	0.1816	0.0219	120	0.0951
27	0.6%	0.0201	120	0.1679	0.0221	120	0.0960
28	0.5%	0.0214	120	0.1781	0.0215	120	0.0933

29	0.6%	0.0265	120	0.2205	0.0298	120	0.1298
30	0.5%	0.0218	120	0.1817	0.0209	120	0.0910
31	0.6%	0.0236	120	0.1967	0.0290	120	0.1261
32	0.5%	0.0219	120	0.1823	0.0224	120	0.0973
33	0.6%	0.0214	120	0.1781	0.0236	120	0.1027
Total harmonic distortion (to 50th component)	5%	2.2900			1.3730		

Harmonic current limit test

Model	SOFAR 15000TL-G2 (T phase)						
Component	Limit	50% of rated current			100% of rated current		
	% of fundamental	Value A	Angle degrees	% of fundamental	Value A	Angle degrees	% of fundamental
1	100%	11.9934	240	100	22.9638	240	100
2	1%	0.0257	240	0.1981	0.0326	240	0.1421
3	4%	0.0238	240	0.1457	0.0253	240	0.1102
4	1%	0.0225	240	0.1685	0.0238	240	0.1037
5	4%	0.0368	240	0.3166	0.0344	240	0.1498
6	1%	0.0217	240	0.1965	0.0220	240	0.0958
7	4%	0.0311	240	0.2366	0.0739	240	0.3219
8	1%	0.0241	240	0.1909	0.0234	240	0.1020
9	2%	0.0229	240	0.2038	0.0240	240	0.1046
10	0.5%	0.0233	240	0.1693	0.0259	240	0.1126
11	2%	0.0241	240	0.2204	0.0397	240	0.1730
12	0.5%	0.0216	240	0.1741	0.0226	240	0.0984
13	2%	0.0245	240	0.1974	0.0368	240	0.1601
14	0.5%	0.0229	240	0.1852	0.0254	240	0.1106
15	1%	0.0215	240	0.2064	0.0240	240	0.1045
16	0.5%	0.0223	240	0.1946	0.0227	240	0.0988
17	1%	0.0289	240	0.2122	0.0422	240	0.1840
18	0.5%	0.0216	240	0.1783	0.0215	240	0.0937
19	1%	0.0279	240	0.1992	0.0410	240	0.1787
20	0.5%	0.0224	240	0.1952	0.0212	240	0.0924
21	0.6%	0.0214	240	0.1884	0.0216	240	0.0943
22	0.5%	0.0220	240	0.1817	0.0212	240	0.0925
23	0.6%	0.0264	240	0.1807	0.0362	240	0.1575
24	0.5%	0.0215	240	0.1662	0.0213	240	0.0929

25	0.6%	0.0271	240	0.2636	0.0349	240	0.1521
26	0.5%	0.0228	240	0.1728	0.0222	240	0.0966
27	0.6%	0.0211	240	0.1692	0.0227	240	0.0987
28	0.5%	0.0225	240	0.1849	0.0215	240	0.0937
29	0.6%	0.0241	240	0.2122	0.0318	240	0.1386
30	0.5%	0.0226	240	0.1930	0.0221	240	0.0963
31	0.6%	0.0236	240	0.2029	0.0277	240	0.1205
32	0.5%	0.0217	240	0.2035	0.0219	240	0.0955
33	0.6%	0.0216	240	0.1963	0.0217	240	0.0944
Total harmonic distortion (to 50th component)	5%	2.3250			1.2450		

Model	SOFAR 10000TL-G2 (R phase)						
Component	Limit	50% of rated current			100% of rated current		
	of fundamental	Value A	Angle degrees	% of fundamental	Value A	Angle degrees	% of fundamental
1	100%	7.5945	0	100	14.3333	0	100
2	1%	0.0257	0	0.3384	0.0282	0	0.1969
3	4%	0.0254	0	0.3347	0.0283	0	0.1973
4	1%	0.0239	0	0.3150	0.0254	0	0.177
5	4%	0.0266	0	0.3503	0.0279	0	0.1947
6	1%	0.0228	0	0.3007	0.0237	0	0.1653
7	4%	0.0228	0	0.3003	0.0231	0	0.1614
8	1%	0.0232	0	0.3053	0.0220	0	0.1536
9	2%	0.0408	0	0.5368	0.0248	0	0.1732
10	0.5%	0.0329	0	0.4327	0.0233	0	0.1628
11	2%	0.0242	0	0.3184	0.0233	0	0.1623
12	0.5%	0.0242	0	0.3182	0.0213	0	0.1484
13	2%	0.0242	0	0.3181	0.0218	0	0.1524
14	0.5%	0.0327	0	0.4303	0.0289	0	0.2018
15	1%	0.0229	0	0.3018	0.0210	0	0.1462
16	0.5%	0.0223	0	0.2939	0.0236	0	0.1645
17	1%	0.0254	0	0.334	0.0253	0	0.1762
18	0.5%	0.0335	0	0.4411	0.0217	0	0.1515
19	1%	0.0235	0	0.3089	0.0260	0	0.1813
20	0.5%	0.0232	0	0.3053	0.0222	0	0.1548
21	0.6%	0.0223	0	0.2937	0.0217	0	0.1514
22	0.5%	0.0218	0	0.2866	0.0223	0	0.1555

23	0.6%	0.0227	0	0.2991	0.0253	0	0.1766
24	0.5%	0.0215	0	0.2827	0.0212	0	0.1476
25	0.6%	0.0218	0	0.2867	0.0241	0	0.1679
26	0.5%	0.0210	0	0.2771	0.0210	0	0.1463
27	0.6%	0.0221	0	0.2914	0.0234	0	0.1629
28	0.5%	0.0230	0	0.3035	0.0218	0	0.1522
29	0.6%	0.0215	0	0.2826	0.0237	0	0.1654
30	0.5%	0.0212	0	0.2787	0.0216	0	0.1509
31	0.6%	0.0229	0	0.3011	0.0237	0	0.1656
32	0.5%	0.0206	0	0.2716	0.0212	0	0.1479
33	0.6%	0.0219	0	0.2879	0.0216	0	0.1505
Total harmonic distortion (to 50th component)	5%	4.0720			1.8160		

Harmonic current limit test

Model	SOFAR 15000TL-G2 (S phase)						
Component	Limit	50% of rated current			100% of rated current		
	% of fundamental	Value A	Angle degrees	% of fundamental	Value A	Angle degrees	% of fundamental
1	100%	7.6053	120	100.00	14.341	120	100.00
2	1%	0.0340	120	0.4465	0.0275	120	0.1919
3	4%	0.0233	120	0.3065	0.0227	120	0.1586
4	1%	0.0236	120	0.3105	0.0218	120	0.1523
5	4%	0.0257	120	0.3376	0.0252	120	0.1754
6	1%	0.0217	120	0.2857	0.0213	120	0.1483
7	4%	0.0234	120	0.308	0.0254	120	0.1774
8	1%	0.0224	120	0.2947	0.0242	120	0.1690
9	2%	0.0248	120	0.3257	0.0222	120	0.1550
10	0.5%	0.0300	120	0.3943	0.0235	120	0.1642
11	2%	0.0257	120	0.3386	0.0218	120	0.1519
12	0.5%	0.0236	120	0.3099	0.0222	120	0.1546
13	2%	0.0263	120	0.3454	0.0224	120	0.1563
14	0.5%	0.0315	120	0.4146	0.0241	120	0.1680
15	1%	0.0222	120	0.2918	0.0211	120	0.1473
16	0.5%	0.0224	120	0.2949	0.0221	120	0.1540
17	1%	0.0249	120	0.3279	0.0262	120	0.1824
18	0.5%	0.0320	120	0.4209	0.0221	120	0.1539

19	1%	0.0227	120	0.2980	0.0247	120	0.1725
20	0.5%	0.0225	120	0.2955	0.0208	120	0.1452
21	0.6%	0.0219	120	0.2883	0.0227	120	0.1585
22	0.5%	0.0226	120	0.2971	0.0218	120	0.1518
23	0.6%	0.0224	120	0.2945	0.0265	120	0.1849
24	0.5%	0.0229	120	0.3009	0.0204	120	0.1420
25	0.6%	0.0219	120	0.2874	0.0255	120	0.1780
26	0.5%	0.0232	120	0.3052	0.0221	120	0.1540
27	0.6%	0.0220	120	0.2890	0.0217	120	0.1516
28	0.5%	0.0255	120	0.3352	0.0229	120	0.1595
29	0.6%	0.0232	120	0.3048	0.0254	120	0.1772
30	0.5%	0.0222	120	0.2920	0.0231	120	0.1613
31	0.6%	0.0214	120	0.2817	0.0243	120	0.1693
32	0.5%	0.0231	120	0.3034	0.0210	120	0.1466
33	0.6%	0.0223	120	0.2937	0.0224	120	0.1561
Total harmonic distortion (to 50th component)	5%	4.0010			1.9950		

Harmonic current limit test

Model	SOFAR 15000TL-G2 (T phase)						
Component	Limit	50% of rated current			100% of rated current		
	% of fundamental	Value A	Angle degrees	% of fundamental	Value A	Angle degrees	% of fundamental
1	100%	7.5995	240	100	14.3101	240	100
2	1%	0.0345	240	0.4544	0.0298	240	0.2081
3	4%	0.0247	240	0.3252	0.0240	240	0.1674
4	1%	0.0244	240	0.3209	0.0236	240	0.1650
5	4%	0.0389	240	0.5114	0.0403	240	0.2816
6	1%	0.022	240	0.2899	0.0223	240	0.1555
7	4%	0.0272	240	0.3583	0.0231	240	0.1615
8	1%	0.0232	240	0.3047	0.0242	240	0.1690
9	2%	0.0411	240	0.5407	0.0221	240	0.1542
10	0.5%	0.0298	240	0.3925	0.0236	240	0.1648
11	2%	0.0275	240	0.3624	0.0245	240	0.1712
12	0.5%	0.0223	240	0.2939	0.0218	240	0.1526
13	2%	0.0256	240	0.3367	0.0238	240	0.1663
14	0.5%	0.0294	240	0.3863	0.0314	240	0.2193

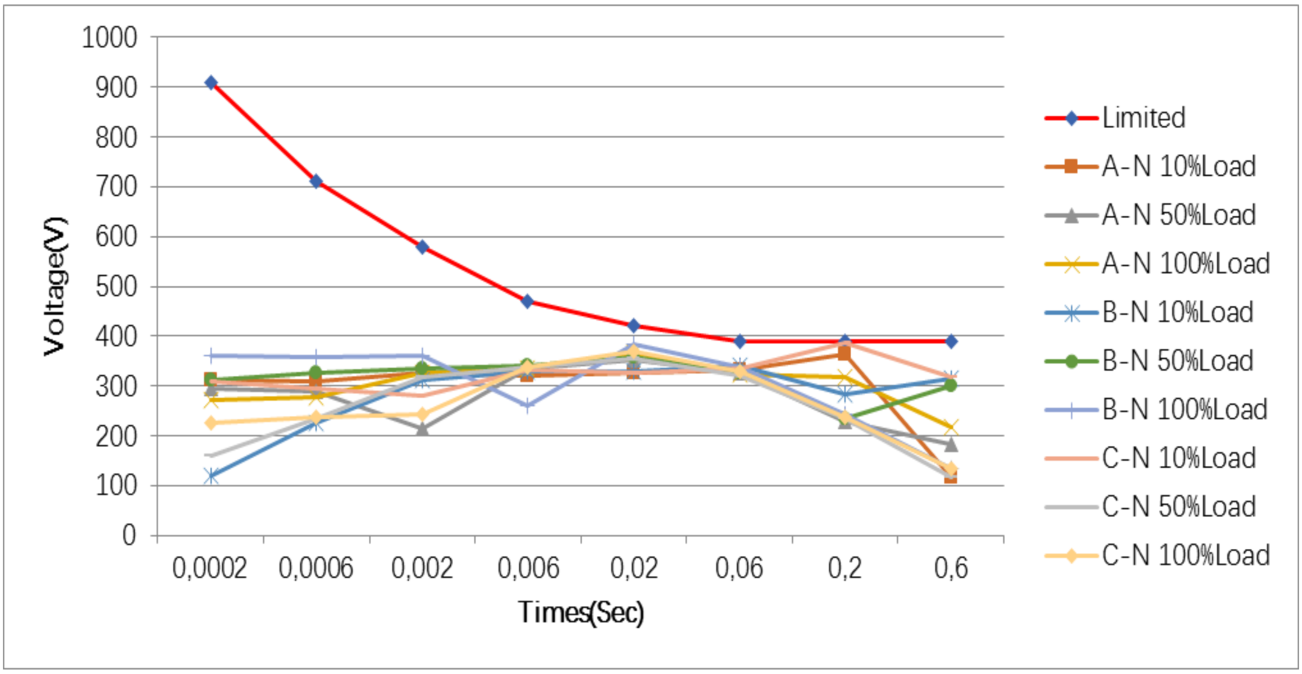
15	1%	0.022	240	0.29	0.0229	240	0.1598
16	0.5%	0.0222	240	0.2921	0.0221	240	0.1545
17	1%	0.0275	240	0.3613	0.0261	240	0.1823
18	0.5%	0.0322	240	0.4233	0.0222	240	0.1548
19	1%	0.023	240	0.3032	0.0296	240	0.2066
20	0.5%	0.0229	240	0.3015	0.0198	240	0.1383
21	0.6%	0.0222	240	0.2926	0.0221	240	0.1542
22	0.5%	0.0214	240	0.282	0.0217	240	0.1518
23	0.6%	0.0246	240	0.3241	0.0282	240	0.1972
24	0.5%	0.0216	240	0.2843	0.0212	240	0.1484
25	0.6%	0.0216	240	0.284	0.0247	240	0.1727
26	0.5%	0.0221	240	0.2903	0.0229	240	0.1597
27	0.6%	0.024	240	0.3157	0.0224	240	0.1565
28	0.5%	0.0257	240	0.3378	0.0228	240	0.1594
29	0.6%	0.022	240	0.2894	0.0267	240	0.1863
30	0.5%	0.0227	240	0.2992	0.0211	240	0.1476
31	0.6%	0.0221	240	0.2909	0.0247	240	0.1723
32	0.5%	0.0209	240	0.2751	0.0212	240	0.1482
33	0.6%	0.0214	240	0.2821	0.0226	240	0.1576
Total harmonic distortion (to 50th component)	5%	3.7710			1.8030		
Note: The impedance of the grid source:0.1Ω							

5.7	TABLE: Voltage fluctuations and flicker			P
Model	SOFAR 15000TL-G2 (R phase)			
	Starting	Stopping	Running	
Limit	4%	4%	Pst = 1.0	Plt = 0.65
Test value	0.28	0.39	0.00	0.12
Model	SOFAR 15000TL-G2 (S phase)			
	Starting	Stopping	Running	
Limit	4%	4%	Pst = 1.0	Plt = 0.65
Test value	0.29	0.59	0.00	0.14
Model	SOFAR 15000TL-G2 (T phase)			
	Starting	Stopping	Running	
Limit	4%	4%	Pst = 1.0	Plt = 0.65
Test value	0.33	0.59	0.00	0.16
The Test inverters' flicker level was found to be lower than the permissible limit as per AS61000.3.11				

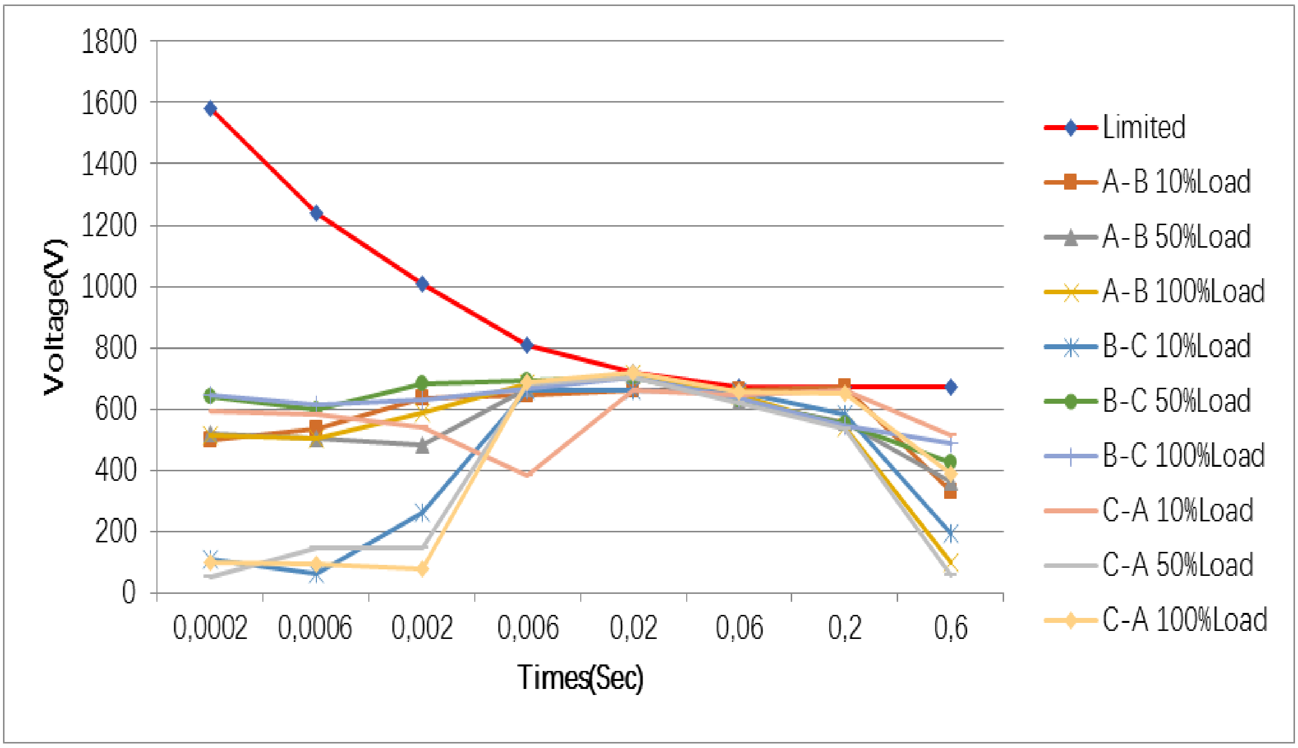
5.8	TABLE: Transient voltage limit test				P
Model	SOFAR 15000TL-G2				
Condition	Duration Seconds	Required (V)	Line-to-neutral volts (R-N)	Required (V)	Line-to-line Volts (R-S)
10(±5)% of rated output (VA)	0,000 2	910	311	1580	496
	0,000 6	710	309	1240	536
	0,002	580	328	1010	636
	0,006	470	321	810	644
	0,02	420	327	720	660
	0,06	390	332	670	660
	0,2	390	364	670	570
	0,6	390	116	670	330
Condition	Duration Seconds	Required (V)	Line-to-neutral volts (S-N)	Required (V)	Line-to-line Volts (R-T)
10(±5)% of rated output (VA)	0,000 2	910	121	1580	110
	0,000 6	710	225	1240	60
	0,002	580	311	1010	260
	0,006	470	329	810	660
	0,02	420	329	720	660
	0,06	390	342	670	656
	0,2	390	285	670	580
	0,6	390	316	670	194
Condition	Duration Seconds	Required (V)	Line-to-neutral volts (T-N)	Required (V)	Line-to-line Volts (S-T)
10(±5)% of rated output (VA)	0,000 2	910	309	1580	590
	0,000 6	710	295	1240	582
	0,002	580	282	1010	542
	0,006	470	331	810	380
	0,02	420	328	720	662
	0,06	390	335	670	646
	0,2	390	386	670	662
	0,6	390	317	670	516
Condition	Duration	Required	Line-to-	Required	Line-to-line

	Seconds	(V)	neutral volts （R-N）	(V)	Volts (R-S)
50(±5)% of rated output (VA)	0,000 2	910	294	1580	518
	0,000 6	710	289	1240	504
	0,002	580	216	1010	482
	0,006	470	334	810	664
	0,02	420	353	720	706
	0,06	390	328	670	622
	0,2	390	229	670	558
	0,6	390	183	670	362
Condition	Duration Seconds	Required (V)	Line-to-neutral volts (S-N)	Required (V)	Line-to-line Volts （R-T）
50(±5)% of rated output (VA)	0,000 2	910	313	1580	642
	0,000 6	710	326	1240	598
	0,002	580	335	1010	684
	0,006	470	342	810	692
	0,02	420	358	720	704
	0,06	390	326	670	630
	0,2	390	234	670	548
	0,6	390	302	670	422
Condition	Duration Seconds	Required (V)	Line-to-neutral volts （T-N）	Required (V)	Line-to-line Volts (S-T)
50(±5)% of rated output (VA)	0,000 2	910	161	1580	50
	0,000 6	710	236	1240	144
	0,002	580	318	1010	146
	0,006	470	339	810	684
	0,02	420	355	720	704
	0,06	390	322	670	620
	0,2	390	236	670	536
	0,6	390	118	670	58
Condition	Duration Seconds	Required (V)	Line-to-neutral volts （R-N）	Required (V)	Line-to-line Volts (R-S)
100(±5)% of rated output	0,000 2	910	272	1580	516

(VA) Condition	0,000 6	710	278	1240	504
	0,002	580	327	1010	588
	0,006	470	335	810	682
	0,02	420	368	720	712
	0,06	390	324	670	644
	0,2	390	319	670	540
	0,6	390	218	670	100
	Duration Seconds	Required (V)	Line-to-neutral volts (S-N)	Required (V)	Line-to-line Volts （R-T）
	0,000 2	910	360	1580	646
	0,000 6	710	357	1240	614
	0,002	580	361	1010	628
	0,006	470	262	810	664
	0,02	420	385	720	702
	0,06	390	337	670	635
	0,2	390	243	670	544
	0,6	390	134	670	486
	Duration Seconds	Required (V)	Line-to-neutral volts （T-N）	Required (V)	Line-to-line Volts (S-T)
	0,000 2	910	227	1580	100
	0,000 6	710	238	1240	94
	0,002	580	243	1010	76
	0,006	470	339	810	686
	0,02	420	369	720	718
	0,06	390	329	670	658
	0,2	390	238	670	650
	0,6	390	133	670	390



Line-to-neutral volts

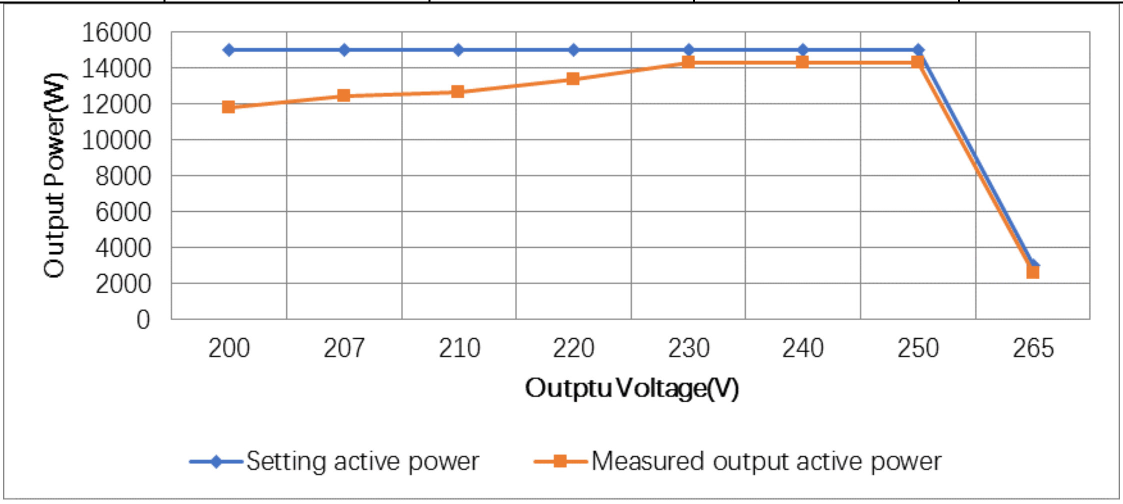


Line-to-line Volts

5.9	TABLE: Direct current injection test			P
Model: SOFAR 15000TL-G2				
		20% （R phase）	60%（R phase）	100% （R phase）
Inverter current, A	Setting	4.8	14.4	24
	Actual	4.37	13.09	21.72
Limit(A)	0.5% × I_{rated} (A)	0.12	0.12	0.12
Result	A	0.0183	0.0144	0.0157
Compliance	(P/F)	P	P	P
		20%（S phase）	60%（S phase）	100%（S phase）
Inverter current, A	Setting	4.8	14.4	24
	Actual	4.39	13.14	21.78
Limit(A)	0.5% × I_{rated} (A)	0.12	0.12	0.12
Result	A	0.0076	0.0079	0.0060
Compliance	(P/F)	P	P	P
		20%（T phase）	60%（T phase）	100%（T phase）
Inverter current, A	Setting	4.8	14.4	24
	Actual	4.38	13.14	21.80
Limit(A)	0.5% × I_{rated} (A)	0.12	0.12	0.12
Result	A	0.0120	0.0088	0.0117
Compliance	(P/F)	P	P	P

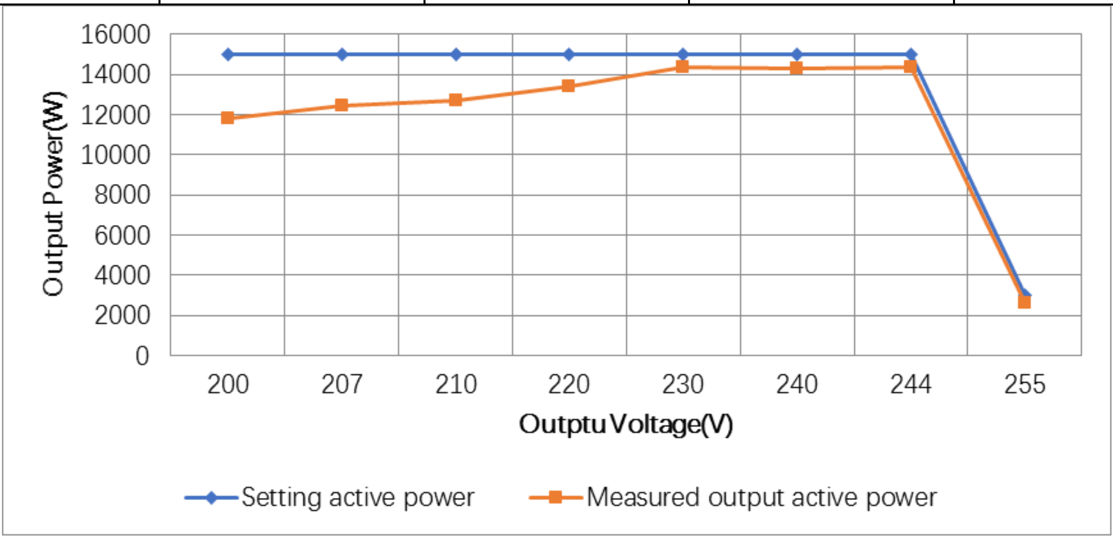
5.9	TABLE: Direct current injection test				P
Model: SOFAR 10000TL-G2					
		20% （R phase）	60%（R phase）	100% （R phase）	
Inverter current, A	Setting	2.89	8.69	14.49	
	Actual	2.91	8.79	14.63	
Limit(A)	0.5% × I_{rated} (A)	0.07	0.07	0.07	
Result	A	0.0057	0.0064	0.0070	
Compliance	(P/F)	P	P	P	
		20%（S phase）	60%（S phase）	100%（S phase）	
Inverter current, A	Setting	2.89	8.69	14.49	
	Actual	2.93	8.80	14.63	
Limit(A)	0.5% × I_{rated} (A)	0.07	0.07	0.07	
Result	A	0.0094	0.0042	0.0055	
Compliance	(P/F)	P	P	P	
		20%（T phase）	60%（T phase）	100%（T phase）	
Inverter current, A	Setting	2.89	8.69	14.49	
	Actual	2.92	8.76	14.58	
Limit(A)	0.5% × I_{rated} (A)	0.07	0.07	0.07	
Result	A	0.0093	0.0097	0.0096	
Compliance	(P/F)	P	P	P	

6.3.2.2	TABLE: Volt – watt response mode			P
Model: SOFAR 15000TL-G2				
Item	Aus. default Value, V	Power measurement, W	Measurement value (P/Prated), %	Maximum value (P/Prated), %
1	200	11832.09	78.88	100
2	207	12443.38	82.96	100
3	210	12700.80	84.67	100
4	220	13355.18	89.03	100
5	230	14335.06	95.57	100
6	240	14342.87	95.62	100
7	250	14346.25	95.64	100
8	265	2591.53	17.28	20



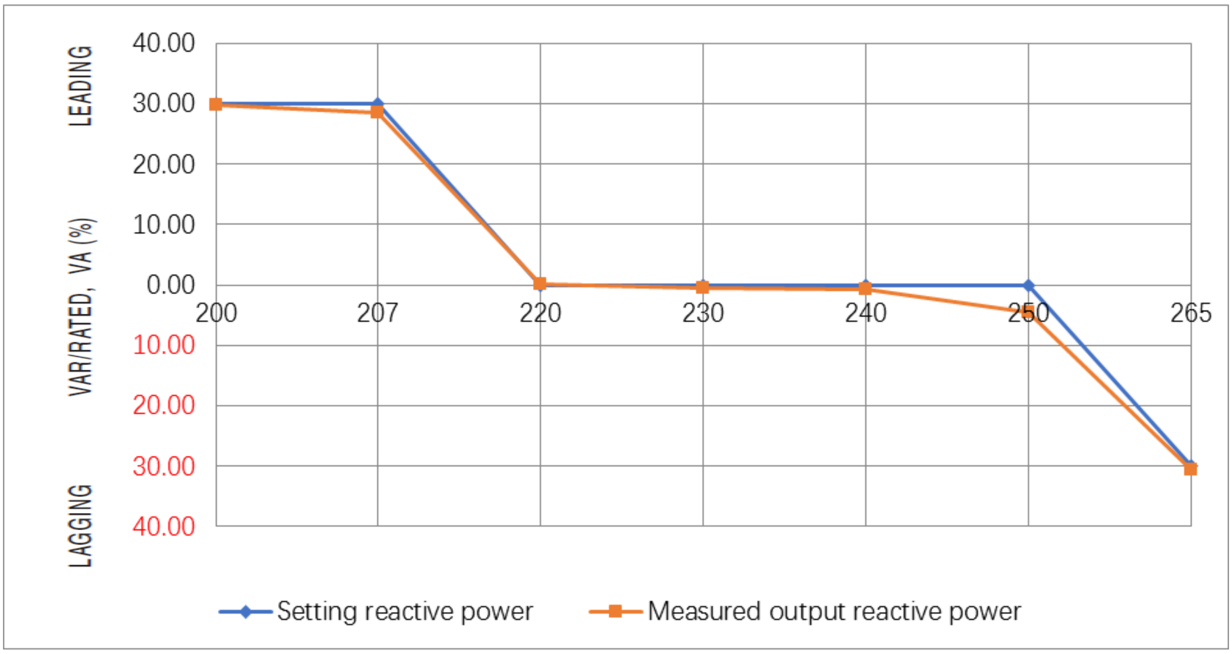
CURVE FOR A VOLT – WATT RESPONSE MODE (AUSTRALIA)

Item	NZ default Value	Power measurement, W	Measurement value (P/Prated), %	Maximum value (P/Prated), %
1	200	11838.89	78.93	100
2	207	12448.00	82.99	100
3	210	12707.93	84.72	100
4	220	13423.66	89.49	100
5	230	14338.20	95.59	100
6	240	14322.95	95.49	100
7	244	14337.06	95.58	100
8	255	2646.56	17.64	20

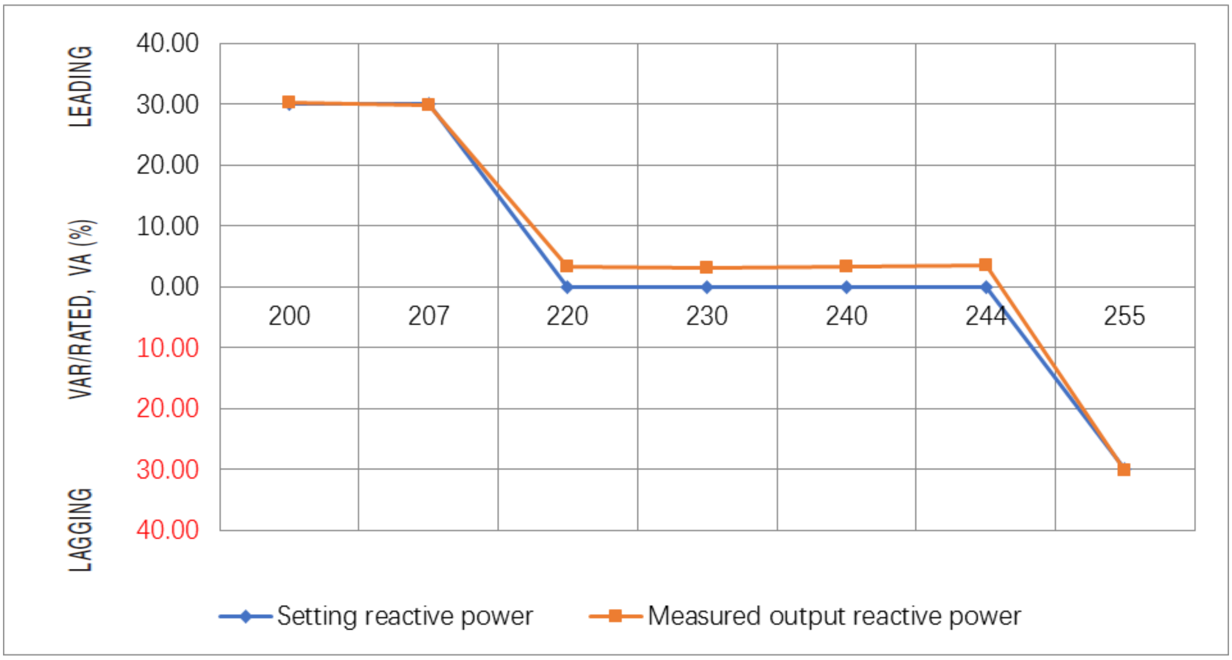


CURVE FOR A VOLT－WATT RESPONSE MODE (New Zealand)

6.3.2.3	TABLE: Volt－Var response mode			P
Model: SOFAR 15000TL-G2				
Item	Aus. default Value, V	Default values for var level (var % rated VA)	Reactive measurement, Var	VAR/RATED, VA (%)
1	200	30% Leading	4921.64	29.83
2	207	30% Leading	4690.54	28.43
3	220	0	16.015	0.10
4	230	0	-88.85	-0.54
5	240	0	-108.33	-0.66
6	250	0	-765.92	-4.64
7	265	30% Lagging	-5046.46	-30.58



Item	NZ. default Value, V	Default values for var level (var % rated VA)	Reactive measurement, K Var	VAR/RATED, VA (%)
1	200	30% Leading	5000.76	30.31
2	207	30% Leading	4941.72	29.95
3	220	0	539.30	3.27
4	230	0	510.68	3.10
5	240	0	542.75	3.29
6	244	0	582.89	3.53
7	255	30% Lagging	-4982.46	-30.20

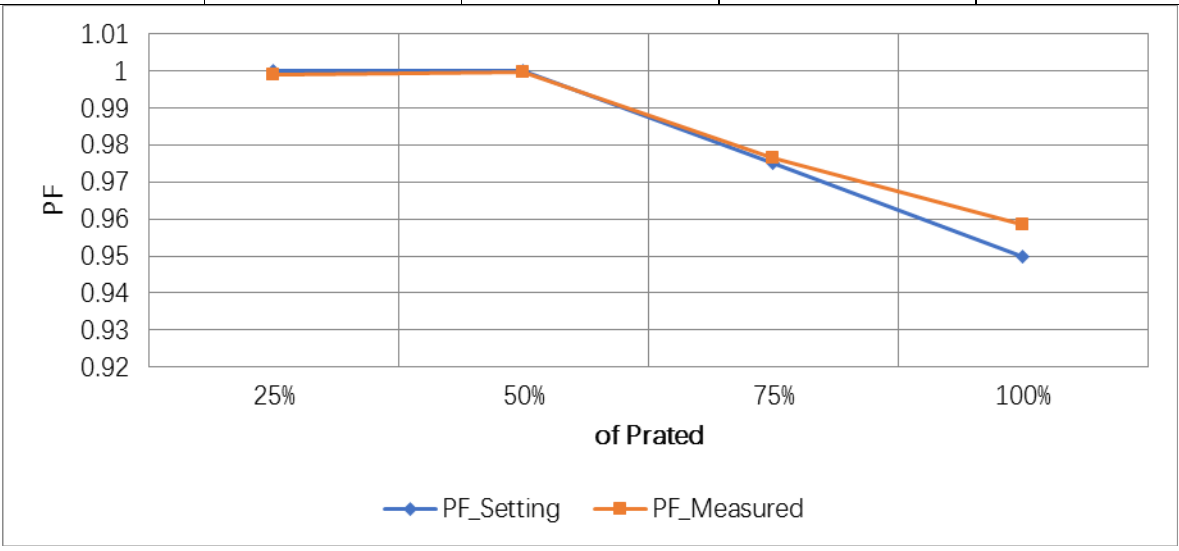


6.3.3	Fixed reactive power mode					P
Model: SOFAR 15000TL-G2						
Setting of rated W	P(W) ind.	Q(Var) ind, max	PF ind, max	P(W) cap.	Q(Var) cap. max	PF cap, max
0%	800.09	-7195.38	0.1105	787.90	8758.07	0.0896
10%	1429.86	-10171.24	0.1393	1495.05	11162.10	0.1329
20%	2974.25	-10639.45	0.2695	3058.82	10636.90	0.2769
30%	4516.75	-10808.76	0.3856	4540.83	10417.85	0.3997
40%	6021.45	-10921.35	0.4828	6007.48	10365.83	0.5014
50%	7517.03	-10811.29	0.5709	7539.29	10365.24	0.5882
60%	9010.17	-10828.64	0.6396	9041.98	10403.89	0.6560
70%	10500.71	-10843.41	0.6957	10524.15	10439.39	0.7100
80%	12441.98	-10856.95	0.7533	12014.15	10562.69	0.7511
90%	12652.30*	-10921.90*	0.7570*	13312.51*	10260.17*	0.7921*
100%	12677.60*	-10813.60	0.7609*	13324.10*	10230.70*	0.7932*
*The inverter is limited by the Max power that can’t attain the intend loading.						

6.3.3	Fixed power factor mode				P
Model: SOFAR 15000TL-G2					
Setting of rated W	PF (setting)	P(W)	S(VA)	Q(Var)	PF
0%	0.80 lagging	94.19	445.49	431.59	0.2244
10%	0.80 lagging	1506.73	1946.47	-1227.3	0.7743
20%	0.80 lagging	3007.01	3798.25	-2317.94	0.7920
30%	0.80 lagging	4508.53	5662.11	-3423.59	0.7965
40%	0.80 lagging	6018.79	7541.77	-4544.14	0.7981
50%	0.80 lagging	7520.44	9400.08	-5639.28	0.8000
60%	0.80 lagging	9027.46	11190.34	-6611.99	0.8067
70%	0.80 lagging	10539.78	13070.16	-7729.30	0.8064
80%	0.80 lagging	12029.41	14971.26	-8912.46	0.8035
90%	0.80 lagging	13230.98	16440.08	-9757.95	0.8048
100%	0.80 lagging	13232.00*	16437.27*	-9751.82*	0.8050*
Setting of rated W	PF (setting)	P(W)	S(VA)	Q(Var)	PF
0%	0.80 leading	91.76	441.03	428.41	0.2185
10%	0.80 leading	1502.42	1785.01	963.68	0.8416
20%	0.80 leading	3002.18	3748.04	2243.82	0.8010
30%	0.80 leading	4494.01	5503.33	3176.52	0.8066
40%	0.80 leading	5994.77	7370.86	4287.12	0.8034
50%	0.80 leading	7489.16	9251.73	5431.95	0.8095
60%	0.80 leading	8987.56	11126.73	6559.46	0.8077
70%	0.80 leading	10486.83	12957.73	7611.03	0.8093
80%	0.80 leading	11982.35	14824.14	8728.02	0.8083
90%	0.80 leading	13179.23	16379.85	9726.64	0.8046
100%	0.80 leading	13275.21*	16499.14*	9797.47*	0.8046*
Setting of rated W	PF (setting)	P(W)	S(VA)	Q(Var)	PF
0%	1	90.83	394.67	342.28	0.2471
10%	1	1501.09	1509.02	-154.05	0.9947
20%	1	2997.75	3001.87	-156.62	0.9986
30%	1	4502.65	4504.87	-140.42	0.9995
40%	1	6003.52	6004.9	-127.21	0.9998
50%	1	7502.73	7503.66	-115.53	0.9999

60%	1	9001.28	9002.02	-111.23	0.9999
70%	1	10507.13	10507.72	-105.45	0.9999
80%	1	12008.54	12009.03	-99.85	0.9999
90%	1	13507.00	13507.47	-101.51	0.9999
100%	1	14682.08	14682.47	-92.84	0.9999

6.3.4	**Characteristic power factor curve for cos Φ (P) (Power response)**			**P**
Model: SOFAR 15000TL-G2				
P(setting)	PF (setting)	P(W)	Q(Var)	PF(measured)
25%	1	3758.83	-146.78	0.9992
50%	1	7512.57	-120.06	0.9999
75%	0.975	11265.63	-2469.31	0.9767
100%	0.950	14650.92	-4354.55	0.9586



Characteristic power factor curve for cos Φ (P) (Power response)

6.4.2	**TABLE: Sinusoidal output in stand-alone mode test**										**N/A**
Component	Limit	5% power or the lowest continuous available output power greater than 5%			50% of rated power			100% of rated power			
	% of fundamental	Value V	Angle degrees	% of fundamental	Value V	Angle degrees	% of fundamental	Value V	Angle degrees	% of fundamental	
1	100%										
2	5%										
3	5%										

4	5%									
5	5%									
6	5%									
7	5%									
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39	5%									
40	5%									

41	5%									
42	5%									
43	5%									
44	5%									
45	5%									
46	5%									
47	5%									
48	5%									
49	5%									
50	5%									
Total harmonic distortion (to 50th component)	5%									

6.4.3	TABLE: Volt－watt response mode for charging of energy storage			N/A
Model:				
Item	Default Value, V	Power measurement, W	Measurement value (P/Prated), %	Maximum value (P/Prated), %
1	200			0
2	207			0
3	220			100
4	250			100
5	265			100

7.3	Active anti-islanding protection	P
Model: SOFAR 15000TL-G2		
Test condition	Frequency=50Hz, U_N=230, Quality = 1 , Distortion factor of chokes < 2%	
Test method	According to IEC 62116.	

No.	PEUT[1)] (% of EUT rating)	Reactive load (% of QL in 6.1.d)[1)]	PAC[2)] (% of nominal)	QAC[3)] (% of nominal)	Run on time (ms)	PEUT (KW)	Actual Qf	VDC	Remarks[4)]			
1	100	100	0	0	1107	14.5	1.00	850	Test	A	at	BL
2	66	66	0	0	1042	9.9	1.00	560	Test	B	at	BL
3	33	33	0	0	1016	4.5	1.00	230	Test	C	at	BL
4	100	100	-5	-5	418	14.5	0.97	850	Test	A	at	IB
5	100	100	-5	0	992	14.5	0.95	850	Test	A	at	IB
6	100	100	-5	5	576	14.5	0.93	850	Test	A	at	IB
7	100	100	0	-5	1051	14.5	1.03	850	Test	A	at	IB
8	100	100	0	5	266	14.5	0.96	850	Test	A	at	IB
9	100	100	5	-5	752	14.5	1.08	850	Test	A	at	IB
10	100	100	5	0	1073	14.5	1.06	850	Test	A	at	IB
11	100	100	5	5	212	14.5	1.03	850	Test	A	at	IB
12	66	66	0	-5	600	9.9	1.04	560	Test	B	at	IB
13	66	66	0	-4	971	9.9	1.04	560	Test	B	at	IB
14	66	66	0	-3	1051	9.9	1.03	560	Test	B	at	IB
15	66	66	0	-2	1012	9.9	1.03	560	Test	B	at	IB
16	66	66	0	-1	1028	9.9	1.01	560	Test	B	at	IB
17	66	66	0	1	1037	9.9	0.99	560	Test	B	at	IB
18	66	66	0	2	971	9.9	0.99	560	Test	B	at	IB
19	66	66	0	3	1138	9.9	0.98	560	Test	B	at	IB
20	66	66	0	4	1026	9.9	0.98	560	Test	B	at	IB
21	66	66	0	5	948	9.9	0.98	560	Test	B	at	IB
22	33	33	0	-5	533	4.5	1.02	230	Test	C	at	IB
23	33	33	0	-4	589	4.5	1.02	230	Test	C	at	IB
24	33	33	0	-3	948	4.5	1.01	230	Test	C	at	IB
25	33	33	0	-2	515	4.5	1.01	230	Test	C	at	IB
26	33	33	0	-1	825	4.5	1.00	230	Test	C	at	IB
27	33	33	0	1	808	4.5	0.98	230	Test	C	at	IB
28	33	33	0	2	633	4.5	0.98	230	Test	C	at	IB
29	33	33	0	3	545	4.5	0.98	230	Test	C	at	IB
30	33	33	0	4	967	4.5	0.98	230	Test	C	at	IB
31	33	33	0	5	839	4.5	0.97	230	Test	C	at	IB

Remark:

1) PEUT: EUT output power

2) PAC: Real power flow at S1 in Figure 1. Positive means power from EUT to utility. Nominal is the 0% test condition value.

3) QAC: Reactive power flow at S1 in Figure 1. Positive means power form EUT to utility. Nominal is the 0% test condition value.

4) BL: Balance condition, IB: Imbalance condition.

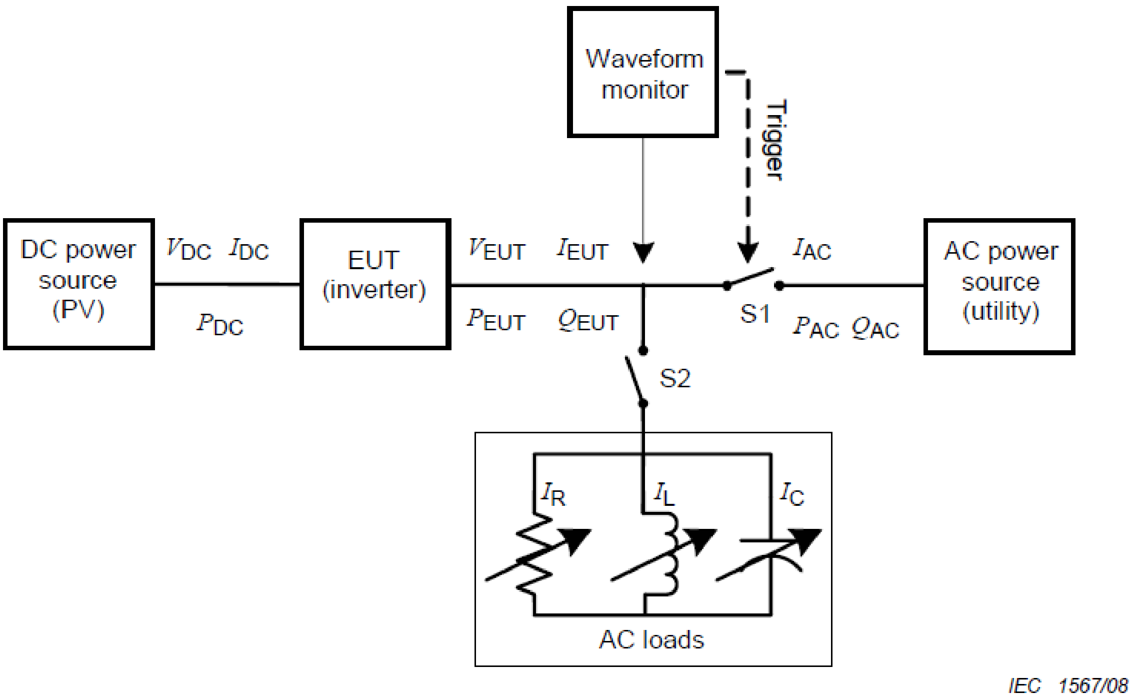
Condition	EUT output power, P_{EUT}	EUT input voltage [c]	EUT trip settings [d]
A	Maximum [a]	> 75 % of rated input voltage range	Voltage and frequency trip settings according to National standards and/or local code
B	50 % to 66 % of maximum	50 % of rated input voltage range, ±10 %	Voltage and frequency trip settings according to National standards and/or local code
C	25 % to 33 % [b] of maximum	< 20 % of rated input voltage range	Voltage and frequency trip settings according to National standards and/or local code

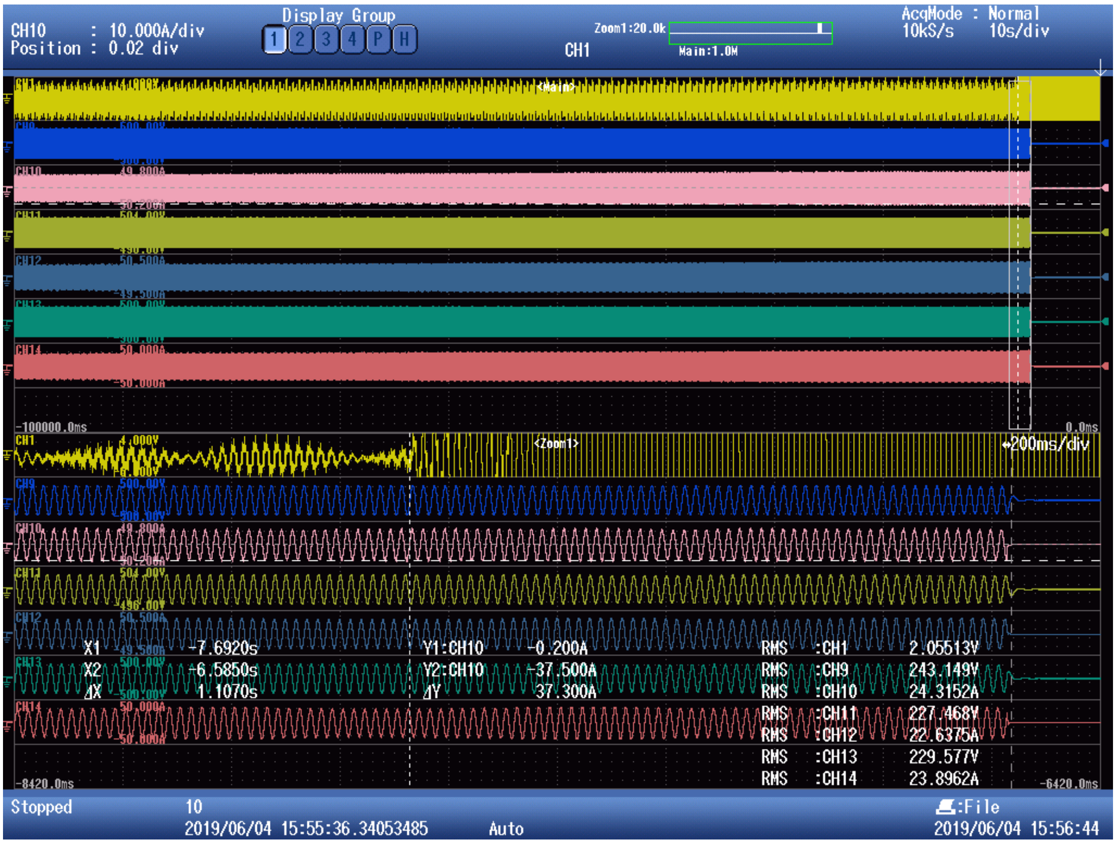
[a] Maximum EUT output power condition should be achieved using the maximum allowable input power. Actual output power may exceed nominal rated output.

[b] Or minimum allowable EUT output level if greater than 33 %.

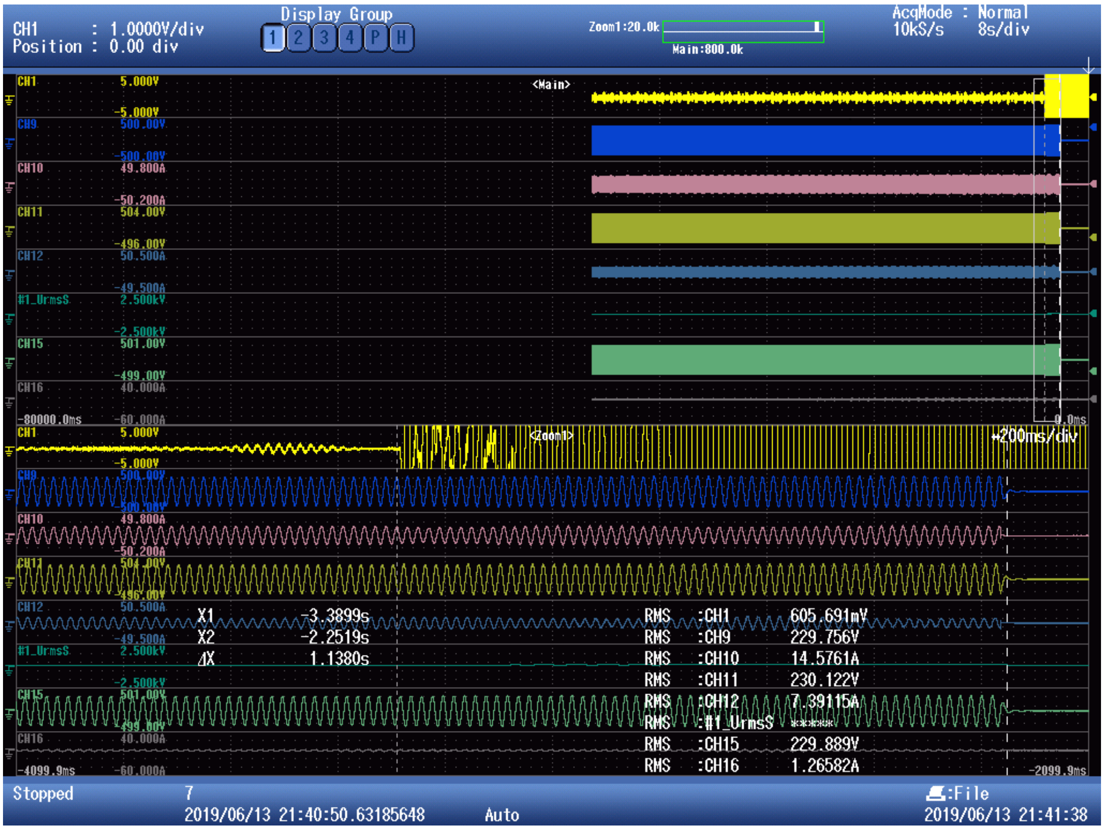
[c] Based on EUT rated input operating range. For example, if range is between X volts and Y volts, 75 % of range = X + 0,75 × (Y – X). Y shall not exceed 0,8 × EUT maximum system voltage (i.e., maximum allowable array open circuit voltage). In any case, the EUT should not be operated outside of its allowable input voltage range.

Note: test A (100%): If any of the recorded run-on times are longer than the one recorded for the rated balance condition, i.e. test procedure 6.1 f), then the non-shaded parameter combinations (no.32~47) also require testing.

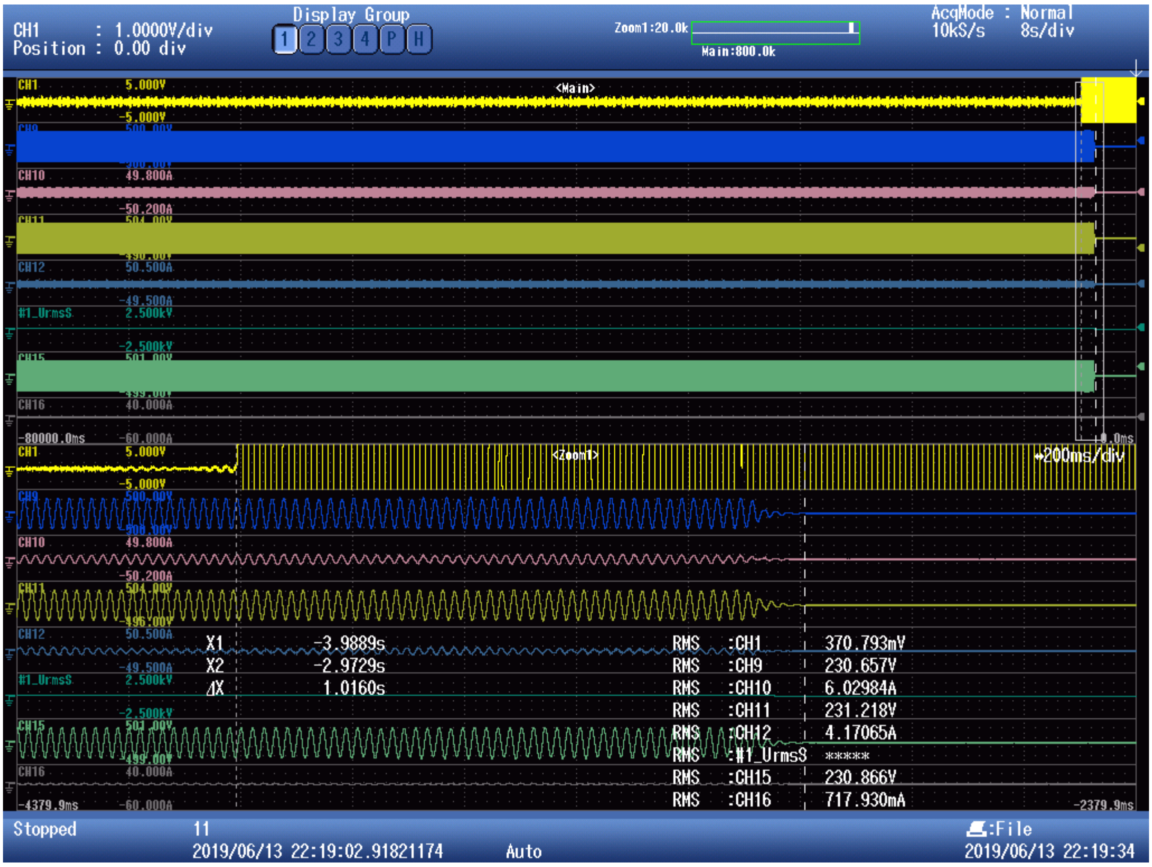




P_{EUT} 100%, P_{AC} 0%, Q_{AC} 0%, = 1107.0ms



P_{EUT} 66%, P_{AC} 0%, Q_{AC} 3%, = 1138ms



P_{EUT} 33%, P_{AC} 0%, Q_{AC} 0%, = 1016ms

Note: CH10,CH12,CH16 denotes current of EUT; CH1 denotes current of signal (the signal from Grid), CH9,CH11,CH15 denotes Voltage of EUT

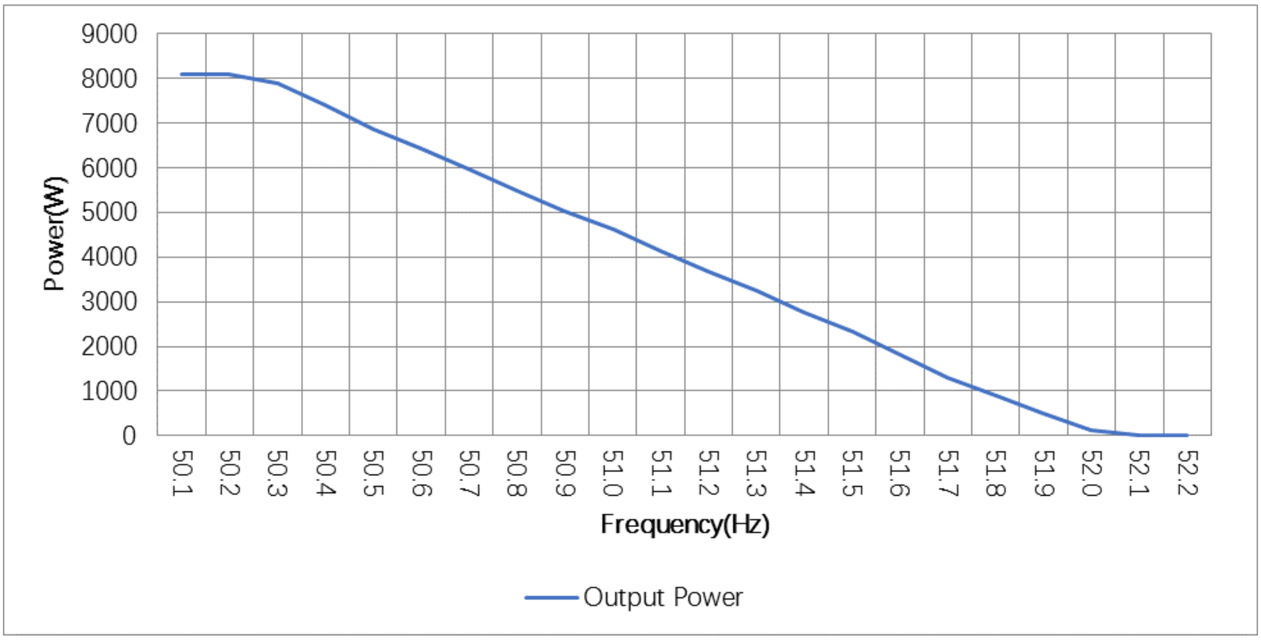
Appendix G2	**TABLE: UNDERVOLTAGE AND OVERVOLTAGE TRIP SETTINGS AND RECONNECTION TEST**			**P**
Grid Frequency (Hz)	50	Grid Voltage (Vac)	230	
Model	Under-voltage (V)	Disconnect time (seconds)	Reconnect time (seconds)	Setting trip voltage (Vac)
SOFAR 15000TL-G2	179.71	1.230 (R phase)	75.86	180
	179.49	1.202 (S phase)		
	178.77	1.228 (T phase)		
	179.29	1.222 (RST phase)		
Confirm the reconnection condition and power rate (for under-voltage)				
Condition (for Australia)	Adjusting the voltage equal to 203V		Adjusting the voltage equal to 207V	
Reconnection	No reconnection		Reconnection	
Time[s]	N/A		75.62s	
Power rate	N/A		17.10%	
Condition (for New Zealand)	Adjusting the voltage equal to 196V		Adjusting the voltage equal to 200V	
Reconnection	No reconnection		Reconnection	
Time[s]	N/A		75.20s	
Power rate	N/A		17.14%	
Model	Over-voltage (V)	Disconnect time (seconds)	Reconnect time (seconds)	Setting trip voltage (Vac)
SOFAR 15000TL-G2	260.54	1.195 (R phase)	82.37	260
	260.13	1.230(S phase)		
	259.65	1.205 (T phase)		
	259.97	1.201(RST phase)		
SOFAR 15000TL-G2	265.26	0.150 (R phase)	76.56	265
	265.44	0.102 (S phase)		
	264.50	0.118(T phase)		
	264.53	0.132 (RST phase)		
Confirm the reconnection condition and power rate (for Over-voltage)				
Condition	Adjusting the voltage equal to 255V		Adjusting the voltage equal to 251V	
Reconnection	No reconnection		Reconnection	
Time[s]	N/A		75.81s	
Power rate	N/A		16.69%	

Appendix G3	**TABLE: UNDER-FREQUENCY AND OVER-FREQUENCY TRIP SETTINGS AND RECONNECTION TEST**			**P**
Grid Frequency (Hz)	50	Grid Voltage (Vac)	230	
Model	Under-frequency (Hz)	Disconnect time (seconds)	Reconnect time (seconds)	Setting trip frequency (Hz)
SOFAR 15000TL-G2	46.94	1.237	79.99	47 (for Australia)
SOFAR 15000TL-G2	45.01	1.128	74.24	45 Hz (for New Zealand)
Confirm the reconnection condition and power rate (for Under-frequency)				
Condition	Adjusting the Frequency equal to 47.45Hz		Adjusting the Frequency equal to 47.55Hz	
Reconnection	No reconnection		Reconnection	
Time[s]	N/A		72.0	
Power rate	N/A		17.01%	
Model	Over-frequency (Hz)	Disconnect time (seconds)	Reconnect time (seconds)	Setting trip frequency (Hz)
SOFAR 15000TL-G2	52.06	0.101	75.38	52
Confirm the reconnection condition and power rate (for Over-frequency)				
Condition	Adjusting the Frequency equal to 50.2Hz		Adjusting the Frequency equal to 50.10Hz	
Reconnection	No reconnection		Reconnection	
Time[s]	N/A		72.2	
Power rate	N/A		16.71%	

Appendix H2	TABLE: SUSTAINED OPERATION FOR VOLTAGE VARIATIONS TEST		P
Test at 50 ±5% rated apparent power (VA):	8250	V_{nom_max} setting (V):	248 (for New Zealand)
Step	Measured average voltage (V)	Deviated from V_{nom_max} set-point (%)	Limit
(f)-1	248.02	0.0081	±1%
(f)-2	248.38	0.1532	±1%
(f)-3	248.38	0.1532	±1%
	The time to disconnect (s)		Limit (s)
(i)	14.7		<30
	The time to reconnect (s)		Limit (s)
(j)	71.8		>60
Test at 50 ±5% rated apparent power (VA):	8250	V_{nom_max} setting (V):	255 (for Australia)
Step	Measured average voltage (V)	Deviated from V_{nom_max} set-point (%)	Limit
(f)-1	255.07	0.027%	±1%
(f)-2	255.07	0.027%	±1%
(f)-3	255.12	0.047%	±1%
	The time to disconnect (s)		Limit (s)
(i)	13.8		<30
	The time to reconnect (s)		Limit (s)
(j)	73.0		>60

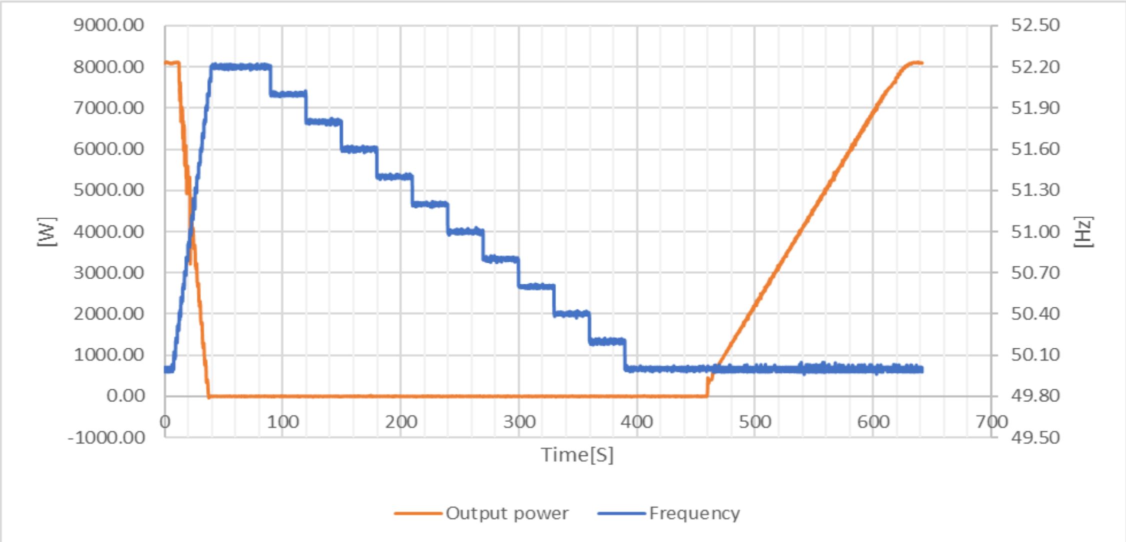
Appendix H3.2	TABLE: Response to an increase in frequency test		P
(c) Test at 50 ±5% rated apparent power (VA):	8250	F_{stop} (Hz):	52
(d) The average inverter power for 5 min P_{ref} (W):		8098.68	
(f) Output frequency (Hz)	Average frequency (Hz)	Average power (W)	
50.1	50.10	8105.24	
50.2	50.20	8106.89	
50.3	50.30	7890.05	
50.4	50.40	7406.02	
50.5	50.50	6857.66	
50.6	50.60	6428.91	
50.7	50.70	5961.92	
50.8	50.80	5472.10	
50.9	50.90	5037.22	

51.0	51.00	4638.91
51.1	51.10	4129.55
51.2	51.20	3672.41
51.3	51.30	3240.28
51.4	51.40	2764.08
51.5	51.50	2323.00
51.6	51.60	1817.87
51.7	51.70	1308.74
51.8	51.80	902.33
51.9	51.90	493.11
52.0	52.00	126.52
52.1	52.10	0
52.2	52.20	0



The graph of the step (f)

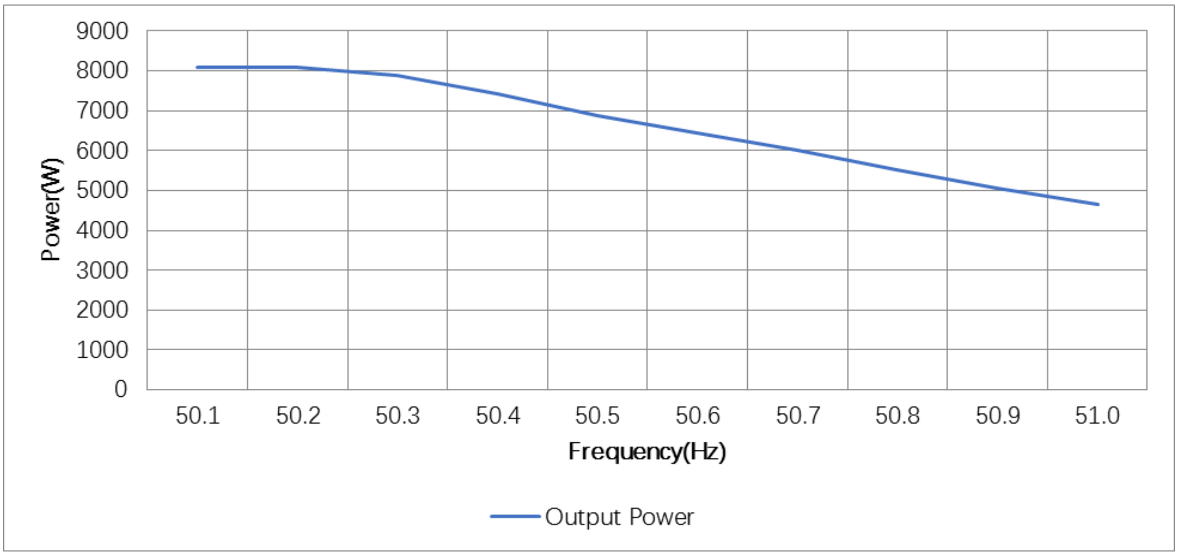
(i) Measured reconnection time (s)	69.4
Reconnection time limit (s)	> 60
Increase power rate (W/min.):	2503.53
Rated power output (W):	15000
Increase power rate based on rated power output (%):	15.69
Power rate limit W_{Gra} (%):	15.00 - 18.33



The graph of the step (i)

(j)	Repeat (c) Test at 50 ±5% rated apparent power (VA):	8250
	Repeat (d) The average inverter power for 5 min P_{ref} (W):	8102.69

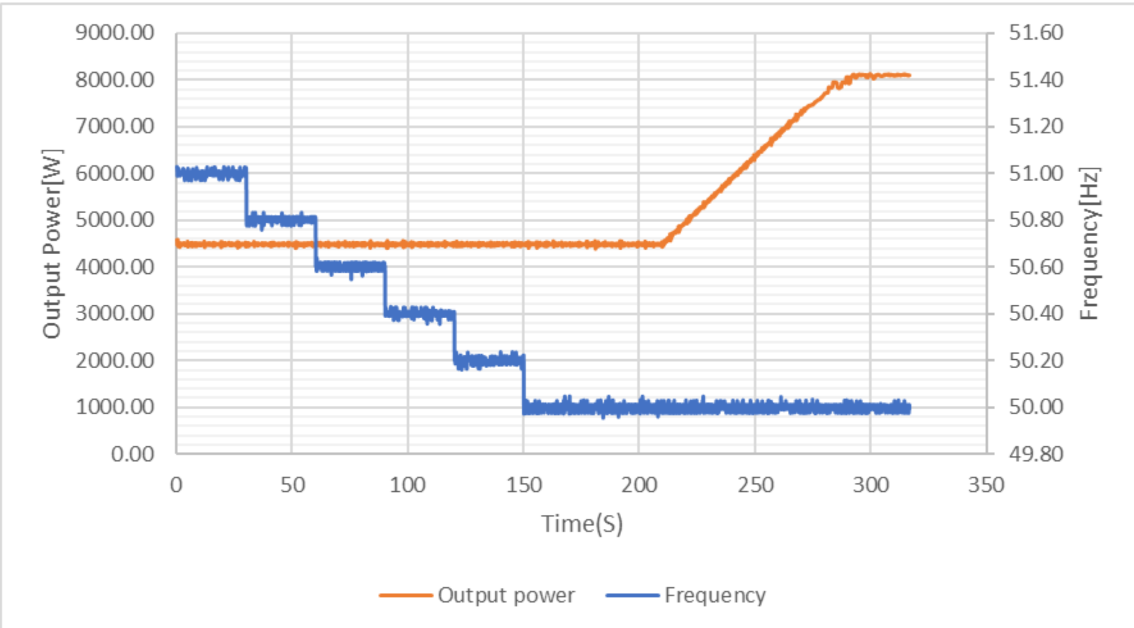
(k) Output frequency (Hz)	Average frequency (Hz)	Average power (W)
50.1	50.10	8085.55
50.2	50.20	8088.47
50.3	50.30	7888.44
50.4	50.40	7421.89
50.5	50.50	6870.03
50.6	50.60	6431.10
50.7	50.70	6014.21
50.8	50.80	5518.81
50.9	50.90	5058.47
51.0	51.00	4654.53



The graph of the step (k)

(m) Output frequency (Hz)	Average frequency (Hz)	Average power (W)
51.0	51.00	4651.00
50.8	50.80	4650.68
50.6	50.60	4650.59
50.4	50.40	4650.64
50.2	50.20	4650.17

(n) Increase power rate (W/min.):	2523.69
Rated power output (W):	15000
Increase power rate based on rated power output (%):	16.82
Power rate limit W_{Gra} (%):	15.00 - 18.33



The graph of the step (n)

Appendix I	**DEMAND AND POWER QUALITY RESPONSE MODE TESTING INCLUDING DISCONNECTION ON EXTERNAL SIGNAL**			**P**
Demand response test	Real power(W)	Reactive power(Var)	Switching time(s)	Pass/ Fail
DRM 0 at 100%	0	0	0.286	Pass
DRM 7	10576.12	-976.45	0.362	Pass
DRM 6 and DRM 7	7331.06	-480.02	0.520	Pass
DRM 6	7331.00	-476.17	0.010	Pass
DRM 5 and DRM 6	0	-731.19	0.341	Pass
DRM 8	14981.94	-860.24	0.940	Pass
DRM 3	--	--	--	--
DRM 3 and DRM 2	--	--	--	--
DRM 2	--	--	--	--
DRM 1 and DRM 2	--	--	--	--
DRM 4	--	--	--	--

(End of report)