TEST REPORT

IS 16169: 2014/IEC 62116:2008

Test Procedure of Islanding Prevention Measures for Utility-Interconnected - Photovoltaic Inverters

Report Reference No.....:	2NL202319020	
Date of issue.....:	24/07/2023	
Total number of pages.....:	20	
Testing Laboratory.....:	Conformity Testing Labs Pvt. Ltd.	
Address.....:	Unit 2, A-33, Mayapuri Industrial Area, Phase-I, New Delhi-110064, India	
Applicant's name.....:	ENERTECH UPS PVT. LTD.	
Address.....:	S. Ho. 399/1-2, Plot No:-5, Bhare P.O, Ghotawade (Near Pirangut), Tal-Mulshi, Dist-Pune-412115	
Test specification.....:	Refer below	
Standard.....:	IS 16169: 2014/ IEC 62116:2008	
Test procedure.....:	As per above standard	
Non-standard test method.....:	N/A	
Test Report Form No. .....:	CTL_IS 16169_TRF_V1.0	
Test Report Form Originator.....:	Conformity Testing Labs Pvt. Ltd., Unit 2, New Delhi	
Master TRF.....:	01/10/2019	
Test item description.....:	Solar PCU	
Trade Mark.....:	EnerTech Answering All Power Needs	

This report is digitally signed and does not require signature on subsequent pages.

Manufacturers.....:	ENERTECH UPS PVT. LTD.
Factory.....:	S. Ho. 399/1-2, Plot No:-5, Bhare P.O, Ghotawade (Near Pirangut), Tal-Mulshi, Dist-Pune-412115
Model/Type reference.....:	Sunmagic-REeFi
Ratings.....:	See copy of marking label (Refer page no. 03)
Serial No.....:	3202212035

Testing procedure and testing location:

Testing Laboratory:.....: **Conformity Testing Labs Pvt. Ltd.**

Testing location/ address .....: Unit 2, A-33, Mayapuri Industrial Area, Phase-I, New Delhi-110064, India

Tested by (name + signature).....: **Vikas Verma** **(Sr. Test Engineer)**

Vikas Verma Digitally signed by Vikas Verma

Approved by (+ signature).....: **Sandeep Kumar Patel** **(Sr. Test Engineer)**

Sandeep Kumar Patel Digitally signed by Sandeep Kumar Patel

Issued by(name+ signature).....: **Madhuri Khanna** **(Customer Executive)**

Madhuri Khanna Digitally signed by Madhuri Khanna

This report is digitally signed and does not require signature on subsequent pages.

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
Cl 6: Test for single or multi-phase inverter Cl 7: Documentation	**Conformity Testing Labs Pvt. Ltd.** Unit 2, A-33, Mayapuri Industrial Area, Phase-I, New Delhi 110064, India
Unintensional Islanding	

Copy of marking plate:

Marking Label of Solar PCU

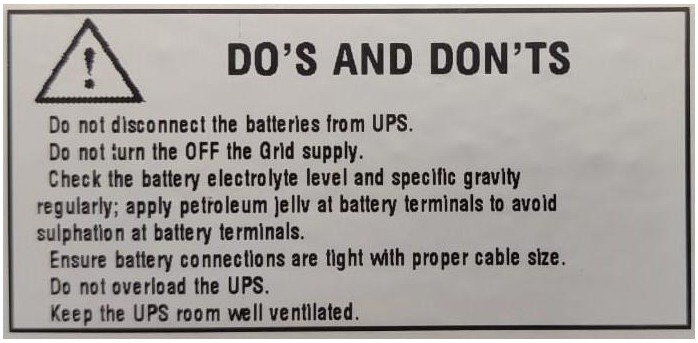
EnerTech
Answering All Power Needs

Serial No. 3202212035

PRODUCT: SOLAR PCU	MODEL: Sunmagic-REeFi
Max. DC Input Voltage	450VDC
DC Input Voltage Range	300-400VDC
DC Input Current	50A
Max. DC Input Current	62A
Rated Input Voltage	3/N/PE AC 230/400V
Rate Input Current	23A per ph
Rated Input Frequency	50Hz
Rated Output Voltage	3/N/PE AC 230/400V
Rated Output Current	21.7A per ph
Rated Output Frequency	50Hz
Rated Apparent Power	15kW
Power Factor	0.8i - 0.8c
Operating Temperature Range	0 to 40°C
Battery Normal Voltage	240VDC
Battery Current rating	62Adc
Environmental Protection Rating	IP20
Protection Class	1
Overvoltage Category	DC (II) , AC (III)
Topology	Isolated
Communication Protocol	RS485
Disp. Date	02-03-2023

ENERTECH UPS PVT. LTD.
S. Ho. 399/1-2, Plot No. :-5, Bhare P.O, Ghotawade
(Near Pirangut), Tal-Mulshi, Dist-Pune-412 115
Made In India

Warning Label on Solar PCU



Possible test case verdicts.....:	See below
- 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..... :	See below
Date of receipt of test item .....:	13/05/2023
Date(s) of performance of tests .....:	22/05/2023 to 08/07/2023
Condition of Samples.....:	Good
Laboratory conditions.....:	See below
Ambient Temperature.....:	25 ± 5°C
Ambient Humidity.....:	45% - 75% RH

GENERAL INFORMATION	
Test item particulars:	Three Phase Solar PCU
Accessories and detachable parts included in the evaluation.....:	N/A
Options included.....:	N/A
Abbreviations used in the report:	Refer below
EUT – Equipment Under Test	MPPT – Maximum Power Point Tracking
Qf– Quality factor	W - Utility Real Power
Var – Utility Reactive Power	VDC – DC Voltage
VEUT – AC Voltage of EUT	tR– Run on time
IR – Resistive load current	IL – Inductive load current
IC – Capacitive load current	PAC – Utility Real Power
QAC – Utility Reactive Power	IAC – Utility Current
Possible test case verdicts.....:	See below
Test case does not apply to the test object.....:	N/A
Test object does meet the requirement.....:	Pass (P)
Test object does not meet the requirement.....:	Fail (F)

Manufacturer's Declaration as per standard:

Similarities between the models: N/A

Differences between models: N/A

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the issuing testing laboratory.
"(See Enclosure #)" refers to additional information appended to the report. "
See appended table)" refers to a table appended to the report.
Throughout this report a point is used as the decimal separator.

General Product Information:

Product Electrical Ratings

Parameter	Value		Remarks
1) Rating	--	--	--
a) Maximum output power	kW	15	--
b) DC voltage range	Vdc	300-400	--
c) DC current limits	Adc	62	--
d) AC voltage range	Vac	3/N/PE AC 230/400	--
e) Frequency range	Hz	50	--
f) AC current limits	A	23/Phase	--
g) Efficiency	%	up to 90	--
h) Voltage trip settings (magnitude and timing)	V	Under Voltage: 196V, 2 sec. Over Voltage: 265V, 2 sec.	--
i) Frequency trip settings (magnitude and timing)	Hz	Under Frequency: 48.1Hz, 1 sec. Over Frequency: 52.2Hz, 1 sec.	--
i) Other software settings	--	N/A	--
j) Firmware version	--	Firmware version: 330.xx	--
2) Others	--	Nil	--
a) Displays	--	LCD	--
b) Temperature range	°C	0 to 40	--
c) Humidity	%	up to 95	--
d) Size	mm	800mm*800mm*450mm	--
e) Weight	Kg	150	--

Clause	Requirement + Test	Result - Remark	Verdict
Discipline: Electrical		**Group:** Power Supplies & Stabilizers	
4	Testing circuit		
	The testing circuit shown in Figure 1 is employed.	See below	P
	Similar circuits are used for three-phase output.	Three phase output	P
	Parameters to be measured are shown in Table 1 and Figure 1. Parameters to be recorded in the test report are discussed in Clause 7.	Parameter to be measured according to clause 7 and reported in the test report	P
5	Testing equipment		
5.1	Measuring instruments	See below	P
	The waveform measurement/capture device is able to record the waveform from the beginning of the islanding test until the EUT ceases to energize the island.	Waveform observed through oscilloscope	P
	For multi-phase EUT, all phases are monitored.	Three phase EUT	P
	A waveform monitor designed to detect and calculate the run-on time may be used.	In compliance	P
	For multi-phase EUT, the test and measurement equipment is recorded each phase current and each phase-to-neutral or phase-to-phase voltage, as appropriate, to determine fundamental frequency active and reactive power flow over the duration of the test.	Three phase EUT	P
	A sampling rate of 10 kHz or higher is recommended. The minimum measurement accuracy is 1 % or less of rated EUT nominal output voltage and 1 % or less of rated EUT output current	In compliance	P
	Current, active power, and reactive power measurements through switch S1 used to determine the circuit balance conditions report the fundamental (50 Hz or 60 Hz) component.	In compliance	P
5.2	DC power source		
5.2.1	General	See below	P
	A PV array or PV array simulator (preferred) may be used. If the EUT can operate in utility-interconnected mode from a storage battery, a DC power source may be used in lieu of a battery as long as the DC power source is not the limiting device as far as the maximum EUT input current is concerned.	DC power source used	P
	The DC power source provides voltage and current necessary to meet the testing requirements described in Clause 6.	In compliance	P
5.2.2	PV array simulator	DC power source used	N/A
	The tests are conducted at the input voltage defined in Table 2 below, and the current is limited to 1,5 times the rated photovoltaic input current, except when specified otherwise by the test requirements.	As above	N/A
	A PV array simulator is recommended, however, any type of power source may be used if it does not influence the test results.	As above	N/A

Clause	Requirement + Test	Result - Remark	Verdict
5.2.3	Current and voltage limited DC power supply with series resistance	DC power supplied used	P
	A DC power source used as the EUT input source is capable of EUT maximum input power (so as to achieve EUT maximum output power) at minimum and maximum EUT input operating voltage.	In compliance	P
	The power source provides adjustable current and voltage limit, set to provide the desired short circuit current and open circuit voltage when combined with the series and shunt resistance described below.	In compliance	P
	A series resistance (and, optionally, a shunt resistance) is selected to provide a fill factor within the range: Output power: Sufficient to provide maximum EUT output power and other levels specified by test conditions of table 5. Response speed: The response time of a simulator to a step in output voltage, due to a 5% load change, results in a settling of the output current to within 10% of its final value in less than 1ms. Stability: Excluding the variations caused by the EUT MPPT, simulator output power remains stable within 2 % of specified power level over the duration of the test: from the point where load balance is achieved until the island condition is cleared or the allowable run-on time is exceeded. Power factor: 0.25 to 0.8	In compliance	P
5.2.4	PV array	DC Source used	N/A
	A PV array used as the EUT input source is capable of EUT maximum input power at minimum and maximum EUT input operating voltage.	As above	N/A
	Testing is limited to times when the irradiance varies by no more than 2 % over the duration of the test as measured by a silicon-type pyranometer or reference device. It may be necessary to adjust the array configuration to achieve the input voltage and power levels prescribed in 6.1.	As above	N/A
5.3	AC power source		
	The utility grid or other AC power source may be used as long as it meets the conditions specified in Table 4. Table 4 – AC power source requirements Items: Voltage — Conditions: Nominal ±2,0 % Items: Voltage THD — Conditions: < 2,5 % Items: Frequency — Conditions: Nominal ±0,1 Hz Items: Phase angle distance 1) — Conditions: 120 ° ± 1,5 ° 1) Three-phase case only	AC Power source meets the requirements as specified in Table 4.	P

Clause	Requirement + Test	Result - Remark	Verdict
5.4	AC loads		
	On the AC side of the EUT, variable resistance, capacitance, and inductance are connected in parallel as loads between the EUT and the AC power source. Other sources of load, such as electronic loads, may be used if it can be shown that the source does not cause results that are different than would be obtained with passive resistors, inductors, and capacitors.	Variable RLC (AC) load used	P
	All AC loads are rated for and adjustable to all test conditions. The equations for Qf are based upon an ideal parallel RLC circuit. For this reason, non-inductive resistors, low loss (high Qf) inductors, and capacitors with low effective series resistance and effective series inductance are utilized in the test circuit. Iron core inductors, if used, are not exceed a current THD of 2 % when operated at nominal voltage. Load components are conservatively rated for the voltage and power levels expected. Resistor power ratings are chosen so as to minimize thermally-induced drift in esistance values during the course of the test.	Meeting the requirements	P
	Active and reactive power is calculated (using the measurements provided in Table 1) in each of the R, L and C legs of the load so that these parasitic parameters (and parasitics introduced by variacs or autotransformers) are properly accounted for when calculating Qf.	In compliance	P
6	Test for single or multi-phase inverter		
6.1	Test procedure	See below	P
	The test uses an RLC load, resonant at the EUT nominal frequency (50 Hz or 60 Hz) and matched to the EUT output power.	Variable RLC (AC) load used	P
	For multi-phase EUT, the load is balanced across all phases and the switch S1 as in Figure1 opens all phases	Three phase EUT	P
	This test is performed with the EUT conditions as in Table 5, where power and voltage values are given as a percent of EUT full output rating.	See below	P
	a). Determine EUT test output power	Refer appended table 6.1	P
	b) Adjusting the DC input source	Refer appended table 6.1	P
	c) Turn off the EUT and open S1	Refer appended table 6.1	P
	d) Adjust the RLC circuit to have Qf = 1.0 ±0.05	Refer appended table 6.1	P
	e). Connect the RLC load configured in step d) to the EUT by closing S2	Refer appended table 6.1	P
	f). Open the utility-disconnect switch S1 to initiate the test, Run-on time is recorded.	Refer appended table 6.1	P

	g). For test condition A, adjust the real load and only one of the reactive load components to each of the load imbalance conditions shown in the shaded portion of table 6. If any of the recorded run-on times are longer than the one recorded for the rated balance condition, then the non-shaded parameter combinations also require testing.	Refer appended table 6.1	P
	h) For test condition B and C, adjust the only one reactive load components by approximately 1,0% per test, within a total range of 95% to 105% of the operating point. If run-on times are still increasing at the 95% or 105% points, additional 1% increments have to be taken until run-on times begin decreasing.	Refer appended table 6.1	P
6.2	Pass/fail criteria		
	An EUT is considered to comply with the requirements for islanding protection when each case of recorded run-on time is less than 2 s or meets the requirements of local codes.	Refer appended table 6.1	P
7	Documentation		
	At a minimum, the following information is recorded and maintained in the test report.	Refer below	P
	a) Specifications of EUT. Table 8 provides an example of the type of information that is provided.	See attached technical data sheet on page no. 19-20	P
	b) Measurement results. Table 9 provides an example of the type of information that is provided. Actual measured values are to be recorded.	Refer appended table 6.1	P
	c) Block diagram of test circuit.	Refer page no. 14	P
	d) Specifications of the test and measurement equipment. Table 10 provides an example of the type of information that is provided.	In compliance	P
	e) Any test configuration or procedure details such as methods of achieving specified load and EUT output conditions.	In compliance	P
	f) Any additional information required by the testing laboratory's accreditation.	Nil	N/A
	g) Specify the evaluation criterion from clause 6.2 that was utilized to determine if the product passed or failed the test.	Comply with the criteria	P
Annex A	Islanding as it applies to PV systems(Informative)	In compliance	P
A.1	General	Refer attachment-1	P
A.2	Impact of distortion on islanding	Refer attachment-1	P
Annex B	Test for independent islanding detection device (relay)(Informative)		N/A
B.1	Introduction	No such application	N/A
B.2	Testing circuit	As above	N/A
B.3	Testing equipment	As above	N/A
B.4	Testing procedure	As above	N/A
B.5	Documentation	As above	N/A

6.1 Table: Tested condition and run-on time

S no.	PEU T a (% of EUT Rating)	Reactive load (% of QL)	PAC b (% of nominal)	QAC c (% of nominal	Run on time (ms)	PEU T (KW)	Pr(resistive) KW	Pl (Inductive) Kvar	Pc (Capacitve) Kvar	Actual Qf	VDC	Remarks
1.	100	100	0	0	340	15.000	L1: 5.115 L2: 5.110 L3: 5.117	L1: 5.170 L2: 5.165 L3: 5.158	L1: 4.969 L2: 4.991 L3: 4.972	L1: 0.991 L2: 0.994 L3: 0.990	400	Test A at BL
2.	66	66	0	0	130	9.900	L1: 3.274 L2: 3.261 L3: 3.268	L1: 3.269 L2: 3.283 L3: 3.261	L1: 3.285 L2: 3.278 L3: 3.281	L1: 1.001 L2: 1.006 L3: 1.001	264	Test B at BL
3.	33	33	0	0	94	4.950	L1: 1.574 L2: 1.566 L3: 1.572	L1: 1.563 L2: 1.552 L3: 1.544	L1: 1.564 L2: 1.568 L3: 1.559	L1: 0.993 L2: 0.996 L3: 0.987	132	Test C at BL
4.	100	100	-5	-5	422	15.000	L1: 5.210 L2: 5.212 L3: 5.193	L1: 5.196 L2: 5.227 L3: 5.216	L1: 4.962 L2: 4.978 L3: 4.971	L1: 0.975 L2: 0.979 L3: 0.981	400	Test A at IB
5.	100	100	-5	0	359	15.000	L1: 5.207 L2: 5.203 L3: 5.196	L1: 4.962 L2: 4.968 L3: 4.972	L1: 4.961 L2: 4.967 L3: 4.974	L1: 0.953 L2: 0.955 L3: 0.957	400	Test A at IB
6.	100	105	-5	5	325	15.000	L1: 5.215 L2: 5.225 L3: 5.220	L1: 4.975 L2: 4.995 L3: 4.978	L1: 4.968 L2: 4.975 L3: 4.988	L1: 0.953 L2: 0.954 L3: 0.955	400	Test A at IB
7.	100	100	0	-5	312	15.000	L1: 5.125 L2: 5.115 L3: 5.056	L1: 5.199 L2: 5.202 L3: 5.135	L1: 4.964 L2: 4.982 L3: 4.962	L1: 0.991 L2: 0.995 L3: 0.998	400	Test A at IB
8.	100	100	0	5	345	15.000	L1: 4.981 L2: 4.969 L3: 4.863	L1: 4.701 L2: 4.709 L3: 4.719	L1: 4.972 L2: 4.913 L3: 4.968	L1: 0.971 L2: 0.968 L3: 0.996	400	Test A at IB
9.	100	100	5	-5	395	15.000	L1: 5.115 L2: 5.165 L3: 5.185	L1: 5.201 L2: 5.203 L3: 5.215	L1: 4.955 L2: 4.982 L3: 4.952	L1: 0.992 L2: 0.986 L3: 0.980	400	Test A at IB
10.	100	100	5	0	282	15.000	L1: 5.132 L2: 5.115 L3: 5.099	L1: 5.145 L2: 5.136 L3: 5.145	L1: 4.951 L2: 4.901 L3: 4.944	L1: 0.983 L2: 0.981 L3: 0.989	400	Test A at IB
11.	100	100	5	5	399	15.000	L1: 4.975 L2: 4.945 L3: 4.952	L1: 5.125 L2: 5.130 L3: 5.115	L1: 4.805 L2: 4.799 L3: 4.815	L1: 0.997 L2: 1.003 L3: 1.002	400	Test A at IB
12.	100	100	-10	10	332	15.000	L1: 5.110 L2: 5.125 L3: 5.105	L1: 4.990 L2: 4.995 L3: 5.955	L1: 4.755 L2: 4.758 L3: 4.772	L1: 0.953 L2: 0.951 L3: 0.953	400	Test A at IB
13.	100	100	-5	10	351	15.000	L1: 5.195 L2: 5.185 L3: 5.205	L1: 4.958 L2: 4.965 L3: 4.950	L1: 4.962 L2: 4.913 L3: 4.955	L1: 0.955 L2: 0.953 L3: 0.951	400	Test A at IB
14.	100	100	0	10	317	15.000	L1: 5.215 L2: 5.210 L3: 5.218	L1: 4.978 L2: 4.995 L3: 4.959	L1: 4.966 L2: 4.915 L3: 4.953	L1: 0.953 L2: 0.951 L3: 0.950	400	Test A at IB
15.	100	100	10	10	310	15.000	L1: 4.995 L2: 5.050 L3: 4.990	L1: 5.165 L2: 5.135 L3: 5.210	L1: 4.852 L2: 4.865 L3: 4.775	L1: 1.002 L2: 0.990 L3: 1.000	400	Test A at IB

16.	100	100	10	5	325	15.000	L1: 5.015 L2: 5.065 L3: 5.045	L1: 5.165 L2: 5.175 L3: 5.185	L1: 4.880 L2: 4.875 L3: 4.890	L1:1.001 L2: 0.992 L3: 0.998	400	Test A at IB
17.	100	100	10	0	370	15.000	L1: 5.125 L2: 5.110 L3: 5.145	L1: 5.155 L2: 5.145 L3: 5.175	L1: 4.895 L2: 4.890 L3: 4.895	L1: 0.980 L2: 0.982 L3: 0.978	400	Test A at IB
18.	100	100	10	-5	305	15.000	L1: 4.965 L2: 4.985 L3: 4.975	L1: 5.150 L2: 5.115 L3: 5.175	L1: 4.775 L2: 4.825 L3: 4.790	L1: 0.999 L2: 0.997 L3: 1.001	400	Test A at IB
19.	100	100	10	-10	348	15.000	L1: 4.995 L2: 4.999 L3: 5.065	L1: 5.165 L2: 5.145 L3: 5.135	L1: 4.785 L2: 4.825 L3: 4.825	L1: 0.995 L2: 0.997 L3: 0.983	400	Test A at IB
20.	100	100	5	-10	345	15.000	L1: 5.145 L2: 5.135 L3: 5.120	L1: 5.275 L2: 5.245 L3: 5.255	L1: 4.785 L2: 4.825 L3: 4.910	L1: 0.976 L2: 0.980 L3: 0.992	400	Test A at IB
21.	100	100	0	-10	238	15.000	L1: 5.160 L2: 5.155 L3: 5.145	L1: 5.175 L2: 5.145 L3: 5.160	L1: 4.885 L2: 4.835 L3: 4.855	L1: 0.974 L2: 0.968 L3: 0.973	400	Test A at IB
22.	100	100	-5	-10	285	15.000	L1: 5.212 L2: 5.205 L3: 5.201	L1: 5.444 L2: 5.450 L3: 5.460	L1: 4.961 L2: 4.903 L3: 4.964	L1: 0.997 L2: 0.993 L3: 1.001	400	Test A at IB
23.	100	100	-10	-10	298	15.000	L1: 5.285 L2: 5.299 L3: 5.279	L1: 5.445 L2: 5.453 L3: 5.465	L1: 4.966 L2: 4.915 L3: 4.971	L1: 0.984 L2: 0.977 L3: 0.987	400	Test A at IB
24.	100	100	-10	-5	386	15.000	L1: 5.322 L2: 5.299 L3: 5.285	L1: 5.427 L2: 5.435 L3: 5.431	L1: 4.973 L2: 4.980 L3: 4.968	L1: 0.976 L2: 0.982 L3: 0.983	400	Test A at IB
25.	100	100	-10	0	364	15.000	L1: 5.362 L2: 5.333 L3: 5.341	L1: 5.452 L2: 5.444 L3: 5.458	L1: 4.977 L2: 4.985 L3: 4.980	L1: 0.971 L2: 0.977 L3: 0.976	400	Test A at IB
26.	100	100	-10	5	392	15.000	L1: 5.265 L2: 5.250 L3: 5.235	L1: 5.315 L2: 5.325 L3: 5.335	L1: 4.925 L2: 4.945 L3: 4.930	L1: 0.972 L2: 0.977 L3: 0.980	400	Test A at IB
27.	66	66	0	-5	305	9.900	L1: 3.275 L2: 3.265 L3: 3.285	L1: 3.325 L2: 3.315 L3: 3.320	L1: 3.230 L2: 3.220 L3: 3.245	L1: 1.001 L2: 1.001 L3: 1.999	264	Test B at IB
28.	66	66	0	-4	257	9.900	L1: 3.249 L2: 3.235 L3: 3.262	L1: 3.195 L2: 3.215 L3: 3.210	L1: 3.272 L2: 3.265 L3: 3.252	L1: 0.995 L2: 1.002 L3: 0.990	264	Test B at IB
29.	66	66	0	-3	284	9.900	L1: 3.272 L2: 3.265 L3: 3.283	L1: 3.205 L2: 3.225 L3: 3.218	L1: 3.266 L2: 3.278 L3: 3.280	L1: 0.989 L2: 0.996 L3: 0.990	264	Test B at IB
30.	66	66	0	-2	279	9.900	L1: 3.268 L2: 3.260 L3: 3.275	L1: 3.235 L2: 3.228 L3: 3.230	L1: 3.272 L2: 3.285 L3: 3.295	L1: 0.996 L2: 0.999 L3: 0.996	264	Test B at IB
31.	66	66	0	-1	294	9.900	L1: 3.270 L2: 3.281 L3: 3.268	L1: 3.275 L2: 3.305 L3: 3.295	L1: 3.258 L2: 3.252 L3: 3.262	L1: 0.999 L2: 0.999 L3: 1.003	264	Test B at IB
32.	66	66	0	1	246	9.900	L1: 3.301 L2: 3.291 L3: 3.288	L1: 3.230 L2: 3.246 L3: 3.225	L1: 3.264 L2: 3.270 L3: 3.275	L1: 0.984 L2: 0.990 L3: 0.988	264	Test B at IB
33.	66	66	0	2	301	9.900	L1: 3.274 L2: 3.261 L3: 3.268	L1: 3.200 L2: 3.213 L3: 3.190	L1: 3.292 L2: 3.286 L3: 3.290	L1: 0.991 L2: 0.996 L3: 0.991	264	Test B at IB
34.	66	66	0	3	282	9.900	L1: 3.268 L2: 3.255 L3: 3.226	L1: 3.166 L2: 3.178 L3: 3.158	L1: 3.278 L2: 3.271 L3: 3.269	L1: 0.986 L2: 0.991 L3: 0.996	264	Test B at IB

35.	66	66	0	4	268	9.900	L1: 3.266 L2: 3.259 L3: 3.272	L1: 3.131 L2: 3.146 L3: 3.123	L1: 3.277 L2: 3.279 L3: 3.270	L1: 0.981 L2: 0.986 L3: 0.977	264	Test B at IB
36.	66	66	0	5	281	9.900	L1: 3.279 L2: 3.268 L3: 3.282	L1: 3.100 L2: 3.110 L3: 3.089	L1: 3.282 L2: 3.274 L3: 3.269	L1: 0.973 L2: 0.976 L3: 0.968	264	Test B at IB
37.	33	33	0	-5	182	4.950	L1: 1.578 L2: 1.568 L3: 1.573	L1: 1.622 L2: 1.615 L3: 1.610	L1: 1.545 L2: 1.552 L3: 1.549	L1: 1.003 L2: 1.010 L3: 1.004	132	Test C at IB
38.	33	33	0	-4	195	4.950	L1: 1.585 L2: 1.588 L3: 1.592	L1: 1.610 L2: 1.595 L3: 1.585	L1: 1.552 L2: 1.558 L3: 1.560	L1: 0.997 L2: 0.993 L3: 0.988	132	Test C at IB
39.	33	33	0	-3	145	4.950	L1: 1.584 L2: 1.586 L3: 1.591	L1: 1.606 L2: 1.590 L3: 1.583	L1: 1.564 L2: 1.562 L3: 1.560	L1: 1.001 L2: 0.994 L3: 0.988	132	Test C at IB
40.	33	33	0	-2	162	4.950	L1: 1.565 L2: 1.575 L3: 1.562	L1: 1.552 L2: 1.565 L3: 1.578	L1: 1.562 L2: 1.558 L3: 1.550	L1: 0.995 L2: 0.991 L3: 1.001	132	Test C at IB
41.	33	33	0	-1	180	4.950	L1: 1.572 L2: 1.568 L3: 1.578	L1: 1.568 L2: 1.571 L3: 1.575	L1: 1.566 L2: 1.560 L3: 1.558	L1: 0.997 L2: 0.998 L3: 0.993	132	Test C at IB
42.	33	33	0	1	175	4.950	L1: 1.541 L2: 1.549 L3: 1.542	L1: 1.540 L2: 1.531 L3: 1.523	L1: 1.556 L2: 1.549 L3: 1.543	L1: 1.005 L2: 0.994 L3: 0.994	132	Test C at IB
43.	33	33	0	2	199	4.950	L1: 1.565 L2: 1.554 L3: 1.551	L1: 1.528 L2: 1.513 L3: 1.509	L1: 1.572 L2: 1.570 L3: 1.564	L1: 0.990 L2: 0.992 L3: 0.990	132	Test C at IB
44.	33	33	0	3	177	4.950	L1: 1.552 L2: 1.560 L3: 1.567	L1: 1.512 L2: 1.500 L3: 1.493	L1: 1.561 L2: 1.565 L3: 1.554	L1: 0.990 L2: 0.982 L3: 0.972	132	Test C at IB
45.	33	33	0	4	169	4.950	L1: 1.576 L2: 1.570 L3: 1.573	L1: 1.501 L2: 1.483 L3: 1.476	L1: 1.567 L2: 1.568 L3: 1.561	L1: 0.973 L2: 0.971 L3: 0.965	132	Test C at IB
46.	33	33	0	5	187	4.950	L1: 1.579 L2: 1.568 L3: 1.574	L1: 1.480 L2: 1.468 L3: 1.461	L1: 1.564 L2: 1.562 L3: 1.560	L1: 0.964 L2: 0.966 L3: 0.959	132	Test C at IB

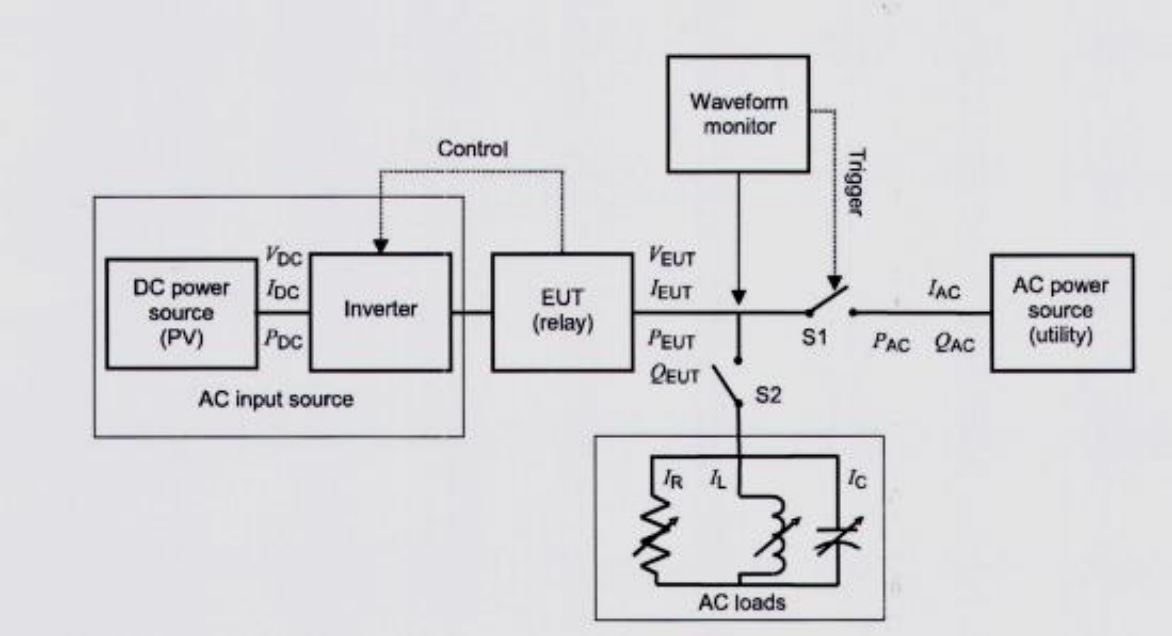
a PEUT: EUT output power.

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

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

d BL: balance condition, IB: imbalance condition.

Block Diagram of Test Circuit



Attachment-1

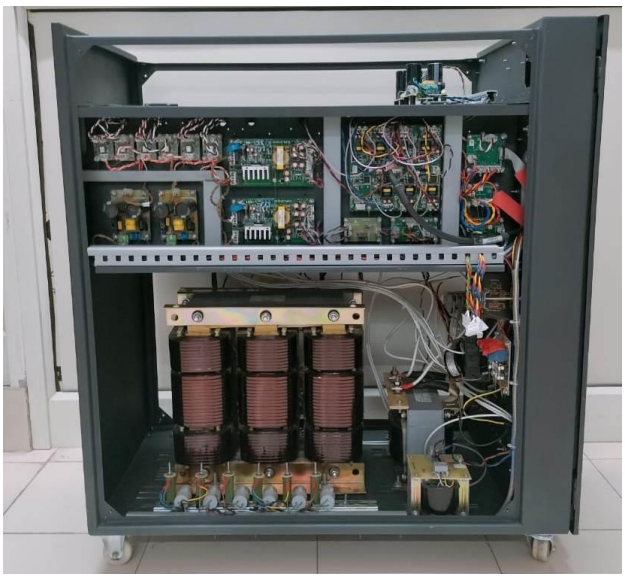
Photographs of the Sample:

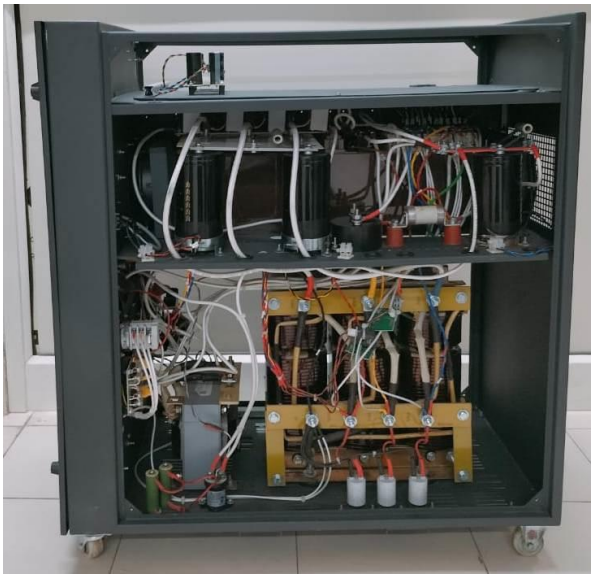
Front View

Rear View

Top View

Internals View

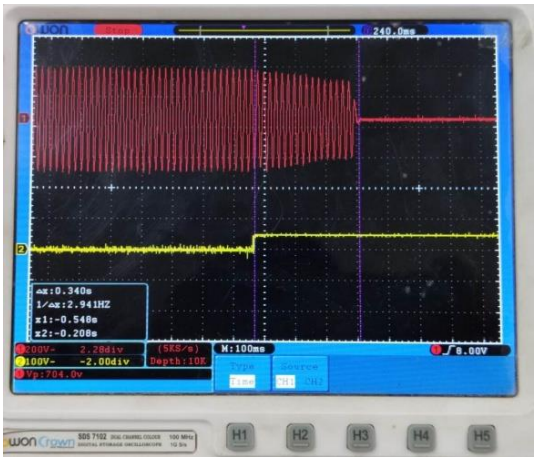




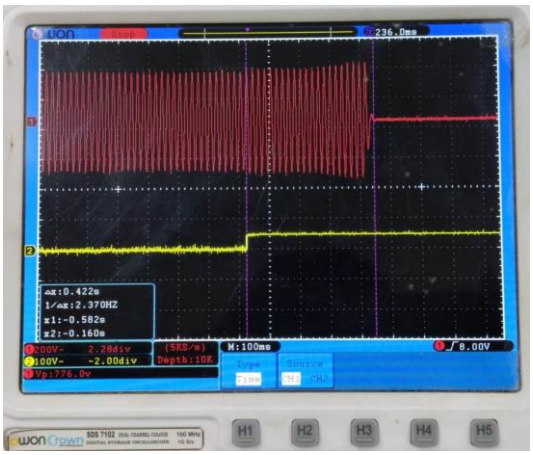
Sides View

Waveforms

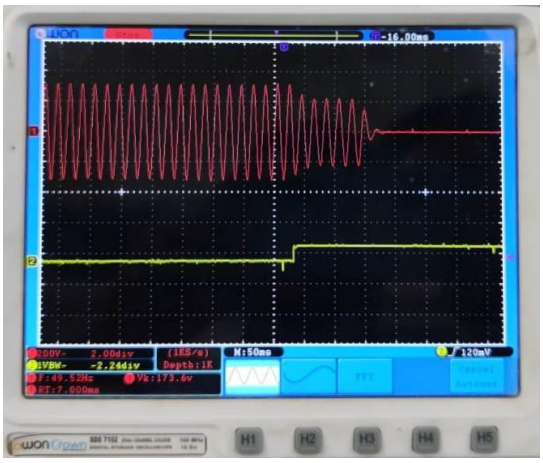
100% Balanced Condition



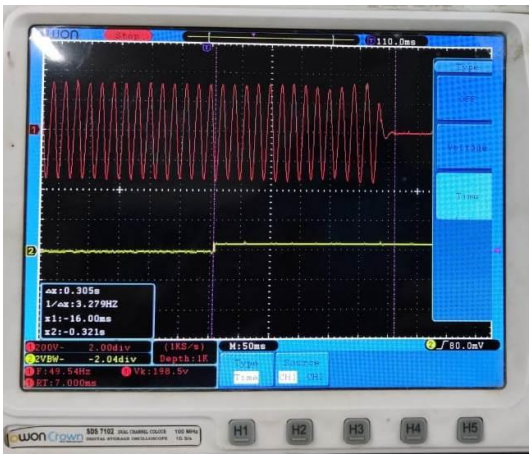
100% Un-Balanced Condition



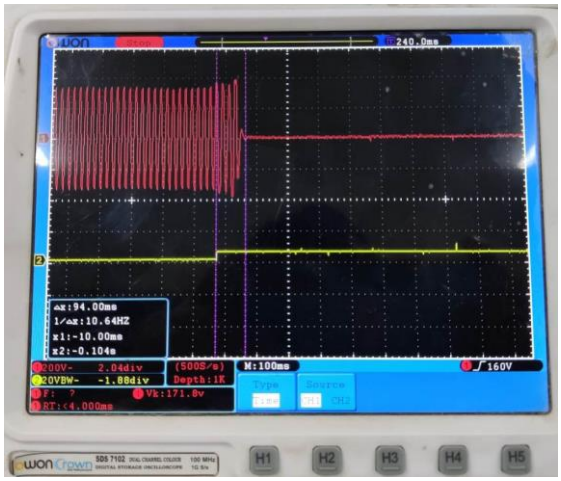
66% Balanced Condition



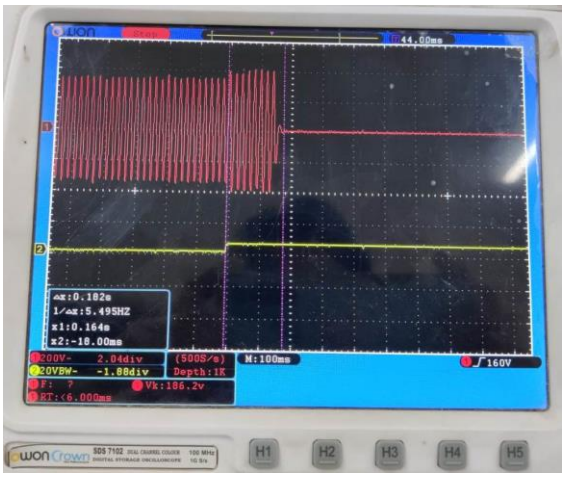
66% Un-Balanced Condition



33% Balanced Condition



33% Un-Balanced Condition



Technical Data sheet

SPECIFICATION

EnerTech
Answering All Power Needs

STANDARD SPECIFICATION SMART STORAGE SOLAR INVERTER SunMagic REeFI																
INVERTER CAPACITY (kVA)	5	10	15	20	25	30	40	50	60	80	100	120	150	200	250	300
GRID																
Input Wiring	3PH five wire (3 PH + N + E)															
Input Neutral Requirement	YES															
Nominal Voltage	3/N/PE AC 230/400V															
Grid Frequency Sync Range	50 Hz (± 6%)															
Unity power Factor for grid charging	Near to Unity															
Operating condition	Continuous															
Input Fault Level	>=10 kA															
Self-Consumption	up to 4%															
Charger Peak Efficiency	upto 95%															
DG Compatibility	YES (Double of Inverter Capacity)															
Grid Compatibility	YES SAME AS INVERTER CAPACITY															
Input Voltage distortion allowed	LESS THAN 3%															
Grid Charger capacity	50 % of KVA rating															
SOLAR																
Charger Type	MPPT															
Max PV Connection in kWP	5	10	15	20	25	30	40	50	60	80	100	120	150	200	250	300
Max PV Voltage (VOC)	250V	300V	450V	500V	500V	500/600 V	500/600 V	500/600 V	500/600 V	500/600 V	500/600 V	500/600 V	600V	900V	1100V	1100V
MPPT Voltage Range	120-180V	165-250V	300-400V for 240VDC / 450-600V for 360VDC OR 384VDC											800 - 1000V		
MPPT Modes Available	3 (Selectable)															
No of MPPT Channel	1								2	2	2	2	2	3	3	3
Panel Reverse Protection	Yes															
Solar Charger Efficiency	up to 95%															
BATTERY																
Nominal Battery Voltage (VDC)	96	120		240		360	360 / 384							480/600	576 / 600	
Battery Buffer Setting	DC Voltage Selectable Through kay pad															
Grid Charging Current	SETTABLE THROUGH KAY PAD															
Temperature Compensated Charging	YES															
Battery Charging Voltage	Selectable from LCD Display															
Type & No. of cells	Lead Acid / VRLA / Ni-Cd/ Lithium Ion															
BMS compatible	YES															
OUTPUT																
Load Power Factor	Unity (kVA = kW)															
Output Voltage (Inverter Mode)	3/N/PE AC 230/400V															
Output Frequency (Free Running)	50 Hz ± 1%															
Output Waveform	Pure Sine wave															
Peak Inverter Efficiency (Full Load)	upto 90 %															
Total Harmonic Distortion	upto 3% at Linear Load															
Overload Capacity	125% for 60Sec, 150% for 5 Sec															
Changeover Time (Full load)	<10 msec															
DC to AC Galvanic Isolation	In built Isolation Transformer at Inverter Output															
Anti Islanding Function	In Compliance with IEC 62116															
Auto Bypass feature	YES															
Unbalance load handaling capacity	YES															
Duty	Continuous															
CONFIGURATION																
Modes Available	Grid saving, Battery backup, Export															
power Export to Grid	Enable / Disable option Available															
power import from Grid	Enable / Disable option Available															
ENVIRONMENTAL																
Acoustic Noise Level from 1 m	≤ 65 dB															
Operating Temperature	0 to 40 Deg C(Dust free cooled and dry environment)															
Storage Temperature	-10 Deg C to 60 Deg C															
Relative Humidity	Up to 95 % (Non Condensing)															
Altitude	< 1000 meter above sea level															
Sysmic Requirement	upto 0.5g															

SPECIFICATION

EnerTech
Answering All Power Needs

PHYSICAL																
Enclosure Protection Grade	IP 20 Compatible to IEC 60529:2001- As per MNRE Requirement															
Enclosure Thickness	as per industrial standard															
Cooling	Forced Air															
Colour	RAL 7016							RAL 9016								
Cable Entry	Bottom															
Parameters displayed on LCD																
Input Group	1. Voltage, 2.Current, 3. Frequency, 4. kW, 5. kVA, 6. Import kWh , 7. Export kWh, 8. PF															
Inverter Group	1. Voltage, 2. Current, 3. Frequency, 4. kVA															
OutputGroup	1. Voltage, 2. Frequency															
OutputGroup	1. Solar Voltage , 2. Solar Current, 3. Power(kW), 4. Solar Energy (kWh)															
Battery Group	1. Voltage, 2.Current 3. SoC															
PROTECTIONS																
ELECTRICAL PROTECTIONS	CIRCUIT BREAKER and Fuse															
ELECTRONIC PROTECTIONS																
	Alarms are provided for all important protections.															
Inverter Group	1.Input Under Voltage, 2.Input Over Voltage, 3. Charger Over Voltage, 4. Under /Over Frequency															
Inverter Group	1. Output Under Voltage,2.Output Over Voltage 3. Overload, 4. Output short Circuit, 5. Inverter Over Temperature															
Solar Group	1. Surge Protection , 2. Reverse PV Pannel protection															
Battery Group	1. Battery low , 2. Battery Over charge 3.,Battery Charging Current limit															
CONNECTIVITY																
Communication	RS 232 or RS 485															
Protocol	MODBUS RTU															
LCD with backlight & Tactile kay pad Interface	YES															
Testing standard	IEC -61683:1999, IEC- 60068-2-1, IEC-60068-2-2, IEC-60068-2-14, IEC-60068-2-30- As per MNRE Requirement															
Saftey Factor	1 for electronic devices, 1 for electrical															
Earthing Connection (Ref. is 3043)	Earth terminal block				25- 40 kVA : 3 x 25 mm GI (Earth bus bar running along the panel)			45-150 kVA : 6 x 50 mm GI (Earth bus bar running along the panel)						200-300KVA : 6 x 50 mm GI (Earth bus bar running along the panel)		
Illumination lamp	N.A.							11 W CFL								
Gland Plate	NA							3 mm MS C.R.C.A.								
Utility Socket	NA							5 A / 230 VAC								
Dimensions (in mm)																
KVA Rating	5	10	15	20	25	30	40	50	60	80	100	120	150	200	250	300
Width (W)	450	450	450	450	450	450	600	800	800	1100	1100	1100	1565	1570	2900	2900
Depth (D)	800	800	800	800	950	950	1000	950	950	800	800	800	850	850	850	850
Height (H)	800	800	800	800	800	800	1300	1700	1700	1900	1900	1900	1900	1900	1900	1900
Weight (Kg) APPROX.	125	150	150	300	350	350	650	650	700	850	900	1000	1200	1400	1500	1600
Add on ACCESSORIES (not standard Part fo inverter)																
	1)GSM Based Remote Monitoring, 2.) 2) Modbus RS485 3) RADIATION SENSOR (Pyranometer) 4) SMOKE DETECTOR. 5) IP 42 Enclosure and above. 6) MANUAL BYPASS															

******End of Test Report*****