NISE

National Institute of Solar Energy

(An Autonomous Institution of MNRE, GOI)
19 K.m Stone, Gurgaon-Faridabad Road, Gwal Phari, Gurgaon (Haryana)-122003

File No: 468/2017-18 /CSC/NISE/242 Dated: 29/05/18

To,
M/s- Enertech UPS Pvt. Ltd.
Sr No 399/1-2, Bhare P.O. Ghotawade
Near Pirangut, Tal Mulshi, Dist- Pune- 412115

Subject: Issue of Test Report by National Institute of Solar Energy ('NISE')

Dear Sir,

Please refer to your letter No./Order Form No 07 Dated 12/03/18 In this connection, I am directed to enclose herewith the Test Report No 468/2017-18/CSC/NISE Dated 29/05/18 In respect of your submitted samples in original, for ready reference and record.

2. Discrepancies, if any observed, in respect of any of the entries contained in the above report should be brought to the notice of this office within 30 days from the date of issue of this letter, falling which it will be presumed that the entries therein are in order and no further correspondence will be entertained thereafter on this particular report.

3. We would like to solicit your views and therefore enclosing a Feedback Form with a request to be filled up by you and then send as soon as possible. Your suggestions are valuable for us to make our further improvements and take corrective action in improving our quality of service.

4. Further, You are also requested to collect your samples at your cost within 60 days, from the date of issue of this letter falling which NISE will dispose of the sample in best possible manner and NISE will not be responsible in any manner for this sample.

Kindly acknowledge the receipt of this letter along with original test report and original Invoice.

National Institute of Solar Energy Gurugram

Yours faithfully

(In-charge, Customer Service Cell)
(National Institute of Solar Energy)

Encl:
1. Test Report-Total Page 15
2. Feedback Form

Copy forwarded for Information to:
1. PA to Director General-NISE
2. Guard File
3. Office Copy

National Institute of Solar Energy

(An autonomous Institute of Ministry of New & Renewable Energy)
Gurugram-Faridabad Road, Gwalpahari, Gurugram-122003
Ph. 0124-2579251 (CSC), Fax: 0124-2579207
Email Id: csc.nise.mnre@gmail.com

Test Report

1.	Service Request No.	44/1217
2.	Requested By (Name & Address of the organization)	M/s Enertech UPS PVT. LTD. Sr. No. 399/1-2, Bhare P.O. Ghotawade Near Pirangut, Tal Mulshi, Dist- Pune -412115
3.	Details of the test item	
	a) Nomenclature	Hybrid type inverter (Battery + PV + Grid Import + Grid Export)
	b) Capacity	20 KVA/20 kW
	c) Manufactured By	M/s Enertech UPS PVT. LTD.
	d) Model / Type No.	20 kVA/20 kW/240 V
	e) Serial No.	1) 201709296 2) 201709298
	f) Testing procedure	Prototype submitted by the client
	g) Testing parameters	✓ Inverter efficiency test - as per IEC 61683" Photovoltaic systems –Power conditioners –Procedure for measuring efficiency." ✓ Grid parallel operation test - as per CEI IEC 61727- "Photovoltaic (PV) systems -Characteristics of the utility interface." ✓ Islanding test –as per IEC 62116 "Test procedure of islanding prevention measures for utility-interconnected photovoltaic inverters." ✓ Environmental test as per IEC 60068-2 (1, 2, 14, 30)
6.	Date of Submission of Samples	12/03/2018
7.	The condition of samples on receipt	Good
8.	Date of Completion of Tests	25/05/2018

B. Major equipment USED

S.No.	Equipment Used	Model	Calibration Agency/Report Reference	Last calibration date
1	Solar array simulator	ETS600*25D-PVE	Calibrated from ERTL(N)	05/04/2018
2	Power Analyzer	WT 1800	Calibrated from ERTL(N)	09/04/2018
3	Digital Oscilloscope, Tektronix TDS210	DPO	Calibrated from ERTL(N)	23/03/2018
4	AC power source	61704	Calibrated from ERTL(N)	04/04/2018
5	Anti-Islanding Testing Device	Actual RLC Load 60 KVA	Calibrated from ERTL(N)	05/04/2018

Tested By Kamlesh
Date.....

Authorized Signatory
Date.....

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Date 29/05/18

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Inverter Efficiency Test Result as per IEC-61683 for Hybrid mode (for details, please see Annexure I)			
Cl 4.2	Temperature maintained in the laboratory.		27°C
Cl 4.3	Output voltage and frequency		230 V and 50Hz
Cl 4.4	Input voltage		PV (292-397) VMP, battery 240
Cl 5.1	Rated output efficiency (for details, please see Annexure		given below
Cl 5.2	Partial output efficiency (for details, please see Annexure		given below

Efficiency at minimum voltage (292 V)			
	DC input power-PV (%)	Efficiency (%)	Uncertainty (± in %)
Partial output	5	62.14	0.61
	10	78.61	0.59
	25	87.71	0.43
	50	90.59	0.35
	75	89.98	0.14
Rated output	100	89.32	0.15

Efficiency at medium voltage (343 V)			
	DC input power-PV (%)	Efficiency (%)	Uncertainty (± in %)
Partial output	5	53.40	0.75
	10	74.60	0.65
	25	87.86	0.30
	50	89.06	0.16
	75	89.95	0.16
Rated output	100	88.10	0.16

Efficiency at maximum voltage (397 V)			
	DC input power-PV (%)	Efficiency (%)	Uncertainty (± in %)
Partial output	5	44.58	0.50
	10	75.02	0.51
	25	84.16	0.52
	50	87.34	0.19
	75	88.58	0.15
Rated output	100	87.83	0.15

Inverter Efficiency Test Result as per IEC-61683 for Standalone mode (for details, please see Annexure II)			
	Load %	System Efficiency (%) at pf 1	Uncertainty (± in %)
Partial output	5	73.34	0.22
	10	82.07	0.19
	25	90.13	0.14
	50	92.74	0.14
	75	92.67	0.14
Rated output	100	92.24	0.13
	Load %	System Efficiency (%) at pf 0.8	Uncertainty (± in %)
Partial output	5	---	---
	10	---	---
	25	91.18	0.14
	50	89.05	0.17
	75	91.25	0.14
Rated output	100	90.96	0.13

Tested By Kamlesh
Date.....

Authorized Signatory
Date..... Rajesh Kumar 29/05/2018

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Islanding prevention measures for utility-interconnected photovoltaic inverters: IEC 62116	
Cl 6.2	Pass (for details, please see Annexure III)

Photovoltaic (PV) systems –Characteristics of the utility interface (CEI IEC -61727)	
Cl- 4.4,4.5,4.6,4.7,5.3,5.4	Pass (for details please see annexure IV)

Environmental test as per IEC 60068-2 (1, 2, 14, 30)
Pass (for details please see annexure VI)

Photographs of the sample (for details, please see Annexure-VII)

NOTE:

1. This test report refers only to the particular items submitted for testing as per specifications/requirements stipulated by the customer.
2. The results reported in the Test Report are valid at the time of and under the stipulated conditions of measurements.
3. The test report shall not be reproduced except in full unless written permission for the publication of an approved abstract has been obtained from the Director, National Institute of Solar Energy.
4. The client is requested to collect the tested sample back within 30 days from the date of issue of the report

Kamlesh

Tested By

Date.....

Rajesh Kumar 29/05/2018

Authorized Signatory

Date.....

National Institute of Solar Energy Gurugram

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Date.....

Test Report No. 468/2017-18/CSC/NISE

Certificate No. - T C - 5697

Annexure – I

*Efficiency in Hybrid Mode = Output Power (Battery + Load + Grid Import/Export) / Solar Input
* (-) sign in AC Power: Power import from grid
*(+) sign in AC Power: Power export to grid

Table 1: System efficiency as per IEC 61683 for Hybrid mode at maximum voltage (292 V)

S.No.	Load %	5	10	25	50	75	100
1.	RMS Voltage 1 (V)	225.38	232.16	227.28	229.27	228.93	228.27
2.	RMS Current 1 (I)	1.66	1.61	4.16	11.01	19.01	24.15
3.	Active Power 1 (P)	195.00	247.00	872.00	2399.00	3976.00	5022.00
4.	Reactive Power 1 (Q)	318.00	279.00	367.00	789.00	1766.00	2272.00
5.	Apparent Power 1 (S)	373.00	373.00	946.00	2525.00	4351.00	5512.00
6.	Power Factor 1 (PF)	0.52	0.66	0.92	0.95	0.91	0.91
7.	Frequency 1 (Hz)	50.01	49.96	50.04	50.01	50.05	49.92
8.	RMS Voltage 2 (V)	224.86	231.52	227.00	230.50	230.88	228.35
9.	RMS Current 2 (I)	1.10	4.16	7.50	16.98	24.65	31.65
10.	Active Power 2 (P)	84.00	892.00	1624.00	3864.00	5555.00	6660.00
11.	Reactive Power 2 (Q)	232.00	366.00	508.00	625.00	1230.00	2805.00
12.	Apparent Power 2 (S)	246.00	964.00	1701.00	3914.00	5690.00	7227.00
13.	Power Factor 2 (PF)	0.34	0.93	0.95	0.99	0.98	0.92
14.	Frequency 2 (Hz)	50.01	49.96	50.04	50.01	50.05	49.92
15.	RMS Voltage 3 (V)	224.28	232.66	226.35	231.42	231.39	227.62
16.	RMS Current 3 (I)	1.81	2.59	7.79	12.43	20.30	31.06
17.	Active Power 3 (P)	161.00	451.00	1682.00	2697.00	4074.00	6169.00
18.	Reactive Power 3 (Q)	372.00	400.00	528.00	996.00	2340.00	3455.00
19.	Apparent Power 3 (S)	405.00	603.00	1763.00	2875.00	4698.00	7071.00
20.	Power Factor 3 (PF)	0.40	0.75	0.95	0.94	0.87	0.87
21.	Frequency 3 (Hz)	50.01	49.96	50.05	50.00	50.05	49.92
22.	Voltage THD 1 (%)	0.99	0.91	1.22	1.35	1.35	1.50
23.	Current THD 1 (%)	39.65	52.09	20.14	11.05	9.20	8.79
24.	Voltage THD 2 (%)	0.99	0.91	1.27	1.38	1.47	1.68
25.	Current THD 2 (%)	63.30	14.40	18.48	9.76	7.05	5.89
26.	Voltage THD 3 (%)	1.24	1.10	1.37	1.72	1.90	2.14
27.	Current THD 3 (%)	42.41	30.54	15.43	7.93	6.62	5.43
28.	PV Voltage (V)	296.65	282.27	297.50	278.45	281.86	286.04
29.	PV Current (I)	3.50	7.10	16.70	35.90	53.30	69.70
30.	Total Input PV Power (W)	1030.00	2010.00	4980.00	9990.00	15020.00	19930.00
31.	Battery Voltage (V)	270.54	265.50	274.55	265.50	262.94	266.27
32.	Battery Current (I)	2.20	0.00	0.70	0.30	0.30	0.20
33.	Input dc Power (W)	590.00	10.00	190.00	90.00	90.00	50.00
34.	Efficiency (%)	62.14	78.61	87.71	90.59	89.98	89.32

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Table 2: System efficiency as per IEC 61683 for Hybrid mode at maximum voltage (343 V)							
S.No.	Load %	5	10	25	50	75	100
35.	RMS Voltage 1 (V)	222.67	223.73	223.52	222.85	223.36	223.40
36.	RMS Current 1 (I)	1.62	2.31	3.82	10.28	17.84	25.34
37.	Active Power 1 (P)	87.00	357.00	709.00	2233.00	3775.00	4988.00
38.	Reactive Power 1 (Q)	349.00	375.00	476.00	509.00	1277.00	2679.00
39.	Apparent Power 1 (S)	360.00	517.00	854.00	2291.00	3985.00	5661.00
40.	Power Factor 1 (PF)	0.24	0.69	0.83	0.98	0.95	0.88
41.	Frequency 1 (Hz)	50.00	49.91	49.97	49.90	49.94	49.97
42.	RMS Voltage 2 (V)	221.39	223.95	222.05	222.99	223.97	223.31
43.	RMS Current 2 (I)	1.01	2.40	6.98	14.68	22.89	32.94
44.	Active Power 2 (P)	78.00	433.00	1490.00	3213.00	4873.00	6584.00
45.	Reactive Power 2 (Q)	209.00	316.00	430.00	623.00	1594.00	3279.00
46.	Apparent Power 2 (S)	223.00	536.00	1550.00	3273.00	5128.00	7355.00
47.	Power Factor 2 (PF)	0.35	0.81	0.96	0.98	0.95	0.90
48.	Frequency 2 (Hz)	50.00	49.90	49.97	49.90	49.94	49.96
49.	RMS Voltage 3 (V)	220.80	222.51	221.49	221.63	222.71	222.94
50.	RMS Current 3 (I)	2.27	3.87	9.05	15.96	23.90	31.96
51.	Active Power 3 (P)	403.00	767.00	1936.00	3343.00	4794.00	6040.00
52.	Reactive Power 3 (Q)	297.00	392.00	517.00	1158.00	2311.00	3781.00
53.	Apparent Power 3 (S)	501.00	861.00	2004.00	3537.00	5322.00	7126.00
54.	Power Factor 3 (PF)	0.80	0.89	0.97	0.94	0.90	0.85
55.	Frequency 3 (Hz)	49.99	49.90	49.97	49.90	49.94	49.97
56.	Voltage THD 1 (%)	1.23	1.08	1.48	1.60	1.64	1.69
57.	Current THD 1 (%)	42.63	44.41	22.53	11.79	9.38	8.47
58.	Voltage THD 2 (%)	1.33	1.12	1.51	1.70	1.79	1.90
59.	Current THD 2 (%)	88.12	25.05	19.55	11.40	7.68	6.01
60.	Voltage THD 3 (%)	1.51	1.25	1.66	1.91	2.11	2.36
61.	Current THD 3 (%)	28.75	22.60	14.16	8.63	6.33	5.76
62.	PV Voltage (V)	375.71	298.81	318.17	318.94	323.15	335.23
63.	PV Current (I)	2.70	6.60	15.10	31.20	46.50	59.60
64.	Total Input PV Power (W)	1000.00	1980.00	4820.00	9970.00	15010.00	19980.00
65.	Battery Voltage (V)	269.48	254.14	272.57	256.40	267.28	267.10
66.	Battery Current (I)	0.50	0.30	0.30	0.30	0.20	0.00
67.	Input dc Power (W)	140.00	80.00	100.00	90.00	60.00	10.00
68.	Efficiency (%)	53.40	74.60	87.86	89.06	89.95	88.10

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Table 3: System efficiency as per IEC 61683 for Hybrid mode at maximum voltage (397 V)							
S.No.	Load %	5	10	25	50	75	100
69.	RMS Voltage 1 (V)	220.20	221.44	220.95	221.48	221.70	223.70
70.	RMS Current 1 (I)	2.06	3.13	5.78	11.46	20.25	28.19
71.	Active Power 1 (P)	59.00	510.00	1240.00	2433.00	4208.00	5689.00
72.	Reactive Power 1 (Q)	450.00	468.00	310.00	724.00	1565.00	2722.00
73.	Apparent Power 1 (S)	454.00	692.00	1278.00	2539.00	4490.00	6306.00
74.	Power Factor 1 (PF)	0.13	0.74	0.97	0.96	0.94	0.90
75.	Frequency 1 (Hz)	49.93	49.88	49.84	49.87	49.90	49.92
76.	RMS Voltage 2 (V)	219.79	221.32	222.56	223.31	224.07	226.89
77.	RMS Current 2 (I)	1.50	1.76	6.68	14.51	22.05	30.63
78.	Active Power 2 (P)	201.00	242.00	1392.00	3181.00	4624.00	6249.00
79.	Reactive Power 2 (Q)	261.00	304.00	522.00	622.00	1739.00	3040.00
80.	Apparent Power 2 (S)	330.00	389.00	1487.00	3241.00	4941.00	6949.00
81.	Power Factor 2 (PF)	0.61	0.62	0.94	0.98	0.94	0.90
82.	Frequency 2 (Hz)	49.93	49.88	49.85	49.87	49.90	49.92
83.	RMS Voltage 3 (V)	218.27	219.40	220.73	222.27	221.74	224.34
84.	RMS Current 3 (I)	2.03	4.56	7.69	14.41	24.16	31.94
85.	Active Power 3 (P)	260.00	856.00	1497.00	2889.00	4448.00	5709.00
86.	Reactive Power 3 (Q)	359.00	518.00	799.00	1381.00	2984.00	4330.00
87.	Apparent Power 3 (S)	443.00	1001.00	1697.00	3202.00	5357.00	7165.00
88.	Power Factor 3 (PF)	0.59	0.86	0.88	0.90	0.83	0.80
89.	Frequency 3 (Hz)	49.92	49.88	49.84	49.87	49.89	49.92
90.	Voltage THD 1 (%)	1.34	1.32	1.48	1.64	1.69	1.75
91.	Current THD 1 (%)	36.67	30.70	10.43	9.51	8.67	7.02
92.	Voltage THD 2 (%)	1.48	1.46	1.56	1.75	1.92	1.96
93.	Current THD 2 (%)	54.21	47.73	20.38	11.30	8.52	6.77
94.	Voltage THD 3 (%)	1.72	1.63	1.80	1.96	2.19	2.32
95.	Current THD 3 (%)	42.07	19.87	16.08	9.15	6.79	5.94
96.	PV Voltage (V)	404.13	334.27	383.39	355.89	384.42	378.54
97.	PV Current (I)	2.40	5.90	12.90	26.70	39.00	53.30
98.	Total Input PV Power (W)	960.00	1970.00	4930.00	9610.00	14970.00	20150.00
99.	Battery Voltage (V)	268.20	266.42	263.15	270.86	268.13	267.88
100.	Battery Current (I)	1.20	0.50	0.10	0.40	0.10	0.20
101.	Input dc Power (W)	310.00	130.00	20.00	110.00	20.00	50.00
102.	Efficiency (%)	44.58	75.02	84.16	87.34	88.58	87.83

Kamlesh

Tested By

Date.....

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Test Report No. 468/2017-18/CSC/NISE

Certificate No. : T C - 5007

Annexure – II

*Efficiency = Output Load / Input Power (Battery)

Table.1: Inverter Efficiency Test Standalone Mode Power Factor = 1 at battery voltage: 240 V							
S.No.	Load %	5	10	25	50	75	100
1.	RMS Voltage 1 (V)	225.33	226.08	226.55	226.63	226.02	225.07
2.	RMS Current 1 (I)	1.44	2.91	7.23	14.44	21.65	28.75
3.	Active Power 1 (P)	324.29	656.77	1637.45	3272.76	4893.22	6470.13
4.	Reactive Power 1 (Q)	1.24	1.21	1.12	1.41	3.16	5.66
5.	Apparent Power 1 (S)	324.29	656.77	1637.45	3272.76	4893.22	6470.13
6.	Power Factor 1 (PF)	1.00	1.00	1.00	1.00	1.00	1.00
7.	Frequency 1 (Hz)	49.96	49.96	49.96	49.96	49.96	49.96
8.	RMS Voltage 2 (V)	232.33	231.06	231.25	232.19	232.56	232.69
9.	RMS Current 2 (I)	1.39	2.82	7.38	14.68	22.29	29.77
10.	Active Power 2 (P)	323.55	652.29	1706.62	3408.85	5184.02	6926.97
11.	Reactive Power 2 (Q)	1.44	1.40	0.87	1.41	4.00	6.00
12.	Apparent Power 2 (S)	323.56	652.30	1706.62	3408.85	5184.02	6926.97
13.	Power Factor 2 (PF)	1.00	1.00	1.00	1.00	1.00	1.00
14.	Frequency 2 (Hz)	49.96	49.96	49.96	49.96	49.96	49.96
15.	RMS Voltage 3 (V)	232.45	232.66	233.77	234.18	233.50	232.88
16.	RMS Current 3 (I)	1.49	2.99	7.01	14.34	22.44	29.96
17.	Active Power 3 (P)	346.07	696.53	1638.61	3358.22	5239.85	6977.22
18.	Reactive Power 3 (Q)	3.05	2.87	2.45	2.65	6.00	9.17
19.	Apparent Power 3 (S)	346.08	696.53	1638.61	3358.22	5239.85	6977.23
20.	Power Factor 3 (PF)	1.00	1.00	1.00	1.00	1.00	1.00
21.	Frequency 3 (Hz)	49.96	49.96	49.96	49.96	49.96	49.96
22.	Voltage THD 1 (%)	2.50	1.84	1.34	2.11	2.30	2.32
23.	Current THD 1 (%)	2.50	1.84	1.33	2.09	2.29	2.31
24.	Voltage THD 2 (%)	2.82	1.83	1.24	1.97	2.13	2.10
25.	Current THD 2 (%)	2.83	1.84	1.23	1.96	2.12	2.09
26.	Voltage THD 3 (%)	2.50	2.07	1.83	2.19	2.27	2.22
27.	Current THD 3 (%)	2.51	2.08	1.81	2.18	2.27	2.21
28.	Total AC output Power (W)	993.9	2005.6	4982.7	10039.8	15317.1	20374.3
29.	Battery Voltage (V)	243.27	243.55	243.30	242.99	242.55	242.77
30.	Battery Current (I)	5.60	10.00	22.70	44.60	68.10	91.00
31.	Input dc Power (W)	1360	2440	5530	10830	16530	22090
32.	Efficiency (%)	73.34	82.07	90.13	92.74	92.67	92.24

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Table.2: Inverter Efficiency Test Standalone Mode Power Factor = .8 at battery voltage: 240 V					
S.No.	Load %	25	50	75	100
1.	RMS Voltage 1 (V)	225.04	225.53	224.15	224.42
2.	RMS Current 1 (I)	14.59	7.31	22.33	28.4145
3.	Active Power 1 (P)	2662.70	1332.49	4066.37	5070.55
4.	Reactive Power 1 (Q)	1921.73	972.28	2918.62	3866.71
5.	Apparent Power 1 (S)	3283.75	1649.50	5005.37	6376.67
6.	Power Factor 1 (PF)	0.81	0.81	0.81	0.7952
7.	Frequency 1 (Hz)	49.96	49.96	49.96	49.959
8.	RMS Voltage 2 (V)	230.76	230.91	230.51	230.53
9.	RMS Current 2 (I)	14.84	7.36	22.83	29.815
10.	Active Power 2 (P)	2696.76	1358.80	4191.02	5568.11
11.	Reactive Power 2 (Q)	2111.61	1021.37	3182.09	4029.57
12.	Apparent Power 2 (S)	3425.11	1699.86	5262.16	6873.23
13.	Power Factor 2 (PF)	0.79	0.80	0.80	0.8101
14.	Frequency 2 (Hz)	49.96	49.96	49.96	49.959
15.	RMS Voltage 3 (V)	231.43	232.29	230.37	231.17
16.	RMS Current 3 (I)	15.19	7.55	23.26	29.6108
17.	Active Power 3 (P)	2853.13	1415.10	4372.14	5453.33
18.	Reactive Power 3 (Q)	2052.04	1034.35	3097.53	4137.38
19.	Apparent Power 3 (S)	3514.43	1752.82	5358.20	6845.2
20.	Power Factor 3 (PF)	0.81	0.81	0.82	0.7967
21.	Frequency 3 (Hz)	49.96	49.96	49.96	49.959
22.	Voltage THD 1 (%)	2.92	2.36	2.90	2.925
23.	Current THD 1 (%)	2.28	1.94	2.32	2.304
24.	Voltage THD 2 (%)	2.87	2.52	2.77	2.624
25.	Current THD 2 (%)	2.26	2.31	2.21	2.029
26.	Voltage THD 3 (%)	3.06	2.66	2.95	3.001
27.	Current THD 3 (%)	2.39	2.53	2.35	2.345
28.	Total AC output Power (VA)	10223.29	5102.18	15625.73	20095.1
29.	Battery Voltage (V)	37.10	19.00	57.30	70.2
30.	Battery Current (I)	242.72	242.35	241.54	252.08
31.	Input dc Power (W)	9010.00	4610.00	13840.00	17690
32.	Efficiency (%)	91.18	89.05	91.25	90.96

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Annexure – III

Islanding prevention measures for utility-interconnected photovoltaic inverters: IEC 62116											
No.	PEUT) (% of EUT rating)	Reactive load (% of Q_L	P_{AC}) (% of nominal)	Q_{AC}) (% of nominal)	Run on time (ms)	PEUT (kW)	Actual Q_f Phase A	Actual Q_f Phase B	Actual Q_f Phase C	VDC	Remarks
1	100	100	0	0	290	20	1.014	1.006	1.010	397	Test A at BL*
2	66	66	0	0	291	6.6	1.002	1.006	1.006	343	Test B at BL
3	33	33	0	0	300	13.8	1.003	1.001	1.008	292	Test C at BL
4	100	100	−5	−5	306	20	1.002	1.104	1.180	397	Test A at IB
5	100	100	−5	0	260	20	1.206	1.114	1.118	397	Test A at IB*
6	100	100	−5	+5	266	20	1.223	1.118	1.190	397	Test A at IB
7	100	100	0	−5	246	20	1.032	1.001	0.991	397	Test A at IB
8	100	100	0	+5	282	20	0.997	0.956	0.947	397	Test A at IB
9	100	100	+5	−5	290	20	1.092	1.058	1.042	397	Test A at IB
10	100	100	+5	0	272	20	1.076	1.034	1.020	397	Test A at IB
11	100	100	+5	+5	258	20	1.046	1.007	0.990	397	Test A at IB
12	66	66	0	−5	279	13.8	1.145	1.117	1.192	343	Test B at IB
13	66	66	0	−4	293	13.8	1.168	1.107	1.203	343	Test B at IB
14	66	66	0	−3	283	13.8	1.144	1.093	1.207	343	Test B at IB
15	66	66	0	−2	268	13.8	1.140	1.072	1.168	343	Test B at IB
16	66	66	0	−1	271	13.8	1.128	1.082	1.191	343	Test B at IB
17	66	66	0	1	290	13.8	1.110	1.072	1.156	343	Test B at IB
18	66	66	0	2	252	13.8	1.108	1.077	1.196	343	Test B at IB
19	66	66	0	3	286	13.8	1.103	1.062	1.142	343	Test B at IB
20	66	66	0	4	292	13.8	1.137	1.051	1.154	343	Test B at IB
21	66	66	0	5	261	13.8	1.119	1.051	1.149	343	Test B at IB
22	33	33	0	−5	290	6.6	1.128	1.123	1.234	292	Test C at IB
23	33	33	0	−4	273	6.6	1.123	1.134	1.204	292	Test C at IB
24	33	33	0	−3	291	6.6	1.127	1.130	1.204	292	Test C at IB
25	33	33	0	−2	290	6.6	1.121	1.105	1.217	292	Test C at IB
26	33	33	0	−1	167	6.6	1.136	1.109	1.225	292	Test C at IB
27	33	33	0	1	300	6.6	1.121	1.113	1.194	292	Test C at IB
28	33	33	0	2	270	6.6	1.114	1.120	1.193	292	Test C at IB
29	33	33	0	3	260	6.6	1.107	1.109	1.166	292	Test C at IB
30	33	33	0	4	272	6.6	1.099	1.100	1.182	292	Test C at IB
31	33	33	0	5	251	6.6	1.107	1.092	1.180	292	Test C at IB

*BL: Balance Condition

*IL: Imbalance Condition

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Annexure – IV

Photovoltaic (PV) systems –Characteristics of the utility interface (CEI IEC -61727)

Clause		Remark
4.4	**DC injection** [The PV system shall not inject DCcurrent greater than 1 % of the rated inverter output current, into the utility AC interface under any operating condition]	Ok
4.6	**Harmonics and waveform distortion** [Total harmonic current distortion shall be less than 5 % at rated inverter output. Each harmonic shall be limited to the percentages listed in Table 1. Even harmonics in these ranges shall be less than 25 % of the lower odd harmonic limits listed.]	Ok

Table 1 – Current distortion limits

Odd harmonics	Distortion limit	Max Measured Value Φ_1	Max Measured Value Φ_2	Max Measured Value Φ_3
3rd through 9th	Less than 4.0 %	2.035 % @ 5th	1.70 % @ 5th	1.78 % @ 5th
11th through 15t	Less than 2.0 %	0.359 % @11th	0.29 % @ 11th	0.44 % @ 11th
17th through 21st	Less than 1.5 %	0.04 % @17th	0.03 % @17th	0.01 % @17th
23rd through 33rd	Less than 0.6 %	0.005 % @31st	0.009 % @31th	0.05 % @31th

Even harmonics	Distortion limit	Max Measured Value Φ_1	Max Measured Value Φ_2	Max Measured Value Φ_3
2rd through 8th	Less than 1.0 %	0.141 % @ 2nd	0.194 % @ 2th	0.122 % @ 2th
10th through 32nd	Less than 0.5 %	0.017 % @ 12th	0.016 % @ 12th	0.052 % @ 12th

4.7	**Power factor** [The PV system shall have a lagging power factor greater than 0. 9 when the output is greater than 50 % of the rated inverter output power.]	Ok
5.2.1	**Over/under voltage**	Ok

Table 2 – Response to abnormal voltages

Voltage (at point of utility connection)	Maximum trip time*	Measured Value
V < 0.5 $V_{Nominal}$	0.1 s	78 ms at 110 V
50 % ≤ V < 85%	2.0 s	290 ms at 160 V
85 % ≤ V < 110 %	Continuous operation	(190 < V < 273)
110 % < V < 135 %	2.0 s	120 ms at 289 V
135 % ≤ V	0.05 s	Not tested

5.2.2	**Over/under frequency** [When the utility frequency is outside the range of ±1 Hz, the system shall cease to energize the utility line within 0. 2 s. The purpose of the allowed range and time delay is to allow continued operation for short-term disturbances and to avoid excessive nuisance tripping in weak-utility system conditions.]	Range (47 - 53) Hz
5.3	**Islanding protection** The PV system must cease to energize the utility line within 2 s of loss of utility.	See Annexure-III
5.4	**Response to utility recovery** Following an out-of-range utility condition that has caused the photovoltaic system to cease energizing, the photovoltaic system shall not energize the utility line for 20 s to 6 min after the utility service voltage and frequency have recovered to within the specified ranges.	240 seconds

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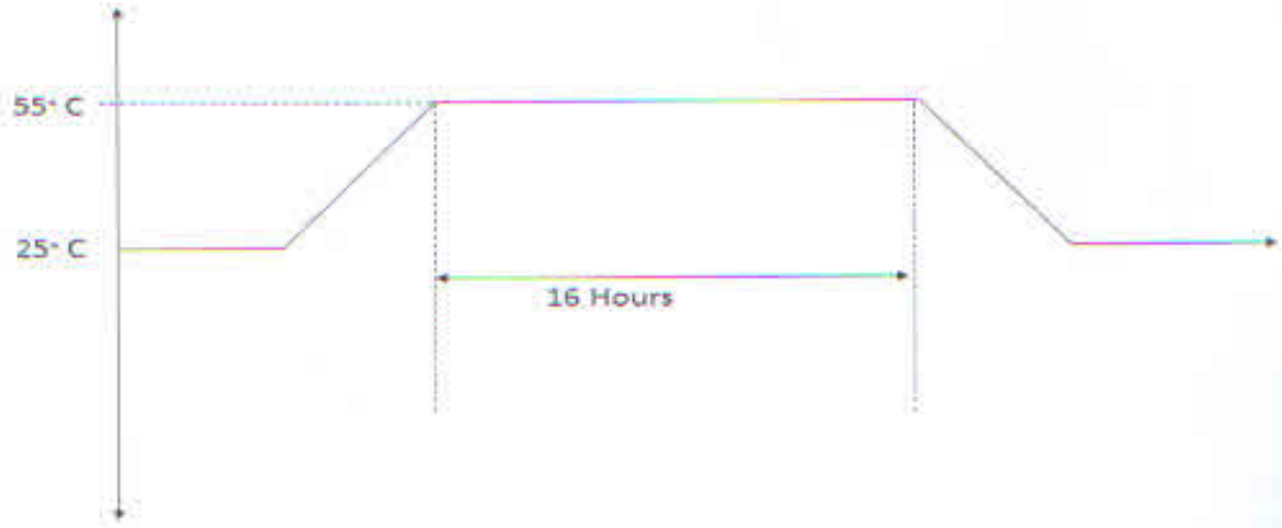
Annexure-VI

Environmental testing as IEC 60068-2-2 Dry heat test			
Sr. No	Requirement + Test	Result/Remarks	
1	Dry Heat Test	Pass	
1.1	Pre-check: examination before environmental conditioning		Pass
1.1.1	Physical damages	No physical damages observed	Pass
1.1.2	EUT working condition	AC Voltage 1/2/3 (V)- 225.06/ 232.68/ 232.94 V Total active Power (p)- 20387.2 Watt Frequency: 49.9 Hz Total DC Power - 22090 Watt	Pass

DRY HEAT TEST SPECIFICATION



1.2.1	EUT operating condition	Powered On	
1.2.2	Test temperature	+55°C	
1.2.3	One cycle duration	16 hours	
1.2.4	No. of cycles	1 cycle	
1.3	Post check: examination after environmental conditioning		Pass
1.3.1	Physical damages	No physical damages observed	Pass
1.3.2	EUT working condition	AC Voltage 1/2/3 (V)- 250/ 225.08 / 232.7 V Total active Power (p)- 20388.62 Watt Frequency: 49.9 Hz Total DC Power - 22090 Watt	Pass

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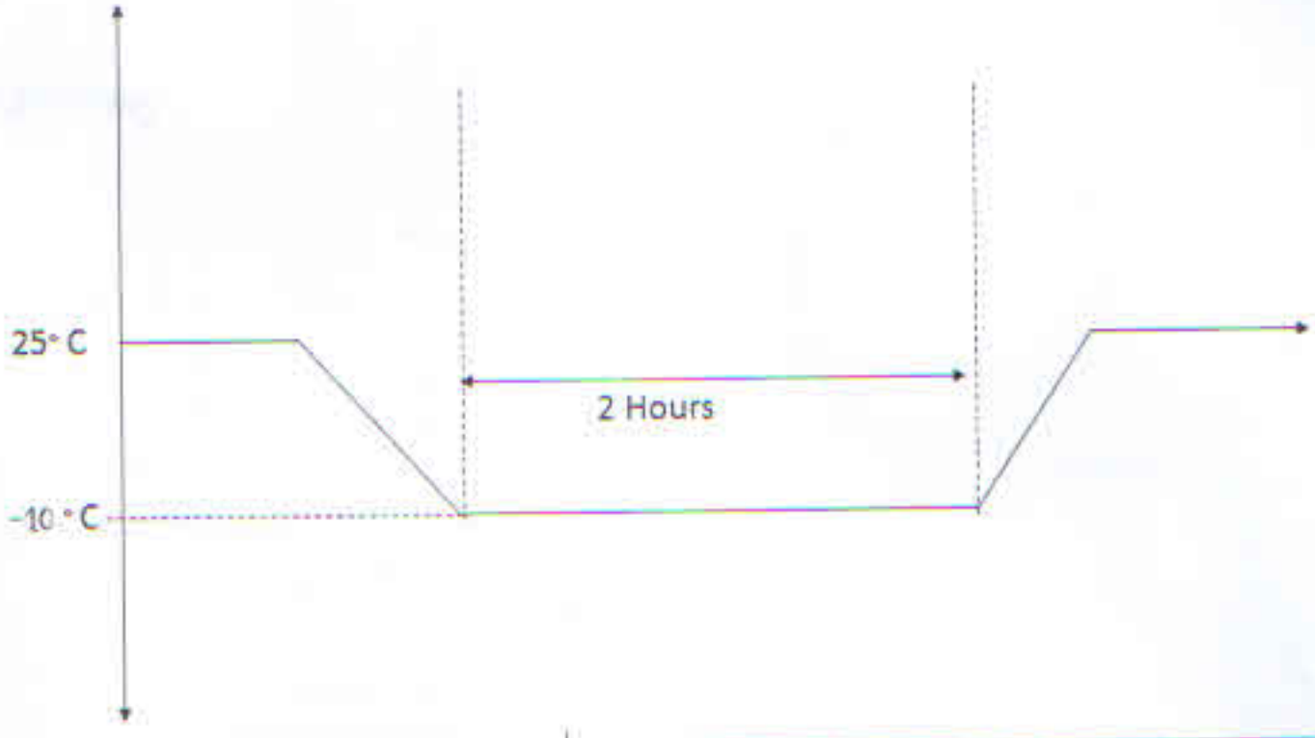
Environmental testing as IEC 60068-2-1 cold Test		
Sr. No	Requirement + Test	Result/Remarks
2	Cold Test	Pass

COLD TEST SPECIFICATION



2.1	EUT operating condition	Powered On	
2.1.2	Test temperature	-10°C	
2.1.3	One cycle duration	2 hours	
2.1.4	No. of cycles	1 cycle	
2.2	Post check: examination after environmental conditioning		Pass
2.2.1	Physical damages	No physical damages observed	Pass
2.2.2	EUT working condition	AC Voltage 1/2/3 (V)- 225.08/ 232.7/232.89 V Total active Power (p)- 20384.93Watt Frequency: 49.9 Hz Total DC Power - 22100 Watt	Pass

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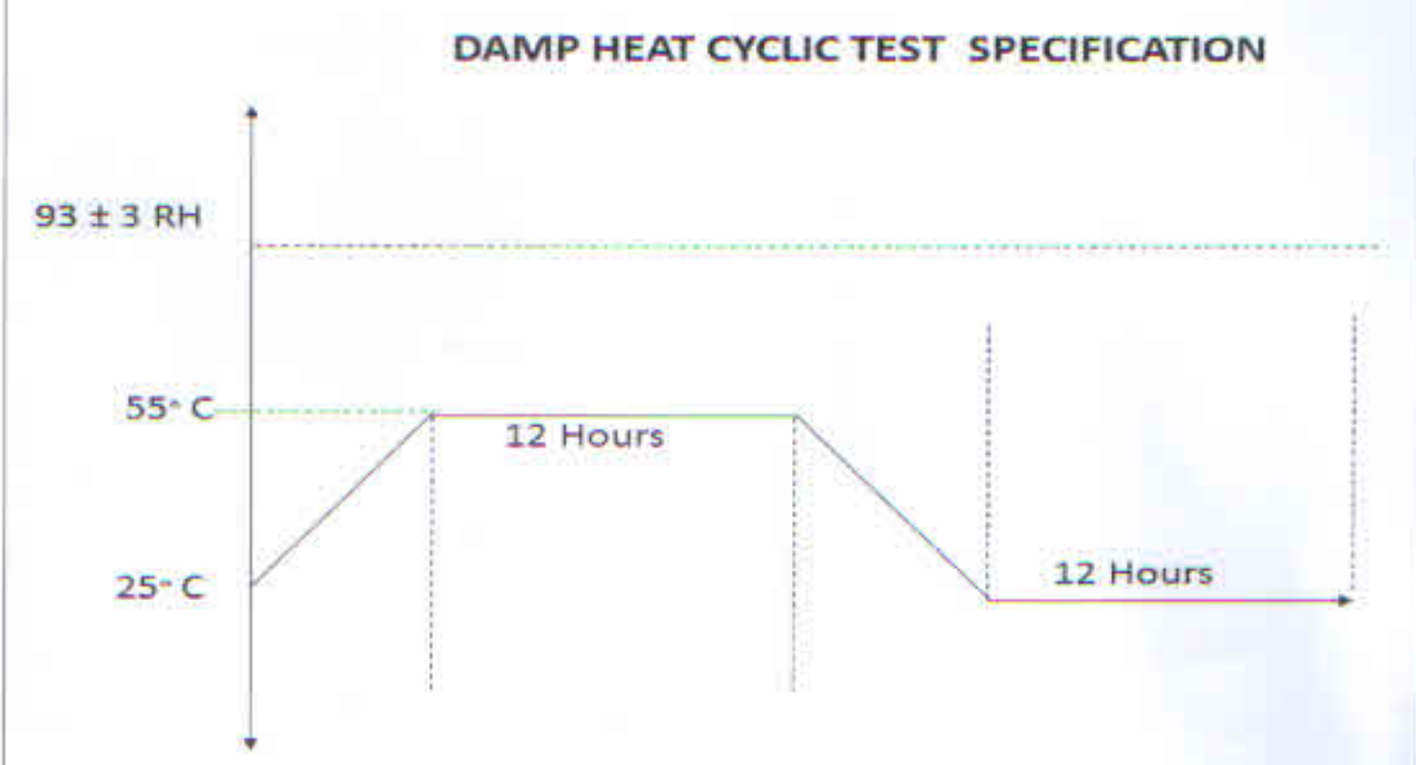
Environmental testing as IEC 60068-2-30 Damp Heat Cyclic Test			
Sr. No	Requirement + Test	Result/Remarks	
3	Damp Heat Cyclic Test	Pass	



3.1	EUT operating condition	Powered On	
3.1.1	Ramp-up / -down time	3 hours	
3.1.2	One cycle duration	12 hours + 12 hours	
3.1.3	No. of cycles	Two-cycle	
3.1.4	Total test duration	48 hours	
3.2	Post check: examination after environmental conditioning		Pass
3.2.1	Physical damages	No physical damages observed	Pass
3.2.2	EUT working condition	AC Voltage 1/2/3 (V)- 225.07/ 232.69/ 232.88 V Total active Power (p)- 20372.21 Watt Frequency: 49.9 Hz Total DC Power - 22070 Watt	Pass

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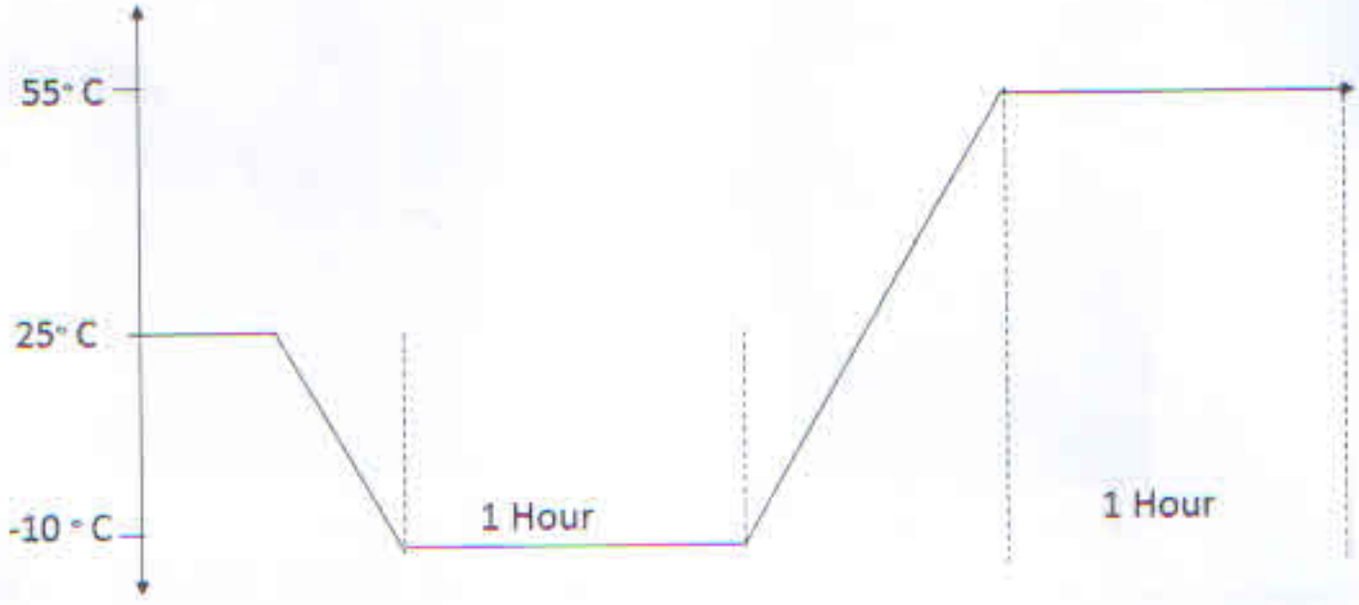
Environmental testing as IEC 60068-2-14 Change of Temperature Test		
Sr. No	Requirement + Test	Result/Remarks
4	Change of Temperature Test	Pass

CHANGE OF TEMPERATURE TEST SPECIFICATION



4.1	EUT operating condition	Powered On	
4.1.1	Test Temperature	Upper : + 55°C Lower : - 10 °C	
4.1.2	The rate of change of temperature	1°C/min	
4.1.3	Dwell Time	1 Hr. at each temperature	
4.1.4	No. of cycles	Five cycle	
4.2	Post check: examination after environmental conditioning		Pass
4.2.1	Physical damages	No physical damages observed	Pass
4.2.2	EUT working condition	AC Voltage 1/2/3 (V)- 225.07/ 232.69/ 232.89 V Total active Power (p)- 20377.73 Watt Frequency: 49.9 Hz Total DC Power - 22060 Watt	Pass

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Annexure-VII

Visual inspection of product

a. Front view (photograph)

b. Back view (photograph)

c. Side view (photograph)

d. Marking label (photograph)

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Customer Service Cell

Feed Back

Company Name:
Company Address:
Name of Person giving Feedback:
Designation & Location:

Sr. No.	Particulars	Feedback Ratings			
		Excellent*	Good	Average	Poor*
1	Contents of Report				
2	Sample Handling				
3	Time Taken				
4	Test Report Format				
5	Courtesy				

*Please give comments:

Remarks: ____
____
____
____

Signature & Date of Client

(Name of Authorised Person)
For Official Use
Acknowledged by__________________ Date__________________ Mode: By Post/Hand/E-mail
T.A/T.M.E