

Speed Post

टेलीफोन/Telephone :

ईमेल/email : msb@cpri.in

फेक्स/ Fax : 080-23601213 / 23604682

ered@cpri.in

336

केन्द्रीय विद्युत अनुसंधान संस्थान, बेंगलूर - 560 080

CENTRAL POWER RESEARCH INSTITUTE, BANGALORE - 560 080

ऊर्जा दक्षता तथा पुनर्नवीकरणयि ऊर्जा प्रभाग (ईआरईडी)

ENERGY EFFICIENCY AND RENEWABLE ENERGY DIVISION (ERED)

स/No./ERED/INV / REP / TO104 & TO120
/ To

दिनांक/Date : 15/11/2018

M/s. System level Solutions (INDIA) Pvt. Ltd.,
Plot no. 32, Zone, D-A Phase 1, G.I.D.C. Estate,
Vithal vdyognagar - 388121, Anand, Gujarat.

विषय / Sub : Test report

संदर्भ / Ref :

महोदय / Dear Sir,

उपयुक्त विषयक पत्र स: CPR1/ERED/INV/REP/TO104 & TO120 दिनांक..... 24/09/18.....

..... इसके साथ संबंध है

We are enclosing herewith letter No. CPR1/ERED/INV/REP/TO104 & TO120 dated..... 24/09/2018

.....on the subject mentioned above.

संलग्नक : उपरोक्तानुसार

End : As above

भावदीय,

Yours faithfully,

अपर निदेशक



केन्द्रीय विद्युत अनुसंधान संस्थान

(भारत सरकार की सोसाइटी, विद्युत मंत्रालय)

प्रो सर सी. वी. रामन रोड, सदाशिवनगर डाक घर, पो. बा. सं. 8066, बेंगलूर - 560 080

CENTRAL POWER RESEARCH INSTITUTE

(A Govt of India Society under Min. of Power)

Prof. Sir C.V. Raman Road, Sadashivanagar P.O., P.B. No. 8066, Bangalore - 560 080, India

वेबसाइट/website : <http://www.cpri.in>

ENERGY EFFICIENCY AND RENEWABLE ENERGY DIVISION

Phone/Tele fax: 080-22702165 email: sudhira.cpri.in,

CPRI/ERED/INV/REP/T0120

31/10/2018.

To,

M/s System Level Solutions (INDIA) Pvt. Ltd.,
Plot No: 32, Zone D-4 Phase 1, G.I.D.C. Estate,
Vithal Udyognagar - 388 121. Anand, Gujarat

Dear Sir,

Please find the enclosed test report for the following:

1.5 kW Grid Tied Micro String Solar Inverter as per IS 16169:2014 / IEC
62116: 2008 - 1 No.

Please acknowledge the receipt of the test report. Thank you for utilizing our services.

Corrections, if any, in the report may please be brought to our notice within 45 days
from the date of issue of the report.

Kindly make arrangement to take back the equipment tested within 15 days, failing
which the same will be disposed of.

Thanking you,

Yours Sincerely,

(R. Sudhir Kumar)
Head of Division

CENTRAL POWER RESEARCH INSTITUTE

TEST REPORT



CPRI

Test Report Number : CPRI BLR ERD18T0120 **Dated:** 31.10.2018

Name & Address of the Customer : M/s System Level Solutions (India) Pvt. Ltd.,
Plot No. 32, Zone D-4 Phase 1, G.I.D.C Estate,
Vithul Udyognagar, Anand, Gujarat - 388121

Name & Address of the Manufacturer : M/s System Level Solutions (India) Pvt. Ltd.,
Plot No. 32, Zone D-4 Phase 1, G.I.D.C Estate,
Vithul Udyognagar, Anand, Gujarat - 388121

Particulars of sample tested : 1.5 kW solar grid tied inverter
Condition of sample on Receipt : Physical condition is good

Type : Single phase Utility interactive type
Description of sample tested : 1.5 kW solar grid tied inverter (refer photos)
Serial number : 1114A4050125
Number of samples tested : One
Date(s) of test (s) : 26.09.2018 to 24.10.2018
CPRI sample code no(s) : ERED1819S0183

Particulars of tests conducted : Anti-Islanding test

Test in accordance with Standard / specification : IS 16169:2014 / IEC-62116: 2008

Sampling Plan : NA

Customer's requirement : Anti-Islanding test as per IS 16169:2014 / IEC-62116: 2008
Deviations (if any) : None

Name of the witnessing persons

Customer's representative : Nil
Other than customer's representative : Nil

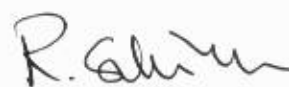
Test subcontracted with address of the laboratory : N/A

Documents constituting this report (In words)

Number of sheets : Twelve
Number of Oscillograms : Nil
Number of graphs : Nil
Number of photos : Nil
Number of test circuit diagram : Nil
Number of drawings : Nil


(K. Jaykishan Kumar)
Test Engineer




(R. Sudhir Kumar)
Head of Division
Approved by

CENTRAL POWER RESEARCH INSTITUTE

TEST REPORT

Test Report Number: CPRIBLRERED1819T0120

Date: 31.10.2018



Equipment Used

Table 1: List of equipments used for testing

Sl.No.	Name	Make	Model	Calibration Validity Upto
1	Power analyser	Hioki	3390	10.09.2019
2	Current sensor-500A	Hioki	9709	23.08.2019
3	Current sensor-50A	Hioki	6862	10.09.2019
4	DC power supply	Unotron	3527	23.08.2019
5	Variable voltage – current DC power supply	Ametek	SGA200/125D-1AAB	27.11.2018
6	Oscilloscope	Teledyne- lecroy	HDO4024	10.09.2019

Note: All tests were conducted within the validity period of respective equipment shown above.


(K. Jeykishan Kumar)
Test Engineer

Description of test equipment

Table 2: Specification of Testing Equipment

Items	Specifications	Remarks
1) DC Power source (or PV array simulator)	PV array simulator (acting as DC source)	
a) Voltage Range	0 - 1000 V (0.01 V steps)	
b) Current Range	0 - 750 A (0.01 A steps)	
2) AC Power source		
a) Output wiring	3-phase, 4 wire system	
b) Output capacity	540 kVA	
c) Output voltage	400 V AC	
d) Output frequency	16 - 500 Hz	
3) Digital Meter	Power analyser(s)	
a) Voltage Range	Voltage (V): 1000 V, AC/DC	
b) Current Range	Current(A): 5mA-500A, DC/ 50mA-10000A,AC	
c) Frequency range (Accuracy)	(40 - 69) Hz, ± 0.1 Hz	
d) Measurement items	Active power (kW) Reactive power (kVAr) Volt-Ampere (kVA) Power factor(PF) Frequency (Hz) Electrical Energy (kWh)	
e) Waveform recorder	High definition oscilloscope	Single phase waveform measurement with trigger input signal
a) Sampling speed	2.5 GS/s	
b) Recording device	In-built waveform recorder	
4) AC Load		
a) Resistive load Maximum voltage Current range Capacity	1000 V, AC 750 A, AC 200 kW	
b) Inductive load Maximum voltage Current range Capacity	1000 V, AC 750 A, AC 200 kVAr	
c) Capacitive load Maximum voltage Current range Capacity	1000 V, AC 750 A, AC 200 kVAr	


(K. Jeykishan Kumar)
Test Engineer

CENTRAL POWER RESEARCH INSTITUTE

TEST REPORT

Test Report Number: CPRIBLRERED1819T0120

Date: 31.10.2018



CPRI

Description of the sample

Table 3: Specification of equipment under test (EUT) provided by Manufacturer

Parameter	Value	Remarks
1) Rating		
a) Maximum Output power	1.5 kW	
b) DC Voltage range	22 V – 55 V	48.75 V, Nominal
c) DC Current range	40 A	
d) AC Voltage range	(202 - 268) V	
e) Frequency range	(48 - 52) Hz	
f) AC Current Limits	6.09 A (RMS)	
g) Efficiency	95%	
h) Voltage and frequency trip settings(magnitude and timings)	---	
i) Other software settings	---	
j) Firmware version	---	
2) Others		
a) Displays	---	
b) Temperature Range	25°C to 60°C	
c) Humidity	---	
d) Size	32.2 cm x 27.8 cm x 8.0 cm (W x H x D)	
e) Weight	7.5 Kg	


 (K. Jeykishan Kumar)
 Test Engineer

CENTRAL POWER RESEARCH INSTITUTE

TEST REPORT

Test Report Number: CPRIBLRERED1819T0120

Date: 31.10.2018



CPRI

TEST RESULTS

Table 4: List of tested conditions and run on time

No.	P _{EUT} (% of EUT Rating)	Reactive load (% of Q _L)	P _{AC} (% Of nominal)	P _{ac} (W) Actual	Q _{AC} (% Of nominal)	Q _{ac} (VAr) Actual	Run on time (ms)	P EUT (W)	Actual Qf	V _{DC} (Volt)	Remarks (Refer Table 36 of this report)
1	100	100	0	0	0	0	115	1403	1.00	44.03	Test A at BL
2	66	66	0	0	0	0	107	995	1.00	38.50	Test B at BL
3	33	33	0	0	0	0	97	493	1.00	33.20	Test C at BL
4	100	100	-5	-75	-5	-75	115	1403	0.97	44.03	Test A at IB
5	100	100	-5	-75	0	0	116	1404	0.96	44.03	Test A at IB
6	100	100	-5	-75	+5	+75	100	1401	0.99	44.03	Test A at IB
7	100	100	0	0	-5	-75	144	1401	1.01	44.03	Test A at IB
8	100	100	0	0	+5	+75	92	1402	0.97	44.03	Test A at IB
9	100	100	+5	+75	-5	-75	150	1400	1.03	44.03	Test A at IB
10	100	100	+5	+75	0	0	123	1400	1.04	44.03	Test A at IB
11	100	100	+5	+75	+5	+75	98	1400	1.02	44.03	Test A at IB
12	100	100	-10	-150	+10	+150	97.6	1401	1.04	44.03	Test A at IB
13	100	100	-5	-75	+10	+150	103	1406	1.01	44.00	Test A at IB
14	100	100	0	0	+10	+150	90.2	1403	1.03	44.00	Test A at IB
15	100	100	+10	+150	+10	+150	119	1408	1.04	44.05	Test A at IB
16	100	100	+10	+150	+5	+75	97.8	1406	1.05	44.00	Test A at IB
17	100	100	+10	+150	0	0	111	1407	1.01	44.02	Test A at IB
18	100	100	+10	+150	-5	-75	190	1407	1.03	44.02	Test A at IB
19	100	100	+10	150	-10	-150	110	1406	1.04	44.02	Test A at IB
20	100	100	+5	+75	-10	-150	116	1405	1.01	44.02	Test A at IB
21	100	100	0	0	-10	-150	171	1408	1.05	44.02	Test A at IB
22	100	100	-5	-75	-10	-150	122	1402	0.98	44.02	Test A at IB
23	100	100	-10	-150	-10	-150	288	1405	0.95	44.02	Test A at IB
24	100	100	-10	-150	-5	-75	90.8	1405	0.96	44.02	Test A at IB
25	100	100	-10	-150	0	0	101	1403	0.96	44.02	Test A at IB
26	100	100	-10	-150	+5	+75	90.6	1403	0.97	44.02	Test A at IB
27	100	100	+5	+75	+10	+150	98.6	1404	0.98	44.02	Test A at IB

K. Jeykishan Kumar
(K. Jeykishan Kumar)
Test Engineer

CENTRAL POWER RESEARCH INSTITUTE

TEST REPORT

Test Report Number: CPRI BLRERED1819T0120

Date: 31.10.2018



CPRI

TEST RESULTS

Table 4 (Continued): List of tested conditions and run on time

No.	P _{EUT} (% of EUT Rating)	Reactive load (% of Q _L)	P _{AC} (% Of nominal)	P _{ac} (W) Actual	Q _{AC} (% Of nominal)	Q _{AC} (VAr) Actual	Run on time (ms)	P _{EUT} (W)	Actual Qf	V _{DC} (Volt)	Remarks (Refer Table 52 of this report)
28	66	66	0	0	-5	-75	111	995	1.04	38.54	Test B at BL
29	66	66	0	0	-4	-60	254	992	1.03	38.58	Test B at BL
30	66	66	0	0	-3	-45	193	992	1.02	38.48	Test B at BL
31	66	66	0	0	-2	-30	115	985	1.01	38.56	Test B at IB
32	66	66	0	0	-1	-15	226	995	1.00	38.55	Test B at IB
33	66	66	0	0	1	+15	99	997	0.99	38.55	Test B at IB
34	66	66	0	0	2	+30	98	988	0.98	38.54	Test B at IB
35	66	66	0	0	3	+45	129	995	0.97	38.54	Test B at IB
36	66	66	0	0	4	+60	76	991	0.96	38.51	Test B at IB
37	66	66	0	0	5	+75	96	995	0.96	38.37	Test B at IB
38	33	33	0	0	-5	-75	202	497	1.05	32.42	Test C at IB
39	33	33	0	0	-4	-60	170	491	1.04	32.52	Test C at IB
40	33	33	0	0	-3	-45	117	496	1.02	32.57	Test C at IB
41	33	33	0	0	-2	-30	136	492	1.01	32.67	Test C at IB
42	33	33	0	0	-1	-15	224	495	1.00	33.08	Test C at IB
43	33	33	0	0	1	+15	129	493	0.99	33.20	Test C at IB
44	33	33	0	0	2	+30	84	494	0.99	33.07	Test C at IB
45	33	33	0	0	3	+45	85	491	0.98	32.36	Test C at IB
46	33	33	0	0	4	+60	105	492	0.96	32.87	Test C at IB
47	33	33	0	0	5	+75	87	495	0.95	32.55	Test C at IB

- 1) P_{EUT}: EUT output power.
- 2) P_{AC}: Real power flow at S1 in Figure 1. Positive sign indicates power flow from EUT to utility. Nominal is the 0% test condition value.
- 3) Q_{AC}: Reactive power flow at S1 in Figure 1. Positive sign indicates power flow from EUT to utility. Nominal is the 0% test condition value.
- 4) BL: Balance Condition, IB: Imbalance Condition.


 (K. Jeykishan Kumar)
 Test Engineer

CENTRAL POWER RESEARCH INSTITUTE

TEST REPORT

Test Report Number: CPRIBLRERED1819T0120

Date: 31.10.2018



TEST CONDITIONS

Table 5: Test conditions as per Table 5 of IS 16169:2014/ IEC 62116:2008

Test Condition	EUT output power (P_{EUT})	EUT input voltage(3)	EUT trip setting
A	Maximum(1)	>90% of rated input voltage range	Manufacturer specified voltage and frequently trip settings
B	50% - 66% of Maximum	50% of rated input voltage range, +10%	Set voltages and frequency trip settings to nominal values
C	25% - 33%(2) Maximum	<10% of rated input voltage range	Set voltage and frequency trip settings to nominal values

Note:

- 1) Maximum EUT output power condition should be achieved using the maximum allowable input power. Actual output power may exceed nominal rated output.
- 2) Or Minimum allowable EUT output level if greater than 33%.
- 3) Based on EUT rated input operating range. For example if range is between X volts and Y volts, 90% of range = $X + 0.9 * (Y-X)$. 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.


(K. Jeykishan Kumar)
 Test Engineer



TEST PROCEDURE

Test procedure for achieving specified load and EUT output conditions

1. Determine EUT Output Power
2. Adjust DC input source
 - a. S1 closed, S2 opened
 - b. Turn EUT ON, Measure EUT power output
 - c. Measure real , reactive power, frequency, utility power(real and reactive)
 - d. Real power = reactive power for utility
3. Turn OFF EUT and Open S1
4. Adjust RLC load to have $Q_f = 1 \pm 0.05$
 - a. Inductive reactance = EUT real power
 - b. Inductor as first element
 - c. Adjust capacitor to have : $Q_C + Q_L = - Q_{EUT}$
 - d. Connect resistor to have power consumed by RLC circuit = P EUT
5. Connect RLC load as per item 4 and Close S2.
6. Close S1 and turn the EUT ON
7. Adjust RLC to have I AC to be) A through S1 with 1 % tolerance
8. Disconnect S1 to initiate the test.
9. Run on time , t_R to be recorded
10. For test condition A, adjust real load and only one reactive component by approximately 1 % per test within a total range of 95% to 105%.
11. If run on times are increasing, and then increase 1% increments until run on time decreases.
12. Test C load conditions may be achieved using inverter control to limit output power rather than power supply limit.

Note:

Test procedure is as per IS 16169:2014/ IEC 62116:2008


(K. Jeykishan Kumar)
Test Engineer

TEST REPORT

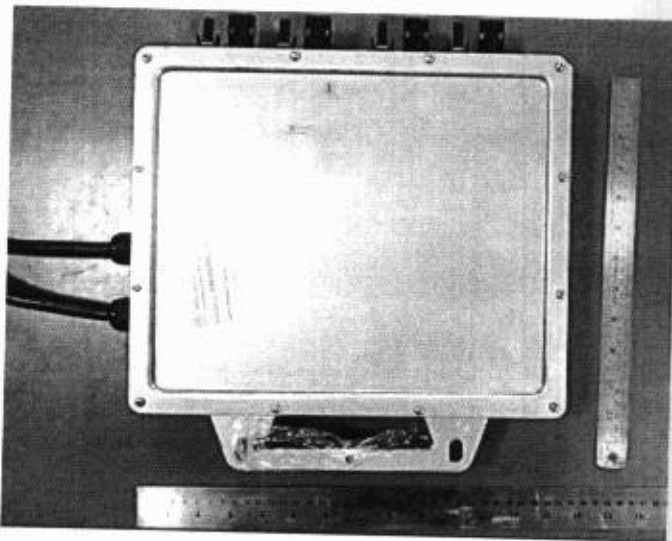
Test Report Number: CPRIBLRERED1819T0120

Date: 31.10.2018

Photos of test equipment

CPRI

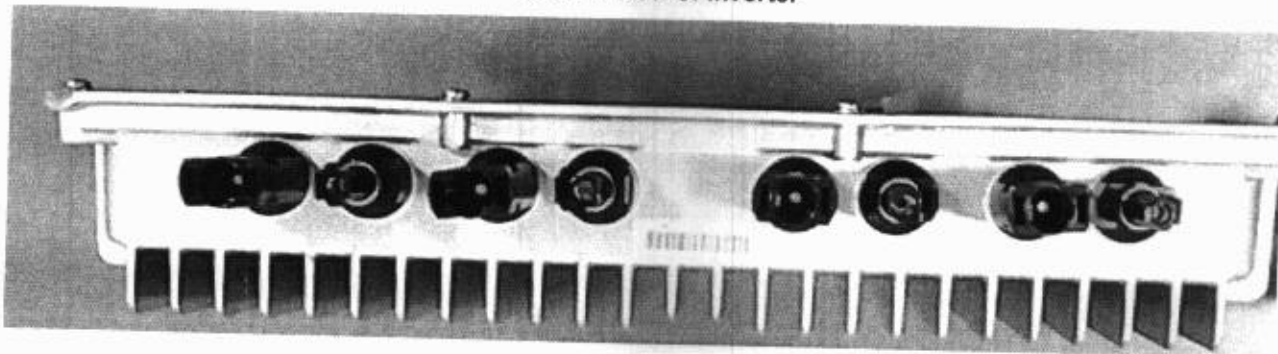
1. Top side view of inverter



2. Name plate reading



3. Side view of Inverter



K. Jeykishan
 (K. Jeykishan Kumar)
 Test Engineer

CENTRAL POWER RESEARCH INSTITUTE

TEST REPORT

Test Report Number: CPRIBLRERED1819T0120

Date: 31.10.2018



CPRI

NOTE

- a) The Test results relate only to the item(s) tested.
- b) Publication or reproduction of the test report /certificate in any form other than by complete set of the whole test report /certificate and in the language written is not permitted without the written consent of CPRI.
- c) Any Corrections/erasure invalidates the test report/certificate
- d) NABL has accredited this laboratory as per ISO/IEC 17025 – 2005 standard, vide certificate No.TC – 5452 (Relevant number of NABL certificate of accreditation for testing (Electrical) for the tests carried out.)
- e) Any anomaly/discrepancy in the test report /certificate should be brought to the notice of CPRI within 45 days from the date of issue.


(K. Jeykishan Kumar)
Test Engineer