



केन्द्रीय विद्युत अनुसंधान संस्थान

(भारत सरकार की सोसाइटी, विद्युत मंत्रालय)

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

CENTRAL POWER RESEARCH INSTITUTE

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

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वेब साइट/website : <http://www.cpri.in>

ENERGY EFFICIENCY AND RENEWABLE ENERGY DIVISION

Phone/Tele fax: 080-22702368 email: sudhir@cpri.in,

CPRI/ERED/INV/REP/T0050

31/07/2018.

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/IEC-61683: 1999 – 11
(Re-affirmed-2015) - 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

TEST REPORT

Test Report Number: CPRIBLRERED1819T0050

Dated: 31.07.2018

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,
Vithal Udyognagar - 388 121, Anand, Gujarat.

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,
Vithal Udyognagar - 388 121, Anand, Gujarat.

Particulars of sample tested : 1.5 kW Grid Tied Micro String Solar Inverter
Condition of sample on Receipt : Physical condition is good
Type : Grid Tied Micro String Solar Inverter
Model Number : MSI1500
Serial number : 1114A4050125

Number of samples tested : One
Date(s) of test (s) : 25th June 2018 & 26th June 2018.
CPRI sample code no(s) : ERED1819S0183
Particulars of tests conducted : Efficiency test

Test in accordance with Standard / specification : IS/IEC -61683: 1999-11 (Re-affirmed- 2015)

Customer's requirement : Efficiency test as per IEC- 61683: 1999-11
Deviations (if any) : None

Name of the witnessing persons

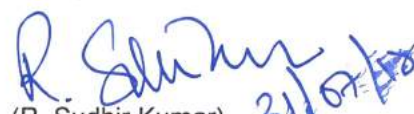
Customer's representative : None
Other than customer's representative : None
Test subcontracted with address of the laboratory : NA

Documents constituting this report (In words)

Number of sheets : Eleven
Number of Oscillograms : Nil
Number of graphs : One
Number of photos : Three
Number of circuit diagrams : Two
Number of drawings : Nil
Number of tables : Seven


(K. Jeykishan Kumar)
Test in charge




(R. Sudhir Kumar)
Head of Division
Approved By

CENTRAL POWER RESEARCH INSTITUTE

TEST REPORT

Test Report Number: CPRI BLRERED1819T0050

Dated: 31.07.2018



Equipments Used

Table 1: List of equipments used for testing

Sl.No.	Name	Make	Model	Calibration Validity Upto
1.	Power Analyser	Hioki	3390	18-08-2018
2.	Current sensor-500A	Hioki	9709-05	18-08-2018
3.	Programmable DC power supply	AMETEK	Terrasas PV simulator	

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


(K. Jeykishan Kumar)
Test Engineer

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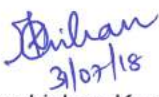
Dated: 31.07.2018



Description of the sample

Table 2: 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 (WxHxD)	
e) Weight	7.5 Kg	


(K. Jeykishan Kumar)
Test Engineer

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TEST CIRCUIT

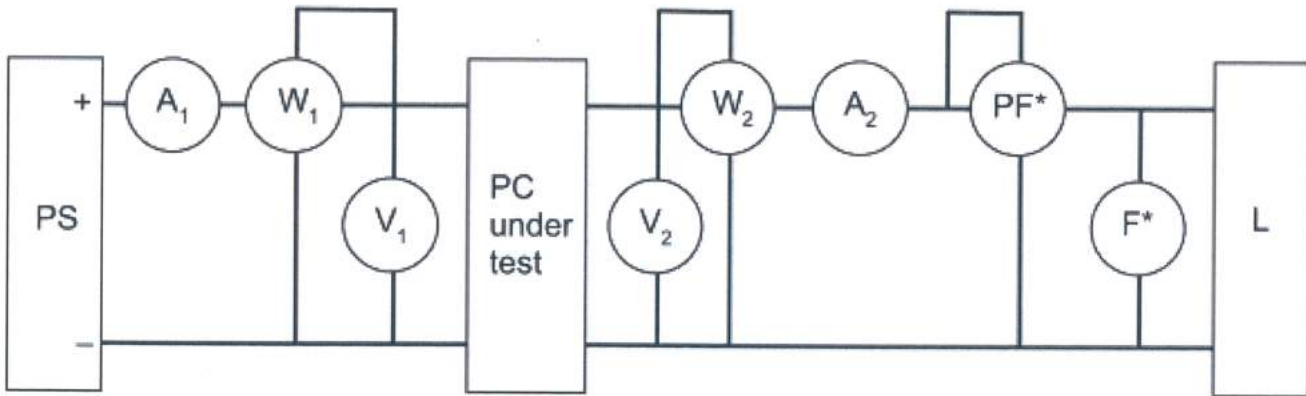


Figure 1a – Stand-alone type

IEC 1566/99

Figure 1: Test circuit diagram for measuring by considering the power conditioner is stand-alone type

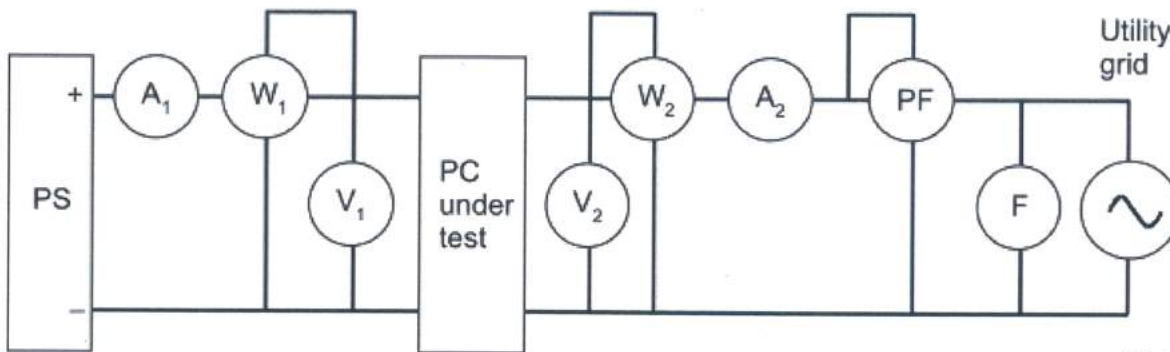


Figure 1b – Utility-interactive type

IEC 1567/99

Figure 1.b: Test circuit diagram for measuring by considering the power conditioner is utility-interactive type

-where

PC	Power Conditioner	L	Load
PS	Variable voltage-current DC power supply	F	Frequency meter
A1	DC ammeter	V1	DC voltmeter
A2	AC or DC ammeter	V2	AC or DC voltmeter
W1	DC wattmeter	PF	Power factor meter
W2	AC or DC wattmeter		

K. Jeykishan Kumar
31/07/18
(K. Jeykishan Kumar)
Test Engineer

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TEST RESULTS

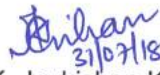
1. Loss measurements as per Cl. 7 of IS/IEC 61683: 1999 (Reaffirmed 2015)

Table 3: No load loss measurement as per Cl. 7.1 of IS/IEC 61683: 1999 (Reaffirmed 2015)

No load test: No load test is carried out as per Cl. No. 7.1 of IEC 61683-1999				
Input DC Voltage, V _{dc}		Input DC Current, A	No load loss, W	Energy averaged over a period of 1 minute, Wh
V _{min}	37.54 V	0.04	1.5	0.025
V _{nominal}	48.75 V	0.03	1.46	0.024
90% of V _{max}	54 V	0.03	1.62	0.027
No load loss is measured by considering the power conditioner is a "utility-interactive type".				

Table 4: Standby loss measurement as per Cl. 7.2 of IS/IEC 61683: 1999 (Reaffirmed 2015)

Standby loss test: Standby loss test is carried out as per Cl. No. 7.2 of IEC 61683-1999	
Provision for standby mode is not provided with the Inverter.	
Standby loss is measured by considering the power conditioner is a "stand-alone type".	


 31/07/18
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TEST RESULTS

2. Efficiency calculations as per Cl. No. 4.6, 5.1, 5.2 & 5.3 of IS/IEC 61683: 1999 (Reaffirmed 2015)

Table 5: Measured parameters at manufacturer's minimum rated input DC voltage: $V_{min} = 37.5 V$

Sl. No.	Particulars	Testing, % load						
		5%	10%	25%	50%	75%	100%	120%
1	Input DC Voltage (V)	-	37.5	37.55	38	37.79	37.73	-
2	Input DC Current (A)	-	4.05	10.01	19.86	29.87	39.82	-
3	Input DC Power (W)	-	152	376	756	1129	1502	-
4	Output RMS Voltage (V)	-	230.44	230.42	230.42	230.45	230.43	-
5	Output RMS Current (A)	-	0.656	1.507	3.094	4.62	6.143	-
6	Output AC Power (W)	-	135	340	705	1058	1406	-
7	Power Efficiency (%)	-	88.75	90.51	93.35	93.74	93.62	-
8	Power factor	-	0.89	0.98	0.98	0.99	0.99	-
9	Voltage THD (%)	-	0.04	0.04	0.04	0.06	0.07	-
10	Current THD (%)	-	19.78	8.07	4.48	3.28	2.73	-
11	Input Energy (Wh)	-	2.53	6.22	12.6	18.81	25.03	-
12	Output Energy (Wh)	-	2.25	5.67	11.75	17.63	23.43	-
13	Energy Efficiency (%)	-	88.93	91.15	93.25	93.72	93.60	-

Note:

1. 120% load was excluded due to limitation of power conditioning unit.
2. Energy averaged over a period of 1 minute, Wh

(Signature)
31/07/18
(K. Jeykishan Kumar)
Test Engineer

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Dated: 31.07.2018



TEST RESULTS

Table 6: Measured parameters at inverter's nominal input DC voltage: $V_{nom} = 48.75$ V

Sl. No.	Particulars	Testing, % load						
		5%	10%	25%	50%	75%	100%	120%
1	Input DC Voltage (V)	-	48.14	48.07	48.41	47.4	48.81	-
2	Input DC Current (A)	-	3.114	7.79	15.45	23.64	30.75	-
3	Input DC Power (W)	-	150	375	748	1121	1501	-
4	Output RMS Voltage (V)	-	230.42	230.43	230.42	230.46	230.45	-
5	Output RMS Current (A)	-	0.652	0.652	3.045	4.90	6.179	-
6	Output AC Power (W)	-	134	346	696	1076	1415	-
7	Power Efficiency (%)	-	89.18	92.29	93.08	95.99	94.24	-
8	Power factor	-	0.89	0.98	0.99	0.99	0.99	-
9	Voltage THD (%)	-	0.04	0.04	0.04	0.05	0.07	-
10	Current THD (%)	-	21.59	8.09	4.49	2.88	2.66	-
11	Input Energy (Wh)	-	2.5	6.25	12.46	18.68	25.01	-
12	Output Energy (Wh)	-	2.23	5.76	11.6	17.93	23.58	-
13	Energy Efficiency (%)	-	89.2	92.16	93.09	95.98	94.28	-

Note:

1. 120% load was excluded due to limitation of power conditioning unit.
2. Energy averaged over a period of 1 minute, Wh


(K. Jeykishan Kumar)
Test Engineer

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TEST RESULTS

Table 7: Measured parameters at 90% of inverter's maximum input DC voltage (60 V): $V_{max} = 54 V$

Sl. No.	Particulars	Testing, % load						
		5%	10%	25%	50%	75%	100%	120%
1	Input DC Voltage (V)	-	-	53.9	54.74	54.64	54.02	-
2	Input DC Current (A)	-	-	7.03	13.76	20.62	27.7	-
3	Input DC Power (W)	-	-	379	754	1125	1503	-
4	Output RMS Voltage (V)	-	-	230.42	230.46	230.42	230.45	-
5	Output RMS Current (A)	-	-	1.569	3.08	4.65	6.18	-
6	Output AC Power (W)	-	-	355	706	1066	1423	-
7	Power Efficiency (%)	-	-	93.66	93.63	94.75	94.01	-
8	Power factor	-	-	0.98	0.99	0.99	0.99	-
9	Voltage THD (%)	-	-	0.04	0.04	0.06	0.07	-
10	Current THD (%)	-	-	7.80	3.92	2.92	2.61	-
11	Input Energy (Wh)	-	-	6.31	12.56	18.75	25.05	-
12	Output Energy (Wh)	-	-	5.91	11.76	17.76	23.71	-
13	Energy Efficiency (%)	-	-	93.66	93.63	94.72	94.65	-

Note:

1. 120% and 10% load was excluded due to limitation of power conditioning unit.
2. Energy averaged over a period of 1 minute, Wh

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31/07/18
(K. Jeykishan Kumar)
Test Engineer

TEST REPORT

Test Report Number: CPRIBLRERED1819T0050

Dated: 31.07.2018



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TEST SUMMARY

Efficiency measurement test result							
Serial No : 1114A4050125 Model : MSI1500		Temperature: 25 °C ± 2 °C Output Voltage: 230 Vac, 50Hz					
Input Voltage (V dc) (140 V – 180 V) (V _{min} - V _{max})		Power Level					
		10%	25%	50%	75%	100%	120%
		150 W	375 W	750 W	1125 W	1500 W	1800 W
η (%) Rated output efficiency and partial output efficiency							
V _{min}	37.5 V	88.75	90.51	93.35	93.74	93.62	-
V _{nominal}	48.75 V	89.18	92.29	93.08	95.99	94.24	-
V _{max} (90% of max. V dc)	54 V	--	93.66	93.63	94.75	94.01	-

Graph 1: Load – Efficiency characteristics

No-Load Loss Inverter connected to the AC main, supplied with nominal input voltage- inverter acts as utility-interactive type W ₁ at 48.75 V= 1.46 W	Standby Loss Provision for standby mode is not provided with the inverter
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Efficiency tolerance of power conditioner at rated condition (%) = -1.08%

Note: 1. Efficiency tolerance has been calculated as per Cl. 5.4 of IS/IEC 61683-1999: Reaffirmed 2015

(K. Jeykishan Kumar)
 Test Engineer

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TEST REPORT

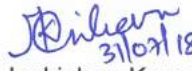
Test Report Number: CPRIBLRERED1819T0050

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NOTE

- a) The test results are only for the item 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 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.
- f) The verification of the sample drawings by CPRI is limited to dimensional checks only wherever possible.


(K. Jeykishan Kumar)
Test Engineer