TEST REPORT
IEC 61683

Photovoltaic systems – Power conditioners – Procedure for measuring efficiency

Report Number.....:	**TUV/PTL/20-21/SFTY-WT/0081**
Date of issue.....:	**20/04/2021**
Total number of pages.....	**16**
Name of Testing Laboratory preparing the Report.....:	**TUV India Private Limited.** ANJANI PALLADIUM, 203 & 204, SECOND FLOOR AND MEZZANINE FLOOR, 104B, SURVEY NO.126/1, BANER MAIN ROAD, BANER, PUNE 411045, MAHARASHTRA, INDIA
Applicant's name .....:	**ENERTECH UPS PVT. LIMITED**
Address.....:	S.NO 399/12 BHARE GAON.P O. GHOTAWADE, DIST PUNE 412115
Test specification:	
Standard.....:	IEC 61683:1999
Test procedure .....:	As above
Non-standard test method .....:	N/A
Test Report Form No. .....:	IEC61683B
Test Report Form(s) Originator ....:	TUV INDIA
Master TRF.....:	Dated 2020-02-04

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Test item description .....:	SOLAR PCU (Sunmagic +)
Trade Mark .....:	
Manufacturer.....:	ENERTECH UPS PVT. LIMITED
Model/SR.NO.....:	202102637
Ratings .....:	Battery dc:240Vdc Pv range: 300-460Vdc Ac input:360-460Vac Ac output:400Vac Frequency: 50Hz Rating:15KW/15KVA

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):

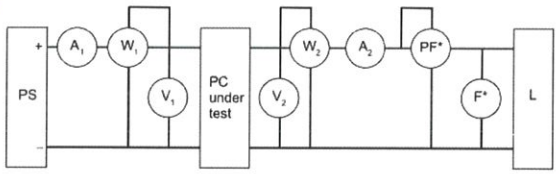
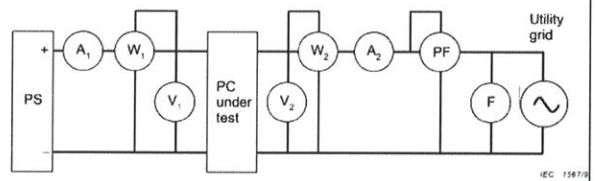
☒ **Testing Laboratory:**	**TUV India Private Limited.**	
Testing location/ address.....:	**ENERTECH UPS PVT. LIMITED** S.NO 399/12 BHARE GAON.P O. GHOTAWADE, DIST PUNE 412115	
Tested by (name, function, signature).....:	**Mr. Mayur Ramteke** **(Test Engineer)**	
Approved by (name, function, signature)...:	**Mr. Navnath korekar** **(Sr. Test Engineer)**	

List of Attachments (including a total number of pages in each attachment): Photo View Of The Equipment Under Test: 2 Pages (14-15) Equiment used:1 page(page no. 16)	
Summary of testing:	
Tests performed (name of test and test clause): Input voltage(cl no 4.4) Ripple and distortion(cl no 4.5) Resistive load(cl no.4.6) Reactive load(cl no 4.7) Resistive plus non linear load(cl no 4.8) Complex load(cl no 4.9) No load loss(cl no 7.1) Stand by loss(cl no 7.2)	**Testing location:** **ENERTECH UPS PVT. LIMITED** S.NO 399/12 BHARE GAON.P O. GHOTAWADE, DIST PUNE 412115
☒ **The product fulfils the requirements of _ IEC 61683:1999**	

Test item particulars ..... :	SOLAR PCU (Sunmagic +)
Classification of installation and use ..... :	Provided
Supply Connection ..... :	Battery dc:240Vdc Pv range:300-460Vdc Ac input:360-460Vac Ac output:400Vac Frequency: 50Hz Rating:15KW/15KVA
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.....:	3/03/2021
Date (s) of performance of tests .....:	3/03/2021
General remarks:	
"(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 / ☒ point is used as the decimal separator.**	
Name and address of factory (ies) .....:	**ENERTECH UPS PVT. LIMITED** S.NO 399/12 BHARE GAON.P O. GHOTAWADE, DIST PUNE 412115
General product information: The inverter is for indoor use only. It must be protected from rain or excessive moisture and installed in a clean environment, free from flammable liquids, gasses, or corrosive substances. Do not put drinks, plants, or any other containers holding liquids, on top of the unit. The Unit must be commissioned by a EUPL engineer before it is put into service. Failure to observe this condition will invalidate any implied warranty.	

IEC 61683:1999			
Clause	Requirement – Test	Measuring result – Remark	Verdict
4	Efficiency measurement conditions		P
	Efficiency is measured under the conditions in the following clauses.	See below	P
	Specific conditions may be excluded by mutual agreement when those conditions are outside the manufacturer's allowable operating range.	No such specific condition	N/A
4.1	DC power source for testing	See below	P
	For power conditioners operating with fixed input voltage, the d.c. power source is a storage battery or constant voltage power source to maintain the input voltage.	complied	P
	For power conditioners that employ maximum power point tracking (MPPT) and shunt-type power conditioners, either a photovoltaic array or a photovoltaic array simulator is utilized.	No such construction	N/A
4.2	Temperature	See below	P
	All measurements are to be made at an ambient temperature of 25 °C ± 2 °C.	Complied	P
	Other ambient temperatures may be allowed by mutual agreement. However, the temperature used must be clearly stated in all documentation.	See above	N/A
4.3	Output voltage and frequency	See below	P
	The output voltage and frequency are maintained at the manufacturer's stated nominal values.	Complied	P
4.4	Input voltage	See below	P
	Measurements performed in each of the following tests are repeated at three power conditioner input voltages: a) manufacturer's minimum rated input voltage; b) the inverter's nominal voltage or the average of its rated input range; c) 90 % of the inverter's maximum input voltage.	Complied	P
	In the case where a power conditioner is to be connected with a battery at its input terminals, only the nominal or rated input voltage may be applied.	Complied	P
4.5	Ripple and distortion	See below	P
	Record input voltage and current ripple for each measurement. Also record output voltage and current distortion (if a.c.) or ripple (if d.c.). Ensure that these measurements remain within	See stand alone result table	P

IEC 61683:1999			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	the manufacturer's specified values.		
4.6	Resistive loads/utility grid	See below	P
	At unity power factor, or at the intrinsic power factor of grid-connected inverters without power factor adjustment, measure the efficiency for power levels of 10 %, 25 %, 50 %, 75 %, 100 % and 120 % of the inverter's rating.	Not a grid-connected	N/A
	Stand-alone inverters are also measured at a power level of 5 % of rated. The power conditioner test is conducted with a specified resistive and reactive grid impedance.	complied	P
4.7	Reactive loads	See below	P
	For stand-alone inverters, measure the efficiency with a load which provides a power factor equal to the manufacturer's specified minimum level (or 0,25, whichever is greater) and at power levels of 25 %, 50 % and 100 % of rated VA.	See below	N/A
	Repeat for power factors of 0,5 and 0,75 (do not go below the manufacturer's specified minimum PF) and power levels of 25 %, 50 %, and 100 % of rated VA.	Measurement done at 0.75 power factor (as declared by manufacturer)	P
4.8	Resistive plus non-linear loads	See below	P
	For stand-alone inverters, measure the efficiency with a fixed non-linear load (total harmonic distortion (THD) = (80 ± 5) %) equal to (25 ± 5) % of the inverter's rated VA plus sufficient resistive load in parallel to achieve a total load of 25 %, 50 % and 100 % of rated VA.	Complied	P
	Repeat the measurements with a fixed non-linear load equivalent to (50 ± 5) % of the inverter's rated VA plus sufficient resistive load in parallel to achieve a total load of 50% and 100% of rated VA.	Complied	P
	The type of non-linear load must be clearly stated in all documentation.	provided	P
4.9	Complex loads	See below	P
	When a non-linear plus a sufficient reactive load condition is specified for stand-alone inverters, measure the efficiency with a fixed non-linear load (THD = (80 ± 5) %) equal to (50 ± 5) % of the inverter's rated VA plus a sufficient reactive load (PF = 0,5) in parallel to achieve a total load of 50 % and 100 % of rated VA.	Complied	P

IEC 61683:1999			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	The type of complex load is clearly stated in all documentation.	provided	P
5	Efficiency calculations	See below	P
5.1	Rated output efficiency	See stand alone result table	P
5.2	Partial output efficiency	No such case	N/A
5.3	Energy efficiency	See above	N/A
5.4	Efficiency tolerances	See above	N/A
6	Conditions of loading for output ports	See below	P
6.1	Test circuit	See below	P
	Figure 1a is applied to standard-alone power conditioners	See below	P
	 Figure 1a – Stand-alone type	STAND ALONE TYPE	P
	Figure 1b is applied to utility-interactive power conditioners	See above	N/A
	 Figure 1b – Utility-interactive type PC power conditioner PS variable voltage-current d.c. power supply A_1 DC ammeter A_2 AC or d.c. ammeter W_1 DC wattmeter W_2 AC or d.c. wattmeter L load F frequency meter V_1 DC voltmeter V_2 AC or d.c. voltmeter PF power factor meter	See above	N/A
6.2	Measurement procedure	complied	P
7	Loss measurement	See below	P
7.1	No-load loss	see table for no load loss	P
7.2	Standby loss	see table for Standby loss	P
Annex A	Power conditioner description	Complied	P

IEC 61683:1999			
Clause	Requirement – Test	Measuring result – Remark	Verdict
Annex B	Power efficiency and conversion factor	no such case	N/A
Annex C	Weighted-average energy efficiency	no such case	N/A
Annex D	Derivation of efficiency tolerance in table 2	no such case	N/A

TABLE	Efficiency recording and efficient calculation sheet (**N/A**)								
power conditioner type	Grid-connected								
Model:									
Parameters of power conditioner	Minimum rated input voltage: Nominal voltage: Maximum input voltage: Rated output voltage: Rated output frequency: Rated output power:								
PV input voltage	a) Manufacturer's minimum rated input voltage								
Temperature (°C)									
Operating period for energy measurement (min)									
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/							/	/
Input voltage ripple (V)	/							/	/
Input current (A)	/							/	/
Input current ripple (A)	/							/	/
Input power (Pi) (W)	/							/	/
Output power (Po) (W)	/							/	/
Output efficiency	/							/	/
Input energy (Wi) (kWh)	/							/	/
Output energy (Wo) (kWh)	/							/	/
Energy efficiency	/							/	/
PV input voltage	b) The inverter's nominal voltage								
Temperature (°C)									
Operating period for energy measurement (min)									
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/							/	/
Input voltage ripple (V)	/							/	/

Input current (A)	/							/	/
Input current ripple (A)	/							/	/
Input power (Pi) (W)	/							/	/
Output power (Po) (W)	/							/	/
Output efficiency	/							/	/
Input energy (Wi) (kWh)	/							/	/
Output energy (Wo) (kWh)	/							/	/
Energy efficiency	/							/	/
PV input voltage	c) 90% of the inverter's maximum input voltage								
Temperature (°C)									
Operating period for energy measurement (min)									
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/							/	/
Input voltage ripple (V)	/							/	/
Input current (A)	/							/	/
Input current ripple (A)	/							/	/
Input power (Pi) (W)	/							/	/
Output power (Po) (W)	/							/	/
Output efficiency	/							/	/
Input energy (Wi) (kWh)	/							/	/
Output energy (Wo) (kWh)	/							/	/
Energy efficiency	/							/	/
Remark: *If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived;									

TABLE	Efficiency recording and efficient calculation sheet
power conditioner type	Stand-alone
Model:	--

Parameters of power conditioner	Minimum rated input voltage:240 Vdc Nominal voltage: 240 Vdc Maximum input voltage: 240 Vdc Rated output voltage:400 Vac Rated output frequency:50 Hz Rated output power:15 KW/ 15 KVA								
PV input voltage	a) Manufacturer's minimum rated input voltage								
Temperature (°C)	24.8°C								
Operating period for energy measurement (min)	--								
Resistive load									
Percentage of rated output VA	5%	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	243.6	242.5	246.5	245.8	243.2	244.5	240	/	/
Input voltage ripple (V)	0.12	0.91	0.14	0.10	0.11	0.21	0.34	/	/
Input current (A)	5.1	8.2	17.6	31.1	50.1	66.5	78.6	/	/
Input current ripple (A)	1.3	0.2	1.5	0.6	0.3	2.5	5.4	/	/
Input power (Pi) (kW)	1.2	1.9	4.3	7.64	12.18	16.22	18.86	/	/
Output power (Po) (kW)	0.8	1.5	3.7	7.5	11.1	15	18	/	/
Output efficiency	66%	78.9%	86.0%	98.1%	91.1%	92.5%	94.4%	/	/
Reactive load									
PF	0.25 or minimum			0.50(>minimum)			0.75(>minimum)		
Percentage of rated output VA	25%	50%	100%	25%	50%	100%	25%	50%	100%
Input voltage (V)	/	/	/	/	/	/	240.5	244	244.5
Input voltage ripple (V)	/	/	/	/	/	/	0.15	0.3	0.546
Input current (A)	/	/	/	/	/	/	15.6	32.1	67
Input current ripple (A)	/	/	/	/	/	/	1.2	1.7	1.7
Input power (Pi) (kW)	/	/	/	/	/	/	3.74	7.8	16.3
Output power (Po) (kW)	/	/	/	/	/	/	3.7	7.5	14.9
Output efficiency	/	/	/	/	/	/	98%	96.1%	91.4%
Non-linear load									
Non-linear load	25% of rated VA			50% of rated VA			/		

Percentage of rated output VA	25%	50%	100%	25%	50%	100%	/	/	/
Input voltage (V)	242	242.8	244.4	/	242.1	243.5	/	/	/
Input voltage ripple (V)	0.209	0.10	0.25	/	0.3	0.3	/	/	/
Input current (A)	17	32	66.6	/	34.9	68	/	/	/
Input current ripple (A)	2.6	0.6	1.9	/	0.4	3.0	/	/	/
Input power (Pi) (kW)	4.1	7.7	16.27	/	8.4	16.5	/	/	/
Output power (Po) (kW)	3.6	7.2	15.1	/	7.6	15.3	/	/	/
Output efficiency	90%	93%	92%	/	90%	92%	/	/	/
Complex load									
Percentage of rated output VA	50%	100%	/	/	/	/	/	/	/
Input voltage (V)	242	242	/	/	/	/	/	/	/
Input voltage ripple (V)	0.2	1.4	/	/	/	/	/	/	/
Input current (A)	37.4	64	/	/	/	/	/	/	/
Input current ripple (A)	1.9	1.6	/	/	/	/	/	/	/
Input power (Pi) (kW)	9.0	15.48	/	/	/	/	/	/	/
Output power (Po) (kW)	7.75	14.28	/	/	/	/	/	/	/
Output efficiency	86.33%	92.22%	/	/	/	/	/	/	/
Remark: *If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived;									

TABLE	No load loss	**P**
power conditioner type	(Stand-alone)	
Measure input voltage (V)	247.7	
Measured input power(W)	396.32	
Remark: No load loss is measured when the power conditioner works at rated input voltage and it's load is disconnected.		

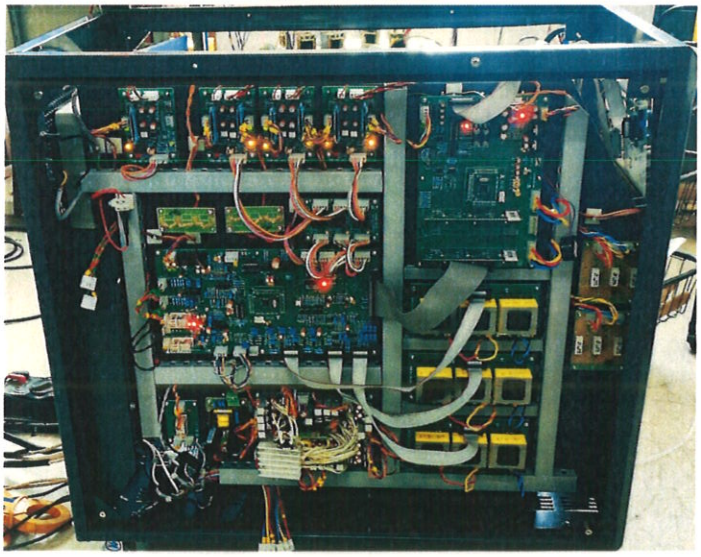
TABLE	Standby loss	**P**
power conditioner type	(Stand-alone)	
Measure input voltage (V)	248.5	
Measured input power(W)	0.00	
Remark: Standby loss is measured when the power conditioner works at rated input voltage and in standby mode.		

EUT PHOTOGRAPH:

FRONT VIEW

SIDE VIEW

REAR VIEW



INTERNAL VIEW

Equipment used

Equipment name	Calibration date	Calibration due date
Digital multimeter	29/12/2020	29/12/2020
Digital power meter	29/12/2020	29/12/2020
Digital clamp meter	29/12/2020	29/12/2020

--- End of test report---