

**TEST REPORT
IEC 61683**

**Photovoltaic systems – Power conditioners –
Procedure for measuring efficiency**

Report Number.....: TUV/PTL/20-21/SFTY-WT/0080

Date of issue.....: 20/04/2021

Total number of pages..... 16

Name of Testing Laboratory preparing the Report.....: **TUV India Private Limited.**
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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



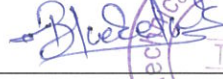
Test Report Form No.: IEC61683B

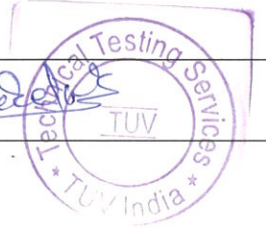
Test Report Form(s) Originator: TUV INDIA

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.....	202102649	
Ratings	Battery dc:120Vdc Pv range: 165-320Vdc Ac input:170-270Vac Ac output:230Vac Frequency: 50Hz Rating:10KW/10KVA	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/>	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) Equipment 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
<input checked="" type="checkbox"/> The product fulfils the requirements of _ IEC 61683:1999	

Copy of marking plate:

PRODUCT :- SOLAR PCU (Sunmagic)		QAF 1501-02
SR.NO:- 202102649	AC INPUT - 170- 270VAC	
RATING :- 10 KW / 10KVA	AC OUTPUT :- 230VAC	
BATTERY DC:- 120 VDC	FREQ. :- 50 Hz	
PV RANGE :- 165- 320VDC	DISP. DATE :- 26 - 02- 2021	
PRIORITY :-	INST. DATE :-	
	ENERTECH UPS PVT. LIMITED	
	S.No. 399 / 12, BHARE GAON, P.O GHOTAWADE, DIST-PUNE-412-115 MOB : 9373679255 , 9372623418 Email : support@enertechups.com Web : www.enertechups.com	

Test item particulars	SOLAR PCU (Sunmagic)
Classification of installation and use	Provided
Supply Connection	Battery dc:120Vdc Pv range:165-320Vdc Ac input:170-270Vac Ac output:230Vac Frequency: 50Hz Rating:10KW/10KVA
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:	
<p>"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report.</p> <p>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</p>	
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) = $(80 \pm 5) \%$) equal to $(25 \pm 5) \%$ 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 $(50 \pm 5) \%$ 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 = $(80 \pm 5) \%$) equal to $(50 \pm 5) \%$ 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
	<p>Figure 1a – Stand-alone type</p>	STAND ALONE TYPE	P
	Figure 1b is applied to utility-interactive power conditioners	See above	N/A
	<p>Figure 1b – Utility-interactive type</p> <p>PC_ power conditioner PS_ variable voltage-current d.c. power supply A₁ DC ammeter A₂ AC or d.c. ammeter W₁ DC wattmeter W₂ AC or d.c. wattmeter L_ load F_ frequency meter V₁ DC voltmeter V₂ AC or d.c. voltmeter PF_ power factor meter</p>	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:120 Vdc Nominal voltage: 120 Vdc Maximum input voltage: 120 Vdc Rated output voltage:230 Vac Rated output frequency:50 Hz Rated output power:10 kW/ 10 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)	126.6	126.4	122.8	123.2	123.9	127.2	123.5	/	/
Input voltage ripple (V)	0.192	0.32	0.83	1.5	1.9	1.9	3.6	/	/
Input current (A)	7.6	11.1	24.1	47.1	66.1	87.5	117	/	/
Input current ripple (A)	0.2	0.4	1.0	2.1	3.1	2.1	1.8	/	/
Input power (Pi) (kW)	0.9	1.40	2.95	5.82	8.18	11.13	14.44	/	/
Output power (Po) (kW)	0.5	1.0	2.5	5.1	7.5	10.2	12.6	/	/
Output efficiency	55.9%	71.4%	84.7%	87.9%	91.6%	91.6%	87.25%	/	/
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)	/	/	/	/	/	/	122.4	125.1	123.3
Input voltage ripple (V)	/	/	/	/	/	/	1.04	1.6	4.3
Input current (A)	/	/	/	/	/	/	26.3	47.6	94
Input current ripple (A)	/	/	/	/	/	/	1.3	2.6	4.5
Input power (Pi) (kW)	/	/	/	/	/	/	3.2	5.9	11.59
Output power (Po) (kW)	/	/	/	/	/	/	2.6	5.1	10.2
Output efficiency	/	/	/	/	/	/	81%	84%	88%
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)	127.1	123.1	123.3	/	125.4	122.9	/	/	/
Input voltage ripple (V)	0.74	1.42	2.3	/	2.3	2.23	/	/	/
Input current (A)	9.4	39.8	95.7	/	85.6	81.4	/	/	/
Input current ripple (A)	0.8	1.9	2.1	/	3.9	3.0	/	/	/
Input power (Pi) (kW)	1.19	4.92	11.79	/	10.73	10	/	/	/
Output power (Po) (kW)	0.67	4.26	10.47	/	9.6	9.49	/	/	/
Output efficiency	56.3%	86.58%	88%	/	81.4%	94.9%	/	/	/
Complex load									
Percentage of rated output VA	50%	100%	/	/	/	/	/	/	/
Input voltage (V)	122	120.9	/	/	/	/	/	/	/
Input voltage ripple (V)	1.4	2.7	/	/	/	/	/	/	/
Input current (A)	32	84	/	/	/	/	/	/	/
Input current ripple (A)	2.3	0.43	/	/	/	/	/	/	/
Input power (Pi) (kW)	3.9	10.1	/	/	/	/	/	/	/
Output power (Po) (kW)	3.04	7.9	/	/	/	/	/	/	/
Output efficiency	77.94%	78.21%	/	/	/	/	/	/	/
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)	124.8V	
Measured input power(W)	187.2	
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)	125.2	
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:



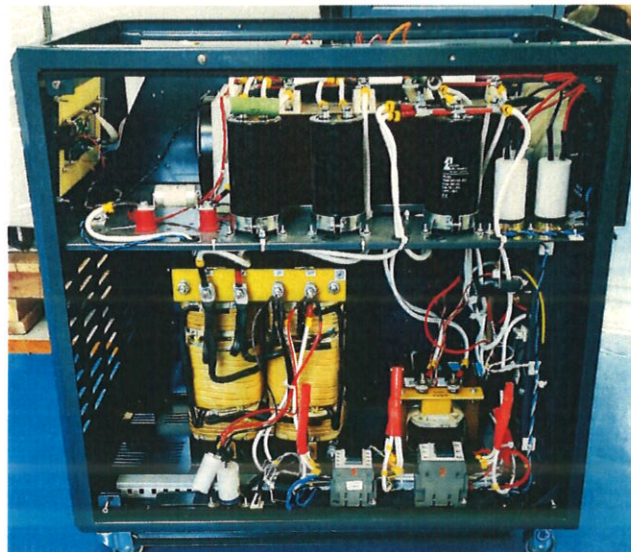
FRONT VIEW



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---