TEST REPORT
IEC 61683
Photovoltaic systems – Power conditioners – Procedure for measuring efficiency

Report Reference No.	ES160105015S
Compiled by (name + signature)	Simon Fan
Approved by (name + signature)	William Guo
Date of issue	April 05, 2016
Total number of pages	15 pages
Testing Laboratory name	EMTEK (SHENZHEN) CO., LTD.
Address	Bldg 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China
Testing location/ address	Same as above
Applicant's name	Ningbo Ginlong Technologies Co.,Ltd.
Address	No. 57 Jintong Road, Seafront(Binhai) Industrial Park, Xiangshan, Ningbo, Zhejiang, 315712,P.R.China
Test specification:	
Standard	IEC 61683:1999
Test procedure	IEC report
Non-standard test method	N/A
Test Report Form No.	IEC61683A
Test Report Form(s) Originator	EMTEK
Master TRF	Dated 2016-03
Test item description	PV inverter
Trade Mark	N/A
Manufacturer	Ningbo Ginlong Technologies Co.,Ltd.
	No. 57 Jintong Road, Seafront(Binhai) Industrial Park, Xiangshan, Ningbo, Zhejiang, 315712,P.R.China
Model/Type reference	Solis-20K, Solis-20K-HV, Solis-25K, Solis-30K, Solis-36K-HV, Solis-40K-HV, URE-20K, URE-20K-HV, URE-25K, URE-30K, URE-36K-HV, URE-40K-HV
Ratings	See the rating labels.

Summary of testing:

The product has been tested according to standard IEC 61683:1999.

List of Attachments (including a total number of pages in each attachment):

N/A

Test item particulars.....:	
Equipment mobility.....:	☐ movable ☐ hand-held ☒ stationary ☒ fixed ☐ transportable ☐ for building-in
Connection to the mains.....:	☐ pluggable equipment ☐ direct plug-in ☒ permanent connection ☐ for building-in
Enviromental category.....:	☒ outdoor ☐ indoor unconditional ☐ indoor conditional
Class of equipment.....:	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Mass of equipment (kg).....:	N/A
IP protection class.....:	IP65
Possible test case verdicts:	
- test case does not apply to the test object..... :	N(/A, Not applicable)
- test object does meet the requirement..... :	P (Pass)
- test object does not meet the requirement ..... :	F (Fail)
Testing ..... :	
Date of receipt of test item..... :	January 07, 2016
Date (s) of performance of tests..... :	January 07, 2016 to April 01, 2016

General remarks:

"(see Attachment #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.
The tests results presented in this report relate only to the object tested.
This report shall not be reproduced except in full without the written approval of the testing laboratory.
List of test equipment must be kept on file and available for review.
Additional test data and/or information provided in the attachments to this report.
Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

General product information:

1. The Solar Inverter converts DC voltage into AC voltage.
2. The unit is providing EMC filtering at the output toward mains. The unit does not provide galvanic separation from input to output. The output is switched off redundant by the high power switching bridge and a two relays. This assures that the opening of the output circuit will also operate in case of one error.
3. All models are identical to model Solis-40K-HV in software and similar in hardware, except different Bus capacitor, type of IGBT and output power which de-rated by software. All tests were performed on the representative model Solis-40K-HV.
4. Solis (20-40)K series and URE(20-40)K series are same except for the model number.

Copy of marking plate:

solis inverters
Made in China by Ginlong Technologies

Model Number	Solis-20K-HV
$P_{DC\ max}$	23kW
$U_{DC\ max}$	1000Vd.c.
$I_{DC\ max\ (each\ MPPT)}$	18A/18Ad.c.
$U_{DC\ startup}$	350Vd.c.
$V_{DC\ MPPT\ range}$	200-800V
$V_{AC\ norm}$	3~480Va.c.
$F_{AC\ norm}$	60Hz
$P_{AC\ norm}$	20kW
I_{ACmax}	25Aa.c.
PF	1
Ambient temperature	-25~60℃
Ingress protection	IP65
Protective class	Class I
Overvoltage category	III(MAINS)/II(PV)
Certifications	IEC62109-1/-2, AS3100 VDE 0126-1-1, G59/3 AS4777.2/.3, C10/11 RD1699, EN50438
S/N:	4 4 5 0 1 5 0 6 1 3 9 2

solis inverters
Made in China by Ginlong Technologies

Model Number	Solis-20K
$P_{DC\ max}$	23kW
$U_{DC\ max}$	1000Vd.c.
$I_{DC\ max\ (each\ MPPT)}$	18A/18A/18A/18Ad.c.
$U_{DC\ startup}$	350Vd.c.
$V_{DC\ MPPT\ range}$	200-800V
$V_{AC\ norm}$	3~400Va.c.
$F_{AC\ norm}$	50Hz
$P_{AC\ norm}$	20kW
I_{ACmax}	30.3Aa.c.
PF	1
Ambient temperature	-25~60℃
Ingress protection	IP65
Protective class	Class I
Overvoltage category	III(MAINS)/II(PV)
Certifications	IEC62109-1/-2, AS3100 VDE 0126-1-1, G59/3 AS4777.2/.3, C10/11 RD1699, EN50438
S/N:	4 5 1 0 1 5 0 6 2 3 0 0

solis inverters
Made in China by Ginlong Technologies

Model Number	Solis-25K
$P_{DC\ max}$	28.8kW
$U_{DC\ max}$	1000Vd.c.
$I_{DC\ max\ (each\ MPPT)}$	18A/18A/18A/18Ad.c.
$U_{DC\ startup}$	350Vd.c.
$V_{DC\ MPPT\ range}$	200-800V
$V_{AC\ norm}$	3~400Va.c.
$F_{AC\ norm}$	50Hz
$P_{AC\ norm}$	25kW
I_{ACmax}	37.8Aa.c.
PF	1
Ambient temperature	-25~60℃
Ingress protection	IP65
Protective class	Class I
Overvoltage category	III(MAINS)/II(PV)
Certifications	IEC62109-1/-2, AS3100 VDE 0126-1-1, G59/3 AS4777.2/.3, C10/11 RD1699, EN50438
S/N:	4 3 5 0 1 5 0 4 3 0 7 6

solis inverters
Made in China by Ginlong Technologies

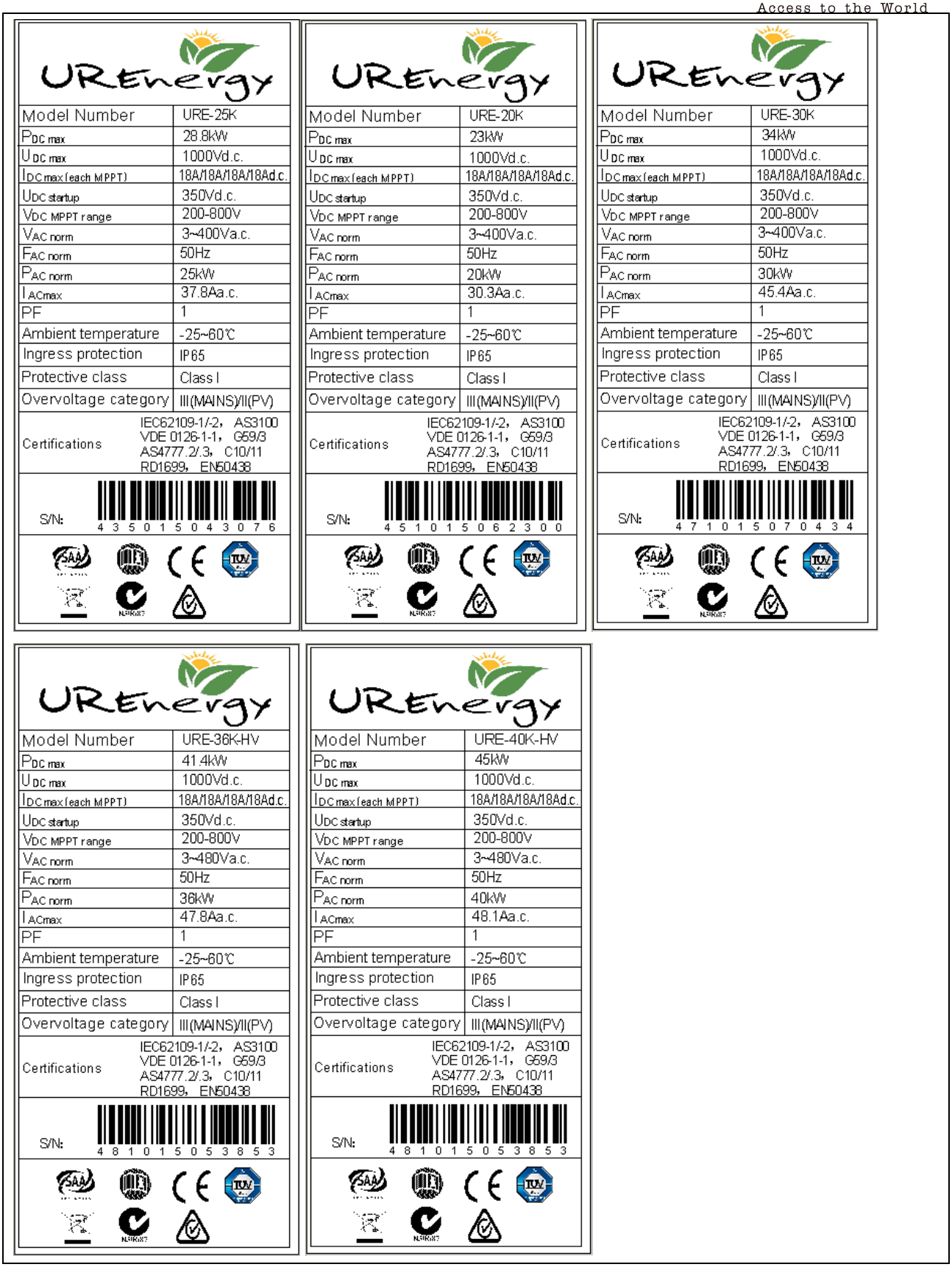
Model Number	Solis-30K
$P_{DC\ max}$	34kW
$U_{DC\ max}$	1000Vd.c.
$I_{DC\ max\ (each\ MPPT)}$	18A/18A/18A/18Ad.c.
$U_{DC\ startup}$	350Vd.c.
$V_{DC\ MPPT\ range}$	200-800V
$V_{AC\ norm}$	3~400Va.c.
$F_{AC\ norm}$	50Hz
$P_{AC\ norm}$	30kW
I_{ACmax}	45.4Aa.c.
PF	1
Ambient temperature	-25~60℃
Ingress protection	IP65
Protective class	Class I
Overvoltage category	III(MAINS)/II(PV)
Certifications	IEC62109-1/-2, AS3100 VDE 0126-1-1, G59/3 AS4777.2/.3, C10/11 RD1699, EN50438
S/N:	4 7 1 0 1 5 0 7 0 4 3 4

solis inverters
Made in China by Ginlong Technologies

Model Number	Solis-36K-HV
$P_{DC\ max}$	41.4kW
$U_{DC\ max}$	1000Vd.c.
$I_{DC\ max\ (each\ MPPT)}$	18A/18A/18A/18Ad.c.
$U_{DC\ startup}$	350Vd.c.
$V_{DC\ MPPT\ range}$	200-800V
$V_{AC\ norm}$	3~480Va.c.
$F_{AC\ norm}$	50Hz
$P_{AC\ norm}$	36kW
I_{ACmax}	47.8Aa.c.
PF	1
Ambient temperature	-25~60℃
Ingress protection	IP65
Protective class	Class I
Overvoltage category	III(MAINS)/II(PV)
Certifications	IEC62109-1/-2, AS3100 VDE 0126-1-1, G59/3 AS4777.2/.3, C10/11 RD1699, EN50438
S/N:	4 8 1 0 1 5 0 5 3 8 5 3

solis inverters
Made in China by Ginlong Technologies

Model Number	Solis-40K-HV
$P_{DC\ max}$	45kW
$U_{DC\ max}$	1000Vd.c.
$I_{DC\ max\ (each\ MPPT)}$	18A/18A/18A/18Ad.c.
$U_{DC\ startup}$	350Vd.c.
$V_{DC\ MPPT\ range}$	200-800V
$V_{AC\ norm}$	3~480Va.c.
$F_{AC\ norm}$	50Hz
$P_{AC\ norm}$	40kW
I_{ACmax}	48.1Aa.c.
PF	1
Ambient temperature	-25~60℃
Ingress protection	IP65
Protective class	Class I
Overvoltage category	III(MAINS)/II(PV)
Certifications	IEC62109-1/-2, AS3100 VDE 0126-1-1, G59/3 AS4777.2/.3, C10/11 RD1699, EN50438
S/N:	4 8 1 0 1 5 0 5 3 8 5 3



URE-25K	
$P_{DC\ max}$	28.8kW
$U_{DC\ max}$	1000Vd.c.
$I_{DC\ max\ (each\ MPPT)}$	18A/18A/18A/18Ad.c.
$U_{DC\ startup}$	350Vd.c.
$V_{DC\ MPPT\ range}$	200-800V
$V_{AC\ norm}$	3~400Va.c.
$F_{AC\ norm}$	50Hz
$P_{AC\ norm}$	25kW
I_{ACmax}	37.8Aa.c.
PF	1
Ambient temperature	-25~60℃
Ingress protection	IP65
Protective class	Class I
Overvoltage category	III(MAINS)/II(PV)
Certifications	IEC62109-1/-2, AS3100 VDE 0126-1-1, G59/3 AS4777.2/.3, C10/11 RD1699, EN50438
S/N:	4 3 5 0 1 5 0 4 3 0 7 6

URE-20K	
$P_{DC\ max}$	23kW
$U_{DC\ max}$	1000Vd.c.
$I_{DC\ max\ (each\ MPPT)}$	18A/18A/18A/18Ad.c.
$U_{DC\ startup}$	350Vd.c.
$V_{DC\ MPPT\ range}$	200-800V
$V_{AC\ norm}$	3~400Va.c.
$F_{AC\ norm}$	50Hz
$P_{AC\ norm}$	20kW
I_{ACmax}	30.3Aa.c.
PF	1
Ambient temperature	-25~60℃
Ingress protection	IP65
Protective class	Class I
Overvoltage category	III(MAINS)/II(PV)
Certifications	IEC62109-1/-2, AS3100 VDE 0126-1-1, G59/3 AS4777.2/.3, C10/11 RD1699, EN50438
S/N:	4 5 1 0 1 5 0 6 2 3 0 0

URE-30K	
$P_{DC\ max}$	34kW
$U_{DC\ max}$	1000Vd.c.
$I_{DC\ max\ (each\ MPPT)}$	18A/18A/18A/18Ad.c.
$U_{DC\ startup}$	350Vd.c.
$V_{DC\ MPPT\ range}$	200-800V
$V_{AC\ norm}$	3~400Va.c.
$F_{AC\ norm}$	50Hz
$P_{AC\ norm}$	30kW
I_{ACmax}	45.4Aa.c.
PF	1
Ambient temperature	-25~60℃
Ingress protection	IP65
Protective class	Class I
Overvoltage category	III(MAINS)/II(PV)
Certifications	IEC62109-1/-2, AS3100 VDE 0126-1-1, G59/3 AS4777.2/.3, C10/11 RD1699, EN50438
S/N:	4 7 1 0 1 5 0 7 0 4 3 4

URE-36K-HV	
$P_{DC\ max}$	41.4kW
$U_{DC\ max}$	1000Vd.c.
$I_{DC\ max\ (each\ MPPT)}$	18A/18A/18A/18Ad.c.
$U_{DC\ startup}$	350Vd.c.
$V_{DC\ MPPT\ range}$	200-800V
$V_{AC\ norm}$	3~480Va.c.
$F_{AC\ norm}$	50Hz
$P_{AC\ norm}$	36kW
I_{ACmax}	47.8Aa.c.
PF	1
Ambient temperature	-25~60℃
Ingress protection	IP65
Protective class	Class I
Overvoltage category	III(MAINS)/II(PV)
Certifications	IEC62109-1/-2, AS3100 VDE 0126-1-1, G59/3 AS4777.2/.3, C10/11 RD1699, EN50438
S/N:	4 8 1 0 1 5 0 5 3 8 5 3

URE-40K-HV	
$P_{DC\ max}$	45kW
$U_{DC\ max}$	1000Vd.c.
$I_{DC\ max\ (each\ MPPT)}$	18A/18A/18A/18Ad.c.
$U_{DC\ startup}$	350Vd.c.
$V_{DC\ MPPT\ range}$	200-800V
$V_{AC\ norm}$	3~480Va.c.
$F_{AC\ norm}$	50Hz
$P_{AC\ norm}$	40kW
I_{ACmax}	48.1Aa.c.
PF	1
Ambient temperature	-25~60℃
Ingress protection	IP65
Protective class	Class I
Overvoltage category	III(MAINS)/II(PV)
Certifications	IEC62109-1/-2, AS3100 VDE 0126-1-1, G59/3 AS4777.2/.3, C10/11 RD1699, EN50438
S/N:	4 8 1 0 1 5 0 5 3 8 5 3

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Clause	Requirement – Test	Result - Remark	Verdict
4	Efficiency measurement conditions		P
	Efficiency shall be measured under the matrix of conditions as described in the following clauses and table 1. Specific conditions may be excluded by mutual agreement when those conditions are outside the manufacturer's allowable operating range. The resulting data shall be presented in tabular form and may also be presented graphically.		P
4.1	DC power source for testing		P
	For power conditioners operating with fixed input voltage, the d.c. power source shall be a storage battery or constant voltage power source to maintain the input voltage.		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 shall be utilized.		P
4.2	Temperature		P
	All measurements are to be made at an ambient temperature of 25 °C ± 2 °C. Other ambient temperatures may be allowed by mutual agreement. However, the temperature used must be clearly stated in all documentation.	24 °C	P
4.3	Output voltage and frequency		P
	The output voltage and frequency shall be maintained at the manufacturer's stated nominal values.	3~400Vac/3~480Vac 50Hz	P
4.4	Input voltage		P
	Measurements performed in each of the following tests shall be 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.	See appended table	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.		P
4.5	Ripple and distortion		P

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Clause	Requirement – Test	Result - Remark	Verdict
	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 the manufacturer's specified values. Note that ripple and distortion may not be specified at low power levels, but readings shall be recorded.		P
4.6	Resistive loads/utility grid		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. Stand-alone inverters shall also be measured at a power level of 5 % of rated. The power conditioner test should be conducted with a specified resistive and reactive grid impedance.	See appended table	P
4.7	Reactive loads		N
	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. 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.		N
4.8	Resistive plus non-linear loads		N
	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. 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. The type of non-linear load must be clearly stated in all documentation.		N
4.9	Complex loads		N
	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. The type of complex load shall be clearly stated in all documentation.		N
5	Efficiency calculations		P

IEC 61683			
Clause	Requirement – Test	Result - Remark	Verdict
5.1	Rated output efficiency	See appended table	P
	Rated output efficiency shall be calculated from measured data as follows: η_R=(Po / Pi) x100	See appended table	P
5.2	Partial output efficiency		P
	Partial output efficiency shall be calculated from measured data as follows: η_{par}=(Pop / Pip) x100	See appended table	P
5.3	Energy efficiency		P
	Energy efficiency shall be calculated from measured data as follows: η_E=(Wo / Pi) x100	See appended table	P
5.4	Efficiency tolerances		P
	When an efficiency value has been guaranteed, the tolerance of this value shall be within the value at rated conditions indicated in table 2.	See appended table	P
6	Efficiency test circuits		N
6.1	Test circuits		N
	Figure 1 shows recommended test circuits for power conditioners which have a single-phase a.c. output or d.c. output. It can as well be regarded as a single-phase representation of a test set-up for multiphase power conditioners.		N
	Figures 1a and 1b shall be applied to stand-alone and utility-interactive power conditioners respectively.		N
	The proposed test circuits in figure 1 are not mandatory, but together with the test descriptions, are intended to establish a base for mutual agreement between user and manufacturer.		N
	The type of power source shall be indicated on all tests and shall adhere to the requirements of 4.1.		N
6.2	Measurement procedure		P
	a) Efficiency is calculated with equation (1) or (2) using measured Pi, Po or Pip, Pop. DC input power Pi, Pip can be measured by wattmeter W1, or determined by multiplying the d.c. voltmeter V1 and d.c. ammeter A1 readings. Output power Po, Pop is measured with wattmeter W2.		P

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Clause	Requirement – Test	Result - Remark	Verdict
	b) DC input voltage, which is measured by d.c. voltmeter V1, shall be varied in the defined range where the output current, which is measured with a.c. ammeter A2, is varied from low output to the rated output.		P
	c) An average indicating instrument shall be used for the d.c. voltmeter and d.c. ammeter. A true r.m.s. type of indicating instrument shall be used for the a.c. voltmeter and a.c. ammeter. The d.c. wattmeter W1 shall be a d.c. measuring type. The wattmeter W2 shall be an a.c. or d.c. measuring type according to the output.		P
	D)Power factor (PF in per cent) can be measured by a power factor meter PF, or calculated from the readings of V2, A2, W2 and as follows: $PF=(W_2 / (V_2 \times A_2)) \times 100$		P
	e) Each meter may be an analogue type or a digital type. The measurement accuracy shall be better than ±0,5 % of the full-scale value for each power measured. Digital power instruments for W1 and W2 are also recommended.		P
	f) An MPPT dynamically adjusts the input voltage so as to maximize the output power. In principle, the monitoring equipment shall sample all of the electrical parameters, such as input voltage and current, output power and current, within the update period of the MPPT. If the MPPT and input source (PV array or PV array simulator) interact in such a way that the input voltage varies by less than 5 %, then averaging of readings is acceptable. The averaging period shall be 30 s or longer.		P
7	Loss measurement		N
7.1	No-load loss		P
	No-load loss shall be measured as follows.		P
	If the power conditioner is a stand-alone type, the reading of d.c. input voltage, output voltage and frequency is given with meters V1, V2 and F respectively in figure 1a, and shall be adjusted to the rated values.		P
	The no-load loss is thus the indicated value of d.c. input wattmeter, W1, when the load is disconnected from the power conditioner.		P
	If the power conditioner is a utility-interactive type, the reading of d.c. input voltmeter V1, a.c. output voltmeter V2 and frequency meter F in figure 1b shall be adjusted to meet the specified voltages and frequency.		P

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Clause	Requirement – Test	Result - Remark	Verdict
	No-load loss is thus the indicated value of d.c. input wattmeter, W1, when a.c. wattmeter, W2, indicates a zero value. For the measurement, allow the power conditioner time to transfer to its no-load operating state, if applicable.		P
7.2	Standby loss		N
	Standby loss shall be measured as follows.		N
	If the power conditioner is a utility-interactive type, standby loss is defined as the consumption of utility power when the power conditioner is not operating but is under standby condition. Standby loss is indicated with a.c. wattmeter, W2 in figure 1b at the rated a.c. output voltage.		N
	If the power conditioner is a stand-alone type, standby loss is defined as the consumption from the d.c. source when the power conditioner is not operating but is under standby condition. Standby loss is indicated with d.c. wattmeter, W1 in figure 1a (without a.c. or d.c. output voltage).		N

	TABLE: Efficiency								P
Solis-30K									
Input voltage (V)	Total load, % of rated VA		5	10	25	50	75	100	120
manufacturer's minimum rated input voltage 500Vdc	Grid-connected 400Vac	Resistive load	95.96	97.77	98.56	98.61	98.5	98.37	/
the inverter's nominal voltage or the average of its rated input range; 650Vdc	400Vac	Resistive load	95.93	97.59	98.6	98.78	98.69	98.56	/
90 % of the inverter's maximum input voltage 720Vdc	400Vac	Resistive load	95.83	97.77	98.6	98.77	98.73	98.63	/
Solis-25K									
Input voltage (V)	Total load, % of rated VA		5	10	25	50	75	100	120

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Clause	Requirement – Test	Result - Remark	Verdict

manufacturer's minimum rated input voltage 500Vdc	Grid-connected 400Vac	Resistive load	95.77	97.66	98.45	98.5	98.39	98.26	/
the inverter's nominal voltage or the average of its rated input range; 650Vdc	400Vac	Resistive load	95.82	97.48	98.49	98.67	98.58	98.45	/
90 % of the inverter's maximum input voltage 720Vdc	400Vac	Resistive load	95.72	97.66	98.49	98.66	98.62	98.52	/
Solis-20K									
Input voltage (V)	Total load, % of rated VA		5	10	25	50	75	100	120
manufacturer's minimum rated input voltage 500Vdc	Grid-connected 400Vac	Resistive load	95.71	97.6	98.39	98.44	98.33	98.2	/
the inverter's nominal voltage or the average of its rated input range; 650Vdc	400Vac	Resistive load	95.76	97.42	98.43	98.61	98.52	98.39	/
90 % of the inverter's maximum input voltage 720Vdc	400Vac	Resistive load	95.66	97.6	98.43	98.6	98.56	98.46	/
Solis-36K-HV									
Input voltage (V)	Total load, % of rated VA		5	10	25	50	75	100	120

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Clause	Requirement – Test	Result - Remark	Verdict

manufacturer's minimum rated input voltage 500Vdc	Grid-connected 480Vac	Resistive load	95.94	97.83	98.62	98.67	98.56	98.43	/
the inverter's nominal voltage or the average of its rated input range; 650Vdc	480Vac	Resistive load	95.99	97.65	98.66	98.84	98.75	98.62	/
90 % of the inverter's maximum input voltage 720Vdc	480Vac	Resistive load	95.89	97.83	98.66	98.83	98.79	98.69	/
Solis-40K-HV									
Input voltage (V)	Total load, % of rated VA		5	10	25	50	75	100	120
manufacturer's minimum rated input voltage 500Vdc	Grid-connected 480Vac	Resistive load	95.81	97.7	98.49	98.54	98.43	98.3	/
the inverter's nominal voltage or the average of its rated input range; 650Vdc	480Vac	Resistive load	95.86	97.52	98.53	98.86	98.72	98.69	/
90 % of the inverter's maximum input voltage 720Vdc	480Vac	Resistive load	95.76	97.7	98.53	98.81	98.76	98.66	/
	~~Stand-alone~~	~~Resistive load~~	--	--	--	--	--	--	--

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Clause	Requirement – Test		Result - Remark					Verdict
		~~Reactive load PF = 0,25 or minimum PF = 0,50 (>minimum) PF = 0,75 (>minimum)~~	--	--	--	--	--	--	--
		~~Non-linear load NL = 25 % of rated VA NL = 50 % of rated VA~~	--	--	--	--	--	--	--
		~~Complex load~~	--	--	--	--	--	--	--
Supplementary information:									

Pictures

Pictures