TEST REPORT

IEC 60068-2-1:2007 Rev. 00

TÜV SÜD test report for environmental testing – Part 2-1: Tests – Test A: Cold

Report reference No. ..... :	64.290.21.30206.01C Part 1 of 4
Date of issue ..... :	2021-09-30
Project handler..... :	Jenn Huang
Testing laboratory ..... :	TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
Address ..... :	5F, Communication Building, 163 Pingyun Rd, Huangpu Ave. West, Guangzhou 510656, P. R. China
Testing location ..... :	Shenzhen SOFARSOLAR Co., Ltd. 401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, Guangdong. P.R.China
Client ..... :	Evolve Energy Group Co., Limited
Client number..... :	101913
Address ..... :	RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN, HONG KONG.
Contact person..... :	rvs@evolveindia.in
Standard ..... :	This TÜV SÜD test report form is based on the following requirements: IEC 60068-2-1:2007 Rev. 00
TRF originated by. ..... :	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch, Dipl.-Ing. Alexander Krenz
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Scheme ..... :	☐ GS, ☐ TÜV Mark, ☐ EU-Directive, ☒ Test verification and conformity
Non-standard test method..... :	☒ No ☐ Yes, see details under Summary
National deviations ..... :	N/A
Number of pages (Report) ..... :	14
Number of pages (Attachments)..... :	N/A
Compiled by.....: Jenn Huang	Approved by ....: Max Fang
(+ signature) Jenn Huang	(+ signature) Max Fang

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Test sample……..:	Solar Grid-tied Inverter
Type of test object..... :	Type verification of conformity
Trademark ..... :	EVVO
Model and/or type reference..... :	E-250KTL-HV, E-255KTL-HV
Rating(s)..... :	See page 5
Manufacturer ..... :	Evolve Energy Group Co., Limited
Manufacturer number…..... :	101913
Address ..... :	RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN, HONG KONG.
Sub-contractors/ tests (clause)..... :	N/A
Name ..... :	N/A

Order description…..... :

☐	Complete test according to TRF
☒	Partial test according to manufacturer's specifications
☐	Preliminary test
☐	Spot check

Date of order……. ..... :	2021-03-16, 2021-09-13
Date of receipt of test item..... :	2021-03-25, 2021-09-13
Date(s) of performance of test..... :	2021-04-27 to 2021-04-28, 2021-09-14 to 2021-09-30

Test item particulars:

Environmental testing – Part 2-1: Test on model E-255KTL-HV

Tests – Test A: Cold

Attachments:

This test report contains 4 parts listed in below table:

Item #	Description	Pages
Part 1	IEC 60068-2-1:2007 test report	14
Part 2	IEC 60068-2-2:2007 test report	12
Part 3	IEC 60068-2-14:2009 test report	17
Part 4	IEC 60068-2-30:2005 test report	14

General remarks:

"(see remark #)" refers to a remark appended to the report.
"(see appended table)" refers to a table appended to the report.
Throughout this report a comma is used as the decimal separator.
The test 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.

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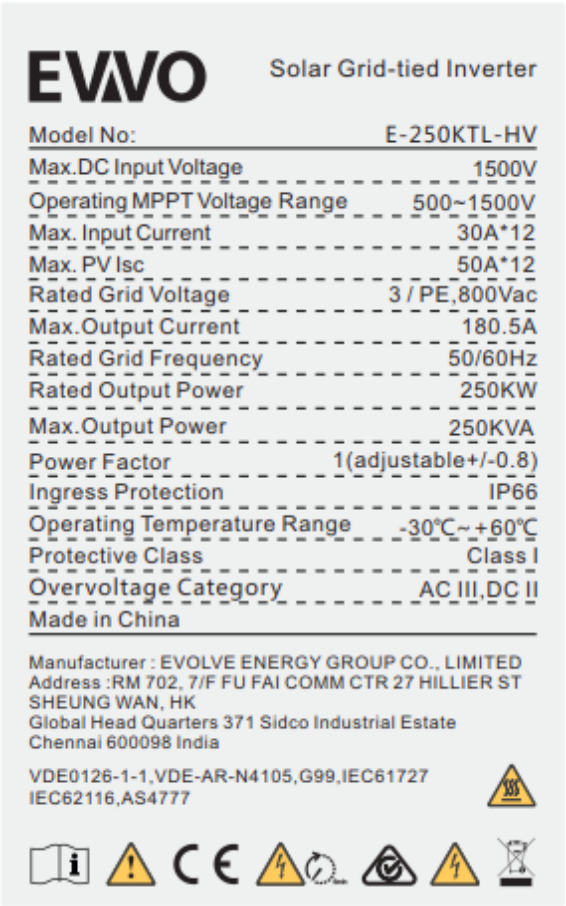
Summary of testing:

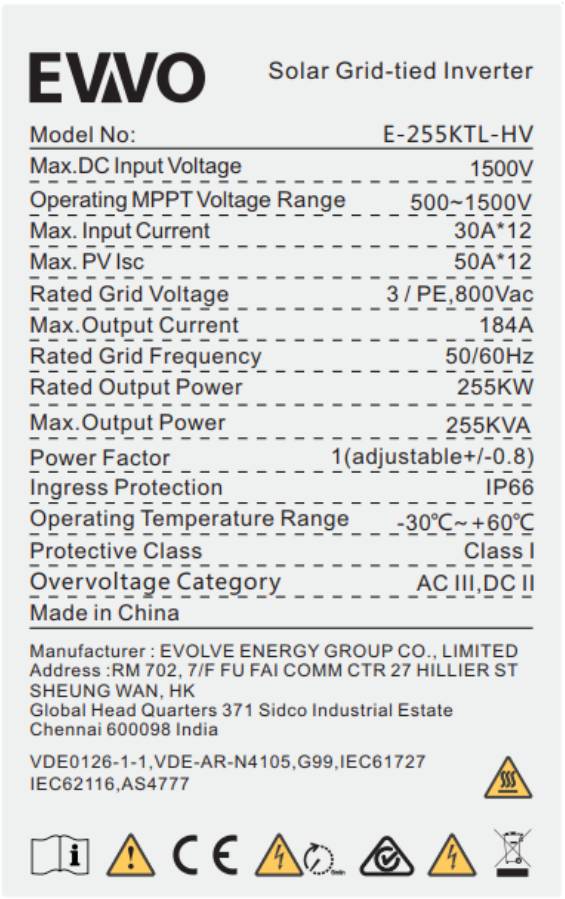
☐ deviation(s) found

☒ no deviations found

If additional information is necessary, please provide

Copy of marking plate





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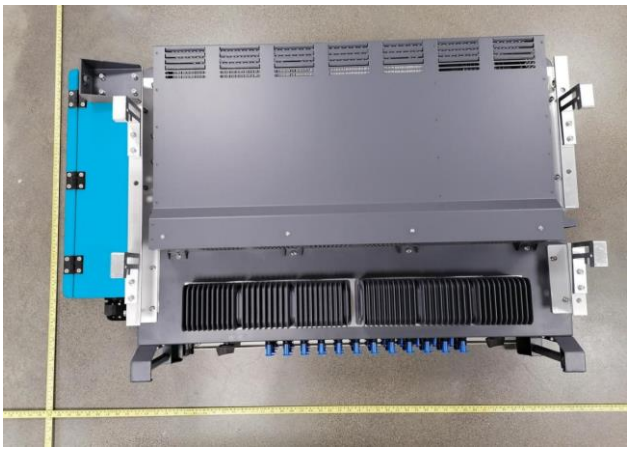
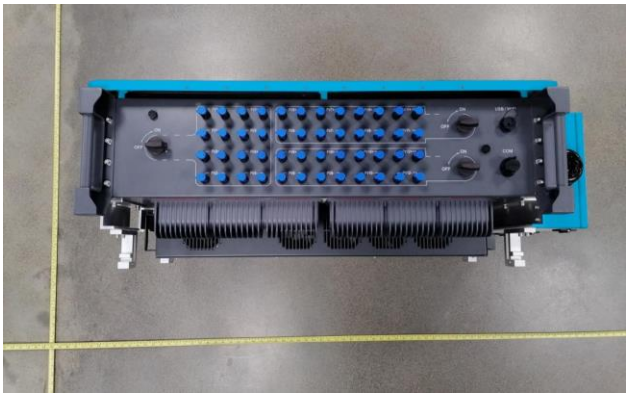
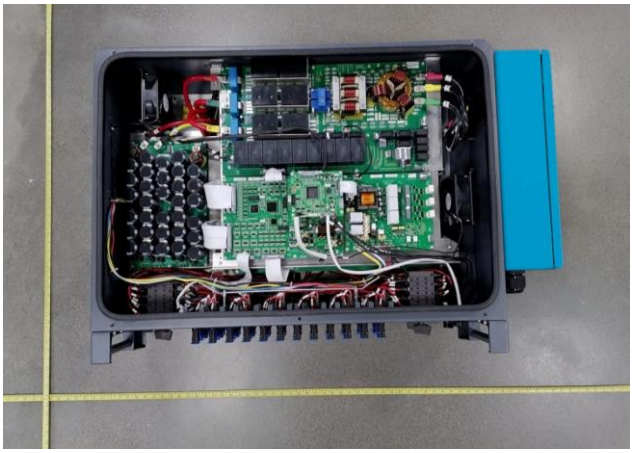
Picture of the product:







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Characteristic data

Model:	E-250KTL-HV	E-255KTL-HV
PV input terminal parameters:		
Max. input voltage	1500Vd.c.	
Rated input voltage	1160Vd.c.	
Start-up voltage	550Vd.c.	
MPPT operating voltage range	500~1500Vd.c.	
Full power MPPT voltage range	800~1300Vd.c.	
Number for DC inputs	24	
Max. input MPPT current	30Ad.c.*12	
Max. input short circuit current	50Ad.c.*12	
AC output rating		
AC output power	250kVA@30°C / 235kVA@40°C / 220kVA@50°C	255kVA@30°C / 235kVA@40°C / 220kVA@50°C
Max. Output current	180.5Aa.c.	184Aa.c.
Nominal grid voltage	3 / PE, 800Va.c.	
Nominal frequency	50Hz / 60Hz	
Power factor	0.8 leading ~ 0.8 lagging	
General		
Operating temperature range	-30~+60℃	
Protection class	CLASS Ⅰ	
Ingress protection	IP66	
Operating altitude range	5000m (> 4000m derating)	

Characteristic data Factory:

Dongguan SOFAR SOLAR Co., Ltd.
1F – 6F, Building E, No.1 JinQi Road, Bihu Industrial Park, Wulian Villiage, Fenggang Town, Dongguan City, P.R. China.

Purpose of the product:

(1) The PV grid-tied inverter is non-isolated (transformerless) solar inverter for connection in parallel to public grid;
(2) The unit shall be used at specified ambient range. Temperature: -30 °C ~ +60 °C, auto-derating temperature refer to rating table; Altitude: ≤ 5000 m; Overvoltage category: II(DC side), III(AC side); Relative humidity range: 0 % ~ 100 %.
(3) In order to protect the PCE, user and installer, external DC and AC circuit breakers shall be equipped at the end-use application;
(4) Low voltage electrical installations shall comply with national and local regulation. Only qualified electricians are allowed to install and maintain the inverter;

Model differences:

The two models have the same hardware construction, only through different software setting to control different output power.

Possible test case verdicts:

- test case does not apply to the test object..... : N/A / not applicable / not included in the order
- test object does meet the requirement..... : P / Pass
- test object does not meet the requirement ..... : F / Fail

Possible suffixes to the verdicts:

- suffix for detailed information for the client……..: - C / Comment
- suffix for important information for factory inspection...: - M / Manufacturing

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IEC 60068-2-1:2007 Rev. 00			
Clause	Requirement – Test	Measuring result – Remark	Verdict
5	Test description		P
5.1	General		P
	Tests Ab, Ad, and Ae are similar. Differences are noted in 5.2.2, 5.3.2 and 5.4.2. All other portions of the test are the same, starting with Clause 6. The rate of change of temperature within the chamber shall not exceed 1 K per minute, averaged over a period of not more than 5 min. The relevant specification shall define the functioning of the specimen under test.		P
	Care shall be taken to see that any cooling devices of the specimen are in accordance with the requirement in the relevant specification.		P
5.2	Test Ab: Cold for non heat-dissipating specimens with gradual change of temperature		N/A
5.2.1	Object		N/A
	This procedure is intended for non heat-dissipating specimens which are subjected to a lower temperature for a time long enough for the specimen to achieve temperature stability.		N/A
5.2.2	General description		N/A
	The specimen is introduced into the chamber which is at the temperature of the laboratory.		N/A
	The temperature is then adjusted to the temperature appropriate to the degree of severity, as specified in the relevant specification. After temperature stability of the test specimen has been reached, the specimen is exposed to these conditions for the specified duration.		N/A
	For specimens that are required to be operational (even though they do not meet the requirements of being heat dissipating), power shall then be applied to the specimen and a functional test is performed as necessary.		N/A
	A further period of stabilization may be necessary and the specimen shall then be exposed to the low temperature conditions for a duration as specified in the relevant specification.		N/A
	Specimens under test are normally in non-operating conditions.		N/A
	High air velocity circulation is normally used for this test.		N/A
5.3	Test Ad: Cold for heat-dissipating specimens with gradual change of temperature that are powered after initial temperature stabilization		P

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IEC 60068-2-1:2007 Rev. 00			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	Testing is required by this PPP to demonstrate that the EUT is fully in accordance with the applicable requirements of this PPP.		P
5.3.1	Object		P
	This procedure is for heat-dissipating specimens which are subjected to a low temperature for a time long enough for the specimen to achieve temperature stability.		P
5.3.2	General description		P
	The specimen is introduced into the chamber which is at the temperature of the laboratory. If necessary, a test is performed to determine if the chamber fulfils the requirements of low air velocity. The temperature is then adjusted to the temperature appropriate to the degree of severity, as specified in the relevant specification.		P
	After temperature stability of the test specimen has been reached, the specimen is powered on and stabilized again and then exposed to these conditions for the specified duration. The specimen shall remain in the operating condition in accordance with the duty cycle and at the loading condition (if applicable) as prescribed by the relevant specification.		P
	Low air velocity circulation is normally used for this test.		P
5.4	Test Ae: Cold for heat-dissipating specimens with gradual change of temperature that are required to be powered throughout the test		N/A
5.4.1	Object		N/A
	This procedure is intended for heat dissipating specimens which are subjected to a low temperature for a time long enough for the specimen to achieve temperature stability and which are required to be powered throughout the test period.		N/A
5.4.2	General description		N/A
	The specimen is introduced into the chamber which is at the temperature of the laboratory. If necessary, a test is performed to determine if the chamber fulfils the requirements of low air velocity chamber. Power is then applied to the specimen and a functional test is performed, as necessary. The temperature is then adjusted to the temperature appropriate to the degree of severity as specified in the relevant specification.		N/A

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Clause	Requirement – Test	Measuring result – Remark	Verdict
	After temperature stability of the test specimen has been reached, the specimen is exposed to these conditions for the specified duration.		N/A
	Low air velocity circulation is normally used for this test.		N/A
5.4.3	Energizing the specimen		N/A
	The specimen shall then be switched on or electrically loaded and checked to ascertain whether it is capable of functioning in accordance with the relevant specification.		N/A
	The specimen shall remain in the operating condition in accordance with the duty cycle and at the loading condition (if applicable) as prescribed by the relevant specification.		N/A
6	Test procedure		P
6.1	Confirmation of performance		P
	IEC 60068-3-5 provides guidance for the confirmation of performance of temperature test chambers. IEC 60068-3-1 provides general guidance for the performance of Tests A and B.		P
	The chamber shall be large enough compared with the size and amount of heat-dissipation of the test sample.		P
6.2	Working space		P
	The dimensions of the test sample shall be such that it is entirely within the working space of the test chamber.		P
	The temperature of incident air delivered to the test specimen shall be within ± 2 K of test severity temperature during the steady-state condition. The air temperature in the working space shall be measured in accordance with 4.5.		P
	Where, due to the size of the chamber, it is not feasible to maintain these tolerances, the tolerance may be widened to ±3 K down to –25 °C and ±5 K down to –65 °C. When this is done, the tolerance used shall be specified in the test report.	±3K for -25°C	P
6.3	Thermal radiation		P
	The ability of the specimen to transfer heat by thermal radiation shall be minimized. This will normally result in the screening of any heating or cooling elements from the specimen and ensuring that parts of the chamber surfaces are not significantly different in temperature from that of		P

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IEC 60068-2-1:2007 Rev. 00			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	the conditioning air.		
6.4	Specimen with artificial cooling		P
	The relevant specification shall define the characteristics of the coolant supplied to the specimen. When the coolant is air, care shall be taken that the air is not contaminated by oil and dry enough to avoid moisture problems.		P
6.5	Mounting		P
	Thermal conduction and other relevant characteristics of the mounting and connections of the test specimen should be specified in the relevant specification. When the test specimen is intended for use with specific mounting devices, these shall be used for testing.		P
6.6	Severities		P
	The severities, as indicated by temperature and duration of exposure, shall be prescribed by the relevant specification. They shall be:		P
	a) chosen from the values given in 6.6.1and 6.6.2; or b) derived from the known environment if this gives significantly different values; or c) derived from other known sources of relevant data (for example IEC 60721).		P
6.6.1	Temperature	-25°C	P
	– 65 °C / – 40 °C / – 20 °C / + 5 °C – 55 °C / – 33 °C / – 10 °C – 50 °C / – 25 °C / – 5 °C		
6.6.2	duration		P
	2 h / 72 h 16 h / 96 h	16 h	P
	When this testing procedure is used in connection with tests associated with endurance or reliability, due note shall be taken of IEC publications that give particular recommendations for the duration of such tests.		N/A
6.7	Preconditioning		P
	The relevant specification may call for preconditioning.		P
6.8	Initial measurements		P
	The initial state of the specimen shall be known. This may be achieved by visual inspection, and/or functional tests as required by the relevant		P

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Clause	Requirement – Test	Measuring result – Remark	Verdict
	specification.		
6.9	Conditioning		P
	The specimen shall be exposed to the low temperature conditions for the duration, as detailed in the relevant specification.		P
	For the exceptional cases when the specimen does not achieve temperature stability, the duration of the test starts at the time that the specimen is energized. Such cases are typically caused by specimens having long duty cycles.		P
6.10	Intermediate measurements	Not required	N/A
	The relevant specification may call for loading and/or measurements during or at the end of conditioning while the specimen is still in the chamber. If such measurements are required, the relevant specification shall define the measurements and the period(s) after which they shall be carried out. For these measurements, the specimen shall not be removed from the chamber.		N/A
6.11	Final temperature ramp		P
	If the specimen remains in operating or loaded condition during the test, it shall be switched off or unloaded before the temperature is raised with the exception of Test Ae in which the specimen shall remain operational throughout the recovery period.		N/A
	At the end of the specified duration, the specimen shall remain in the chamber and the temperature shall be gradually raised to a value lying within the limits of standard atmospheric conditions for testing. The rate of change of temperature within the chamber shall not exceed 1 K per minute, averaged over a period of not more than 5 min.		P
6.12	Recovery		P
	The specimen shall be subjected to the recovery procedure in the chamber or otherwise, as deemed suitable. Appropriate steps may be taken to remove droplets of water, as required, without damaging the specimen.		P
	The specimen shall then remain under standard atmospheric conditions for recovery for a period adequate for the attainment of temperature stability, with a minimum of 1 h.		P
	If required by the relevant specification, the specimen shall be switched on or loaded and		P

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IEC 60068-2-1:2007 Rev. 00			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	measured continuously during the recovery period.		
	If the standard conditions given above are not appropriate for the specimen to be tested, the relevant specification may call for other recovery conditions.		N/A
6.13	Final measurements		P
	The specimen shall be visually inspected and such performance checks made as are required by the relevant specification.		P
7	Information to be given in the relevant specification		P
8	Information to be given in the test report		P

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6.8	TABLE: Visual inspection (Initial)	P
Test Date (MM/DD/YYYY) start/end……..:	09/17/2021~09/17/2021	—
Sample #	Nature and position of initial findings – comments or attach photos	Verdict
1#		Normal
Supplementary information:		

6.8	TABLE: Fuctional test (Initial)			P
Test Date (MM/DD/YYYY) start/end……..:	09/17/2021~09/17/2021			—
Sample #	Inverter functioning			Verdict
	Start up (Yes or No)	Operation (Yes or No)	Shut down(Yes or No)	
1#	Yes	Yes	Yes	Normal
Supplementary information:				

6.8	Table: Dielectric withstand test (initial)			P
Test Date (MM/DD/YYYY) start/end……..:	09/17/2021~09/17/2021			—
Sample #	Voltage applied between	Voltage applied (V)	Dielectric breakdown, Yes (description) or No	Verdict
1#	PV, AC and PE	2828 Vd.c.	No	P
1#	PV, AC and Communication port	5656 Vd.c.	No	P
Supplementary information:				

6.9	TABLE: Cold Test	P
Test Date (MM/DD/YYYY) start/end .....:	09/17/2021~09/18/2021	—
Type of test……..:	[ ] Ab, [X] Ad, [ ] Ae	—
Temperature change gradual……...:	1 K/min	—
Specimen cooling type ……..……:	Heat dissipating	—
Temperature maintained ……..:	- 25 °C	—
Duration at each tempearture…….……..:	16 hours	—
Condition …….:	As below	—

Step	Required temperature	Measured temperature	Requested time	Measured time
EUT stabilization	25 °C ± 2 °C	/	/	/
Temperature lowering	-25°C	/	50 min	50min
EUT stabilization	- 25 °C ± 2 °C	/	/	/
Temperature maintenance	- 25 °C ± 2 °C	/	16 h	16h

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Temeperature rising	25°C	/	50 min	50min
Recovery at laboratory temperature	25 °C ± 2 °C	/	≥ 1 h	2h

Temperature curve setting:

6.11 Final measurement

Visual inspection after Cold Test		P
Test Date (MM/DD/YYYY) start/end……..:	09/18/2021~09/18/2021	—
Sample #	Nature and position of initial findings – comments or attach photos	Verdict
	The specimen [did not] exhibit broken, cracked, bent, misaligned or torn external surface. The specimen [did not] exhibit visible corrosion of output connections. The specimen [did not] exhibit cracked or damaged wire or cable. The specimen [did not] exhibit exposed live electrical parts. The specimen [did not] exhibit any other conditions which may affect functioning, performance or safety. The specimen [did not] exhibit any shorting of live terminals / live parts or cables. The specimen [did not] exhibit any sparking of live terminals / live parts or cables.	P

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	The specimen [did not] exhibit any smoking. The specimen [did not] stopped functioning.	
Table: Dielectric withstand test after Cold Test		P
Test Date (MM/DD/YYYY) start/end……..:	09/18/2021~09/18/2021	—

Sample #	Voltage applied between	Voltage applied (V)	Dielectric breakdown, Yes (description) or No	Verdict
1#	PV, AC and PE	2828 Vd.c.	No	P
1#	PV, AC and Communication port	5656 Vd.c.	No	P

TABLE: Functioning Test for PV grid-interactive inverter after Cold Test				P
Sample #	Inverter functioning			Verdict
	Start up	Operation	Shut down	
1#	Yes	Yes	Yes	Normal
Supplementary information:				

-- End of Test Report --

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TEST REPORT

IEC 60068-2-2:2007 Rev. 00

TÜV SÜD test report for environmental testing – Part 2-2: Tests – Test B: Dry heat

Report reference No. ..... :	64.290.21.30206.01C Part 2 of 4
Date of issue ..... :	2021-09-30
Project handler..... :	Jenn Huang
Testing laboratory ..... :	TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
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Testing location..... :	Shenzhen SOFARSOLAR Co., Ltd. 401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, Guangdong. P.R.China
Client ..... :	Evolve Energy Group Co., Limited
Client number..... :	101913
Address ..... :	RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN, HONG KONG.
Contact person..... :	rvs@evolveindia.in
Standard ..... :	This TÜV SÜD test report form is based on the following requirements: IEC 60068-2-2:2007 Rev. 00
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Scheme ..... :	☐ GS, ☐ TÜV Mark, ☐ EU-Directive, ☒ Test verification of conformity
Non-standard test method..... :	☒ No ☐ Yes, see details under Summary
National deviations ..... :	N/A
Number of pages (Report) ..... :	12
Number of pages (Attachments)..... :	N/A
Compiled by.....: Jenn Huang	Approved by .....: Max Fang
(+ signature) Jenn Huang	(+ signature) Max Fang

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5F, Communication Building, 163 Pingyun Rd, Huangpu Ave. West,Guangzhou, 510656, P.R.China

Test sample……..:	Solar Grid-tied Inverter
Type of test object..... :	Type verification of conformity
Trademark ..... :	EVVO
Model and/or type reference..... :	E-250KTL-HV, E-255KTL-HV
Rating(s)..... :	See 64.290.21.30206.01C Part 1 of 4
Manufacturer ..... :	Evolve Energy Group Co., Limited
Manufacturer number…..... :	101913
Address ..... :	RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN, HONG KONG.
Sub-contractors/ tests (clause)..... :	N/A
Name ..... :	N/A

Order description…..... :

☐	Complete test according to TRF
☒	Partial test according to manufacturer's specifications
☐	Preliminary test
☐	Spot check

Date of order…… ..... :	2021-03-16, 2021-09-13
Date of receipt of test item..... :	2021-03-25, 2021-09-13
Date(s) of performance of test..... :	2021-04-28 to 2021-04-29, 2021-09-14 to 2021-09-30

Test item particulars:

Environmental testing – Part 2-2: Test on model E-255KTL-HV

Tests – Test B: Dry heat

Attachments:

See 64.290.21.30206.01C Part 1 of 4

General remarks:

"(see remark #)" refers to a remark appended to the report.
"(see appended table)" refers to a table appended to the report.
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Summary of testing: ☐ deviation(s) found ☒ no deviations found If additional information is necessary, please provide
Copy of marking plate: See 64.290.21.30206.01C Part 1 of 4
Picture of the product: See 64.290.21.30206.01C Part 1 of 4
Characteristic data: See 64.290.21.30206.01C Part 1 of 4
Characteristic data Factory: See 64.290.21.30206.01C Part 1 of 4
Purpose of the product: See 64.290.21.30206.01C Part 1 of 4

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IEC 60068-2-2:2007 Rev. 00			
Clause	Requirement – Test	Measuring result – Remark	Verdict
5	Test description		P
5.1	General		P
	Tests Bb, Bd, and Be are similar. Differences are noted in 5.2.2, 5.3.2 and 5.4.2. All other portions of the test are the same, starting with Clause 6. The rate of change of temperature within the chamber shall not exceed 1 K per minute, averaged over a period of not more than 5 min. The relevant specification shall define the functioning of the specimen under test.		P
	Care shall be taken to see that any cooling devices of the specimen are in accordance with the requirement in the relevant specification.		P
5.2	Test Bb: Dry heat for non heat-dissipating specimens with gradual change of temperature		N/A
5.2.1	Object		N/A
	This procedure is for non heat-dissipating specimens which are subjected to an elevated temperature for a time long enough for the specimen to achieve temperature stability.		N/A
5.2.2	General description		N/A
	The specimen is introduced into the chamber which is at the temperature of the laboratory.		N/A
	The specimen is introduced into the chamber, which is at the temperature of the laboratory. The temperature is then adjusted to the temperature appropriate to the degree of severity as specified in the relevant specification. After temperature stability of the test specimen has been reached, the specimen is exposed to these conditions for the specified duration.		N/A
	For specimens that are required to be operational (even though they do not meet the requirements of being heat dissipating) power shall then be applied to the specimen and a functional test is performed as necessary.		N/A
	A further period of stabilization may be necessary and the specimen shall then be exposed to the high temperature conditions for a duration as specified in the relevant specification.		N/A
	Specimens under test are normally in non-operating conditions.		N/A
	High air velocity circulation is normally used for this test.		N/A

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IEC 60068-2-2:2007 Rev. 00			
Clause	Requirement – Test	Measuring result – Remark	Verdict
5.3	Test Bd: Dry heat for heat-dissipating specimens with gradual change of temperature that are not powered during the conditioning period		P
5.3.1	Object		P
	This procedure is for heat dissipating specimens which are subjected to an elevated temperature for a time long enough for the specimen to achieve temperature stability.		P
5.3.2	General description		P
	If necessary, a test is performed to determine if the test facility fulfils the requirements of a low air velocity chamber or not. The specimen is introduced into the chamber, which is at the temperature of the laboratory. The temperature is then adjusted to the temperature appropriate to the degree of severity as specified in the relevant specification.		P
	Low air velocity circulation is normally used for this test.		P
5.3.3	Energising the specimen		N/A
	The specimen shall then be switched on or electrically loaded and checked to ascertain whether it is capable of functioning in accordance with the relevant specification.		N/A
	The specimen shall remain in the operating condition in accordance with the duty cycle and at the loading condition (if applicable) as prescribed by the relevant specification.		N/A
	After temperature stability of the test specimen has been reached, the specimen is exposed to these conditions for the duration as specified in the relevant specification. Low air velocity circulation is normally used for this test.		N/A
5.4	Test Be: Dry heat for heat-dissipating specimens with gradual change of temperature that are required to be powered throughout the test		N/A
5.4.1	Object		N/A
	This procedure is for heat dissipating specimens which are subjected to an elevated temperature for a time long enough for the specimen to achieve temperature stability and which are required to be powered throughout the test period.		N/A
5.4.2	General description		N/A
	If necessary, a test is performed to determine if the test facility fulfils the requirements of a low air		N/A

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IEC 60068-2-2:2007 Rev. 00			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	velocity chamber or not. The specimen is introduced into the chamber, which is at the temperature of the laboratory. The specimen shall then be switched on or electrically loaded and checked to ascertain whether it is capable of functioning in accordance with the relevant specification.		
	The specimen shall remain in the operating condition in accordance with the duty cycle and at the loading condition (if applicable) as prescribed by the relevant specification.		N/A
	The temperature is then adjusted to the temperature appropriate to the degree of severity as specified in the relevant specification.		N/A
	After temperature stability of the test specimen has been reached, the specimen is exposed to these conditions for the specified duration.		N/A
	The relevant specification shall define the functioning of the specimen under test.		N/A
	Low air velocity circulation is normally used for this test.		N/A
6	Test procedure		P
6.1	Confirmation of performance		P
	IEC 60068-3-5 provides guidance for the confirmation of performance of temperature test chambers. IEC 60068-3-1 provides general guidance for the performance of Tests A and B.		P
	The chamber shall be large enough compared with the size and amount of heat-dissipation of the test sample.		P
6.2	Working space		P
	The dimensions of the test sample shall be such that it is entirely within the working space of the test chamber.		P
	The temperature of incident air delivered to the test specimen shall be within ± 2 K of test severity temperature during the steady-state condition. The air temperature in the working space shall be measured in accordance with 4.5.		P
6.3	Thermal radiation		P
	The ability of the specimen to transfer heat by thermal radiation shall be minimized. This will normally result in the screening of any heating or cooling elements from the specimen and ensuring that parts of the chamber surfaces are not		P

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IEC 60068-2-2:2007 Rev. 00			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	significantly different in temperature from that of the conditioning air.		
6.4	Mounting		P
	Thermal conduction and other relevant characteristics of the mounting and connections of the test specimen should be specified in the relevant specification. When the test specimen is intended for use with specific mounting devices, these shall be used for testing.		P
6.5	Severities		P
6.5.1	General		P
	The severities, as indicated by temperature and duration of exposure, shall be prescribed by the relevant specification. They shall be:		P
	a) chosen from the values given in 6.5.2 and 6.5.3; or b) derived from the known environment if this gives significantly different values; or c) derived from other known sources of relevant data (for example IEC 60721).		P
6.5.2	Temperature		P
	+1 000 °C, +800 °C, +630 °C, +500 °C, +400 °C, +315 °C, +250 °C, +200 °C, +175 °C, +155 °C, +125 °C, +100 °C, +85 °C, +70 °C, +65 °C, +60 °C, +55 °C, +50 °C, +45 °C, +40 °C, +35 °C, +30 °C	60°C	P
6.5.3	Duration		P
	2 h, 16 h, 72 h, 96 h, 168 h, 240 h, 336 h, 1 000 h	16 h	P
	When this testing procedure is used in connection with tests associated with endurance or reliability, due note shall be taken of IEC publications that give particular recommendations for the duration of such tests.		N/A
6.6	Preconditioning		P
	The relevant specification may call for preconditioning.		P
6.7	Initial measurements		P
	The initial state of the specimen shall be known. This may be achieved by visual inspection, and/or functional tests as required by the relevant specification.		P
6.8	Conditioning		P

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IEC 60068-2-2:2007 Rev. 00			
Clause	Requirement – Test	Measuring result – Remark	Verdict
6.8.1	Steady state conditions		P
	The specimen shall be exposed to the high temperature conditions for the duration as detailed in the relevant specification.		P
	For the exceptional cases when the specimen does not achieve temperature stability, the duration of the test starts at the time that the specimen is energized. Such cases are typically caused by specimens having long duty cycles.		P
6.8.2	Absolute humidity		P
	The absolute humidity shall not exceed 20 g of water vapour per cubic metre of air (corresponding to approximately 50 % relative humidity at 35 ºC) the relative humidity shall not exceed 50 %.		P
6.9	Intermediate measurements	Not required	N/A
	The relevant specification may call for loading and/or measurements during or at the end of conditioning while the specimen is still in the chamber. If such measurements are required, the relevant specification shall define the measurements and the period(s) after which they shall be carried out. For these measurements, the specimen shall not be removed from the chamber.		N/A
6.11	Final temperature ramp		P
	If the specimen remains in operating or loaded condition during the test, it shall be switched off or unloaded before the temperature is raised with the exception of Test Ae in which the specimen shall remain operational throughout the recovery period.		N/A
	At the end of the specified duration, the specimen shall remain in the chamber and the temperature shall be gradually raised to a value lying within the limits of standard atmospheric conditions for testing. The rate of change of temperature within the chamber shall not exceed 1 K per minute, averaged over a period of not more than 5 min.		P
6.12	Recovery		P
	The specimen shall be subjected to the recovery procedure in the chamber or otherwise, as deemed suitable. Appropriate steps may be taken to remove droplets of water, as required, without damaging the specimen.		P

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IEC 60068-2-2:2007 Rev. 00			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	The specimen shall then remain under standard atmospheric conditions for recovery for a period adequate for the attainment of temperature stability, with a minimum of 1 h.		P
	If required by the relevant specification, the specimen shall be switched on or loaded and measured continuously during the recovery period.		N/A
	If the standard conditions given above are not appropriate for the specimen to be tested, the relevant specification may call for other recovery conditions.		N/A
6.13	Final measurements		P
	The specimen shall be visually inspected and such performance checks made as are required by the relevant specification.		P
7	Information to be given in the relevant specification		P
8	Information to be given in the test report		P

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6.7	**TABLE: Visual inspection (Initial)**	P
Test Date (MM/DD/YYYY) start/end……..:	09/18/2021~09/18/2021	—
Sample #	Nature and position of initial findings – comments or attach photos	Verdict
1#		
Supplementary information:		

6.7	**TABLE: Fuctional test (Initial)**			P
Test Date (MM/DD/YYYY) start/end……..:	09/18/2021~09/18/2021			—
Sample #	Inverter functioning			Verdict
	Start up	Operation	Shut down	
1#	Yes	Yes	Yes	Nominal
Supplementary information:				

6.7	**Table: Dielectric withstand test (initial)**			P
Test Date (MM/DD/YYYY) start/end……..:	09/18/2021~09/18/2021			—
Sample #	Voltage applied between	Voltage applied (V)	Dielectric breakdown, Yes (description) or No	Verdict
1#	PV, AC and PE	2828 Vd.c.	No	P
1#	PV, AC and Communication port	5656 Vd.c.	No	P
Supplementary information:				

6.8	**TABLE: Dry Heat Test**	P
Test Date (MM/DD/YYYY) start/end .....:	09/18/2021~09/19/2021	—
Type of test……..:	[ ] Bb, [X] Bd, [ ] Be	—
Temperature change gradual……...:	1 K/min	—
Specimen cooling type ……:	Heat dissipating	—
Temperature maintained ……..:	60°C	—
Duration at each tempearture……..:	16 hours	—
Condition ……:	As below	—

Step	**Required temperature**	**Measured temperature**	**Requested time**	**Measured time**
EUT stabilization	25 °C ± 2 °C	/	/	/
Temperature increase	60°C	/	50 min	50min
EUT stabilization	60 °C ± 2 °C	/	/	/
Temperature maintenance	60 °C ± 2 °C		16 h	16.5h

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Temeperature decrease	25°C	/	50 min	50min
Recovery at laboratory temperature	25 °C ± 2 °C		≥ 1 h	2h

Temperature curve setting:

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6.13 Final measurement

Visual inspection after Dry Test		P
Test Date (MM/DD/YYYY) start/end……..:	09/19/2021~09/19/2021	—

Sample #	Nature and position of initial findings – comments or attach photos	Verdict
1#	The specimen [did not] exhibit broken, cracked, bent, misaligned or torn external surface. The specimen [did not] exhibit visible corrosion of output connections. The specimen [did not] exhibit cracked or damaged wire or cable. The specimen [did not] exhibit exposed live electrical parts. The specimen [did not] exhibit any other conditions which may affect functioning, performance or safety. The specimen [did not] exhibit any shorting of live terminals / live parts or cables. The specimen [did not] exhibit any sparking of live terminals / live parts or cables. The specimen [did not] exhibit any smoking. The specimen [did not] stopped functioning.	P

Table: Dielectric withstand test after Dry Heat Test				P
Test Date (MM/DD/YYYY) start/end……..:	09/19/2021~09/19/2021			—
Sample #	Voltage applied between	Voltage applied (V)	Dielectric breakdown, Yes (description) or No	Verdict
1#	PV, AC and PE	2828 Vd.c.	No	P
1#	PV, AC and Communication port	5656 Vd.c.	No	P

TABLE: Grid protection Functioning Test for PV grid-interactive inverter after Dry Heat Test				P
Sample #	Inverter functioning			Verdict
	Start up	Operation	Shut down	
1#	Yes	Yes	Yes	P
Supplementary information:				

-- End of Test Report --

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TEST REPORT

IEC 60068-2-14:2009 Rev. 00

TÜV SÜD test report for environmental testing – Part 2-14: Tests – Test N: Change of temperature

Report reference No. ..... :	64.290.21.30206.01C Part 3 of 4
Date of issue ..... :	2021-09-30
Project handler..... :	Jenn Huang
Testing laboratory ..... :	TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
Address ..... :	5F, Communication Building, 163 Pingyun Rd, Huangpu Ave. West, Guangzhou 510656, P. R. China
Testing location..... :	Shenzhen SOFARSOLAR Co., Ltd. 401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, Guangdong. P.R.China
Client ..... :	Evolve Energy Group Co., Limited
Client number..... :	101913
Address ..... :	RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN, HONG KONG.
Contact person..... :	rvs@evolveindia.in
Standard ..... :	This TÜV SÜD test report form is based on the following requirements: IEC 60068-2-14:2009 Rev. 00
TRF originated by. ..... :	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch, Dipl.-Ing. Alexander Krenz
Copyright blank test report ..... :	This test report is based on the content of the standard (see above). The test report considered selected clauses of the a.m. standard(s) and experience gained with product testing. It was prepared by TÜV SÜD Product Service GmbH. TUV SUD Group takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.
Scheme ..... :	☐ GS, ☐ TÜV Mark, ☐ EU-Directive, ☒ Test verification of conformity
Non-standard test method..... :	☒ No ☐ Yes, see details under Summary
National deviations ..... :	N/A
Number of pages (Report) ..... :	17
Number of pages (Attachments)..... :	N/A
Compiled by.....: Jenn Huang	Approved by ....: Max Fang
(+ signature) Jenn Huang	(+ signature) Max Fang

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Test sample……..:	Solar Grid-tied Inverter
Type of test object..... :	Type verification of conformity
Trademark ..... :	EVVO
Model and/or type reference..... :	E-250KTL-HV, E-255KTL-HV
Rating(s)..... :	See 64.290.21.30206.01C Part 1 of 4
Manufacturer ..... :	Evolve Energy Group Co., Limited
Manufacturer number…..... :	101913
Address ..... :	RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN, HONG KONG.
Sub-contractors/ tests (clause)..... :	N/A
Name ..... :	N/A

Order description…..... :

☐	Complete test according to TRF
☒	Partial test according to manufacturer's specifications
☐	Preliminary test
☐	Spot check

Date of order……. ..... :	2021-03-16, 2021-0-13
Date of receipt of test item..... :	2021-03-25, 2021-09-13
Date(s) of performance of test..... :	2021-04-29 to 2021-04-30, 2021-09-14 to 2021-09-30

Test item particulars:

Environmental testing – Part 2-14: Test on model E-255KTL-HV

Tests – Test N: Change of temperature

Attachments:

See 64.290.21.30206.01C Part 1 of 4

General remarks:

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"(see appended table)" refers to a table appended to the report.
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Summary of testing: ☐ deviation(s) found ☒ no deviations found If additional information is necessary, please provide
Copy of marking plate: See 64.290.21.30206.01C Part 1 of 4
Picture of the product: See 64.290.21.30206.01C Part 1 of 4
Characteristic data: See 64.290.21.30206.01C Part 1 of 4
Characteristic data Factory: See 64.290.21.30206.01C Part 1 of 4
Purpose of the product: See 64.290.21.30206.01C Part 1 of 4

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IEC 60068-2-14:2009 Rev. 00			
Clause	Requirement – Test	Measuring result – Remark	Verdict
4	General		P
4.1	Design of change of temperature tests		P
	Tests Na, Nb and Nc comprise alternate periods at a high and at a low temperature with welldefined transfers from one temperature to the other. The conditioning run from laboratory ambient to the first conditioning temperature, then to the second conditioning temperature, then back to laboratory ambient is considered one test cycle.	Nb	P
4.2	Test parameters		P
	Test parameters comprise the following: – laboratory ambient; – high temperature; – low temperature; – duration of exposure; – transfer time or rate of change; – number of test cycles.		P
	The high and low temperatures are understood to be ambient temperatures which will be reached by most specimens with a certain time-lag.		P
	Only in exceptional cases may they be specified outside the normal storage or operating temperature range of the object under test.		P
	The test is accelerated because the number of severe changes of temperature in a given period is greater than that which will occur under field conditions.		P
4.3	Purpose and choice of the tests		P
	Change of temperature testing is recommended in the following cases: – evaluation of electrical performance during a change of temperature, Test Nb; – evaluation of mechanical performance during a change of temperature, Test Nb, – evaluation of electrical performance after a specified number of rapid changes of temperature, Test Na or Test Nc; – evaluation of the suitability of mechanical components, and of materials and combinations of materials to withstand rapid changes of	Nb	P

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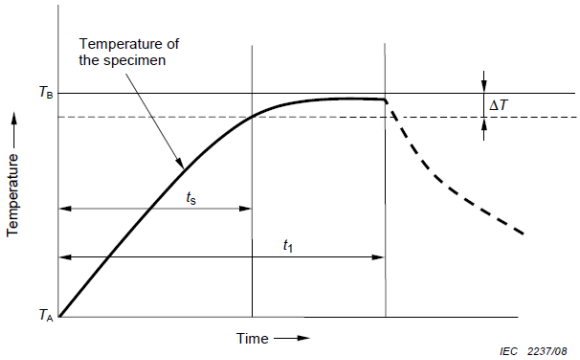
IEC 60068-2-14:2009 Rev. 00			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	temperature, Test Na or Test Nc; – evaluation of the suitability of construction of components to withstand artificial stressing, Test Na or Test Nc.		
	The change of temperature tests specified in the IEC 60068 series is not intended to evaluate the difference in material constants or electrical performance when operating under temperature stability at the two extremes of temperature.		P
4.4	Choice of the duration of the exposure		P
	The duration of the exposure should be based on the requirements stated in 7.2.3, 8.2.3 or 9.2.2, or as stated in the relevant specification, keeping in mind the following points:		P
	a) The exposure begins as soon as the specimen is in the new environment.		P
	b) Stabilization occurs when the temperature difference (ΔT) between the specimen and the test medium is within 3 K to 5 K, or as stated in the test specification. The stabilization period, (ts), is from the start of exposure until the time when the temperature is within the specified difference. A representative point (or points) on the specimen may be used for this measurement.		P
	The test duration, t1, shall be longer than the specimen stabilization time, ts. Figure 1 provides a graphical representation of the process. This may not be appropriate for heat generating specimens.  **Figure 1 – Determination of test duration time (t_1)**		P
4.5	Choice of the duration of the transfer time		N/A
	If, in the case of the two-chamber method, because of the large size of the specimens the		N/A

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IEC 60068-2-14:2009 Rev. 00			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	transfer time cannot be made in 3 min, the transfer time may be increased without an appreciable influence on the test results as follows: $t_2 \leq 0{,}05\ t_s$ where t_2 is the duration of the transfer time; t_s is the stabilisation period of the specimen.		
4.6	Applicability limits of change of temperature tests		P
	Inside a specimen, the temperature change rate depends on the heat conduction of its materials, the spatial distribution of its heat capacity and its dimensions.		P
	The change of temperature at a point on the surface of a specimen follows approximately an exponential law. Inside large specimens, such alternate exponential rises and decreases may lead to periodic and approximately sinusoidal changes of temperature with much lower amplitudes than the applied temperature swing.		P
	The mechanism of heat transfer between the test specimen and the conditioning medium in the chamber or bath should be taken into account. Liquid in motion leads to very high rates of change of temperature on the surface of the specimens and still air to very low rates.		P
	The two-bath method with water as a conditioning medium (Test Nc) should be restricted to specimens which are either sealed or are by their nature insensitive to water, since their performance and properties may deteriorate by immersion.		N/A
	In particular cases, such as with specimens sensitive to water, a test with liquid other than water may need to be specified. When designing such a test, the characteristics of heat transfer of the liquid, which may differ from those of water, shall be taken into account.		N/A
5	Guidance for the selection of the kind of test		P
	The severity of the test will increase with the increase in the temperature difference, the increase in rate of temperature change, and the heat transfer to the specimen.		P
	The application of Tests N is preferred as part of a sequence of tests. Some types of damage may not become apparent by the final measurements		P

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IEC 60068-2-14:2009 Rev. 00			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	of a Test N, but may appear only during subsequent tests (e.g. Test Q: Sealing, Test F: Vibration or Test D: Accelerated damp heat).		
	The change of temperature Test Nc (Two-bath method) should not be used as an alternative to Test Q (Sealing).		N/A
	When specifying a change of temperature test, the properties of the objects under test which are affected by conditions of changing temperature, and their possible failure mechanisms, should be kept in mind. The initial and the final measurements should be specified accordingly.		P
6	Initial and final measurements		P
	Tests Na, Nb and Nc all use the same initial and final measurements.		P
6.1	Initial measurements		P
	The specimen shall be visually examined and electrically and mechanically checked as required by the relevant specification		P
6.2	Final measurements		P
	The specimen shall be visually examined and electrically and mechanically checked, as required by the relevant specification.		P
7	Test Na: Rapid change of temperature with prescribed time of transfer		N/A
7.1	General description of the test		N/A
	This test determines the ability of components, equipment or other articles to withstand rapid changes of ambient temperature. The exposure times adequate to accomplish this will depend upon the nature of the specimen. The specimen shall be either in the unpacked, switched-off, ready for use state, or as otherwise specified in the relevant specification. The specimen is exposed to rapid changes of temperature in air, or in a suitable inert gas, by alternate exposure to low temperature and to high temperature.		N/A
7.2	Testing procedure		N/A
7.2	Testing chamber		N/A
	Two separate chambers or one rapid temperature change rate chamber may be used. If two chambers are used, one for the low temperature and one for the high temperature, the location shall be such as to allow transfer of the specimen from one chamber to the other within the prescribed time. Either manual or automatic		N/A

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IEC 60068-2-14:2009 Rev. 00			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	transfer methods may be used.		
	The chambers shall be capable of maintaining the atmosphere at the appropriate temperature for the test in any region where the specimen is placed.		N/A
	After insertion of the test specimens, the air temperature shall be within the specified tolerance after a time of not more than 10 % of the exposure time.		N/A
7.2.2	Mounting or supporting of the test specimen		N/A
	Unless otherwise specified in the relevant specification, the thermal conduction of the mounting or supports shall be low, such that for practical purposes the specimen is thermally isolated. When testing several specimens simultaneously they shall be so placed that free circulation shall be provided between specimens, and between specimens and chamber surfaces.		N/A
7.2.3	Severities		N/A
	The severity of the test is defined by the combination of the two temperatures, the transfer time, the exposure time of the specimen and the number of cycles.		N/A
	The lower temperature, TA, shall be specified in the relevant specification and should be chosen from the test temperatures of IEC 60068-2-1 and IEC 60068-2-2.		N/A
	The higher temperature, TB, shall be specified in the relevant specification and should be chosen from the test temperatures of IEC 60068-2-1 and IEC 60068-2-2.		N/A
	The exposure time, t1, of each of the two temperatures depends upon the heat capacity of the specimen. It may be 3 h, 2 h, 1 h, 30 min or 10 min, or as specified in the relevant specification. Where no exposure period is specified in the relevant specification, it is understood to be 3 h.		N/A
	The preferred number of test cycles is five, unless otherwise specified in the relevant specification.		N/A
7.2.4	Conditioning		N/A
	The specimen and the temperature in the test chamber shall be at the ambient temperature of the laboratory, +25 °C ± 5 K. If required by the relevant specification the specimen shall be brought into operating condition.		N/A

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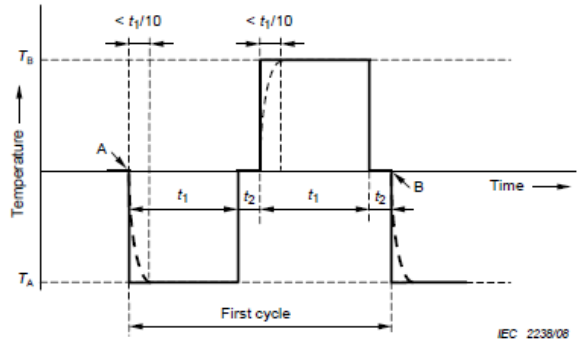
Clause	Requirement – Test	Measuring result – Remark	Verdict
7.2.5	Test cycle		N/A
	The test specimen shall be exposed to the cold temperature, TA. The temperature, TA, shall be maintained for the specified period t1. t1 includes an initial time, not longer than 0,1 t1 for temperature stabilization of the air temperature in the chamber (see 7.2.1).		N/A
	The specimen shall then be exposed to the hot temperature, TB, in a period, t2, which should not be more than 3 min.		N/A
	t2 shall include the time need for the removal from one chamber and the insertion into the second chamber as well as any dwell time at the ambient temperature of the laboratory.		N/A
	TB shall be maintained for the specified period, t1. t1 includes an initial time, not longer than 0,1 t1 for temperature stabilization of the air temperature in the chamber (see 7.2.1). NOTE 3 The exposure time is measured from the moment of insertion of the specimen into the chamber. For the next cycle the specimen shall be exposed to the cold temperature, TA, in a transfer time, t2, which shall not be more than 3 min. The first cycle comprises the two exposure times, t1, and the two transfer times, t2 (see Figure 2).		N/A
			N/A
	At the end of the last cycle the specimen shall be subjected to the recovery procedures		N/A
7.3	Recovery		N/A
	At the end of the test cycle, the specimen shall remain in standard atmospheric conditions for testing for a period adequate for the attainment of temperature stability. The relevant specification may prescribe a specific recovery period for a given type of specimen.		N/A

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Clause	Requirement – Test	Measuring result – Remark	Verdict
7.4	Information to be given in the relevant specification		N/A
8	Test Nb: Change of temperature with specified rate of change		P
8.1	General description of the test		P
	This test determines the ability of components, equipment or other articles to withstand and/or function during changes of ambient temperature.		P
	The specimen shall be either in the unpacked, switched-off, ready for use state, or as otherwise specified in the relevant specification.		P
	The specimen is exposed to changes of temperature in air by exposure in a chamber to prescribed temperatures varied at a controlled rate. During this exposure the performance of the specimen may be monitored.		P
8.2	Testing procedure		P
8.2.1	The chamber for this test shall be so designed that in the working space where the specimen under test is placed a temperature cycle can be performed in such a manner that a) the low temperature required for the test can be maintained, b) the high temperature required for the test can be maintained, c) the change rate required for the test from low temperature to high temperature or vice versa can be performed at the required rate of change.		P
8.2.2	Mounting or supporting of the test specimen		P
	Unless otherwise specified in the relevant specification, the thermal conduction of the mounting or support shall be low, such that for practical purposes the specimen is thermally isolated. When testing several specimens simultaneously they shall be so placed that free circulation is provided between the specimens, and between the specimens and chamber surfaces.		P
8.2.3	Severities		P
	The severity of the test is defined by the combination of the two temperatures, the rate of temperature change, the exposure time of the specimen and the number of cycles.		P
	The lower temperature TA shall be specified in the relevant specification and should be chosen from the test temperatures of IEC 60068-2-1 and	-25°C	P

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Clause	Requirement – Test	Measuring result – Remark	Verdict
	IEC 60068-2-2.		
	The higher temperature TB shall be specified in the relevant specification and should be chosen from the test temperatures of IEC 60068-2-1 and IEC 60068-2-2.	60°C	P
	The air temperature shall be lowered or raised between 90 % and 10 % of D = TB - TA within a tolerance of 20 % of the temperature change rate. Preferred values are (1 ± 0,2) K/min, (3 ± 0,6) K/min, (5 ± 1) K/min, (10 ± 2) K/min, or (15 ± 3) K/min,	1K/min	P
	The exposure time, t1, to each of the two temperatures depends upon the heat capacity of the specimen. It may be 3 h, 2 h, 1 h, 30 min, or 10 min, or as specified in the relevant specification. Where no exposure period is prescribed in the relevant specification it is understood to be 3 h.	3h	P
	The specimen shall be subjected to two consecutive cycles, unless otherwise specified in the relevant specification.		P
8.2.4	Conditioning		P
	The specimen and the temperature in test chamber shall be at the ambient temperature of the laboratory, +25 °C ±5 K. If required by the relevant specification, the specimen shall be brought into operating condition		P
8.2.5	Test cycle	Two cycle	P
	The air temperature in the chamber shall then be lowered to the specified low temperature, TA, at the specified rate (see Figure 3). After temperature stability in the chamber has been reached, the specimen shall be exposed to the low temperature condition for the specified period, t1. The air temperature in the chamber shall then be raised to the specified high temperature, TB, at the specified rate (see Figure 3). After temperature stability in the chamber has been reached, the specimen shall be exposed to the high temperature condition for the specified period, t1. The air temperature in the chamber shall then be lowered to the value of the laboratory ambient		P

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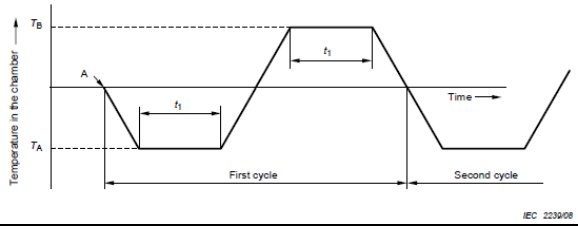
Clause	Requirement – Test	Measuring result – Remark	Verdict
	temperature, +25 °C ±5 K, at the specified rate (see Figure 3). This procedure constitutes one cycle.		
			P
8.3	Recovery		P
	At the end of the test cycle, the specimen shall remain in standard atmospheric conditions for testing for a period adequate for the attainment of temperature stability. The relevant specification may prescribe a specific recovery period for a given type of specimen.		P
8.4	Information to be given in the relevant specification		P
9	Test Nc: Rapid change of temperature, two-fluid-bath method		N/A
9.1	General description of the test		N/A
	This test determines the ability of components, equipment or other articles to withstand rapid changes of temperature.		N/A
	This test procedure results in a severe thermal shock and is applicable to glass-metal seals and similar specimens.		N/A
	The specimen is immersed alternately in two baths, one filled with liquid at a low temperature, TA, and one filled with liquid at a high temperature, TB.		N/A
	Testing procedure		N/A
	Testing equipment		N/A
	Two baths, one at low temperature and one at high temperature, shall be provided in such a way that the specimen under test can be easily immersed and be quickly transferred from one bath to the other. The low temperature bath shall contain liquid at the lower temperature, TA, stated in the relevant specification. If no temperature is stated the liquid shall have a temperature of 0 °C. The bath for the high temperature shall contain liquid at the upper temperature, TB, as required		N/A

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Clause	Requirement – Test	Measuring result – Remark	Verdict
	by the relevant specification. If no temperature is stated the liquid shall have a temperature of 100 °C. The baths shall be so constructed that at no moment during the test shall the temperature of the cold bath rise more than 2 K above TA or the temperature of the warm bath fall more than 5 K below TB. The liquids used for the test shall be compatible with the materials and finishes used in the manufacture of the specimens.		
9.2.2	Severities		N/A
	The severity of the test is defined by the specified bath temperatures, the period of transfer from one bath to the other, t2, and the number of cycles.		N/A
	The relevant specification shall specify the duration parameters to be used and the chosen value of t1.		N/A
	Number of test cycles is 10, unless otherwise specified in the relevant specification.		N/A
9.2.3	Conditioning		N/A
	The specimen shall be subjected to the test in the unpacked condition.		N/A
9.3	Test cycle		N/A
	The specimen under test while being at the ambient temperature of the laboratory shall be immersed into the cold bath containing liquid at the temperature TA as stated in the relevant specification.		N/A
	The specimen shall be maintained immersed in the cold bath for the appropriate period, t1.		N/A
	The specimen shall then be removed from the cold bath and immersed in the hot bath containing liquid at the temperature TB as stated in the relevant specification. The transfer time t2 shall be as stated in the relevant specification. The specimen shall be maintained immersed in the hot bath for the appropriate period, t1. The specimen shall then be removed from the hot bath. The period t2 between removal from the hot bath and immersion in the cold bath shall be as specified in the relevant specification. One cycle consists of two immersion times, t1, and two transfer times, t2 (see Figure 4). At the end of the last cycle, the specimen shall be subjected to the recovery procedure.		N/A

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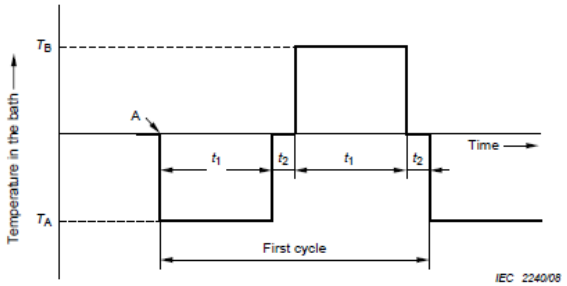
IEC 60068-2-14:2009 Rev. 00			
Clause	Requirement – Test	Measuring result – Remark	Verdict
			N/A
9.4	Recovery		N/A
	At the end of the test cycle, the specimen shall be subjected to laboratory ambient temperature. Droplets of liquid shall be removed. If cleaning is necessary, then the method shall be defined by the relevant specification. The relevant specification may prescribe a specific recovery period for a given type of specimen.		N/A
9.5	Information to be given in the relevant specification		N/A
10	Information to be given in the test report		P

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6.1	TABLE: Visual inspection (Initial)	P
Test Date (MM/DD/YYYY) start/end……..:	09/19/2021~09/19/2021	—
Sample #	Nature and position of initial findings – comments or attach photos	Verdict
1#		Normal
Supplementary information:		

6.1	TABLE: Fuctional test (Initial)			P
Test Date (MM/DD/YYYY) start/end……..:	09/19/2021~09/19/2021			—
Sample #	Inverter functioning			Verdict
	Start up	Operation	Shut down	
1#	Yes	Yes	Yes	P
Supplementary information:				

6.1	Table: Dielectric withstand test (initial)			P
Test Date (MM/DD/YYYY) start/end……..:	09/19/2021~09/19/2021			—
Sample #	Voltage applied between	Voltage applied (V)	Dielectric breakdown, Yes (description) or No	Verdict
1#	PV, AC and PE	2828 Vd.c.	No	P
1#	PV, AC and Communication port	5656 Vd.c.	No	P
Supplementary information:				

8	TABLE: Test Nb: Change of temperature with specified rate of change	P
Test Date (MM/DD/YYYY) start/end .....:	09/19/2021~09/20/2021	—
Type of test……..:	[X] Nb	—
Temperature change gradual……...:	1 K/min	—
Lower temperature T_A ……...:	-25°C	—
Higher temperature T_B ……..……...:	60°C	—
Specimen cooling type ……..……:	Fan	—
Air circulation ……..……:	--	—
Duration t1 ...……..:	3 hours	—
Cycle ……..:	2 cycles	—

Step	Required temperature	Measured temperature	Requested time	Measured time

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EUT stabilization	25 °C ± 2 °C	/	/	/
Temperature lowering	-25°C	/	50 min	50min
EUT stabilization	- 25 °C ± 2 °C	/	/	/
Temperature maintenance	- 25 °C ± 2 °C	/	3 h	3h
Temeperature rising	60°C	/	85 min	85min
EUT stabilization	60 °C ± 2 °C	/	/	/
Temperature maintenance	60 °C ± 2 °C	/	3 h	3h
Recovery at laboratory temperature	25 °C ± 2 °C	/	35 min	35min

Temperature curve setting:

6.2 Final measurement

Visual inspection after Change of temperature Test		P
Test Date (MM/DD/YYYY) start/end……..:	09/20/2021~09/20/2021	—
Sample #	Nature and position of initial findings – comments or attach photos	Verdict
	The specimen [did not] exhibit broken, cracked, bent, misaligned or torn external surface. The specimen [did not] exhibit visible corrosion of output connections. The specimen [did not] exhibit cracked or damaged wire or cable. The specimen [did not] exhibit exposed live electrical parts. The specimen [did not] exhibit any other conditions which may affect functioning,	P

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	performance or safety. The specimen [did not] exhibit any shorting of live terminals / live parts or cables. The specimen [did not] exhibit any sparking of live terminals / live parts or cables. The specimen [did not] exhibit any smoking. The specimen [did not] stopped functioning.	

Table: Dielectric withstand test after Change of temperature Test				P
Test Date (MM/DD/YYYY) start/end……..:	09/20/2021~09/20/2021			—
Sample #	Voltage applied between	Voltage applied (V)	Dielectric breakdown, Yes (description) or No	Verdict
1#	PV, AC and PE	2828 Vd.c.	No	P
1#	PV, AC and Communication port	5656 Vd.c.	No	P

TABLE: Grid protection Functioning Test for PV grid-interactive inverter after Change of temperature Test				P
Test Date (MM/DD/YYYY) start/end .....:	09/20/2021~09/20/2021			—
Sample #	Inverter functioning			Verdict
	Start up	Operation	Shut down	
1#	Yes	Yes	Yes	P
Supplementary information:				

-- End of Test Report --

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TEST REPORT

IEC 60068-2-30:2005 Rev. 00

TÜV SÜD test report for environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)

Report reference No. ..... :	64.290.21.30206.01C Part 4 of 4
Date of issue ..... :	2021-09-30
Project handler..... :	Jenn Huang
Testing laboratory ..... :	TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
Address ..... :	5F, Communication Building, 163 Pingyun Rd, Huangpu Ave. West, Guangzhou 510656, P. R. China
Testing location ..... :	Shenzhen SOFARSOLAR Co., Ltd. 401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen, Guangdong. P.R.China
Client ..... :	Evolve Energy Group Co., Limited
Client number..... :	101913
Address ..... :	RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN, HONG KONG.
Contact person..... :	rvs@evolveindia.in
Standard ..... :	This TÜV SÜD test report form is based on the following requirements: IEC 60068-2-30:2005 Rev. 00
TRF originated by. ..... :	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch, Dipl.-Ing. Alexander Krenz
Copyright blank test report ..... :	This test report is based on the content of the standard (see above). The test report considered selected clauses of the a.m. standard(s) and experience gained with product testing. It was prepared by TÜV SÜD Product Service GmbH. TUV SUD Group takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.
Scheme ..... :	☐ GS, ☐ TÜV Mark, ☐ EU-Directive, ☒ Test verification of conformity
Non-standard test method..... :	☒ No ☐ Yes, see details under Summary
National deviations ..... :	N/A
Number of pages (Report) ..... :	14
Number of pages (Attachments)..... :	N/A
Compiled by.....: Jenn Huang	Approved by ....: Max Fang
(+ signature) Jenn Huang	(+ signature) Max Fang

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Test sample……..:	Solar Grid-tied Inverter
Type of test object..... :	Type verification of conformity
Trademark ..... :	EVVO
Model and/or type reference..... :	E-250KTL-HV, E-255KTL-HV
Rating(s)..... :	See 64.290.21.30206.01C Part 1 of 4
Manufacturer ..... :	Evolve Energy Group Co., Limited
Manufacturer number…..... :	101913
Address ..... :	RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN, HONG KONG.
Sub-contractors/ tests (clause)..... :	N/A
Name ..... :	N/A

Order description…..... :

☐	Complete test according to TRF
☒	Partial test according to manufacturer's specifications
☐	Preliminary test
☐	Spot check

Date of order……. ..... :	2021-03-16, 2021-09-13
Date of receipt of test item..... :	2021-03-25, 2021-09-13
Date(s) of performance of test..... :	2021-04-25 to 2021-04-27, 2021-09-14 to 2021-09-30

Test item particulars:

Environmental testing – Part 2-30: Test on model E-255KTL-HV

Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)

Attachments:

See 64.290.21.30206.01C Part 1 of 4

General remarks:

"(see remark #)" refers to a remark appended to the report.
"(see appended table)" refers to a table appended to the report.
Throughout this report a comma is used as the decimal separator.
The test results presented in this report relate only to the object tested.
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Summary of testing: ☐ deviation(s) found ☒ no deviations found If additional information is necessary, please provide
Copy of marking plate: See 64.290.21.30206.01C Part 1 of 4
Picture of the product: See 64.290.21.30206.01C Part 1 of 4
Characteristic data: See 64.290.21.30206.01C Part 1 of 4
Characteristic data Factory: See 64.290.21.30206.01C Part 1 of 4
Purpose of the product: See 64.290.21.30206.01C Part 1 of 4

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IEC 60068-2-30:2005 Rev. 00			
Clause	Requirement – Test	Measuring result – Remark	Verdict
3	General description		P
	This test comprises one or more temperature cycles in which the relative humidity is maintained at a high level.		P
	Two variants of the cycle are given which are identical except for the temperature fall period; during this part of the cycle, variant 2 allows wider tolerances of relative humidity and the rate of temperature fall.		P
	The upper temperature of the cycle and the number of cycles (see Clause 5) determine the test severity.		P
	Test profiles illustrating the procedure are shown in Figures 1, 2a, 2b and 3.		P
	The tolerances stated in this standard do not take measurement uncertainty into consideration.		P
4	Testing chamber – Construction requirements		P
4.1	The temperature can be varied cyclically between 25 °C ± 3 K and the appropriate upper temperature specified with the tolerance and rate of change specified in 7.3 and Figures 2a or 2b, as applicable.		P
	The total temperature tolerance of ±3 K is intended to take account of absolute errors in the measurement, slow changes of temperature, and temperature variations of the working space. However, in order to maintain the relative humidity within the required tolerances, it is necessary to keep the temperature difference between any two points in the working space at any moment within narrower limits. The required humidity conditions will not be achieved if such temperature differences exceed 1 K. It may also be necessary to keep short-term fluctuations within ±0,5 K to maintain the required humidity.		P
4.2	The relative humidity in the working space can be maintained within the limits given in 7.3 and in Figures 2a or 2b, as applicable.		P
4.3	Care shall be taken to ensure that the conditions prevailing at any point in the working space are uniform and are as similar as possible to those prevailing in the immediate vicinity of suitably located temperature and humidity sensing devices. The chamber shall meet the performance criteria as detailed in IEC 60068-3-6.		P

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4.4	The specimens under test shall not be subjected to radiant heat from the chamber conditioning processes.		P
	Water used for the maintenance of chamber humidity shall have a resistivity of not less than 500 Ωm.		P
	Condensed water shall be continuously drained from the chamber and not used again until it has been re-purified.		
	Precautions shall be taken to ensure that no condensed water is allowed to fall on the specimens.		P
4.6	The dimensions, properties and/or electrical loading of the specimens under test shall not appreciably influence conditions within the chamber.		P
5	Severities		P
5.1	The combination of the upper temperature and the number of cycles define the severity of the test.		P
5.2	The severity shall be chosen from the following: a) upper temperature: 40 °C, number of cycles: 2, 6, 12, 21, 56; b) upper temperature: 55 °C, number of cycles: 1, 2, 6.	60°C, 2 cycles	P
6	Initial measurement		P
	The specimens shall be visually inspected, and functionally tested, as required by the relevant specification		P
7	Conditioning		P
	The specimens shall be introduced into the chamber either in the unpacked, switched-off, ready-for-use state, or as otherwise specified in the relevant specification.		P
	Where no specific mounting is prescribed, the thermal conduction of the mounting shall be low, so that for all practical purposes the specimen is thermally isolated.		P
7.1	Temperature tolerances		P
	The total temperature tolerance of ± 2 K and ± 3 K given in this standard is intended to take account of absolute errors in the measurement, slow changes of temperature, and temperature		P

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Clause	Requirement – Test	Measuring result – Remark	Verdict
	variations of the working space. However, in order to maintain the relative humidity within the required tolerances, it is necessary to keep the temperature difference between any two points in the working space at any moment within narrower limits. The required humidity conditions will not be achieved if such temperature differences exceed 1 K. It may also be necessary to keep short-term fluctuations within ± 0,5 K to maintain the required humidity.		
7.2	Stabilizing period		P
	The temperature of the specimens shall be stabilized at 25 °C ± 3 K (the definition of temperature stability is given in IEC 60068-1 and IEC 60068-5-2). This shall be achieved by either a) placing the specimens in a separate chamber before introducing it into the test chamber, or, b) adjusting the temperature of the test chamber to 25 °C ± 3 K after the introduction of the specimens and maintaining them at this level until the specimens attain temperature stability.		P
	During the stabilization of temperature by either method, the relative humidity shall be within the limits prescribed for standard atmospheric conditions for testing.		P
	Following stabilization, with the specimens in the test chamber, the relative humidity shall be increased to not less than 95 % RH at an ambient temperature of 25 °C ± 3 K.		P
7.3	Description of the 24 h cycle		P
7.3.1	The temperature of the chamber shall be raised to the appropriate upper temperature prescribed by the relevant specification. The upper temperature shall be achieved in a period of 3 h ± 30 min and at a rate within the limits defined by the shaded areas in Figures 2a and 2b.		P
	During this period, the relative humidity shall not be less than 95 % RH. During the last 15 min it shall not be less than 90 % RH.		P
	Condensation may occur on the specimen during this temperature-rise period.		P
7.3.2	The temperature shall then be maintained within the prescribed limits for the upper temperature (±2 K) until 12 h ± 30 min from the start of the cycle.		P

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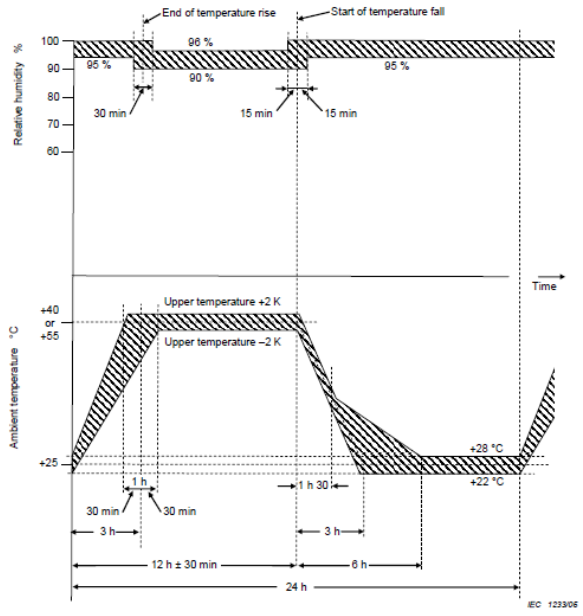
Clause	Requirement – Test	Measuring result – Remark	Verdict
	During this period, the relative humidity shall be 93 % RH ± 3 %RH. During the first and last 15 min it shall be between 90 % RH and 100 % RH.		P
7.3.3	The temperature shall then be lowered in accordance with one of the two variants given below.		P
	Variant 1 (see figure 2a)		P
	The temperature shall be lowered to 25 °C ± 3 K within 3 h to 6 h. The rate of fall for the first one and one half hours shall be such that, if maintained as indicated in Figure 2a, it would result in a temperature of 25 °C ±3 K being attained in 3 h ± 15 min. The relative humidity shall be not less than 95 % RH. During the first 15 min it shall be not less than 90 % RH.		P
			P
	Variant 2 (see Figure 2b)		N/A
	The temperature shall be lowered to 25 °C ± 3 K within 3 h to 6 h, but without the additional requirement for the first hour and one half as in variant 1. The relative humidity shall be not less than 80 % RH.		N/A

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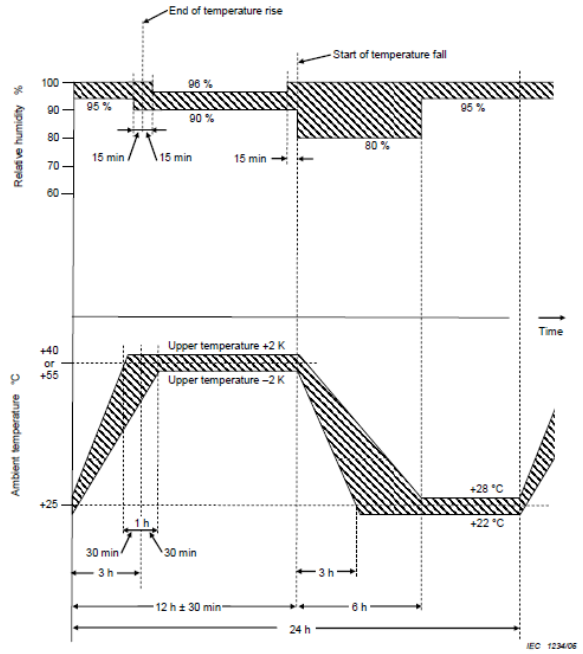
Clause	Requirement – Test	Measuring result – Remark	Verdict
			N/A
7.3.4	The temperature shall then be maintained at 25 °C ± 3 K with a relative humidity of not less than 95 % RH until the 24 h cycle is completed.		P
8	Intermediate measurements		P
	The relevant specification may require functional tests during the conditioning programme.		P
9	Recovery		P
	The relevant specification shall prescribe whether recovery shall be made at standard atmospheric conditions for testing (see 5.3 of IEC 60068-1), or at controlled recovery conditions (see 5.4.1 of IEC 60068-1).		P
	If controlled recovery conditions are required (see Figure 3), the specimen may be transferred to another chamber for this recovery period or may remain in the damp heat chamber.		N/A

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	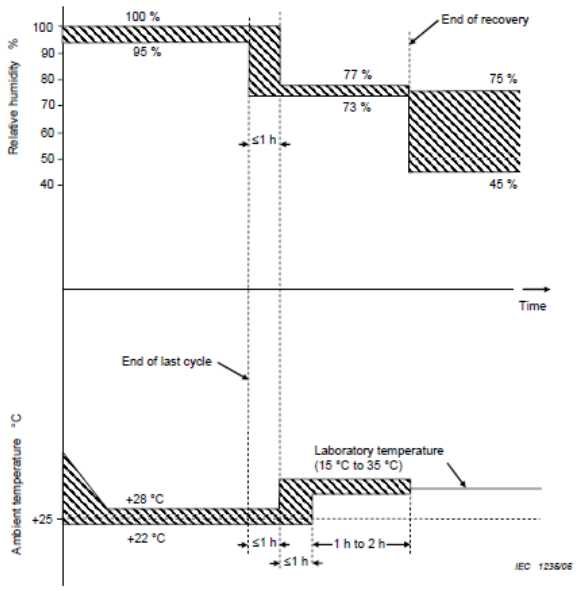 Figure 3 – Test Db – Recovery at controlled conditions		P
	In the former case, the change over time shall be as short as possible and not more than 10 min.		N/A
	In the latter case, the relative humidity shall be reduced to 75 % RH ± 2 % RH in not more than 1 h. The temperature shall then be adjusted to laboratory temperature within ±1 K in not more than one further hour. For large specimens, the relevant specification may allow longer change over times.		P
	The recovery time of 1 h to 2 h is counted from the moment when the prescribed recovery conditions have been obtained.		P
	Specimens having a large thermal time constant may be submitted to recovery for a period sufficient to attain temperature stability (see Clause 4 of 60068-1).		N/A
	The relevant specification shall state whether any special precautions shall be taken regarding the removal of surface moisture.		P
10	Final measurements		P
	The specimens shall be visually inspected, and functionally tested as required by the relevant specification.		P
	The measurements shall be commenced immediately after the recovery period and the parameters most sensitive to changes of relative		P

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Clause	Requirement – Test	Measuring result – Remark	Verdict
	humidity shall be measured first. Unless otherwise specified, the measurement of these parameters shall be completed within 30 min.		
11	Information to be given in the relevant specification		P
	When this test is included in the relevant specification, the following details shall be given as far as they are applicable		P

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6	**TABLE: Visual inspection (Initial)**		P
Initial examination			
Test Date (MM/DD/YYYY) start/end……..:		09/25/2021~09/25/2021	—
Sample #	Nature and position of initial findings – comments or attach photos		Verdict
1#			Normal
Supplementary information:			

6	**TABLE: Fuctional test (Initial)**			P
Test Date (MM/DD/YYYY) start/end……..:		09/25/2021~09/25/2021		—
Sample #	Inverter functioning			Verdict
	Start up	Operation	Shut down	
1#	Yes	Yes	Yes	P
Supplementary information:				

6	**Table: Dielectric withstand test (initial)**			P
Test Date (MM/DD/YYYY) start/end……..:		09/25/2021~09/25/2021		—
Sample #	Voltage applied between	Voltage applied (V)	Dielectric breakdown, Yes (description) or No	Verdict
1#	PV, AC and PE	2828 Vd.c.	No	P
1#	PV, AC and Communication port	5656 Vd.c.	No	P
Supplementary information:				

7	**TABLE: Damp Heat Test**		P
Test Date (MM/DD/YYYY) start/end .....:		09/25/2021~09/27/2021	—
Type of test …..……..……..:		[X] *Variant 2*	—
Temperature change gradual……...:		1 K/min	—
Specimen cooling type .....:		Fan	
Air circulation .....…..……..…..:		--	—
Test condition Temperature …..……..…..:		55°C	—
Test condition Humidity …....……..:		95%	—
Test condition duration. …....……..:		24 h	—
No. of Cycles ……..:		2	—
Temperature curve setting:			

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10 Final measurement

Visual inspection after Damp heat Test		P
Test Date (MM/DD/YYYY) start/end……..:	09/27/2021~09/27/2021	—
Sample #	Nature and position of initial findings – comments or attach photos	Verdict
1#	The specimen [did not] exhibit broken, cracked, bent, misaligned or torn external surface. The specimen [did not] exhibit visible corrosion of output connections. The specimen [did not] exhibit cracked or damaged wire or cable. The specimen [did not] exhibit exposed live electrical parts. The specimen [did not] exhibit any other conditions which may affect functioning, performance or safety. The specimen [did not] exhibit any shorting of live terminals / live parts or cables. The specimen [did not] exhibit any sparking of live terminals / live parts or cables. The specimen [did not] exhibit any smoking. The specimen [did not] stopped functioning.	P
Table: Dielectric withstand test after Damp heat Test		P
Test Date (MM/DD/YYYY) start/end……..:	09/27/2021~09/27/2021	—

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Sample #	Voltage applied between	Voltage applied (V)	Dielectric breakdown, Yes (description) or No	Verdict
1#	PV, AC and PE	2828 Vd.c.	No	P
1#	PV, AC and Communication port	5656 Vd.c.	No	P

TABLE: Functioning Test for PV grid-interactive inverter after Damp heat Test				P
Test Date (MM/DD/YYYY) start/end .....:	09/27/2021~09/27/2021			—
Sample #	Inverter functioning			Verdict
	Start up	Operation	Shut down	
1#	Yes	Yes	Yes	P
Supplementary information:				

-- End of Test Report --

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