

Test Report 2013

Report No : Solic Model AF2.1

<b>Test Report</b> <b>IEC/EN 60335-1</b> <b>Household and similar electrical appliances-Safety-</b> <b>Part 1: General Requirements</b>	
Report No :	
Tested by :	
Approved by :	
Date :	
Test Specification	
Standard :	IEC 60335 - 1:2010 9 (Fifth Edition) EN 60335 - 1 : 2012
Test Item :	
Trade Mark :	Solic 200
Manufacturer :	Earthwise Products Ltd
Model / Type ref :	Model AF 2.1
Ratings :	205 – 260, 50 Hz, 3Kw
Testing Location :	In House

<b>List of Attachments</b>	
No attachments	
<b>Summary of Testing :</b>	
The Solic 200 unit was assessed for basic insulation between the mains circuitry and protective earth/accessible earthed metalwork.	
<b>Tests performed ( name of test and test clause)</b>	
General conditions for tests :	5
Classification :	6
Markings and Instructions :	7
Protection against access to live parts :	8
Power input and current :	10
Heating :	11
Leakage current and electric strength at operating temperature :	13
Moisture resistance :	15
Leakage current and electric strength :	16
Overload protection and associated circuits :	17
Endurance :	18
Abnormal operation :	19
Stability and mechanical hazards :	20
Mechanical strength :	21
Construction :	22
Internal wiring :	23
Components :	24
Supply connections and external flexible cords :	25
Terminals for external conductors :	26
Provision for earthing :	27
Screws and connections :	28
Clearances, creepage distances and solid insulation :	29
Resistance to heat and fire :	30
Resistance to rusting :	31
Radiation, toxicity and similar hazards :	32

<b>Summary of compliance with National Differences</b>
<b>List of countries addressed:</b> Australia, Belgium, Denmark, France, Germany, Iceland, Ireland, Italy, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.
<b>This product fulfils the requirements of IEC /EN 60335 – 1 &amp; AS/NZS 60335 – 1</b>

**Marking plate used on the Solic 200**

**Test Item particulars**

Classification of installation and use : Class 1

Supply connection : Single - phase

**Possible test case verdicts :**

Test case does not apply to the test object : N/A

Test item does meet the requirement : Pass

Test item does not meet the requirement : Fail

**General product information :**

The Solic 200 is an automatic power controller for heaters. It accurately tracks all available surplus power generated by photovoltaic, wind or water powered generators, ensuring all of the green energy produced is fully utilised.

**Note :** The maximum power/current is dependent on the rating of the external load, which is up to a maximum of 3 Kw. The recorded measurements in the appended table are for a unit with no load attached.

<b>Only relevant clauses of IEC/EN 60335-1 shown</b>
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Clause	Requirement / Test	Remark	Verdict
5	<b>General Conditions for Tests</b>		Pass
	Test performed according to cl 5, eg nature of supply, sequence of testing etc.		Pass
6	Classification.		Pass
6.1	Protection against electric shock :	Class 1	Pass
6.2	Protection against harmful ingress of water.	IPXO	N/A
7	<b>Marking and Instructions</b>		Pass
7.1	Rated voltage or voltage range (V)	206 – 260 V	Pass
	Symbol for nature of supply.		N/A
	Rated frequency (Hz).	50Hz	Pass
	Rated power input.	3Kw	Pass
	Rated current.		N/A
	Manufacturer's or responsible vendor's name, trademark or identification mark.	Earthwise Products Ltd	Pass
	Model or type reference.	AF 2.1	Pass
	IP number, other than IPXO.	IP 51	Pass
7.3	Range of rated values marked with the lower and upper limits separated by a hyphen.		Pass
7.6	Correct symbols used.		Pass
	Units of physical quantities and their symbols according to international standardized system.		Pass
7.8	Except for type Z attachment, terminals for connection to the supply mains indicated as follows:		Pass
	Marking of terminals exclusively for the neutral conductor (N).		Pass
	Marking of protective earthing terminals (symbol IEC 60417 – 5019).		Pass
	Marking not placed on removable parts.		Pass
7.12	Sufficient for safe use provided.		Pass

Clause	Requirement / Test	Remark	Verdict
7.12	The appliance is not to be used by persons ( including children) with reduced physical sesory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction.		Pass
	Children being supervised not to play with the appliance.		Pass
7.12.1	Sufficient details for installation supplied.		Pass
	Stationary appliances not fitted with means for disconnection from the supply mains having a contact separation in all poles that provide full disconnection.		Pass
7.12.7	Instructions for fixed appliances stating how the appliance is to be fixed.		Pass
7.13	Instructions and other texts in an official language	English	Pass
7.14	Marking clearly legible and durable		Pass
7.15	Marking on a main part		Pass
	For fixed appliances, name, trademark or identification mark and model or type reference visible after installation.		Pass
8	<b>Protection against Access to Live Parts</b>		Pass
8.1	Adequate protection against accidental contact with live parts		Pass
8.1.1	Requirement applies for all positions, detachable parts removed		Pass
	Use of test probe B of IEC 61032, with a force not exceeding 1 N, no contact with live parts		Pass
	Use of test probe B of IEC 61032 through openings, with a force of 20 N, no contact with live parts.		Pass

Clause	Requirement / Test	Remark	Verdict
10	<b>Power Input and Current</b>		Pass
10.1	Power input at normal operating temperature, rated voltage and normal operation not deviating from rated power input by more than shown in Table 1		Pass
11	<b>Heating</b>		Pass
11.1	No excessive temperatures in normal use		Pass
11.2	The appliance is held, placed or fixed in position as described	Wall mounted	Pass
11.3	Temperature rises, other than windings, determined by thermocouples		Pass
11.4	Heating appliances operated under normal operation at 1.15 times rated power	3.45 Kw	Pass
11.7	Operation duration corresponding to the most unfavourable conditions of normal use		Pass
11.8	Temperature rises monitored continuously and not exceeding the values in Table 3		Pass
	Protective devices did not operate, except	See 24.1.4	Pass
13	<b>Leakage Current and Electrical Strength at Operating Temperature</b>		Pass
13.1	Leakage current not excessive and electric strength adequate		Pass
	Heating appliances operated at 1.15 times the rated power input (W)	3.45 Kw	Pass
	Leakage current measurements	See appended table	Pass
	Electric strength tests according to Table 4	See appended table	Pass
	Leakage current not excessive and electric strength adequate		Pass
15	<b>Moisture Resistance</b>		Pass
15.1	Enclosure provides the degree of moisture protection according to the classification of the appliance		Pass

Clause	Requirement / Test	Remark	Verdict
15.3	Appliances proof against humid conditions		Pass
	Checked by test cabinet: Damp heat steady state in IEC 60068-2-78		Pass
	Humidity test for 48 hours in a humidity cabinet		Pass
	The appliance withstands the tests of Clause 16		Pass
16	<b>Leakage Current and Electrical Strength</b>		Pass
16.1	Leakage current not excessive and electric strength adequate		Pass
	Tests carried out at room temperature and not connected to the supply		Pass
16.2	Single phase appliances test voltage 1.06 times rated voltage (V)	254V	Pass
	Leakage current measurements	See appended table	Pass
16.3	Electric strength tests according to Table 7	See appended table	Pass
	No breakdown during tests		Pass
19	<b>Abnormal Operation</b>		Pass
19.1	The risk of fire, mechanical damage or electric shock under abnormal or careless operation obviated		Pass
	Electronic circuits so designed and applied that a fault will not render the appliance unsafe	See appended table	Pass
	Appliances incorporating electronic circuits subjected to the tests of 19.11 and 19.12, as applicable		Pass

Clause	Requirement / Test	Remark	Verdict
19.11	Electronic circuits, compliance checked by evaluation of the fault conditions, specified in 19.12 for all circuits or parts of circuits, unless		Pass
	They comply with the conditions specified in 19.11.1		Pass
	If the safety of the appliance under any of the fault conditions depends on the operation of a miniature fuse-link complying with IEC 60127, the test of 19.12 is carried out		Pass
	During and after each test the following is checked		Pass
	The appliance complies with the conditions specified in 19.13		Pass
19.11.1	Before applying the fault conditions a) to f) in 19.11.2, it is checked if circuits or parts of the circuit meet both of the following conditions :		Pass
19.11.2	Fault conditions applied one at a time, the appliance operated under conditions specified in cl11, but supplied at rated voltage, the duration of the tests as specified		Pass
	Short circuit of capacitors, unless		Pass
	Short circuit of any two terminals of an electronic component, other than integrated circuits		Pass

Clause	Requirement / Test	Remark	Verdict
19.11.4.8	The appliance is supplied at rated voltage and operated under normal operation. After 60 s the power supply is reduced to a level such that the appliance ceases to respond or parts controlled by the programmable component cease to operate		Pass
19.13	During the test the appliance does not emit flames, molten metal, poisonous or ignitable gas in hazardous amounts		Pass
	Temperature rises not exceeding the values shown in Table 9	See appended table	Pass
	Compliance with clause 8 not impaired		Pass
	If the appliance can still be operated it complies with 20.2		Pass
	Insulation, other than class 3 appliance, withstand the electric strength test of 16.3, the test voltage specified in Table 7		Pass
	Basic insulation (V)	1250V rms	Pass
	After operation or interruption of a control, clearances and creepage distances across the functional insulation withstand the electric strength test of 16.3, the test voltage being twice the working voltage		Pass

Clause	Requirement / Test	Remark	Verdict
	The appliance does not undergo a dangerous malfunction, and		Pass
	No failure of protective electronic circuits, if the appliance is still operable		Pass
20	<b>Stability and Mechanical Hazards</b>		Pass
20.1	Appliances have adequate stability	Fixed equipment	Pass
20.2	Moving parts adequately arranged or enclosed as to provide protection against personal injury		Pass
21	<b>Mechanical Strength</b>		Pass
	Appliance has adequate mechanical strength and is constructed as to withstand rough handling		Pass
	Checked by applying 3 blows to every point of the enclosure, likely to be weak, in accordance with test Ehb of IEC 60068-2-75, spring hammer test, with an impact energy of 0.5 J		Pass
	The appliance shows no damage impairing compliance with this standard, and		Pass
	Compliance with 8.1,15.1 and clause 29 not impaired		Pass
22	<b>Construction</b>		Pass
22.1	Appliance marked with the first numeral of the IP system, relevant requirements of IEC 60529 are fulfilled		Pass

Clause	Requirement / Test	Remark	Verdict
22.2	Stationary appliance: means to ensure all-pole disconnection from the supply being provided		Pass
	A statement in the instruction sheet that a disconnection incorporated in the fixed wiring is to be provided		
22.11	Reliable fixing of non- detachable parts that provide the necessary degree of protection against electric shock,moisture or contact with moving parts		Pass
	Test as described		Pass
22.14	No ragged or sharp edges creating a hazard for the user in normal use, or during user maintenance		Pass
22.18	Current- carrying parts and other metal parts resistant to corrosion under normal conditions of use		Pass
22.31	Neither clearances nor creepage distances between live parts and accessible parts reduced below values for supplementary insulation if wires,screws etc become loose		Pass
22.32	Supplementary and reinforced insulation constructed or protected against pollution so that clearances or creepage distances are not reduced below the values in clause 29		Pass

<b>Clause</b>	<b>Requirement / Test</b>	<b>Remark</b>	<b>Verdict</b>
22.41	No components, other than lamps, containing mercury		Pass
23	<b>Internal Wiring</b>		Pass
23.1	Wireways smooth and free from sharp edges		Pass
	Wires protected against contact with burrs, cooling fins etc		Pass
	Wire holes in metal well rounded or provided with bushings		Pass
	Wires effectively prevented from coming into contact with moving parts		Pass
23.7	The colour combination green/yellow only used for earthing conductors		Pass
24	<b>Components</b>		Pass
24.1	Components comply with safety requirements in relevant IEC standards		Pass
	List of components	See appended table	Pass
24.1.1	Capacitors likely to be permanently subjected to the supply voltage and used for radio interference suppression or for voltage dividing, complying with IEC 60384-14		Pass
	If capacitors have to be tested, they are tested according to Annex F		Pass
24.2	Appliances not fitted with devices causing the protection device in the fixed wiring to operate in the event of a fault in the appliance		Pass

Clause	Requirement / Test	Remark	Verdict
25	<b>Supply connection and external flexible cords</b>		Pass
25.3	Appliance intended to be permanently connected to fixed wiring provided with one of the following means for connection to the supply mains		Pass
	A set of terminals for the connection of cables of fixed wiring, cross sectional areas specified in 26.6, and the appliance allows the connection of the supply conductors after the appliance has been fixed to its support		Pass
	A set of terminals and cable entries, knock-outs or glands, allowing connection of appropriate types of cable or conduit, and the appliance allows the connection of the supply conductors after the appliance has been fixed to its support		Pass
	For a fixed appliance, constructed so that parts can be removed to facilitate easy installation, this requirement is met if it is possible to connect the fixed wiring without difficulty after a part of the appliance has been fixed to its support		Pass
26	<b>Terminals for external conductors</b>		Pass
26.8	Terminal for the connection of fixed wiring, including the earthing terminal, located close to each other		Pass

Clause	Requirement / Test	Remark	Verdict
26.9	Terminals of the pillar type constructed and located as specified		Pass
27	<b>Provision for earthing</b>		Pass
27.1	Accessible metal parts of Class 01 and 1 appliances permanently and reliably connected to an earthing terminal or earthing contact of the appliance inlet		Pass
	Earthing terminals and earthing contacts not connected to the neutral terminal		Pass
27.2	Clamping means of earthing terminals adequately secured against accidental loosening		Pass
27.4	No Risk of corrosion resulting from contact between parts of the earthing terminal and copper of the earthing conductor or other metal		Pass
	Parts providing earthing continuity, other than parts of a metal frame or enclosure, have adequate resistance to corrosion		Pass
27.5	Low resistance of connection between earthing terminal and earthed metal parts		Pass
28	<b>Screws and connections</b>		Pass
28.1	Fixings, electrical connections and connections providing earthing continuity withstands mechanical stresses		Pass

Clause	Requirement / Test	Remark	Verdict
	Screws not of soft metal liable to creep, such as zinc or aluminium		Pass
	Screws used for electrical connections or connections providing earthing continuity screwed into metal		Pass
28.2	Electrical connections and connections providing earthing continuity constructed so that contact pressure is not transmitted through non-ceramic insulating material liable to shrink or distort , unless there is resiliency in the metallic parts to compensate for shrinkage or distortion of the insulating material		Pass
29	<b>Clearances, creepage distances and solid insulation</b>		Pass
	Clearances, creepage distances and solid insulation withstand electrical stress		Pass
29.1	Clearances not less than the values specified in table 16, taking into account the rated impulse voltage for the overvoltage categories of Table 15, unless	See appended table	Pass
29.1.1	Clearances of basic insulation withstand the overvoltages, taking into account the rated impulse voltage		Pass
	The values of Table 16 or the impulse voltage test of clause 14 are applicable	See appended table	Pass

Clause	Requirement / Test	Remark	Verdict
29.1.3	Clearances of reinforced insulation not less than those specified for basic insulation in Table 16, but using the next higher step or rated impulse voltage	See appended table	Pass
29.1.4	Clearances for functional insulation are the largest values determined from Table 16 based on the rated impulse voltage		Pass
29.2	Creepage distances not less than those appropriate for working voltage, taking into account the material group and the pollution degree	See appended table	Pass
	Pollution degree 2 applies, unless		Pass
29.2.1	Creepage distances of basic insulation not less than specified in Table 17		Pass
29.2.4	Creepage distances of functional insulation not less than specified in Table 18	See appended table	Pass
30	<b>Resistance to heat and fire</b>		Pass
	For base materials of printed circuit boards, 30.2.4 applies		Pass
30.2.4	Base material of printed circuit boards subjected to needle-flame test of Annex E	Test not required	Pass
	Test not applicable to condition as specified	See appended table	Pass

Clause	Requirement / Test	Remark	Verdict
31	<b>Resistance to rusting</b>		Pass
	Relevant ferrous parts adequately protected against rusting	Zinc plated screws	Pass
32	<b>Radiation, toxicity and similar hazards</b>		Pass
	Appliance does not emit harmful radiation or present a toxic or similar hazard due to their operation in normal use		Pass
A	<b>Routine tests</b>		Pass
	Description of routine tests carried out by manufacturer	See attached Safe System of Work	Pass
K	<b>Annex K (Normative) Overvoltage categories</b>		Pass
	The information on overvoltage categories is extracted from IEC60664-1		Pass
	Overvoltage category is a numeral defining a transient overvoltage condition		Pass
L	<b>Annex L (Informative) Guidance for the measurement of clearances and creepage distances</b>		Pass
	Sequence for the determination of clearances and creepage distances		
M	<b>Annex M (Normative) Pollution Degree</b>		Pass
	The information on pollution degree is extracted from IEC 60664-1		Pass
	Pollution		Pass
	The microenvironment determines the effect of pollution on the insulation, taking into account the microenvironment		Pass

Clause	Requirement / Test	Remark	Verdict
	Degrees of pollution in the microenvironment		Pass
	For evaluating creepage distances, the following degrees of pollution in the microenvironment are established		Pass
	Pollution degree 2: only non-conductive pollution occurs, except that occasionally a temporary conductivity caused by condensation is to be expected		Pass
O	<b>Annex O (Informative) Selection and sequence of the tests of Clause 30</b>		Pass
	Description of tests for determination of resistance to heat and fire		Pass
Q	<b>Annex Q (Informative) Sequence of tests for the evaluation of electronic circuits</b>		Pass
	Description of tests for appliances incorporating electronic circuits		Pass

Clause	Requirement - Test	Result			Verdict
<b>10.1</b>	<b>Table 1: Power Input deviation</b>				Pass
<b>Input Deviation of / at :</b>	<b>P rated (W)</b>	<b>P measured (W)</b>	<b><math>\Delta P</math></b>	<b>Required <math>\Delta P</math></b>	<b>Remark</b>
220V 50Hz	3Kw	4.7	-	+5% / -10%	See below
240V	3Kw	5.9	-	+5% / -10%	See below
Supplementary Information: Power drawn from the unit off load. Total power is dependent on the external load up to a maximum of 3 Kw.					

Clause	Requirement - Test	Result		Verdict
<b>11.8</b>	<b>Table 3: Heating test, thermocouple measurements</b>			Pass
	Test Voltage (V)			
	Ambient ( $^{\circ}\text{C}$ )			
	<b>Thermocouple Locations</b>	<b>Max Temperature rise measured, <math>\Delta T</math> (K)</b>	<b>Max Temperature rise limit <math>\Delta T</math> (K)</b>	
	Lower case, below Triac			
Supplementary Information :				

Clause	Requirement - Test	Result		Verdict
<b>13.2</b>	<b>Table 4 : Leakage current</b>			Pass
	Heating appliances : 1.15 x rated input	254V		
	<b>Leakage current between</b>	1 (mA)	Max allowed 1 (1mA)	
	Live and earth	0.83	2.4	
	Neutral and earth	0.80	2.4	
Supplementary Information :				

Clause	Requirement - Test	Result	Verdict
<b>13.3</b>	<b>Electrical strength</b>		Pass
	<b>Test voltage applied between :</b>	<b>Test potential applied (V)</b>	<b>Breakdown/flashover (Yes/No)</b>
	Live /Neutral and earth	1000	No
Supplementary Information :			

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Clause	Requirement - Test	Result	Verdict
<b>16.2</b>	<b>Table 5: Leakage current</b>		Pass
	Single phase appliances :	254	
	Three phase appliances 1.06 x rated voltage divided by $\sqrt{3}$	-	
<b>Leakage current between ;</b>		1 (mA)	Max allowed 1 (mA)
Live	Earth	1.16	2.4
Neutral	Earth	1.15	2.4
Supplementary Information :			

Clause	Requirement - Test	Result	Verdict
<b>16.3</b>	<b>Table6: Electric strength</b>		Pass
Test voltage applied between :		Test potential applied (V)	Breakdown/flashover (Yes/No)
Live/Neutral and earth		1250	No
Supplementary Information :			

Clause	Requirement - Test	Result	Verdict
<b>17</b>	<b>Table7:Overload protection</b>		Pass
<b>Thermocouple Locations</b>		<b>Max Temperature rise measured, <math>\Delta T</math> (K)</b>	<b>Max Temperature rise limit <math>\Delta T</math> (K)</b>
Outer casing 1		43.2	100
Outer casing 2		32.2	95
Supplementary Information :			

Clause	Requirement - Test	Result	Verdict
<b>19</b>	<b>Table8: Abnormal operation conditions</b>		Pass
Operational characteristics		Yes / No	Operational conditions
Are there electronic circuits to control the appliance operation?		Yes	Manual or timed operation
Are there "off "or "stand-by" position?		No	
The unintended operation of the appliance results in dangerous malfunction?		No	

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Sub-clause	Operating conditions	Test result description	PEC description	Result							
19.11.2	Triac	Max temperature of 45.6 °C on lower case	N/A	Pass							
Supplementary Information :											
<b>29.1</b>	<b>Table 9 : Clearances</b>			Pass							
	Overvoltage category		2								
Type of insulation :											
Rated impulse voltage (V)	Min. cl (mm)	Basic (mm)	Supplementary (mm)	Reinforced (mm)	Functional (mm)	Verdict / Remark					
2500 V	1.5	2.5				Primary to earth					
2500 V	1.5	2.5				Live & Neutral					
Supplementary Information :											
Clause	Requirement - Test			Result	Verdict						
<b>29.2</b>	<b>Table10 : Creepage distances,basic,supplementary and reinforced insulation</b>			Pass							
Working voltage (V)	Creepage distance in mm Pollution degree										
	<b>1</b>	<b>2</b>		<b>3</b>			Type of insulation				
		Material group			Material group						
		1	2	3a/3b	1	2	3a/3b	B	S	R	Result
230				2.65				1			Pass
230				3.71				2			Pass
Supplementary Information :											
1, Measured from mains circuitry to earth across PCB											
2, Measured between Live and Neutral on PCB before fuse											