

Confidential Report

Client: Energy Remedies Ltd. 6 Brookfields Shannon Co .Clare Ireland. <u>Attention:</u> Vincent Fox	Test of: Solo 3 & 6 To: Essential Safety Requirements of the Low Voltage Directive (2006/95/EC)
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Executive Summary

The following tests were performed to assess compliance with the essential safety requirements of the Low Voltage Directive.

Physical inspection
Marking and Instructions
Mechanical hazards
Input test
Clearance and creepage distances
Dielectric strength test
Earth continuity test
Temperature rise test
Accessible current test
Earth leakage current test
Residual Voltage
Single fault conditions

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Revision history

Rev	Reason for change	Date
1	First issue	10/06/2011

Energy Remedies Solo 3 & 6

to: Essential requirements of Council Directive 2006/95/EC

1. Equipment Under test (E.U.T.)**1.1 Identification of E.U.T.**

Brand Name:	Solo 3 \ Solo 6
Description	Room heater
Serial Number	62311005728
Country of Manufacture	Ireland

The equipment was a heat exchanger with fan assistance.

The solo 6 equipment assessed had dimensions were 950 x 400 x 110mm having a mass of approximately 13.0Kg

2. Test Specification, Methods and Procedures**2.1 Physical inspection**

The EUT was a heat The EUT used a heat exchanger of cooper piping bonded to aluminum fins. Airflow through the exchanger was provided by two variable speed fans. .

The EUT was contained in a single metal enclosure. The mains power was provided by a fixed mains cable. The live and neutral conductors were connected to a transformer which provided 9Vac for the control circuits and various drive voltages for the fans. The equipment was fitted with two pcbs to provide control and user interface functions...

A Protective earth for the metal chassis was connected via screw fasters, with lock washers.

Access to hazardous live parts was checked with a jointed test finger. No access was possible.

2.1.1 Flammability

The material data for the equipment was assessed and the flammability information for safety critical components was found to meet the requirements.

The details of the flammability ratings of critical components were as follows

Enclosure was metal through out
PCB material was UL 94V-0
Mains switch was UL 94V-2
PCB inter board connectors were UL 94V-0
Mains terminal blocks UL 94V-2
PSU connectors were UL 94V-0
Plastic enclosure was UL 94V-2

2.2 Markings and Instructions

Location	Marking
Rating label	Serial No. 62311005728 Voltage: 230V, 50Hz Max current 100mA
User interface markings	See Appendix 3
Installation warning labels	See Appendix 3
Earth terminal symbol	See Appendix 3

The external markings passed the durability test using hexane 85 and water

The documentation clearly specified the intended use of the equipment and gave full instructions for the use of the equipment. All required technical parameters were specified and the equipment's environmental operating conditions were listed.

2.3 Mechanical Hazards

There were no sharp edges which could break the skin.
The EUT passed the rigidity test of 30N static pressure.

The equipment was subject to blows from a 0.5J impact hammer, applied to areas where safety might be compromised. After the test there were no indications of impairment to the safety of the equipment.

2.4 Input Test

The unit was powered from a 50Hz supply with the following input voltages. The following current and power values were measured when the relevant voltages were applied.

Input Voltage (V)	Input Current (mA)	Input Power (W)
207	335	68
230	324	74
264	303	80

During the test the EUT was set to cool setting to give the maximum electrical power consumption. . The measured maximum power consumption was within specified limits.

2.5 Dielectric Strength Test

Using an electric strength tester, an ac voltage was applied between the mains supply conductors and the accessible metal parts, appliance protective earth and to plastic enclosure of the EUT. The test voltage as shown below was applied for one minute.

There was no breakdown of the insulation.

Location	Voltage	Verdict
Live or neutral to PE	1000Vac (BI)	Pass
Live or neutral to Plastic Enclosure	3000Vac (RI)	Pass
Primary to Secondary winding of mains Transformer	3000Vac (RI)	Pass
Transformer windings to Ferrite Core	1750Vac (BI)	Pass

2.6 Clearance and Creepage distances

The following minimum clearances and creepage distances were measured:

Location	Clearance	Creepage	Verdict
Live or neutral to PE	3.0	3.0	Pass
External access to high voltage	>6.0	>6.0	Pass

The minimum allowed clearance for basic insulation was 1.5 mm

The minimum allowed creepage distance for basic insulation was 2.5 mm For Double or reinforce insulation, twice the distances of basic insulation are required.

2.7 Earth Continuity Test

Using an earth continuity tester, a current of 25A was passed for one minute between the protective earth and the locations shown in the table. The maximum allowable resistance was 100mΩ.

Location	Resistance (mΩ)	Verdict
Metal Enclosure Chassis	30	Pass

2.8 Temperature rise test

For this test the EUT was connected to a supply of 264Vac. During the test the heat exchanger was connected to a boiler to provide a supply of hot water. The temperature of the following parts and locations were monitored until they stabilised. The final temperature measurements recorded are listed below.

Part/Location	Temperature Measured (C°)	Temperature at max ambient (C°)	Temperature limit
Ambient	16	40	
Mains Cable	16.7	40.7	70
Control PCB	17.3	41.3	105
Transformer	30.6	54.6	105
Motor Capacitor	16.2	40.2	70
Internal Wiring	16.3	40.3	70
Drive Voltage Connector	17.7	41.7	
Heating Vent Plastic	55.1	-	**
Wall Behind EUT	30.2	54.2	
Wall Above EUT	23.7	47.7	
** Vent temperature dependant on the water temperature supplied from the boiler.			

Temperature on external surfaces complied with the requirements.

2.9 Accessible current test

The EUT was powered with a 264V, 50Hz source and the accessible current was measured using the accessible current measuring circuit and meter. The current was found to be less than 20 μ A under normal operating conditions and when the protective earth was disconnected. The limit for this measurement for normal conditions was 0.5mA rms and for single fault conditions was 3.5mA rms.

2.10 Earth leakage current test

The earth leakage current was measured for both normal and reverse polarity between accessible metal parts, and the protective earth. The maximum current measured during these tests was 20 μ A.

2.11 Residual Voltage

The residual voltage present on the mains coupler following disconnection was measured. The test was repeated to obtain the worst case voltage.

Location	Duration (Sec)	Voltage (V)	Verdict
Live to Earth	1	<30	Pass

2.12 Single Fault Conditions

Transformer overload:

The mains transformer was fitted with a thermal fuse with a current rating of 2A and a thermal rating was 115°C. This fused provided overload protection for the transformer.

Stalled Fan:

One of the fans was jammed to simulate a fan fault. There was no significant change in the EUT's temperature and no additional hazards were observed.

3. Analysis of Test Results, Conclusions

- 3.1** The safety of the EUT is dependant on the current installation and operation of the equipment and the observance of all the safety information contained in the provided documentation.
- 3.2** The operator of the equipment would need to ensure that maintenance is carried out in accordance with the manufacturer's instructions.
- 3.3** The test results were satisfactory
- 3.4** It is the responsibility of the manufacturer to ensure that adherence with Annex III and Annex IV of Council Directive 2006/95/EC is observed

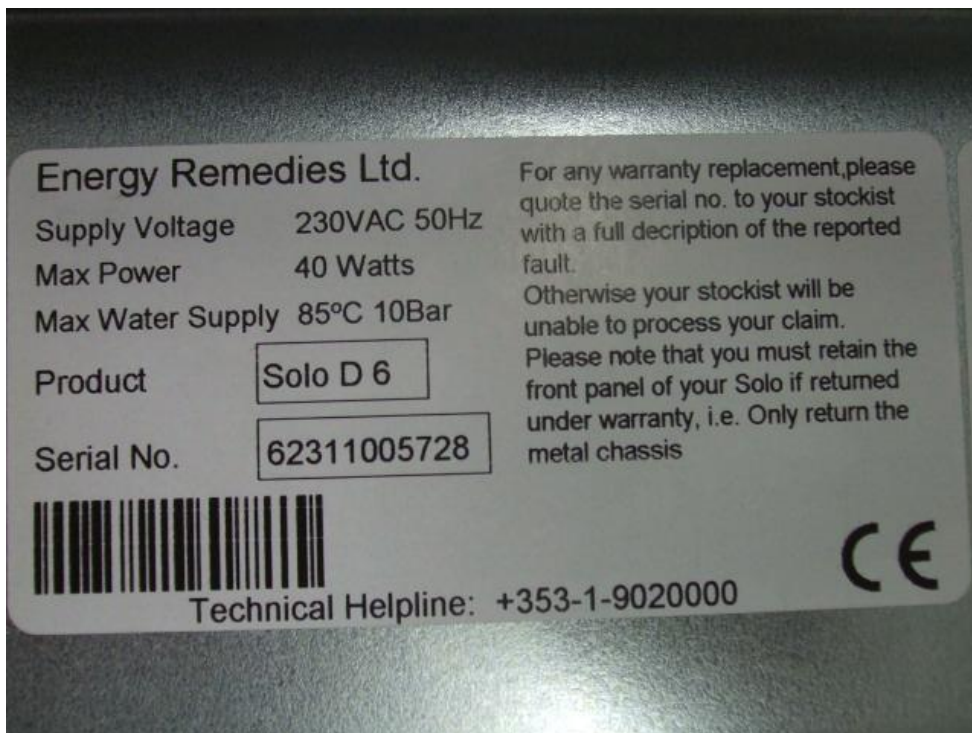
Test Equipment Used

Instrument	Manufacturer	Model	Serial No.
Electric strength tester	Hipotronics	H300 B series	023472-00
Earth continuity tester	Clare	A217	81672/A
Data logger	Agilent	34970A	US37041820
Power Metter	Voltech	PM 3000A	E673
Frequency related leakage current meter per Annex A of EN 61010-1	CEI	E153	-
Digital multimeter	Fluke	45	6790005
Force gauge	Mark-10 Corporation	MG50	41758
Steel sphere	Ergonomics	ITBI5	80
Test finger	Ergonomics	JFP10	186
Test pin	Ergonomics	TAP15	101
Earth leakage tester	Clare	A414	014760B1

Appendix 3: Photography



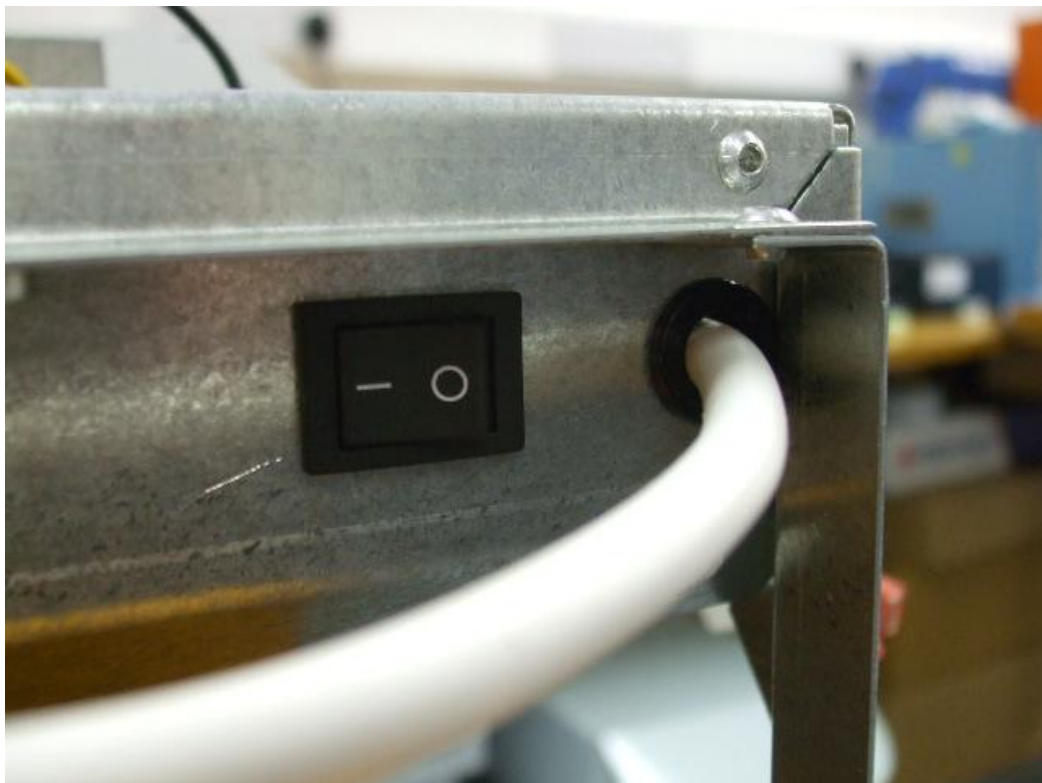
Equipment Under Test



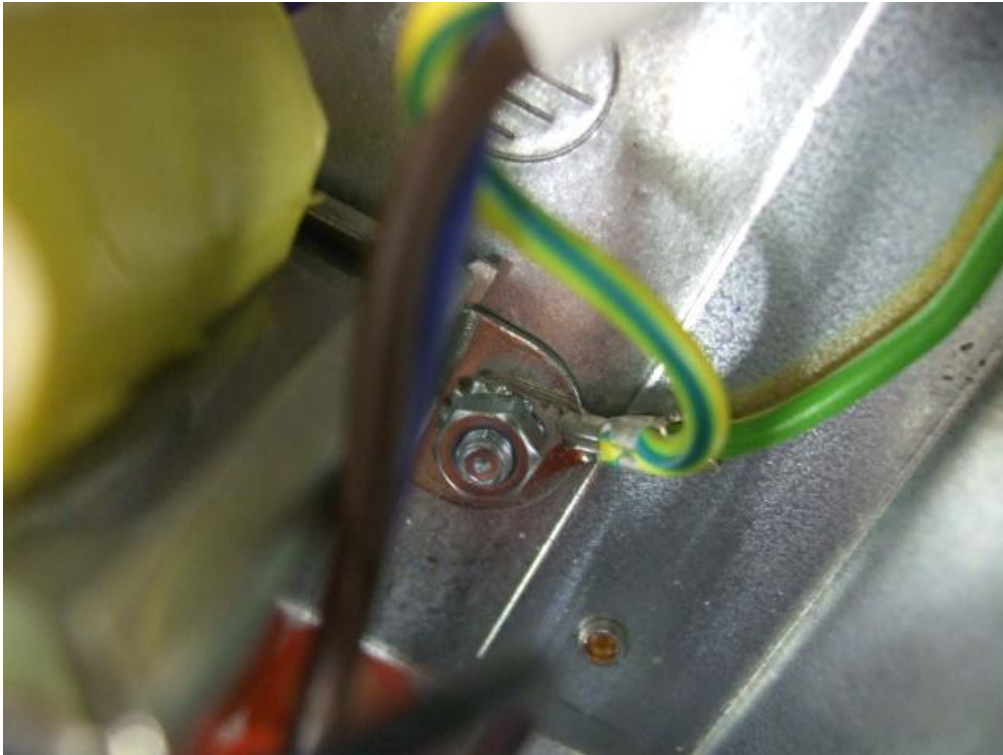
Rating Label



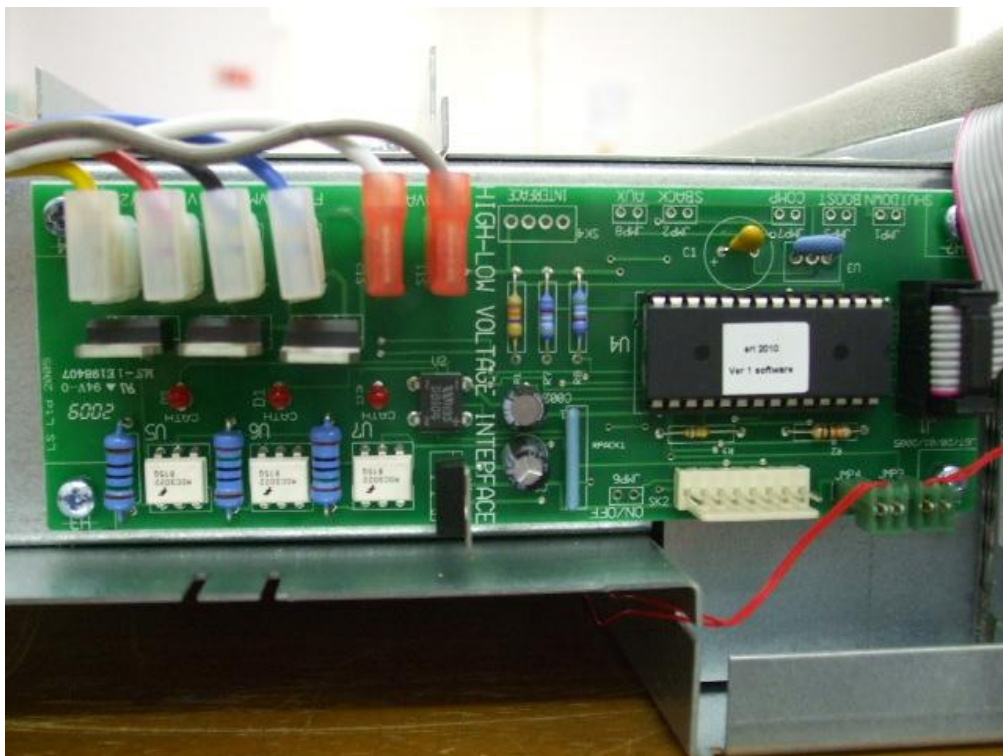
User interface and indicators



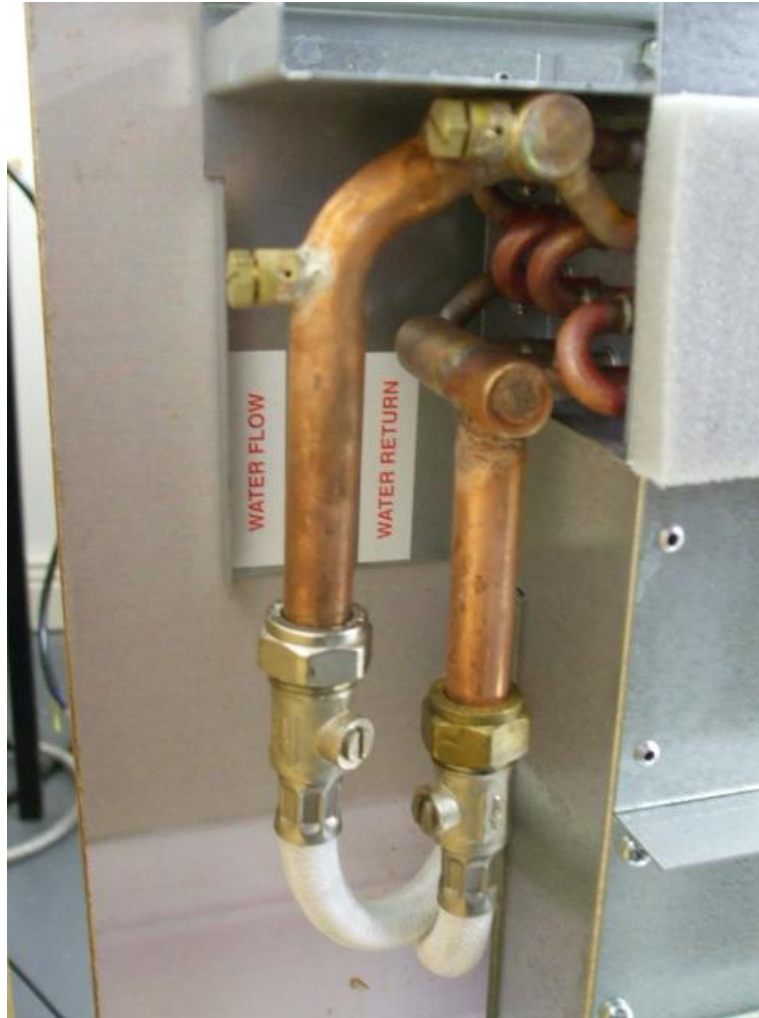
Mains disconnect switch



Earth bond connection and symbol



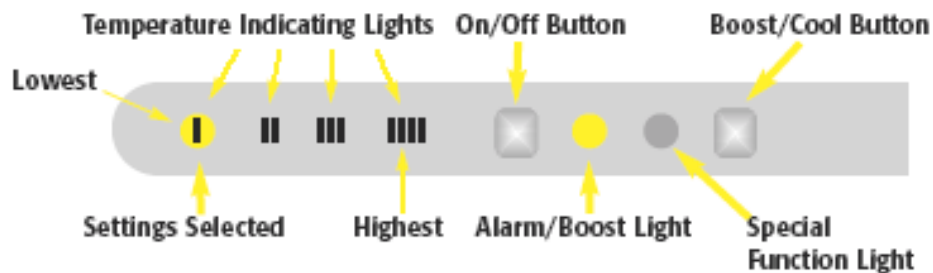
Control printed circuit board



Hot water connections

NEVER COVER OR PLACE ITEMS ON THE UNIT

Service: 087-6901944



Mains on/off Switch

This is located under the RHS edge of Solo and must be in the **on** position for Solo to operate.

Solo on/off Button

When this is pressed for at least 1 sec, if water temperature is greater than 26C and if room temperature is low enough, Solo commences. If water is not warm enough, the alarm/boost light flashes.

Comfort Setting

When this is pressed for at least 1 sec, if water temperature is greater than 26C and if room temperature is low enough, Solo commences. If water is not warm enough, the alarm/boost light flashes.

Boost

Momentary press will result in temperature control being abandoned for 20 minutes and will enable a higher heat output setting not available in comfort settings. The Settings light will extinguish at this point and the Alarm Light will come on full to indicate Boost operation. Note, this also depends on water temperature being high enough to allow heating. System will revert to temperature control after 20 minutes when Alarm/Boost light will go off and settings lights will revert to normal. Anytime during boost period that the boost button is pressed again, boost is halted and the system reverts to normal operation. Pressing again will resume boost etc.

Safety: If the unit is used in a manner not specified by the manufacturer, the safety features of this unit may be impaired.
Electrical: Please ensure that a suitably rated MCB is fitted to the electrical circuit supplying the unit.

Summer Cooling

In summer, it may be desirable to initiate air movement in warm conditions. If the on/off **AND** the Boost buttons are depressed simultaneously for more than 1 second, then the water temperature will be ignored and the airflow will ramp up to boost levels until the Solo is switched off. The Boost light will also come on in this mode.

Temperature Indicating Lights

The setting lights from left to right represent target temperatures.

The selected light will flash slowly while the temperature is being raised. When the temperature reaches setpoint, the light will go on full and Solo will either reduce or stop heating until needed again.

Alarm Light

This will flash if heating is requested and it indicates the water temperature is less than 26C which prevents operation.

Cleaning

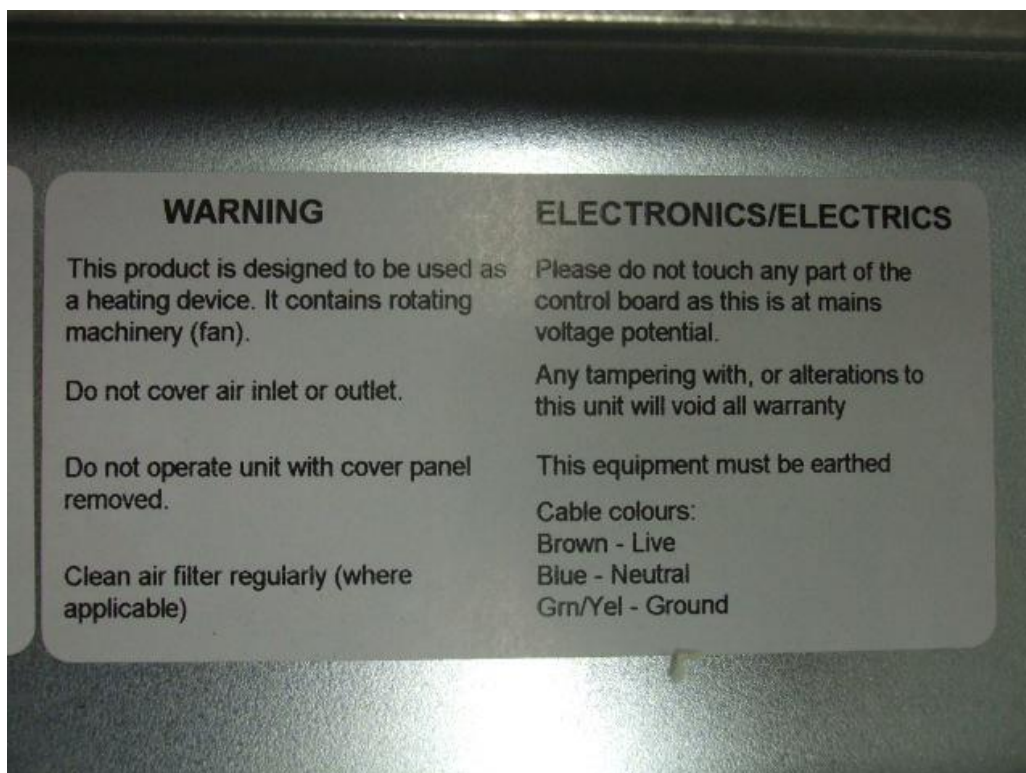
Please only use a moist cloth with no cleaning fluids or abrasives for occasional cleaning of surfaces of Solo.



User operation and warning label



“Do Not Cover” warning label



Product warning label



Electrical installation safety labeld