

TEST REPORT No. **R01.2960**

Έκθεση Ελέγχου α/α

<ul style="list-style-type: none"> • Test Description <i>περιγραφή δοκιμής/ελέγχου</i> 	TESTING OF FIXED STORAGE WATER HEATER
<ul style="list-style-type: none"> • Addressee/Client <i>αποδέκτης/πελάτης</i> • Contract/Ref No <i>σύμβαση α/α</i> • Date Received <i>ημερ. παραλαβής</i> • Date of Issue <i>ημερ. έκδοσης</i> • Test Date(s) <i>ημερ. εκτέλεσης εργασίας</i> • Job No. <i>εργασίας α/α</i> 	<p>ELCORA LTD</p> <p>CNE/CO-2552, 21/04/2010</p> <p>14/05/2010</p> <p>21/06/2010</p> <p>17/05/2010 – 09/06/2010</p> <p>07460</p>
<ul style="list-style-type: none"> • Sample Description <i>περιγραφή δειγμάτων</i> • Manufacturer <i>κατασκευαστής</i> • Address <i>διεύθυνση</i> • Model/Type <i>μοντέλο/Τύπος</i> • Trademark <i>εμπορική επωνυμία</i> • Rating(s) <i>διαβαθμισι</i> • Accepted Model Variations <i>αποδεκτές παραλλαγές προϊόντος</i> 	<p>Fixed Storage Water Heater</p> <p>ELCORA LTD</p> <p>Βιομηχανική Περιοχή Αγίου Αθανασίου Λεμεσός, Κύπρος Κλειστού Κυκλώματος</p> <p>N/A</p> <p>3KW, 160 litres</p> <p>N/A</p>
<ul style="list-style-type: none"> • Test Standard(s) No. and Title <i>αρ. και τίτλος προτύπου δοκιμών</i> • Non-Standard Test method <i>μη συμβατική μέθοδος δοκιμής</i> 	<p>CYS EN 60335-2-21:2003 +A1 2005 + Corrig. 2007 +A2 2008 "Household and similar electrical appliances - Safety - Part 2-21: Particular requirements for storage water heaters", CYS EN 60335-1:2002,+A1:2004 +A2:2006 +A11:2004 +A12:2006 +Corrig. 2007 "Household and similar electrical appliances - Safety Part 1: General requirements", CYS EN 61000-3-3:2008 "Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection"</p> <p>N/A</p>
<ul style="list-style-type: none"> • Tested By <i>Εκτελέσας</i> 	<p>Mr M. Nicolaou, Mr A. Terziev</p>



[Signature]
Head of the Laboratory
Διευθυντής του Εργαστηρίου

The results reported herein refer to the tested samples only. Stable samples will be disposed of after 6 months unless otherwise instructed. This document may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

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Εκθεση Ελέγχου α/α

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Test Items Particulars			
• Serial No:	NA		
• Additional Information:	160 liter; 600KPa; IPX4		
Test Case Verdicts			
• Test case does not apply to the test object:	N/A or N		
• Test object does meet the requirement:	P(ass)		
• Test object does not meet the requirement:	F(ail)		
General Remarks			
This report shall not be reproduced except in full without the written approval of the Testing Laboratory			
The test results presented in this report relate only to the item(s) tested.			
For sample identification see Annex 1			
The calibration of the test equipments is traceable to national standards			
Throughout this report a comma is used as the decimal separator.			
Condition of sample upon receipt:	New in Good Condition		
Copy of rating label / plate:	See Annex 1		
Climatic conditions that prevail during testing:	Maximum	Minimum	Limit
Ambient temperature :	23 °C	20°C	20 ± 5°C
Relative humidity:	30%	60%	20% to 75%
Atmospheric pressure:	97kPa	98kPa	90kPa to 100kPa
Note: Other test conditions as specified by the standards are reported in the relevant test sections			




IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict

5	GENERAL CONDITIONS FOR THE TESTS		
5.2	The tests are carried out on a single appliance that shall withstand all the relevant tests. However, the tests of clauses 20, 22 (except 22.11 and 22.18) to 26, 28, 30 and 31 may be carried out on separate appliances. The test of 22.3 is carried out on a new appliance.	Single appliance sample was used	P
5.3	The tests are carried out in the order of the clauses. However, the test of 22.11 on the appliance at room temperature is carried out before the tests of clause 8. The tests of clause 14 and 21.2 and 22.4 are carried out after the tests of clause 29. of 19.14 is carried out before the tests of 19.11. When the tests are carried out on a single appliance, the tests of 22.102, 22.103, 22.112 and 24.102 are carried out before the tests of Clause 19. (IEC 60335-2-21)		P

6	CLASSIFICATION		
6.1	Protection against electric shock shall be class I, class II or class III.	Class I	P
	Water heaters shall be class I, II or III	Class I	P
6.2	Appliances shall have the appropriate degree of protection against harmful ingress of water.		N
	Water heaters for installation outdoors shall be at least IPX4.	IPX4	P
	Other water heaters shall be at least IPX1.		N

7	MARKING AND INSTRUCTIONS		
7.1	Appliances shall be marked with the		
	– rated voltage or rated voltage range in volts;	220-240V	P
	– symbol for nature of supply, unless the rated frequency is marked;	~ 50Hz	P
	– rated power input in watts or rated current in amperes;	3 kW	P
	– name, trade mark or identification mark of the manufacturer or responsible vendor;	ELCORA Ltd	P
	– model or type reference;	Ανοικτού Τύπου-Κλειστού Κυκλώματος	
	– symbol 5172 of IEC 60417		

IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
7.1	– IP number according to degree of protection against ingress of water	IPX4	P
	The marking of rated voltage or rated voltage range, for appliances intended to be connected to the supply mains, shall cover: – 230 V for single-phase appliances; – 400 V for multi-phase appliances.	220-240V	P
	Appliances, other than cistern-type water heaters, shall be marked with the rated pressure in pascals.	6 bar - 0,6 MPa	P
	Appliances shall be marked with the rated capacity in litres.	160Lt	P
	Closed water heaters shall be marked with a statement that a pressure-relief device is to be fitted in the installation, unless it is incorporated in the appliance.	marked	P
	Closed water heaters having a rated pressure less than 0,6 MPa and low-pressure water heater shall be marked with a statement that a pressure reducing valve is to be fitted in the installation.		N
	Statement that a pressure control valve and expansion control valve (or combined) be fitted in the installation, unless the water supply pressure cannot exceed the rated pressure.		P
	Open-outlet water heaters shall be marked, close to the outlet connection or on a tag attached to the appliance, with the substance of the following: WARNING: This outlet acts as a vent and must only be connected to a fitting recommended by the manufacturer. It must not be connected to a tap.		N
7.2	Stationary appliances for multiple supply shall be marked with the substance of the following: Warning: Before obtaining access to terminals, all supply circuits must be disconnected. This warning shall be placed in the vicinity of the terminal cover.		N
7.3	Appliances having a range of rated values and which can be operated without adjustment throughout the range shall be marked with the lower and upper limits of the range separated by a hyphen.		N
	Appliances having different rated values and which have to be adjusted for use at a particular value by the user or installer shall be marked with the different values separated by an oblique stroke.		N

IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
7.4	If the appliance can be adjusted for different rated voltages, the voltage to which the appliance is adjusted shall be clearly discernible.		N
7.5	For appliances marked with more than one rated voltage or with one or more rated voltage ranges, the rated power input or rated current for each of these voltages or ranges shall be marked.		N
	However, if the difference between the limits of a rated voltage range does not exceed 10 % of the arithmetic mean value of the range, the marking for rated power input or rated current may be related to the arithmetic mean value of the range.	3kW	P
	The upper and lower limits of the rated power input or rated current shall be marked on the appliance so that the relation between input and voltage is clear.		N
7.6	The correct Symbols shall be used as specified in ISO 7000 and IEC 60417		P
	Add to the list of symbols (IEC 60335-1/A2)		P
7.7	Appliances to be connected to more than two supply conductors and appliances for multiple supply shall have a connection diagram fixed to them, unless the correct mode of connection is obvious.		N
7.8	Except for type Z attachment, terminals used for connection to the supply mains shall be indicated as follows:		
	– terminals intended exclusively for the neutral conductor shall be indicated by the letter N;	marked	P
	– protective earthing terminals shall be indicated by symbol 5019 of IEC 60417. 	marked	P
	These indications shall not be placed on screws, removable washers or other parts which can be removed when conductors are being connected.		P
7.9	Marking or placing of switches which may cause a hazard.		N
7.10	The different positions of switches on stationary appliances and the different positions of controls on all appliances shall be indicated by figures, letters or other visual means.	Flush-type switch with visual means for indicating ON/OFF	P
	The figure 0 shall not be used for any other indication unless it is positioned and associated with other numbers so that it does not give rise to confusion with the indication of the OFF position.		N

IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
7.11	Controls intended to be adjusted during installation or in normal use shall be provided with an indication for the direction of adjustment.	marked	P
7.12	Instructions for use shall be provided with the appliance so that the appliance can be used safely.		P
7.12.1	If it is necessary to take precautions during installation of the appliance, appropriate details shall be given. – the type or characteristics of the pressure-relief device and how to connect it, unless it is incorporated in the appliance; (IEC 60335-2-21)		P
	– a discharge pipe connected to the pressure-relief device is to be installed in a continuously downward direction and in a frost-free environment; (IEC 60335-2-21)		P
	– the type or characteristics of a pressure reducing valve and the installation details (for appliances having a rated pressure less than 0,6 MPa). (IEC 60335-2-21)		N
	The instructions for closed water heaters incorporating a heat exchanger shall give details on the installation of control devices and the temperature settings that are necessary to prevent operation of the thermal cut-out caused by the heat from the exchanger. (IEC 60335-2-21)		N
	The instructions for cistern-fed water heaters and low-pressure water heaters shall contain the substance of the following: WARNING: Do not connect any pressure-relief device to the vent pipe of this water heater. (IEC 60335-2-21)		N
7.12.2	If a stationary appliance is not fitted with a supply cord and a plug, or with other means for disconnection from the supply mains having a contact separation in all poles that provide full disconnection under overvoltage category III conditions, the instructions shall state that means for disconnection must be incorporated in the fixed wiring in accordance with the wiring rules.	Flush-type switch fitted	P
7.12.3	If the insulation of the fixed wiring supplying an appliance for permanent connection to the supply mains can come into contact with parts having temperature rise exceeding 50 K during the test of clause 11, the instructions shall state that the fixed wiring insulation must be protected, for example, by insulating sleeving having an appropriate temperature rating.	Max rise is 24,5°C	P

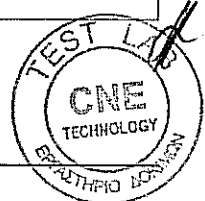
IEC 60335-2-21

Clause	Requirement - Test	Result - Remark	Verdict
7.12.4	The instructions for built-in appliances shall include information with regard to the following		N
	- dimensions of space		N
	- dimensions and position of support		N
	- ventilation openings		N
	- connection/interconnection plug accessible		N
7.12.5	For appliances with type X attachment having a specially prepared cord, the instructions shall contain the substance of the following. If the supply cord is damaged, it must be replaced by a special cord or assembly available from the manufacturer or its service agent.		N
	For appliances with type Y attachment, the instructions shall contain the substance of the following. If the supply cord is damaged, it must be replaced by the manufacturer, its service agent or similarly qualified persons in order to avoid a hazard.		P
	For appliances with type Z attachment, the instructions shall contain the substance of the following.		N
7.12.6	The instructions for heating appliances incorporating a non-self-resetting thermal cut-out that is reset by disconnection of the supply mains shall contain the substance of the following: CAUTION: In order to avoid a hazard due to inadvertent resetting of the thermal cutout, this appliance must not be supplied through an external switching device, such as a timer, or connected to a circuit that is regularly switched on and off by the utility.		N
7.12.7	The instructions for fixed appliances shall state how the appliance is to be fixed to its support.		P
7.12.8	The instructions for appliances connected to the water mains shall state – the maximum inlet water pressure, in pascals; – the minimum inlet water pressure, in pascals		P
7.13	Instructions and other text required by this standard shall be written in an official language of the country in which the appliance is to be sold.	Greek	P
7.14	The markings required by the standard shall be clearly legible and durable.		P

IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
7.15	The markings specified in 7.1 to 7.5 shall be on a main part of the appliance. These markings may be beneath a detachable cover. Other markings may be beneath a cover only if they are near to the terminals.		P
	Stationary appliance: name or trademark or identification mark of the manufacturer or responsible vendor and the model or type reference visible after installation		P
	Indications for switches and controls in vicinity of components; not on removable parts if misleading		P
7.16	Marking of a possible replaceable thermal link or fuse link clearly visible with regard to replacing the link		N
7.101	The water inlet and the water outlet shall be identified. This identification shall not be on detachable parts		P
	If colours used: inlet: blue ,outlet: red IEC 60335-2-21		P
8	PROTECTION AGAINST ACCESS TO LIVE PARTS		
8.1	Appliances shall be constructed and enclosed so that there is adequate protection against accidental contact with live parts.		P
8.1.1	The requirement of 8.1 applies for all positions of the appliance when it is operated as in normal use, and after the removal of detachable parts.		N
8.1.2	Test probe 13 of IEC 61032 is applied without appreciable force through openings in class 0 appliances, class II appliances and class II constructions, except for those giving access to lamp caps and live parts in socket-outlets		N
8.1.3	Use of test probe: no contact with live parts of visible glowing heating elements		N
8.1.4	An accessible part is not considered to be live if:		P
	- the part is supplied at safety extra-low voltage, provided that		N
	• for a.c., the peak value of the voltage does not exceed 42,4 V,		N
	• for d.c., the voltage does not exceed 42,4 V,		N
	- the part is separated from live parts by protective impedance. If protective impedance is used, the current between the part and the supply source shall		P
	• not exceed 2 mA for d.c.,		
	• its peak value shall not exceed 0,7 mA for a.c.		

IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
8.1.4	- for voltages having a peak value over 42,4 V up to and including 450 V, the capacitance shall be < 0,1μF		P
	- for voltages having a peak value over 450 V up to and including 15 kV, the discharge shall be < 45 μF		N
8.1.5	Live parts protected at least by basic insulation before installation or assembly:		P
	- built-in appliances		N
	- fixed appliances		P
	- separate units		N
	Compliance is checked by inspection and by the test of 8.1.1.(IEC 60335-1/A2)		P
8.2	Class II appliances and constructions shall be constructed and enclosed so that there is adequate protection against accidental contact with basic insulation and metal parts separated from live parts by basic insulation only.		N
	It shall only be possible to touch parts which are separated from live parts by double insulation or reinforced insulation.		N
9	STARTING OF MOTOR-OPERATED APPLIANCES		N
10	POWER INPUT AND CURRENT		
10.1	If an appliance is marked with rated power input, the power input at normal operating temperature shall not deviate from the rated power input by more than the deviation shown in table 1.	(see table in Annex 2)	P
10.2	If an appliance is marked with rated current, the current at normal operating temperature shall not deviate from the rated current by more than the deviation shown in table 2.		N
11	HEATING		
11.1	Appliances and their surroundings shall not attain excessive temperatures in normal use.		P
11.2	Placing and mounting of appliance as described		P
11.3	Temperature rises, other than those of windings, are determined by means of fine-wire thermocouples positioned so that they have minimum effect on the temperature of the part under test.		P
11.4	Heating appliances are operated under normal operation and at 1,15 times rated power input.		

IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
11.5	Motor-operated appliances are operated under normal operation and supplied with the most unfavourable voltage between 0,94 times and 1,06 times the rated voltage.		N
11.6	Combined appliances are operated under normal operation and supplied with the most unfavourable voltage between 0,94 times and 1,06 times the rated voltage.		N
11.7	The appliance is operated until steady conditions are established or until the thermostat interrupts the current for the first time after 16 h, whichever is shorter (IEC 60335-2-21)	Steady Condition	P
11.8	Protective devices does not operate		P
	Sealing compound not flowing out		P
	Temperatures not exceeding values in table 3	(see table in Annex 3)	P
	Replacement of temperature rises (IEC 60335-1/A2)		P
12	VOID		
13	LEAKAGE CURRENT AND ELECTRIC STRENGTH AT OPERATING TEMPERATURE		
13.1	At operating temperature, the leakage current of the appliance shall not be excessive and its electric strength shall be adequate.		P
13.2	Leakage current measured by means of circuit described in figure 4 of IEC 60990		P
	Leakage current measurements	(see table in Annex 4)	P
13.3	Electric strength test of insulation	(see table in Annex 4)	P
	No breakdown during the test		P
14	TRANSIENT OVERVOLTAGES		
	Appliances shall withstand the transient overvoltages to which they may be subjected. Compliance is checked by subjecting each clearance having a value less than those specified in table 6 to an impulse voltage test.		P

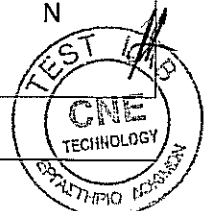


IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
15	MOISTURE RESISTANCE		
15.1	Enclosure provides the degree of moisture protection according to classification of appliance		P
	Appliance subjected to test as specified		P
	Withstand electric strength test specified in 16.3		P
	No trace of water on insulation which can result in a reduction of distances and clearances below values specified in 29.1		P
	NOTE - The external enclosure is carefully wiped to remove any surplus water (IEC 60335-11A2)		P
15.1.1	Appliances other than those classified IPX0 are subjected to the tests of IEC 60529		N
	- IPX1 appliances as described in 14.2.1		N
	- IPX2 appliances as described in 14.2.2		N
	- IPX3 appliances as described in 14.2.3		N
	- IPX4 appliances as described in 14.2.4		P
	- IPX5 appliances as described in 14.2.5		N
	- IPX6 appliances as described in 14.2.6		N
	- IPX7 appliances as described in 14.2.7, for this test the appliance is immersed in water containing 1%NaCl		N
	- Water valves are subjected to the test specified for IPX7 appliances.		N
15.1.2	Appliances normally fixed to a wall and appliances with pins for insertion into socket-outlets are mounted as in normal use in the centre of a wooden board having dimensions which are 15 cm ± 5 cm in excess of those of the orthogonal projection of the appliance on the board. The wooden board is placed at the centre of the oscillating tube.		N
15.2	Appliances subject to spillage of liquid in normal use shall be constructed so that such spillage does not affect their electrical insulation. The test is only applicable to cistern-type water heaters.		N
15.3	Appliances shall be proof against humid conditions that may occur in normal use.		P
	Withstanding the test of Cl. 16 <i>NOTE 101 If the appliance is too large for the humidity cabinet, the test may be carried out on those parts that contain electrical components.</i>		P

IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
LEAKAGE CURRENT AND ELECTRIC STRENGTH			
16.1	No excessive leakage current and adequate insulation and electric strength (tests 16.2 and 16.3).		P
16.2	An a.c. test voltage is applied between live parts and accessible metal parts that are connected to metal foil having an area not exceeding 20 cm x 10 cm in contact with accessible surfaces of insulating materials	(see table in Annex 4)	P
16.3	Immediately after the test of 16.2, the insulation is subjected to a voltage of substantially sinusoidal waveform having a frequency of 50 Hz or 60 Hz for 1 min. The values of the test voltage for different types of insulation are given in table 7.	(see table in Annex 4)	P
17 OVERLOAD PROTECTION OF TRANSFORMERS AND ASSOCIATED CIRCUITS			
	Appliances incorporating circuits supplied from a transformer shall be constructed so that in the event of short circuits which are likely to occur in normal use, excessive temperatures do not occur in the transformer or in the circuits associated with the transformer.		N
18	ENDURANCE		N
19 ABNORMAL OPERATION			
19.1	For closed water heaters, low-pressure water heaters and open-outlet water heaters, compliance is checked by the tests of 19.2, 19.3 and 19.4 if applicable. However, 19.101 applies instead for appliances not liable to be emptied in normal use and having all four of the following features:		P
19.2	Appliances with heating elements are tested under the conditions specified in clause 11 but with restricted heat dissipation. The supply voltage, determined prior to the test, is that required to provide a power input of 0,85 times rated power input under normal operation when the power input has stabilized. This voltage is maintained throughout the test. The appliance is operated empty, any thermal control that operates during the test of Clause 11 being short-circuited.		N
19.3	The test of 19.2 is repeated but with a supply voltage, determined prior to the test, equal to that required to provide a power input of 1,24 times rated power input under normal operation when the power input has stabilized. This voltage is maintained throughout the test.		N

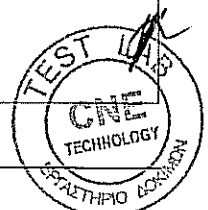
IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
19.4	For open-outlet water heaters, the test of 19.2 is repeated but with the container filled with water to a level at least 10 mm above the highest point of the heating element. The appliance is operated at 1,15 times rated power input under normal operation.		N
19.5	The test of 19.4 is repeated on class 0I appliances and class I appliances incorporating tubular sheathed or embedded heating elements. However, controls are not short-circuited but one end of the element is connected to the sheath of the heating element.		N
19.6	The working voltage of the PTC heating element is increased by 5 % and the appliance is operated until steady conditions are re-established. The voltage is then increased in similar steps until 1,5 times working voltage is reached, or until the PTC heating element ruptures, whichever occurs first.		N
19.7	The appliance is operated under stalled conditions by		N
19.8	One phase of appliances incorporating three-phase motors is disconnected. The appliance is then operated under normal operation and supplied at rated voltage for the period specified in 19.7.		N
19.9	A running overload test is carried out on appliances incorporating motors that are intended to be remotely or automatically controlled or liable to be operated continuously.		N
19.10	Appliances incorporating series motors are operated with the lowest possible load and supplied at 1,3 times rated voltage for 1 min.		N
19.11	Electronic circuits are checked by evaluation of the fault conditions specified in 19.11.2 for all circuits or parts of circuits, unless they comply with the conditions specified in 19.11.1.		N
19.11.1	Fault conditions a) to f) specified in 19.11.2 are not applied to circuits or parts of circuits when both of the following conditions are met:		N
19.11.2	The following fault conditions are considered and, if necessary, applied one at a time, consequential faults being taken into consideration:		N
19.11.3	If the appliance incorporates a protective electronic circuit which operates to ensure compliance with clause 19, the relevant test is repeated with a single fault simulated, as indicated in a) to f) of 19.11.2.		N
19.11.4	Appliances having a device with an off position obtained by electronic disconnection, or with stand-by mode, are subjected to the tests of 19.11.4.1 to 7		N

IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
19.12	If safety of the appliance depends upon the operation of a miniature fuse-link complying with IEC 60127 during any of the fault conditions specified in 19.11.2, the test is repeated but with the miniature fuse-link replaced by an ammeter		N
19.13	During the tests the appliance shall not emit flames, molten metal, or poisonous or ignitable gas in hazardous amounts and temperature rises shall not exceed the values shown in table 9. <i>There shall be no leakage from the container during the tests.</i> (IEC 60335-2-21)		P
19.14	Appliances are operated under the conditions of Clause 11.		N
19. 101	The appliance is tested for 24 h under the conditions specified in Clause 11 but with the container empty.	Heating element damaged. The temperature not exceed specified in Clause 11	P
20	STABILITY AND MECHANICAL HAZARDS		
20.1	Appliances, other than fixed appliances and hand-held appliances, intended to be used on a surface such as the floor or a table shall have adequate stability.		N
20.2	Moving parts adequately arranged or enclosed as to provide protection against personal injury		N
	Protective enclosures, guards and similar parts are non-detachable		P
	Adequate mechanical strength and fixing of protective enclosures		P
	Self-resetting thermal cut-outs and overcurrent protective devices not causing a hazard, if unexpectedly reclosed		N
	Not possible to touch dangerous moving parts with test finger		N
21	MECHANICAL STRENGTH		
21.1	Appliance has adequate mechanical strength and is constructed as to withstand rough handling		P
	No damage after three blows applied to various parts of the enclosure, impact energy $0,5 \pm 0,04$ Nm		P
	if necessary, repetition of groups of three blows on a new sample		N
21.2	Accessible parts of solid insulation shall have sufficient strength to prevent penetration by sharp implements.		N



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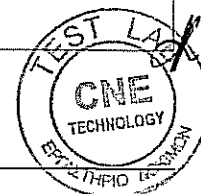
Clause	Requirement - Test	Result - Remark	Verdict
22	CONSTRUCTION		
22.1	If the appliance is marked with the first numeral of the IP system, the relevant requirements of IEC 60529 shall be fulfilled.	IPX4	P
22.2	For stationary appliances, means shall be provided to ensure all-pole disconnection from the supply mains.		P
22.3	Appliances with pins for insertion into socket-outlets shall not impose undue strain on these socket-outlets. The means for retaining the pins shall withstand the forces to which the pins are likely to be subjected in normal use.		N
22.4	Appliances for heating liquids and appliances causing undue vibration shall not be provided with pins for insertion into socket-outlets.		N
22.5	Appliances intended to be connected to the supply mains by means of a plug shall be constructed so that in normal use there is no risk of electric shock from charged capacitors when the pins of the plug are touched.		N
22.6	Appliances shall be constructed so that their electrical insulation cannot be affected by water that could condense on cold surfaces or by liquid that could leak from containers, hoses, couplings and similar parts of the appliance.		P
	The enclosure shall have a drain hole positioned so that the water can drain without impairing electrical insulation, unless condensed water cannot accumulate within the enclosure in normal use. The hole shall be at least 5 mm in diameter or 20 mm ² in area with a width of at least 3 mm.		P
22.7	Appliances containing liquid or gases in normal use or having steam-producing devices shall incorporate adequate safeguards against the risk of excessive pressure.		P
22.8	For appliances having compartments to which access can be gained without the aid of a tool and that are likely to be cleaned in normal use, the electrical connections shall be arranged so that they are not subject to pulling during cleaning.		N
22.9	Appliances shall be constructed so that parts such as insulation, internal wiring, windings, commutators and slip rings are not exposed to oil, grease or similar substances.		P



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Clause	Requirement - Test	Result - Remark	Verdict
22.10	It shall not be possible to reset voltage-maintained non-self-resetting thermal cut-outs by the operation of an automatic switching device incorporated within the appliance. Reset buttons of non-self-resetting controls shall be located or protected so that their accidental resetting is unlikely to occur if this could result in a hazard.		P
22.11	Non-detachable parts that protect against access to live parts, moisture or contact with moving parts shall be fixed in a reliable manner and withstand the mechanical stress occurring during normal use.		P
	Obvious locked position of snap-in devices used for fixing such parts		N
	No deterioration of the fixing properties of snap-in devices used in parts which are likely to be removed during installation or servicing		N
	Tests		P
22.12	Handles, knobs, grips, levers and similar parts shall be fixed in a reliable manner so that they will not work loose in normal use if loosening could result in a hazard. If these parts are used to indicate the position of switches or similar components, it shall not be possible to fix them incorrectly if this could result in a hazard.		N
22.13	Appliances shall be constructed so that when handles are gripped in normal use, contact is unlikely between the operator's hand and parts having a temperature rise exceeding the value specified in table 3 for handles which are held for short periods only in normal use.		N
22.14	Appliances shall have no ragged or sharp edges, other than those necessary for the functioning of the appliance, that could create a hazard for the user in normal use or during user maintenance.		P
22.15	Storage hooks and similar devices for flexible cords shall be smooth and wellrounded.		N
22.16	Automatic cord reels		N
22.17	Spacers intended to prevent the appliance from overheating walls shall be fixed so that it is not possible to remove them from the outside of the appliance by hand or by means of a screwdriver or a spanner.		N
22.18	Current-carrying parts and other metal parts, the corrosion of which could result in a hazard, shall be resistant to corrosion under normal conditions of use. Verify after the tests of clause 19, the relevant parts show no sign of corrosion.		P

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Clause	Requirement - Test	Result - Remark	Verdict
22.19	Driving belts shall not be relied upon to provide the required level of insulation unless they are constructed to prevent inappropriate replacement.		N
22.20	Direct contact between live parts and thermal insulation shall be effectively prevented unless such material is non-corrosive, non-hygroscopic and non-combustible. Compliance is checked by inspection and, if necessary, by appropriate tests.		P
	Thermal insulation shall not be used for basic insulation of internal wiring (IEC 60335-1/A2).		P
22.21	Wood, cotton, silk, ordinary paper and similar fibrous or hygroscopic material shall not be used as insulation, unless impregnated.		N
22.22	Appliances shall not contain asbestos.		P
22.23	Oils containing polychlorinated biphenyl (PCB) shall not be used in appliances.		P
22.24	Bare heating elements shall be supported so that the heating conductor is unlikely to come into contact with accessible metal parts if they rupture.		N
22.25	Appliances, other than those of class III, shall be constructed so that sagging heating conductors cannot come into contact with accessible metal parts.		N
22.26	Class II appliances having parts of class III construction shall be constructed so that the insulation between parts operating at safety extra-low voltage and other live parts complies with the requirements for double insulation or reinforced insulation.		N
22.27	Parts connected by protective impedance shall be separated by double insulation or reinforced insulation.		N
22.28	For class II appliances connected in normal use to the gas mains or to the water mains, metal parts conductively connected to the gas pipes or in contact with the water shall be separated from live parts by double insulation or reinforced insulation.		N
22.29	Class II appliances intended to be permanently connected to fixed wiring shall be constructed so that the required degree of access to live parts is maintained after installation.		N



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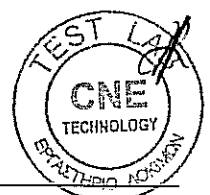
Clause	Requirement – Test	Result – Remark	Verdict
22.30	Parts of class II construction which serve as supplementary insulation or reinforced insulation, and which could be omitted during reassembly after servicing, shall be fixed so that they cannot be removed without being seriously damaged, or		N
	constructed so that they cannot be replaced in an incorrect position and if they are omitted, the appliance is rendered inoperable or manifestly incomplete.		N
22.31	Clearances and creepage distances over supplementary insulation and reinforced insulation shall not be reduced below the values specified in clause 29 as a result of wear.		N
22.32	Supplementary insulation and reinforced insulation shall be constructed or protected so that the deposition of pollution resulting from wear of parts within the appliance does not reduce clearances or creepage distances below the values specified in clause 29.		N
22.33	Conductive liquids that are or may become accessible in normal use shall not be in direct contact with live parts. Electrodes shall not be used for heating liquids (IEC 60335-1/A2)		P
	For class II construction, conductive liquids that are or may become accessible in normal use shall not be in direct contact with basic insulation or reinforced insulation (IEC 60335-1/A2)		N
	For class II construction, conductive liquids which are in contact with live parts shall not be in direct contact with reinforced insulation.		N
22.34	Shafts of operating knobs, handles, levers and similar parts shall not be live unless the shaft is inaccessible when the part is removed.		N
22.35	For constructions other than those of class III, handles, levers and knobs which are held or actuated in normal use shall not become live in the event of an insulation fault.		N
	If these handles, levers and knobs are of metal and if their shafts or fixings are likely to become live in the event of a failure of basic insulation, they shall be adequately covered by insulating material or their accessible parts shall be separated from their shafts or fixings by supplementary insulation		N



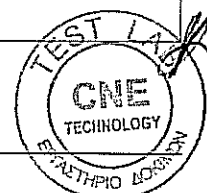
IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
22.35	For stationary appliances this requirement does not apply to handles, levers and knobs, other than those of electrical components, provided that they are reliably connected to an earthing terminal or earthing contact or separated from live parts by earthed metal.		P
22.36	For appliances other than those of class III, handles which are continuously held in the hand in normal use shall be constructed so that when gripped in normal use, the operator's hand is not likely to touch metal parts unless they are separated from live parts by double insulation or reinforced insulation.		N
22.37	For class II appliances, capacitors shall not be connected to accessible metal parts and their casings, if of metal, shall be separated from accessible metal parts by supplementary insulation.		N
	This requirement does not apply to capacitors complying with the requirements for protective impedance specified in 22.42.		N
22.38	Capacitors shall not be connected between the contacts of a thermal cut-out.		P
22.39	Lampholders shall be used only for the connection of lamps.		N
22.40	Motor-operated appliances and combined appliances which are intended to be moved while in operation, or which have accessible moving parts, shall be fitted with a switch to control the motor. The actuating member of this switch shall be easily visible and accessible (IEC 60335-1/A2)		N
22.41	Appliances shall not incorporate components, other than lamps, containing mercury.		P
22.42	Protective impedance shall consist of at least two separate components whose impedance is unlikely to change significantly during the lifetime of the appliance.		N
	If any one of the components is short-circuited or open-circuited the values specified in 8.1.4 shall not be exceeded		N
22.43	Appliances which can be adjusted for different voltages shall be constructed so that accidental changing of the setting is unlikely to occur		N
22.44	Appliances shall not have an enclosure that is shaped and decorated so that the appliance is likely to be treated as a toy by children (IEC 60335-1/A2).		P

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Clause	Requirement - Test	Result - Remark	Verdict
22.45	When air is used as reinforced insulation, the appliance shall be constructed so that clearances cannot be reduced below the values specified in 29.1.3 due to deformation as a result of an external force applied to the enclosure.		N
22.46	Software used in protective electronic circuits shall be software class B or software class C.		N
22.47	Appliances shall withstand the water pressure occurring in normal use.		—
	- twice the rated pressure for closed water heaters;	1,2MPa	P
	- 1,5 times rated pressure for cistern-fed water heaters;		N
	- 0,15 MPa for open-outlet water heaters;		N
	- 0,03 MPa for cistern-type water heaters		N
	Pressure raised at rate of 0,13 MPa/s to specified value and maintained for 15 min		P
	No water leak and no permanent deformation to such an extent that the compliance with this standard is impaired		P
	NOTE 3 Heat exchangers incorporated in an appliance are subjected to a pressure test based on their working pressure.		P
22.48	Appliances intended to be connected to the water mains shall be constructed to prevent backsiphonage of non-potable water into the water mains (IEC 61770).		P
22.49	For remote operation, the duration of operation shall be set before the appliance can be started unless the appliance switches off automatically at the end of a cycle or it can operate continuously without giving rise to a hazard.		N
22.50	Controls incorporated in the appliance, if any, shall take priority over controls actuated by remote operation.		N
22.51	A control on the appliance shall be manually adjusted to the setting for remote operation before the appliance can be operated in this mode.		N



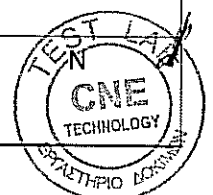
IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
22.52	Socket-outlets on appliances accessible to the user shall be in accordance with the socket-outlet system used in the country in which the appliance is sold.		N
22.101	The rated pressure of closed water heaters intended for direct connection to the water main shall be at least 0,6 MPa (IEC 60335-2-21).	0,6MPa	P
	The rated pressure of closed water heaters and low-pressure water heaters, intended to be supplied by a pressure reducing valve that is not incorporated in the appliance, shall be at least 0,1 MPa (IEC 60335-2-21)		N
	The rated pressure of cistern-fed water heaters shall not exceed 0,2 MPa (IEC 60335-2-21).		N
22.102	Void.		
22.103	Pressure-relief devices of closed water heaters shall prevent the pressure in the container from exceeding the rated pressure by more than 0,1 MPa.		N
22.104	The outlet of open-outlet water heaters shall be constructed so that the water flow is not limited to such an extent that the container is subjected to a significant pressure.		N
	The vent pipe of low pressure water heaters shall have an internal diameter of at least 20 mm.		N
22.105	Cistern-type water heaters shall be constructed so that the container is always at atmospheric pressure by means of a vent having an area of at least 30 mm ² and a minimum dimension of at least 3 mm.		N
22.106	Closed water heaters shall incorporate a thermal cut-out providing all-pole disconnection and which operates independently from the thermostat. However, for appliances intended to be connected to fixed wiring, the neutral conductor need not be disconnected.	Appliance connected to fixed wiring	P
22.107	Heating elements and thermal control sensors in contact with the outer surface of the container shall be held in position securely.		P
22.108	Appliances for wall mounting shall have reliable provision for fixing to a wall, independent of the connection to the water mains.		N
22.109	Appliances having a capacity of more than 15 l that cannot be emptied through a drain fitted in the water pipes shall incorporate means for draining that requires a tool for its operation.		P



IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
22.110	Open-outlet water heaters having plastic containers shall be constructed to ensure that the appliance is only likely to be installed in the intended orientation.		N
22.111	Closed water heaters incorporating a heat exchanger shall be constructed so that during normal use the thermal cut-out does not operate due to heat from the exchanger.		N
	Thermostatic valves, by-pass valves and similar controlling devices used for this purpose shall be supplied with the appliance.		N
22.112	Closed water heaters shall be constructed so that repeated drawing off does not cause the water to boil		P
	Appliance operated as specified in clause 11		P
	When thermostat operates for first time, water is drawn off at a rate of approximately 2 l per min or 10% of the capacity of the appliance per minute, whichever is less, until the thermostat switches on again		P
	When thermostat next operates, water is drawn off again at same rate until thermostat switches on, this sequence being repeated until steady conditions established		P
	Temperature of the water, measured by means of a thermocouple at the outlet, does not exceed 98°C	< 67,6°C	P
23	INTERNAL WIRING		
23.1	Wireways shall be smooth and free from sharp edges.		P
23.2	Beads and similar ceramic insulators on live wires shall be fixed or located so that they cannot change their position or rest on sharp edges		N
23.3	Different parts of an appliance that can move relative to each other in normal use or during user maintenance shall not cause undue stress to electrical connections and internal conductors, including those providing earthing continuity.		N
23.4	Bare internal wiring shall be rigid and fixed so that, in normal use, clearances or creepage distances cannot be reduced below the values specified in clause 29.		N
23.5	The insulation of internal wiring shall withstand the electrical stress likely to occur in normal use.		P
	No breakdown when a voltage of 2000 V is applied for 15 min between the conductor and metal foil wrapped around the insulation		

IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
23.6	When sleeving is used as supplementary insulation on internal wiring, it shall be retained in position by positive means.		N
23.7	Conductors identified by the colour combination green/yellow shall only be used for earthing conductors.		P
23.8	Aluminium wires shall not be used for internal wiring.		P
23.9	Stranded conductors shall not be consolidated by lead-tin soldering where they are subjected to contact pressure, unless the clamping means is constructed so that there is no risk of bad contact due to cold flow of the solder.		N
23.10	The insulation and sheath of internal wiring, incorporated in external hoses for the connection of an appliance to the water mains, shall be at least equivalent to that of light polyvinyl chloride sheathed flexible cord (code designation 60227 IEC 52).		N

24	COMPONENTS		
24.1	Components shall comply with the safety requirements specified in the relevant IEC standards as far as they reasonably apply.	(See Annex 5)	P
24.1.1	The relevant standard for capacitors likely to be permanently subjected to the supply voltage and used for radio interference suppression or for voltage dividing is IEC 60384-14.		N
24.1.2	The relevant standard for safety isolating transformers is IEC 61558-2-6.		N
24.1.3	The relevant standard for switches is IEC 61058-1. The number of cycles of operation declared for 7.1.4 of IEC 61058-1 shall be at least 10000.		N
	If the switch operates a relay or contactor, the complete switching system is subjected to the test.		N
24.1.4	The relevant standard for automatic controls is IEC 60730-1 together with its relevant part 2. Thermal cut-outs incorporated in closed water heaters shall comply with the requirements for type 2B controls in Clauses 13, 15, 16 17 and 20 of IEC 60730-1, unless they are tested with the appliance.	Compliance by declaration of manufacturer. See Annex 5	P
24.1.5	The relevant standard for appliance couplers is IEC 60320-1. However, for appliances classified higher than IPX0, the relevant standard is IEC 60320-2-3.		N
24.1.6	The relevant standard for small lamp holders similar to E10 lamp holders is IEC 60238, the requirements for E10 lamp holders being applicable.		



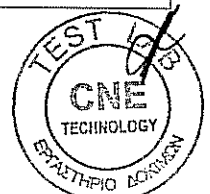
IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
24.1.7	If the remote operation of the appliance is via a telecommunication network, the relevant standard for the telecommunication interface circuitry in the appliance is IEC 62151.		N
24.1.8	The relevant standard for thermal links is IEC 60691. Thermal links that do not comply with IEC 60691 are considered to be an intentionally weak part for the purposes of Clause 19.		N
24.1.9	Relays, other than motor starting relays, are tested as part of the appliance. However, they are also tested in accordance with Clause 17 of IEC 60730-1 under the maximum load conditions occurring in the appliance for at least the number of operations in 24.1.4 selected according to the relay function in the appliance.		N
24.2	Appliances shall not be fitted with – switches or automatic controls in flexible cords;		N
	– devices that cause the protective device in the fixed wiring to operate in the event of a fault in the appliance;		N
	– thermal cut-outs that can be reset by a soldering operation.		N
24.3	Switches intended to ensure all-pole disconnection of stationary appliances, as required in 22.2, shall be directly connected to the supply terminals and shall have a contact separation in all poles, providing full disconnection under overvoltage category III conditions.		N
24.4	Plugs and socket-outlets for extra-low voltage circuits, and those used as terminal devices for heating elements, shall not be interchangeable with plugs and socket-outlets listed in IEC 60083 or IEC 60906-1 or with connectors and appliance inlets complying with the standard sheets of IEC 60320-1.		N
24.5	Capacitors in auxiliary windings of motors shall be marked with their rated voltage and their rated capacitance and shall be used in accordance with these markings.		N
24.6	The working voltage of motors directly connected to the supply mains and having basic insulation that is inadequate for the rated voltage of the appliance, shall not exceed 42 V. In addition, they shall comply with the requirements of annex I.		N



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Clause	Requirement - Test	Result - Remark	Verdict
24.7	Hose-sets for the connection of appliances to the water mains shall comply with IEC 61770. They shall be supplied with the appliance.		N
24.101	Thermal cut-outs shall be non-self-resetting. They shall have a trip-free switching mechanism or be located so that they can only be reset after removal of a non-detachable cover.		P
24.102	The operating temperature of the thermal cut-out of a closed water heater shall ensure that the water temperature cannot exceed 99 °C or that thermal cut-out operates before its temperature exceeds 110 °C.		P
24.102.1	The appliance is operated under the conditions specified in Clause 11 until the thermostat operates for the first time. A quantity of water equal to 25 % of the capacity of the container is then drawn off so that it is replaced by cold water. Immediately after the thermostat operates for the second time, it is short-circuited. The test is continued until the thermal cut-out operates. The outlet valve is then opened and the temperature of the water measured at the outlet. The temperature shall not exceed 99 °C.	Water Outlet Temperature: 92,3°C	P
24.102.2	The operating temperature of the thermal cut-out is measured by means of a thermocouple positioned on its sensing element or as close as possible to it. The appliance is operated under normal operation at rated power input with the outlet valve closed and thermostats short-circuited until the thermal cut-out operates. The thermal cut-out shall operate before its temperature exceeds 110 °C. During the test, compliance with 19.13 shall not be impaired.	Thermal cut-out Temperature: 87,6°C	P

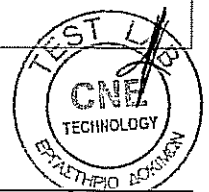
25	SUPPLY CONNECTION AND EXTERNAL FLEXIBLE CORDS		
25.1	Appliances, other than those intended to be permanently connected to fixed wiring, shall be provided with one of the following means for connection to the supply mains:		N
	– supply cord fitted with a plug;		N
	– an appliance inlet having at least the same degree of protection against moisture as required for the appliance;		N
	– pins for insertion into socket-outlets.		N
	Appliances shall not incorporate an appliance inlet (IEC 60335-2-21)		N

25.2	Appliances, other than stationary appliances for multiple supply, shall not be provided with more than one means of connection to the supply mains. Stationary appliances for multiple supply may be provided with more than one means of connection provided that the relevant circuits are adequately insulated from each other.		N
	A voltage of 1 250 V of substantially sinusoidal waveform and having a frequency of 50 Hz or 60 Hz is applied for 1 min between each means of connection to the supply mains.		N
25.3	Appliances intended to be permanently connected to fixed wiring shall allow the connection of the supply conductors after the appliance has been fixed to its support and shall be provided with one of the following means for connection to the supply mains:		
	- a set of terminals allowing the connection of cables of fixed wiring having the nominal cross-sectional areas specified in 26.6;		N
	- a set of terminals allowing the connection of a flexible cord;		N
	- a set of supply leads accommodated in a suitable compartment;		N
	- a set of terminals and cable entries, conduit entries, knock-outs or glands, which allow the connection of the appropriate types of cable or conduit.		P
25.4	For appliances intended to be permanently connected to the fixed wiring and having a rated current not exceeding 16 A, cable and conduit entries shall be suitable for cables or conduits having a maximum overall dimension shown in table 10.		P
	Conduit entries, cable entries and knock-outs shall be constructed or located so that the introduction of the conduit or cable does not reduce clearances or creepage distances below the values specified in clause 29.		P
25.5	Supply cords shall be assembled to the appliance by one of the following methods:		
	- type X attachment;		N
	- type Y attachment;		N
	- type Z attachment, if allowed in the relevant part 2.		N
25.6	Plugs shall not be fitted with more than one flexible cord.		N

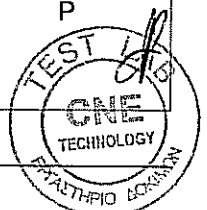


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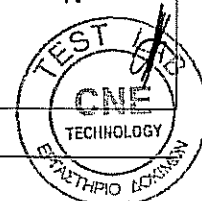
Clause	Requirement - Test	Result - Remark	Verdict
25.7	Supply cords shall be one if the types given in std		N
25.8	Conductors of supply cords shall have a nominal cross-sectional area not less than that shown in table 11.		N
25.9	Supply cords shall not be in contact with sharp points or edges of the appliance.		N
25.10	The supply cord of class I appliances shall have a green/yellow core that is connected to the earthing terminal of the appliance and to the earthing contact of the plug.		N
25.11	Conductors of supply cords shall not be consolidated by lead-tin soldering where they are subjected to contact pressure, unless the clamping means is constructed so that there is no risk of a bad contact due to cold flow of the solder.		N
25.12	The insulation of the supply cords shall not be damaged when moulding the cord to part of the enclosure.		N
25.13	Inlet openings for supply cords shall be constructed so that the sheath of the supply cord can be introduced without risk of damage. Unless the enclosure at the inlet opening is insulating material, a non-detachable lining or non-detachable bushing shall be provided that complies with 29.3 for supplementary insulation. If the supply cord is unsheathed, a similar additional bushing or lining is required, unless the appliance is class 0.		P
25.14	Appliances provided with a supply cord that are moved while in operation shall be constructed so that the supply cord is adequately protected against excessive flexing where it enters the appliance.		N
25.15	Appliances provided with a supply cord, and appliances intended to be permanently connected to fixed wiring by a flexible cord, shall have a cord anchorage. The cord anchorage shall relieve conductors from strain, including twisting, at the terminals and protect the insulation of the conductors from abrasion.		N
	It shall not be possible to push the cord into the appliance to such an extent that the cord or internal parts of the appliance could be damaged.		N



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Clause	Requirement - Test	Result - Remark	Verdict
25.15	During the pull force and torque tests, the cord shall not be damaged and shall show no appreciable strain at the terminals. The pull force is reapplied and the cord shall not be longitudinally displaced by more than 2mm.		N
25.16	Cord anchorages for type X attachments shall be constructed and located so that		N
	– replacement of the cord is easily possible;		N
	– it is clear how the relief from strain and the prevention of twisting are obtained;		N
	– they are suitable for the different types of supply cord that may be connected, unless the cord is specially prepared;		N
	– the cord cannot touch the clamping screws of the cord anchorage if these screws are accessible, unless they are separated from accessible metal parts by supplementary insulation;		N
	– the cord is not clamped by a metal screw which bears directly on the cord;		N
	– at least one part of the cord anchorage is securely fixed to the appliance, unless it is part of a specially prepared cord;		N
	– screws which have to be operated when replacing the cord do not fix any other component. However, this does not apply if - after removal of the screws, or if the component is incorrectly repositioned, the appliance becomes inoperative or is obviously incomplete; - the parts intended to be fastened by them cannot be removed without the aid of a tool during the replacement of the cord;		N
	– if labyrinths can be bypassed the test of 25.15 is nevertheless withstood;		N
	– for class 0 appliances, class 0I appliances and class I appliances, they are of insulating material or are provided with an insulating lining, unless failure of the insulation of the cord does not make accessible metal parts live;		N
– for class II appliances, they are of insulating material or, if of metal, they are insulated from accessible metal parts by supplementary insulation.		N	
25.17	For type Y attachment and type Z attachment, cord anchorages shall be adequate.		N
25.18	Cord anchorages shall be arranged so that they are only accessible with the aid of a tool or shall be constructed so that the cord can only be fitted with the aid of a tool.		P



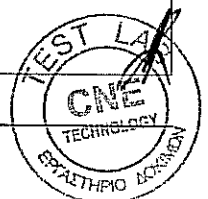
IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
25.19	For type X attachment, glands shall not be used as cord anchorages in portable appliances. Tying the cord into a knot or tying the cord with string is not allowed.		N
25.20	The insulated conductors of the supply cord for type Y attachment and type Z attachment shall be additionally insulated from accessible metal parts by basic insulation for class 0 appliances, class 0I appliances and class I appliances, and by supplementary insulation for class II appliances. This insulation may be provided by the sheath of the supply cord or by other means.		N
25.21	The space for the connection of supply cords having type X attachment, or for the connection of fixed wiring, shall be constructed		N
	– so that it is possible to check that the supply conductors are correctly positioned and connected before fitting any cover;		N
	– so that any cover can be fitted without risk of damage to the conductors or their insulation;		N
	– for portable appliances, so that the uninsulated end of a conductor, should it become free from the terminal, cannot come into contact with accessible metal parts.		N
	Portable appliances are subjected to the following additional test unless they are provided with pillar terminals and the supply cord is clamped within 30 mm of them.		N
	The clamping screws or nuts are loosened in turn. A force of 2 N is applied to the conductor in any direction at a position adjacent to the terminal. The uninsulated end of the conductor shall not come into contact with accessible metal parts.		N
25.22	Appliance inlets shall		
	– be located or enclosed so that live parts are not accessible during insertion or removal of the connector;		N
	– be located so that the connector can be inserted without difficulty;		N
	– be located so that, after insertion of the connector, the appliance is not supported by the connector when it is placed in any position of normal use on a flat surface;		N



IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
25.22	– not be an appliance inlet for cold conditions if the temperature rise of external metal parts of the appliance exceeds 75 K during the test of clause 11, unless the supply cord is unlikely to touch such metal parts in normal use.		N
25.23	Interconnection cords shall comply with the requirements for the supply cord, except that		N
	– the cross-sectional area of the conductors of the interconnection cord is determined on the basis of the maximum current carried by the conductor during the test of clause 11 and not by the rated current of the appliance;		N
	– the thickness of the insulation of the conductor may be reduced if the voltage of the conductor is less than the rated voltage.		N
25.24	Interconnection cords shall not be detachable without the aid of a tool if compliance with this standard is impaired when they are disconnected.		N
25.25	The dimensions of pins of appliances that are inserted into socket-outlets shall be compatible with the dimensions of the relevant socket-outlet. Dimensions of the pins and engagement face are to be in accordance with the dimensions of the relevant plug listed in IEC 60083		N
26	TERMINALS FOR EXTERNAL CONDUCTORS		
26.1	Appliances shall be provided with terminals or equally effective devices for the connection of external conductors. The terminals shall only be accessible after the removal of a non-detachable cover.		P
	However, earthing terminals may be accessible if a tool is required to make the connections and means are provided to clamp the wire independently from its connection.		P
26.2	Appliances having type X attachment, except those having a specially prepared cord, and appliances for connection to fixed wiring shall be provided with terminals in which the connections are made by means of screws, nuts or similar devices, unless the connections are soldered		N
	The screws and nuts shall not be used to fix any other component except that they may also clamp internal conductors if these are arranged so that they are unlikely to be displaced when fitting the supply conductors.		N

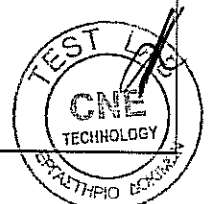
IEC 60335-2-21

Clause	Requirement - Test	Result - Remark	Verdict
26.2	If soldered connections are used, the conductor shall be positioned or fixed so that reliance is not placed upon the soldering alone to maintain it in position.		N
26.3	Terminals for type X attachment and those for connection to fixed wiring shall be constructed so that they clamp the conductor between metal surfaces with sufficient contact pressure but without causing damage to the conductor.		P
	The terminals shall be fixed so that when the clamping means is tightened or loosened. – the terminal does not become loose;		P
	– internal wiring is not subjected to stress;		P
	– clearances and creepage distances are not reduced below the values specified in clause 29.1		P
26.4	Terminals for type X attachment, except type X attachments having a specially prepared cord, and terminals for connection to fixed wiring, shall not require special preparation of the conductor. They shall be constructed or placed so that the conductor cannot slip out when clamping screws or nuts are tightened.		P
26.5	Terminals for type X attachment shall be located or shielded so that if a wire of a stranded conductor escapes when the conductors are fitted, there is no risk of accidental connection to other parts that could result in a hazard.		N
26.6	Terminals for type X attachment and for connection to fixed wiring shall allow the connection of conductors having the nominal cross-sectional areas shown in table 13. However, if a specially prepared cord is used, the terminals need only be suitable for the connection of that cord.		P
26.7	Terminals for type X attachment shall be accessible after removal of a cover or part of the enclosure.		P
26.8	Terminals for the connection of fixed wiring, including the earthing terminal, shall be located close to each other.		P
26.9	Terminals of the pillar type shall be constructed and located so that the end of a conductor introduced into the hole is visible, or can pass beyond the threaded hole for a distance equal to half the nominal diameter of the screw but at least 2,5 mm.		P



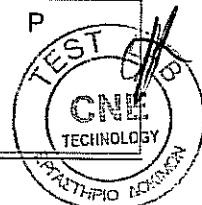
IEC 60335-2-21

Clause	Requirement - Test	Result - Remark	Verdict
26.10	Terminals with screw clamping and screwless terminals shall not be used for the connection of the conductors of flat twin tinsel cords unless the ends of the conductors are fitted with means suitable for use with screw terminals.		N
26.11	For appliances having type Y attachment or type Z attachment, soldered, welded, crimped or similar connections may be used for the connection of external conductors.		N
	For class II appliances, the conductor shall be positioned or fixed so that reliance is not placed upon the soldering, crimping or welding alone to maintain the conductor in position.		N
27	PROVISION FOR EARTHING		
27.1	Accessible metal parts of class 0I appliances and class I appliances that may become live in the event of an insulation fault, shall be permanently and reliably connected to an earthing terminal within the appliance or to the earthing contact of the appliance inlet.		P
	Earthing terminals and earthing contacts shall not be connected to the neutral terminal.		P
	Class 0 appliances, class II appliances and class III appliances shall have no provision for earthing.		N
	Safety extra-low voltage circuits shall not be earthed unless they are protective extra-low voltage circuits.		N
	For class I water heaters, the sheath of the heating element shall be permanently and reliably connected to the earthing terminal unless		P
	- the container is provided with inlet and outlet pipes of metal that are permanently and reliably connected to the earthing terminal, and		P
	- other accessible metal parts of the container in contact with the water are permanently and reliably connected to the earthing terminal.		P
27.2	The clamping means of earthing terminals shall be adequately secured against accidental loosening.		P
27.3	If a detachable part having an earth connection is plugged into another part of the appliance, the earth connection shall be made before the current-carrying connections are established. The current-carrying connections shall be separated before the earth connection when removing the part."		N



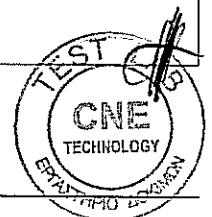
IEC 60335-2-21

Clause	Requirement - Test	Result - Remark	Verdict
27.3	For appliances with supply cords, the arrangement of the terminals, or the length of the conductors between the cord anchorage and the terminals, shall be such that the current carrying conductors become taut before the earthing conductor if the cord slips out of the cord anchorage.		N
27.4	All parts of the earthing terminal intended for the connection of external conductors shall be such that there is no risk of corrosion resulting from contact between these parts and the copper of the earthing conductor or any other metal in contact with these parts.		P
	Parts providing earthing continuity, other than parts of a metal frame or enclosure, shall be of metal having adequate resistance to corrosion. If these parts are of steel, they shall be provided at the essential areas with an electroplated coating having a thickness of at least 5 μm .		P
	Parts of coated or uncoated steel that are only intended to provide or to transmit contact pressure shall be adequately protected against rusting.		N
	If the body of the earthing terminal is a part of a frame or enclosure of aluminium or aluminium alloy, precautions shall be taken to avoid the risk of corrosion resulting from contact between copper and aluminium or its alloys.		N
27.5	The connection between the earthing terminal or earthing contact and earthed metal parts shall have low resistance.		P
	The voltage drop between the earthing terminal of the appliance or the earthing contact of the appliance inlet and the accessible metal part is measured. The resistance calculated from the current and this voltage drop shall not exceed 0,1 Ω .	0,04 Ω	P
27.6	The printed conductors of printed circuit boards shall not be used to provide earthing continuity in hand-held appliances. They may be used to provide earthing continuity in other appliances if at least two tracks are used with independent soldering points and the appliance complies with 27.5 for each circuit.		N
28	SCREWS AND CONNECTIONS		
28.1	Fixings, the failure of which may impair compliance with this standard, electrical connections and connections providing earthing continuity shall withstand the mechanical stresses occurring in normal use.		P



IEC 60335-2-21

Clause	Requirement - Test	Result - Remark	Verdict
28.1	Screws used for these purposes shall not be of metal which is soft or liable to creep, such as zinc or aluminium.		P
	If screws are of insulating material, they shall have a nominal diameter of at least 3 mm Screws shall not be used for any electrical connections or connections providing earthing continuity.		N
	Screws used for electrical connections or for connections providing earthing continuity shall screw into metal.		P
	Screws shall not be of insulating material if their replacement by a metal screw could impair supplementary insulation or reinforced insulation.		N
	Screws that may be removed when replacing a supply cord having a type X attachment or when undertaking user maintenance shall not be of insulating material if their replacement by a metal screw could impair basic insulation.		N
	For Screws and nuts test is performed as specified in IEC 60335-1/A2		P
28.2	Electrical connections and connections providing earthing continuity shall be constructed so that contact pressure is not transmitted through insulating material that is liable to shrink or to distort unless there is sufficient resiliency in the metallic parts to compensate for any possible shrinkage or distortion of the insulating material.		P
28.3	Space-threaded (sheet metal) screws shall only be used for electrical connections if they clamp the parts together.		P
	Thread-cutting (self-tapping) screws and thread rolling screws shall only be used for electrical connections if they generate a full form standard machine screw thread. However, thread-cutting (self-tapping) screws shall not be used if they are likely to be operated by the user or installer.		N
	Thread-cutting, thread rolling and space-threaded screws may be used in connections providing earthing continuity provided it is not necessary to disturb the connection <ul style="list-style-type: none"> – in normal use, – during user maintenance, – when replacing a supply cord having a type X attachment, or – during installation. 		N



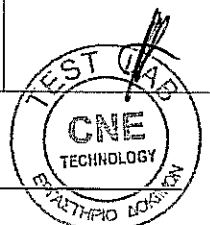
IEC 60335-2-21

Clause	Requirement - Test	Result - Remark	Verdict
28.3	At least two screws must be used for each connection providing earthing continuity unless the screw forms a thread having a length of at least half the diameter of the screw.		P
28.4	Screws and nuts that make a mechanical connection between different parts of the appliance shall be secured against loosening if they also make electrical connections or connections providing earthing continuity.		P
	Rivets used for electrical connections or for connections providing earthing continuity shall be secured against loosening if these connections are subject to torsion in normal use.		N

29	CLEARANCES, CREEPAGE DISTANCES AND SOLID INSULATION		
29.1	Clearances shall not be less than the values specified in Table 16, taking into account the rated impulse voltage for the overvoltage categories of Table 15, unless, for basic insulation and functional insulation, they comply with the impulse voltage test of Clause 14.		P
	However, if the construction is such that the distances could be affected by wear, by distortion, by movement of the parts or during assembly, the clearances for rated impulse voltages of 1 500 V and above are increased by 0,5 mm and the impulse voltage test is not applicable.		N
	The impulse voltage test is not applicable when the microenvironment is pollution degree 3 or for basic insulation of class 0 appliances and class 0I appliances.		P
	Parts, such as hexagonal nuts that can be tightened to different positions during assembly, and movable parts, are placed in the most unfavourable position.		N
	A force is applied to bare conductors, other than those of heating elements, and accessible surfaces to try to reduce clearances when making the measurement. The force is – 2 N, for bare conductors, – 30 N, for accessible surfaces. The force is applied by means of test probe B of IEC 61032. Apertures are assumed to be covered by a piece of flat metal.		P



IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
29.1.1	The clearances of basic insulation shall be sufficient to withstand the overvoltages likely to occur during use, taking into account the rated impulse voltage. The values of Table 16, or the impulse voltage test of Clause 14, are applicable.		P
	The clearance at the terminals of tubular sheathed heating elements may be reduced to 1,0 mm if the microenvironment is pollution degree 1		N
	Lacquered conductors of windings are considered to be bare conductors.		N
29.1.2	Clearances of supplementary insulation shall be not less than those specified for basic insulation in table 16.		N
29.1.3	Clearances of reinforced insulation shall be not less than those specified for basic insulation in table 16, but using the next higher step for rated impulse voltage as a reference.		N
29.1.4	For functional insulation, the values of table 16 are applicable. However, clearances are not specified if the appliance complies with clause 19 with the functional insulation short-circuited. Lacquered conductors of windings are considered to be bare conductors. However, clearances at crossover points are not measured."		N
	The clearance between surfaces of PTC heating elements may be reduced to 1 mm.		N
29.1.5	For appliances having higher working voltages than rated voltage, for example on the secondary side of a step-up transformer, or if there is a resonant voltage, the voltage used for determining clearances from table 16 shall be the sum of the rated impulse voltage and the difference between the peak value of the working voltage and the peak value of the rated voltage.		N
	If the secondary winding of a step-down transformer is earthed, or if there is an earthed screen between the primary and secondary windings, clearances of basic insulation on the secondary side shall be not less than those specified in table 16, but using the next lower step for rated impulse voltage as a reference.		N
	For circuits supplied with a voltage lower than rated voltage, for example on the secondary side of a transformer, clearances of functional insulation are based on the working voltage, which is used as the rated voltage in table 15.		N



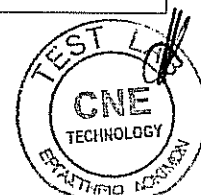
IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
29.2	Appliances shall be constructed so that creepage distances are not less than those appropriate for the working voltage, taking into account the material group and the pollution degree.	Pollution degree 2 applies	P
29.2.1	Creepage distances of basic insulation shall not be less than those specified in table 17.		P
29.2.2	Creepage distances of supplementary insulation shall be at least those specified for basic insulation in table 17.		N
29.2.3	Creepage distances of reinforced insulation shall be at least double those specified for basic insulation in table 17.		N
29.2.4	Creepage distances of functional insulation shall be not less than those specified in table 18. However, creepage distances may be reduced if the appliance complies with clause 19 with the functional insulation short-circuited.		N
29.3	Supplementary insulation and reinforced insulation shall have adequate thickness, or have a sufficient number of layers, to withstand the electrical stresses that can be expected during the use of the appliance. Compliance is checked by:		N
	- measurement, in accordance with 29.3.1,		N
	- an electric strength test in accordance with 29.3.2, if the insulation consists of more than one separate layer, other than natural mica or similar flakey material, or by		N
	- an assessment of the thermal quality of the material combined with an electric strength test, in accordance with 29.3.3. and, for accessible reinforced insulation consisting of a single layer, measurement in accordance with 29.3.Z1.		N
29.3.1	The thickness of the insulation shall be at least - 1 mm for supplementary insulation; - 2 mm for reinforced insulation.		N



IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict

29.3.2	Each layer of material shall withstand the electric strength test of 16.3 for supplementary insulation. Supplementary insulation shall consist of at least 2 layers of material and reinforced insulation of at least 3 layers.		N
29.3.3	The insulation is subjected to the dry heat test Bb of IEC 60068-2-2 for 48 h at a temperature of 50 K in excess of the maximum temperature rise measured during the test of Clause 19. At the end of the period, the insulation is subjected to the electric strength test of 16.3 at the conditioning temperature and also after it has cooled down to room temperature.		N
	If the temperature rise of the insulation measured during the tests of Clause 19 does not exceed the value specified in Table 3, the test of IEC 60068-2-2 is not carried out."		N
29.3.Z1	If accessible reinforced insulation consists of a single layer, the thickness of this layer shall comply with Table Z.1.		N

30	RESISTANCE TO HEAT AND FIRE		
30.1	External parts of non-metallic material, parts of insulating material supporting live parts including connections, and parts of thermoplastic material providing supplementary insulation or reinforced insulation, shall be sufficiently resistant to heat if their deterioration could cause the appliance to fail to comply with this standard. The temperature rises occurring during the tests of 19.2, 19.3 and 19.101 are not taken into account.		N
30.2	Parts of non-metallic material shall be resistant to ignition and spread of fire.		N
30.2.1	Parts of non-metallic material are subjected to the glow-wire test of IEC 60695-2-11, which is carried out at 550 °C.		N
30.2.2	For appliances that are operated while attended, parts of insulating material supporting current-carrying connections, and parts of insulating material within a distance of 3 mm of such connections, are subjected to the glow-wire test of IEC 60695-2-11.		N
30.2.3	Appliances that are operated while unattended are tested as specified in 30.2.3.1 and 30.2.3.2.		N



IEC 60335-2-21			
Clause	Requirement - Test	Result - Remark	Verdict
30.2.3.1	Parts of insulating material supporting connections that carry a current exceeding 0,2 A during normal operation, and parts of insulating material within a distance of 3 mm of such connections, shall have a glow-wire flammability index of at least 850 °C according to IEC 60695-2-12, the test sample being no thicker than the relevant part		N
30.2.3.2	Parts of insulating material supporting current-carrying connections, and parts of insulating material within a distance of 3 mm of such connections, are subjected to the glowwire test of IEC 60695-2-11. However, the glow-wire test is not carried out on parts of material classified as having a glow-wire ignition temperature according to IEC 60695-2-13 of at least		N
30.2.4	The base material of printed circuit boards is subjected to the needle-flame test of Annex E. The flame is applied to the edge of the board where the heat sink effect is lowest when the board is positioned as in normal use.		N

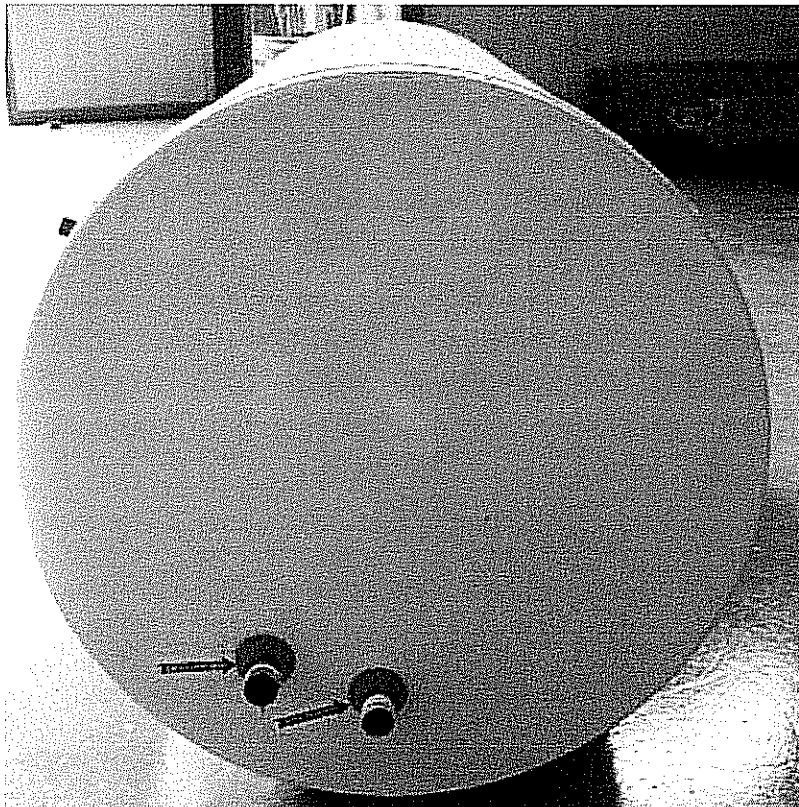
31	RESISTANCE TO RUSTING		
	Ferrous parts, the rusting of which might cause the appliance to fail to comply with this standard, shall be adequately protected against rusting.		P
32	RADIATION, TOXICITY AND SIMILAR HAZARDS		
	Appliances shall not emit harmful radiation or present a toxic or similar hazard.		P

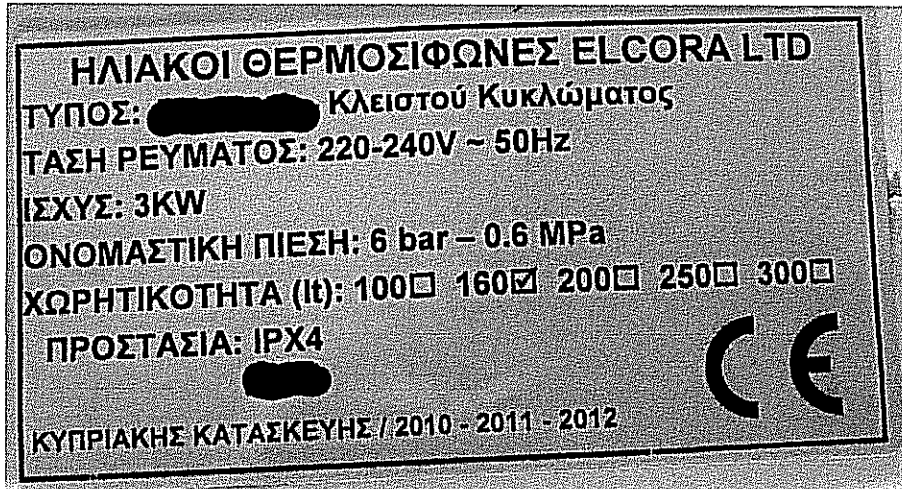
IEC 61000-3-3			
Clause	Requirement - Test	Result - Remark	Verdict
Annex A A.12	For direct water heaters without electronic controls, evaluate dc only by switching the heater on and off (sequence 0 – Pmax – 0).	2,6%	P

END OF REPORT

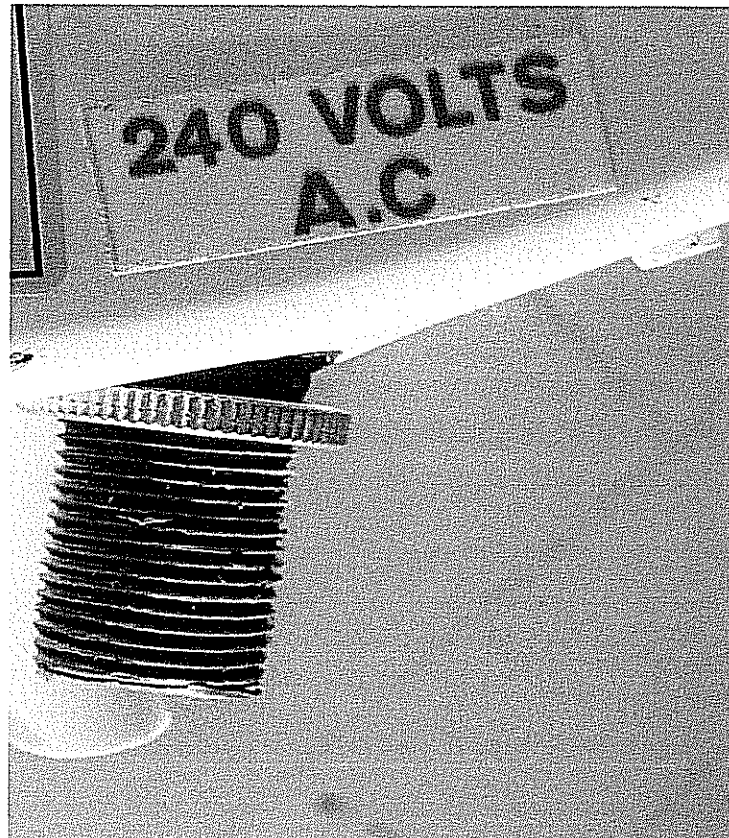


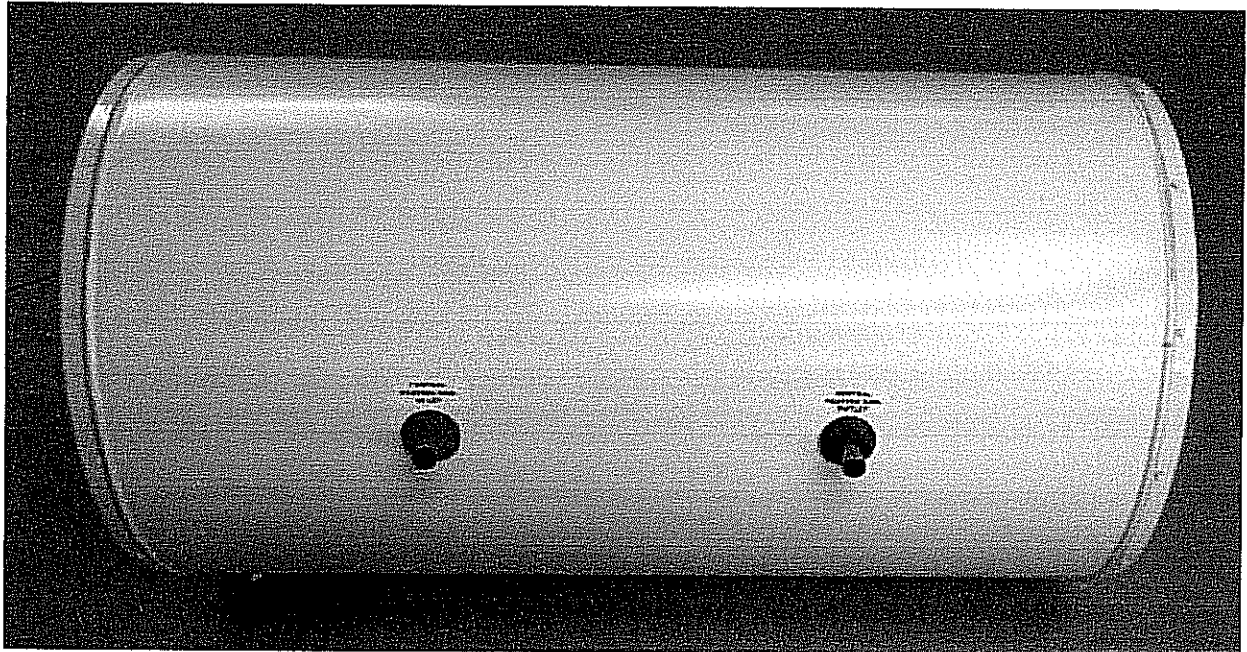
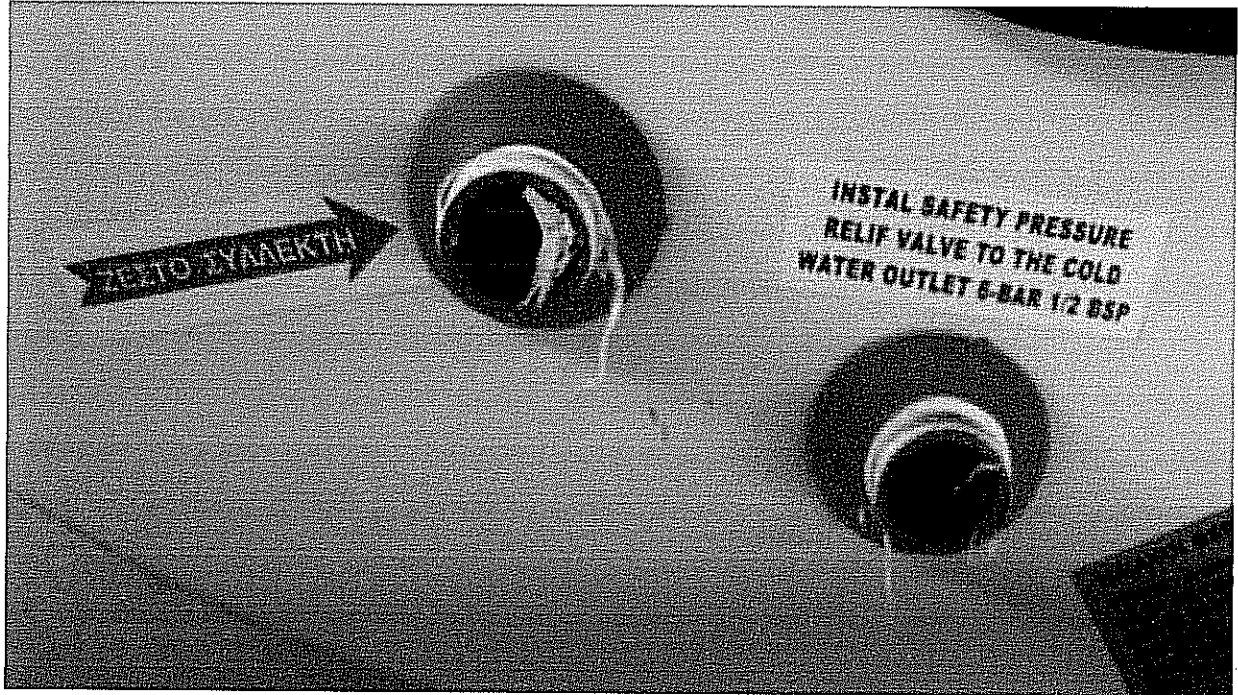
ANNEX 1

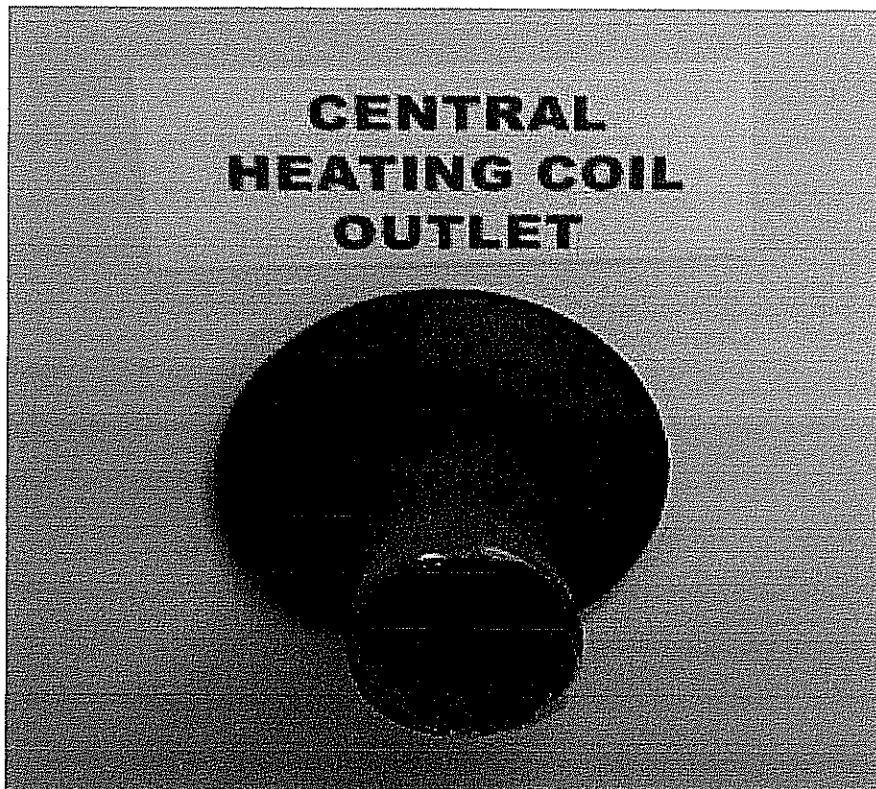
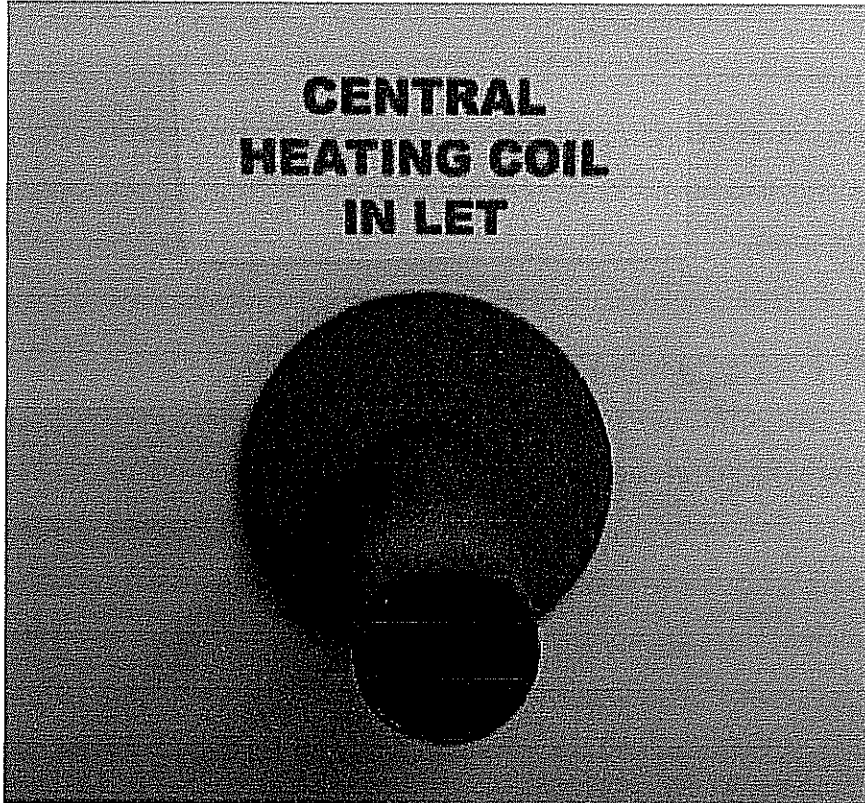


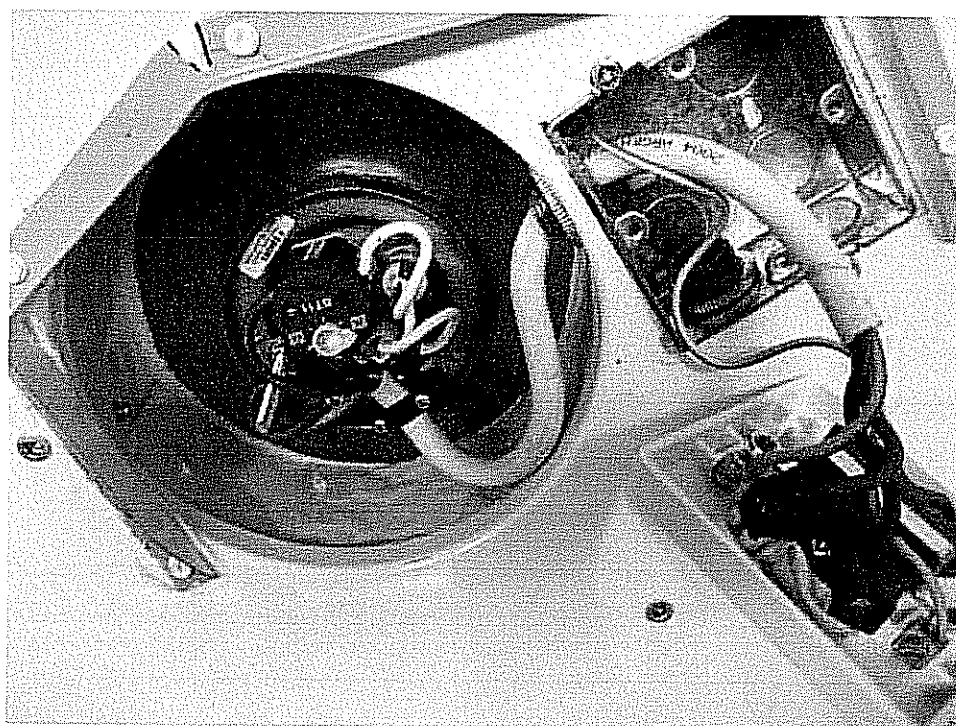
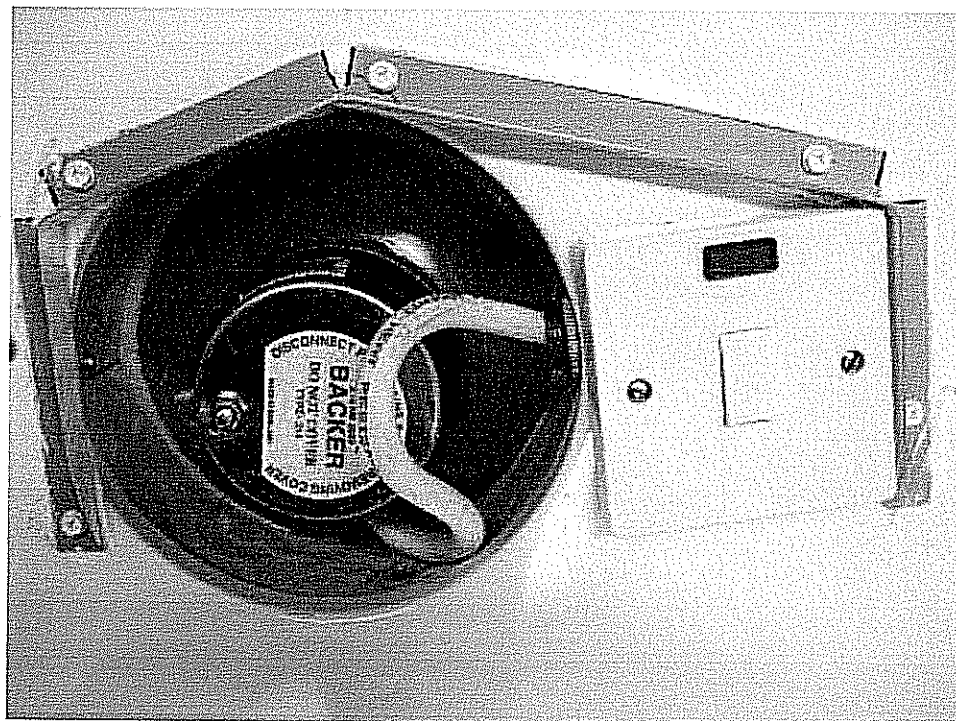


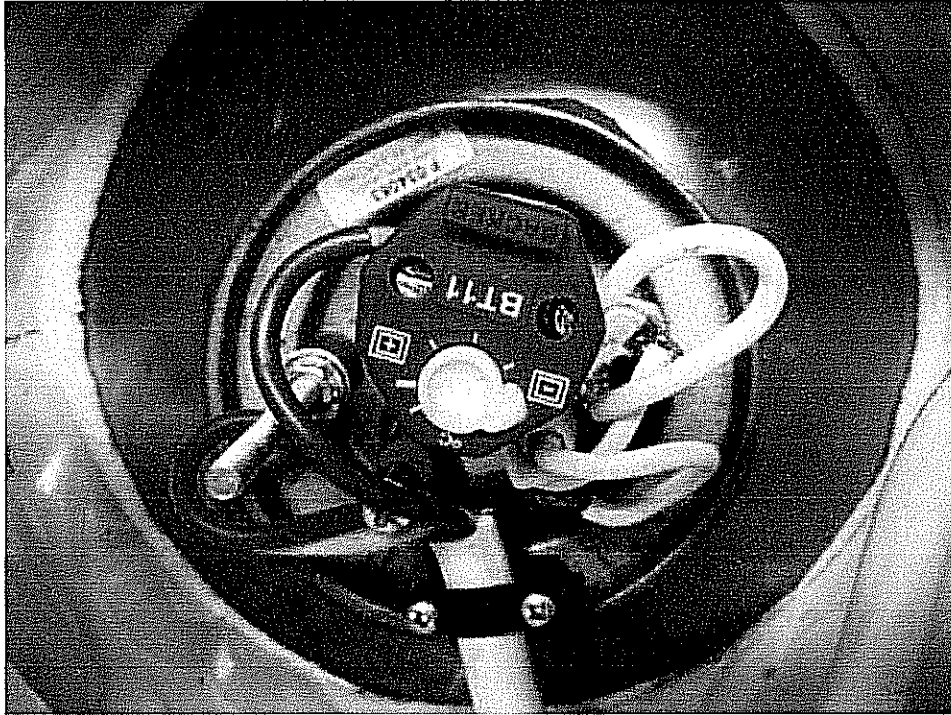












ANNEX 2

10 TABLE: Input deviation measurements					
input deviation dP of/at:	P rated (W)	P (W)	dP	required dP	remark
@230V	3000	2714	-8,9%	+5% or -10%	P
@240V	3000	2928	-2,4 %	+5% or -10%	P

ANNEX 3

11.8 TABLE: Temperature rise measurements		
Initial Room temperature t1 (°C) :	21,5	
Final Room temperature t2 (°C) :	22,9	
Test Wattage (W) :	2904	
Temperature rise dT of part / at:	dT (K)	max. allowed dT (K)
Internal Wire inside the heating element (connected with the heater switch)	22,5	50
Terminal Block (heater switch enclosure)	19,8	30
Earthing terminals, for external conductors	19,8	60
PVC insulation of internal and external wiring	24,8	50
Internal Wire 1 (Phase)	29,2	60
Internal Wire 2 (Neutral)	29,2	60
Thermostat	21,3	30
Rubber, other than synthetic, used for gaskets or other parts	5,4	50
Temperature of part / at:	°C	max. allowed (°C)
Points where the insulation of wires can come into contact with parts of a terminal block	24,6	50°C
Water Temperature	66,8	99°C



ANNEX 4

13.2	TABLE: leakage current measurements at operating temperature		
	heating appliances: at 1,15 times rated input (W) :	3510	-
	motor-operated and combined appliances: at 1,06 times rated voltage (V) :	-	-
leakage current I between:		I (mA)	max. allowed I (mA)
Live and Earth		< 0,10 mA	2,25
Neutral and Earth		< 0,10 mA	2,25

13.3	TABLE: electric strength measurements at operating temperature		
test voltage applied across:		test voltage (V)	breakdown
Live parts and accessible parts over basic insulation		1000	No

16.2	TABLE: leakage current measurements		
	at 1,06 times rated voltage (V) :	254,4	-
leakage current I between:		I (mA)	max. allowed I (mA)
Live parts and accessible parts over basic insulation		< 0,10 mA	2,25

16.3	TABLE: electric strength measurements		
test voltage applied across:		test voltage (V)	breakdown
Live parts and accessible parts over basic insulation		1250	No

17.1	TABLE: overload protection, temperature rise measurements		
	at 1,06 or 0,94 times rated voltage (V) :		
temperature rise dT of part/at:		dT (K)	max. allowed dT (K)
N/A		N/A	N/A



ANNEX 5

24.1					
TABLE: Components					
object / part No.	manufacturer / trademark	type / model	technical data	standard	mark(s) of conformity)
Heating Element	Manufacturer: Backer Electric Company Ltd. Trademark: BACKERSAFE	BS314	3 kW, 240V	EN 60335-2-21	CE marking
Thermostat	Manufacturer: Backer Electric Company Ltd. Trademark: BACKERSAFE	BT11	250V, 15A	EN 60730-1:2000 +A1,+A11,+A12,+A13,+A14,+A15,+A16 EN 60730-2-9:2002+A1,+A2,+A11,+A12	CE marking
Thermal cut-out	Manufacturer: Backer Electric Company Ltd. Trademark: BACKERSAFE	T24	85 °C, Type 2B Controls	EN 60730-1:2000 +A1,+A11,+A12,+A13,+A14,+A15,+A16	CE marking
Flush-Type Switch (Heater Switch)	Manufacturer: Hangzhou Hongshi Electrical Ltd / SWE	W324	20A 250V~, IP20, flush-type, design B, with pillar terminals Pattern No.2	EN 60669-1:1999 + A1:2002	CE marking

