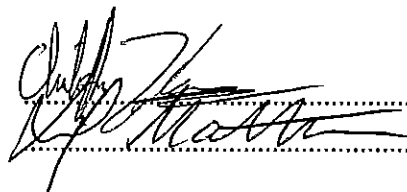
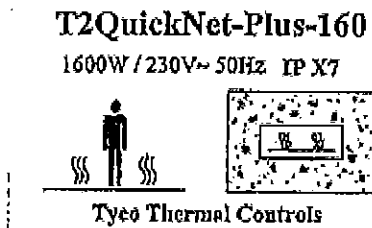


<p>TEST REPORT IEC/EN 60335-2-96 Safety of household and similar electrical appliances Part 2: Flexible sheet heating elements for room heating</p>	
<p>Report Reference No.....: 707591-1</p> <p>Compiled by (+ signature): Christoffer Johansson</p> <p>Approved by (+ signature): Leif Mattsson</p> <p>Date of issue.....: 3 September 2007</p>	
<p>CB Testing Laboratory: Intertek Semko AB</p> <p>Address.....: P.O. Box 1103, SE-164 22 Kista, SWEDEN</p> <p>Testing location/procedure: CBTL [] SMT [] TMP [X]</p> <p>Address.....: as above and at the applicants facility</p>	
<p>Applicant's name: Tyco Thermal Controls Nordic AB</p> <p>Address.....: Box 53, SE-430 63 Hindås, Sweden</p>	
<p>Test specification:</p> <p>Standard: EN 60335-1:2002, A11, A1, A12, A2 (IEC 60335-1:2001, A1, A2) EN 60335-2-96:2002, A1:2004, (IEC 60335-2-96:2002, A1:2003)</p> <p>Test procedure.....: CCA/CB</p> <p>Non-standard test method.....: N/A</p>	
<p>Test Report Form No.: IEC60335_1G</p> <p>Master TRF.....: Dated 02-04</p> <p>Copyright © 2001 IEC System for Conformity Testing and Certification of Electrical Equipment (IECEE), Geneva, Switzerland. All rights reserved.</p> <p>This publication may be reproduced in whole or in part for non-commercial purposes as long as the IECEE is acknowledged as copyright owner and source of the material. IECEE takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.</p>	
<p>Test item description.....: Floor heating system</p> <p>Trade Mark: Tyco Thermal Controls</p> <p>Model/Type reference.....: T2QuickNet-Plus-160</p> <p>Ratings.....: 230V~ 50Hz 157-1600W max 160W/m² IPX7</p>	



Copy of marking plate and summary of test results (information/comments):

Markingplate



A label that contains sufficient space for the locations of the heating units to be listed shall be provided for each installation giving

T2QuickNet-Plus-160 golvvärme anläggning

Fyll i denna installationsrapport och sätt upp det på väl synlig plats vid gruppcentralen. Kom även ihåg att upprätta förläggningsskiss över anläggningen i avsedd ruta.

Observera!

- Spikning, skruvning eller hållagning i golven inte är tillåten med hänsyn till riskerna för kortslutning. Beakta särskilt montering av mallister och liknande.
- Att andra golvtäckningsmtrl än klinker inte är tillåtna tillsammans med T2QuickNet.
- Varaktlig uppsättning av möbler, extra garderober och liknande rumsinredning som täcker stora ytor kan förorsaka överhettning av värmeenheter.

Anläggning

Artikelnr:	Kabellängd:
Totaleffekt:	Spänning: 230 V ~
Utrymme:	Golvarea:

Isolationsmätningar som ska göras under arbetets gång

Isolationsvärde värmematta:		Resistansvärde värmematta:	
Mätning före förläggning (bild 1):	MΩ	Mätning före förläggning (bild 2):	Ω
Mätning efter förläggning men innan inspackling (bild 5):	MΩ	Mätning efter förläggning men innan inspackling (bild 8):	Ω
Mätning efter inspackling men före platsättning (bild 9):	MΩ	Mätning efter inspackling men före platsättning (bild 10):	Ω
Mätning efter platsättning men före spänningssättning (bild 9):	MΩ	Mätning efter platsättning men före spänningssättning (bild 10):	Ω

Installatör

Firmanamn:	
Fullständig adress:	
Montör:	Installationsdatum:
Mobilnr:	Telefonnr:

Förläggningsskiss



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Test item particulars
Possible test case verdicts: - test case does not apply to the test object : N/A - test object does meet the requirement : P(Pass) - test object does not meet the requirement : F(Fail)
Testing
Date of receipt of test item..... : 11 October 2004 Date (s) of performance of tests..... : 1 July – 17 November 2004
General remarks: This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02. The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory. "(see Enclosure #)" refers to additional information appended to the report. "(see appended table)" refers to a table appended to the report. Throughout this report a comma (point) is used as the decimal separator.



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General product information:

For mounting in concrete floor with floor covering of clinkers and similar material. Clause 10, 11, 13.2 and 19 have been performed at type T2QuickNet-Plus-160 for a floor with covering of clinkers, the size of the floor is 4 m². The max input power for m² will be 160W, with thermostat max setting 30 or 35°C see component list.

Clause 13.3, 15.3 which have been followed by 16.2-3 have been performed at unit 4m².

Clause 15.1, 18.101, 18.103, 21.101-103 and 22.101-22.102 have been performed at the short heating cable with cold cable and ordinary isolation at connection and end part.

Width of the mat (m)	Length of the mat (m)	Area (m ²)	Input power (W)
0,5	2,0	1,0	157
0,5	3,0	1,5	240
0,5	4,0	2,0	319
0,5	5,0	2,5	400
0,5	6,0	3,0	475
0,5	7,0	3,5	560
0,5	8,0	4,0	634
0,5	9,0	4,5	762
0,5	10,0	5,0	800
0,5	12,0	6,0	935
0,5	14,0	7,0	1140
0,5	16,0	8,0	1286
0,5	18,0	9,0	1440
0,5	20,0	10,0	1600

Clause 10, 11, 13 and 19 have been tested at the customers facility.



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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict

	Other flexible sheet heating elements can be supplied through them (EN 60 335-2-96)		N
	Flexible sheet heating elements shall be marked with:		
	The indication of orientation, unless heating units are symmetrical (EN 60 335-2-96)		N
	The intended installation (ceilings, walls or floors) (EN 60 335-2-96)	Symbol for floor	P
	The heating mode (direct heating or storage heating), unless intended for both modes (EN 60 335-2-96)	Symbol for direct heating	P
	If the heating unit is only intended for application in floors of concrete or similar materials, it shall be marked accordingly (EN 60 335-2-96)	Symbol for installation in concrete	P
	The marking shall be repeated at least once every 0,5 m of the heating element or on every section that can be cut to form a heating unit (EN 60 335-2-96)		N
	Flexible sheet heating elements that can be cut on site and have to be cut at specified places shall be marked appropriately (EN 60 335-2-96)		N
7.2	Warning for stationary appliances for multiple supply		N
	Warning placed in vicinity of terminal cover		N
7.3	Range of rated values marked with the lower and upper limits separated by a hyphen		N
	Different rated values marked with the values separated by an oblique stroke		N
7.4	Appliances adjustable for different rated voltages, the voltage setting is clearly discernible		N
7.5	Appliances with more than one rated voltage or one or more rated voltage ranges, marked with rated input or rated current for each rated voltage or range, unless		N
	the power input is related to the mean value of the rated voltage range		N
	Relation between marking for upper and lower limits of rated power input or rated current and voltage is clear		N
7.6	Correct symbols used		P
	Additional symbols (EN 60 335-2-96 A1)		P



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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict

7.7	Connection diagram fixed to appliances to be connected to more than two supply conductors and appliances for multiple supply		N
7.8	Except for type Z attachment, terminals for connection to the supply mains indicated as follows:		
	- marking of terminals exclusively for the neutral conductor (N)		N
	- marking of protective earthing terminals (symbol 5019 of IEC 60417)		N
	- marking not placed on removable parts		N
7.9	Marking or placing of switches which may cause a hazard		P
7.10	Indications of switches on stationary appliances and controls on all appliances by use of figures, letters or other visual means		P
	The figure 0 indicates only OFF position, unless no confusion with the OFF position		P
7.11	Indication for direction of adjustment of controls		P
7.12	Instructions for safe use provided	Swedish version checked	P
7.12.1	Sufficient details for installation supplied		P
a)	Instructions for installation shall be provided. They shall include		
	Explanation of the marking and symbol, if necessary (EN 60 335-2-96)		P
	Explanation of the marking and symbol, if necessary (EN 60 335-2-96 A1)		P
b)	Information for incorporating the heating units into the building:		
	Precautions to be taken to avoid damage during installation, such as dropping sharp objects or stepping on the heating unit, or careless pouring of concrete (EN 60 335-2-96)		P
	Dimensions and distances to be taken into account (EN 60 335-2-96)		P
	A statement that the heating units have to be separated from other heat sources such as luminaires and chimneys (EN 60 335-2-96)		P
	Description of the fixing areas of the heating unit (EN 60 335-2-96)		P

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict
	Guidance on how to avoid air gaps between the heating element and the screed of concrete floors(EN 60 335-2-96)		P
	Guidance on how to avoid damage to a heating element and its terminations in timber constructions due to relative movement after installation (EN 60 335-2-96)		N
	A warning against incorporating heating units below a height of 2,3 m into walls or into ceilings inclined at less than 45° to the vertical (EN 60 335-2-96)		N
	The lowest ambient temperature at which heating units may be installed (EN 60 335-2-96)	+5°C	P
	The minimum radius for bending the heating element. (EN 60 335-2-96)	30mm	P
	Except for modular heating units, the instructions shall include:		
	Precautions to be taken to avoid creasing the heating element (EN 60 335-2-96)		N
	A statement that the heating unit is not to be installed on irregular surfaces (EN 60 335-2-96)		N
	A statement that the heating unit is to be installed with the correct orientation for units with non symmetric construction (EN 60 335-2-96 A1)		N
c)	A statement that the installation is to be in accordance with the national wiring rules (EN 60 335-2-96)		P
	The substance of the following shall be included:		
	The heating units are to be supplied through a residual current device (RCD) having a rated residual operating current not exceeding 30 mA. (EN 60 335-2-96 A1)		P
	How to connect heating units to the supply, giving the cross-sectional area of the leads (EN 60 335-2-96)		N
	How to interconnect the heating units, giving the cross-sectional area of the leads (EN 60 335-2-96)		N
d)	The maximum current allowed to flow through one heating unit when other units are supplied through it or when the current can vary depending on its length (EN 60 335-2-96)		N



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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict
e)	List of controls, unless they are incorporated into the heating unit (EN 60 335-2-96)		P
f)	The maximum thermal resistance between the heating unit and the room (EN 60 335-2-96)		P
	The type of covering materials that are allowed to be used in conjunction with the heating units and stating that the advice of the manufacturer is to be requested before materials other than those recommended are used; the thickness of covering materials, which for floors shall be at least 5 mm (EN 60 335-2-96)		P
g)	Characteristics of the thermal insulation that is to be inserted between separate heating units installed to heat a floor and the ceiling below it (EN 60 335-2-96)		N
h)	Specification of any adhesive to be used (EN 60 335-2-96)		P
j)	A statement that a label is to be fixed adjacent to the distribution board and that it has to contain the locations of the heating units (EN 60 335-2-96)		P
k)	if the heating units are installed in a suspended ceiling, or are accessible from the roof space, a statement that a label giving this information is to be fixed to the access point of the ceiling (EN 60 335-2-96)		N
l)	For heating units in timber floor with insulated transformer need not to be class II (EN 60 335-2-96 A1)		N
7.12.2	Stationary appliances not fitted with means for disconnection from the supply mains having a contact separation in all poles that provide full disconnection under over voltage category III, the instructions state that means for disconnection must be incorporated in the fixed wiring in accordance with the wiring rules		P
7.12.3	Insulation of the fixed wiring in contact with parts exceeding 50 K during clause 11; instructions stating that the fixed wiring must be protected		N
7.12.4	Instructions for built-in appliances:		
	- dimensions of space		N
	- dimensions and position of supporting means		N
	- distances between parts and surrounding structure		N

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110313

IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict
	- dimensions of ventilation openings and arrangement		N
	- connection to supply mains and interconnection of separate components		N
	- plug accessible after installation, unless		N
	a switch complying with 24.3		N
7.12.5	Replacement cord instructions, type X attachment with a specially prepared cord		N
	Replacement cord instructions, type Y attachment		N
	Replacement cord instructions, type Z attachment		N
7.12.101	The instructions for applications in floors of concrete or similar material or under tiles shall state that:		
a)	A grid is to be installed above the heating unit. (EN 60 335-2-96)		N
	The grid is to:		
	-Be protected against corrosion but not electrically insulated (EN 60 335-2-96)		N
	-Be electrically and mechanically equivalent to a steel grid having a mesh not more than 50 mm x 50 mm and a wire diameter of 1 mm (EN 60 335-2-96)		N
	Unless the grid covers		
	-class II heating units (EN 60 335-2-96)		N
	-heating units installed with additional electrical insulation. (EN 60 335-2-96)		N
	Fully cover the heating unit including the fixing areas. It may cover several heating units (EN 60 335-2-96)		N
	Be connected to earth (EN 60 335-2-96)		N
	Be fitted with terminals suitable for the connection of two conductors each having a nominal cross-sectional area of 2,5 mm ² (EN 60 335-2-96)		N
	Be checked for electrical continuity during installation. (EN 60 335-2-96)		N
	The grid is not required for:		
	-class III heating units (EN 60 335-2-96)		N
	-class II heating units supplied through an isolating transformer (EN 60 335-2-96)		N

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict

	-Class II heating units that are installed in dry locations and are supplied through a residual current device (RCD) (EN 60 335-2-96)		N
	-Heating units installed in dry locations if the basic insulation and additional electrical insulation each withstand the electric strength test of 16.3 of reinforced insulation (EN 60 335-2-96)		N
	-Heating units incorporating a metallic shield or braid having a resistance per unit length equivalent to that of 0,5 mm ² copper wire. (EN 60 335-2-96)	Earth wire consist of 0,72 mm ² + shield	P
b)	When the heating units have been positioned, they must be covered with a additional (EN60 335-2-96 A1)		N
	These statements are not required if :		
	-screened insulated heating wires are covered with a sheath which complies with test of 21.103; (EN 60 335-2-96 A1)		P
	-the additional electrical insulation complies with the test of 21.102. (EN 60 335-2-96)		N
c)	When heating units having basic insulation only, other than those supplied at safety extra-low voltage, are provided with additional electrical insulation, this additional insulation is to be placed directly on the heating unit (EN 60 335-2-96)		N
d)	Class II heating units are to be installed at a distance of at least 30 mm from conductive parts of the building, such as water pipes. (EN 60 335-2-96)		N
7.12.102	The instructions for applications in metallic ceilings or metallic floors for heating units with basic insulation only, other than those supplied at safety extra-low voltage (EN 60 335-2-96)		N
a)	The flexible sheet heating element is to be fully covered by the ceiling or floor (EN 60 335-2-96)		N

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict
b)	The metallic parts of the ceiling or floor are to be earthed. The instructions shall state that they have to be fitted with terminals suitable for the connection of two conductors each having a nominal cross-sectional area of 2,5 mm ² and explain how the connection to the earthing terminal is to be made to ensure a low resistance. The statements regarding the need for earthing are not required if it is stated that a layer of additional electrical insulation is to be installed between the heating unit and the ceiling. If this insulation is not provided, the name of the manufacturer and reference of the insulation shall be given. (EN 60 335-2-96)		N
7.12.103	The instructions for applications on floors where the heating units are to be covered by tiles shall state that the heating units are to be covered by additional electrical insulation, unless the heating units are class II. (EN 60 335-2-96)	The heating cable have additional electrical insulation	P
7.12.104	The instructions for flexible sheet heating elements that can be cut on site shall state:		
	That this work is only to be carried out by persons authorized by the manufacturer (EN 60 335-2-96)		N
	And shall give information on how to:		
	Cut the element (EN 60 335-2-96)		N
	Protect the edges of the elements (EN 60 335-2-96)		N
	Connect the supply leads and the interconnection leads, and insulate the connections (EN 60 335-2-96)		N
7.12.105	The instructions for heating units for storage heating applications shall specify the rated charging period. (EN 60 335-2-96)		N
7.13	Instructions and other texts in an official language	Swedish version checked	P
7.14	Marking clearly legible and durable		P
	The petroleum test is not carried out (EN 60 335-2-96)		P
	The superimposed rectangle according to cl 7.6 shall be at least 15 mm (EN 60 335-2-96 A1)	The symbol is 15 mm	P
7.15	Marking on a main part	At the Heating unit and at the distribution board (7.101)	P

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict

	Marking clearly discernible from the outside, if necessary after removal of a cover		N
	For portable appliances, cover can be removed or opened without a tool		N
	For stationary appliances, name, trademark or identification mark and model or type reference visible after installation		N
	For fixed appliances, name, trademark or identification mark and model or type reference visible after installation according to the instructions		N
	Indications for switches and controls placed on or near the components. Marking not on parts which can be positioned or repositioned in such a way that the marking is misleading		N
7.16	Marking of a possible replaceable thermal link or fuse link clearly visible with regard to replacing the link		N
7.101	A label that contains sufficient space for the locations of the heating units to be listed shall be provided for each installation giving (EN 60 335-2-96)		P
	It shall state the substance of the following:		
	The name, trade mark or identification mark of the manufacturer or responsible vendor (EN 60 335-2-96).....:	Tyco Thermal Controls	P
	The model or type reference (EN 60 335-2-96).....:	T2QuickNet-Plus-160	P
	Flexible sheet heating units are installed in the ceiling/floor (EN 60 335-2-96)		P
	Do not restrict the thermal emission of the heated ceiling/floor (EN 60 335-2-96)		P
	Do not affix materials other than those recommended (EN 60 335-2-96)		P
	Do not insert nails or screws (EN 60 335-2-96)		P
8	PROTECTION AGAINST ACCESS TO LIVE PARTS		
8.1	Adequate protection against accidental contact with live parts		P
8.1.1	Requirement applies for all positions, detachable parts removed		N
	Insertion or removal of lamps, protection against contact with live parts of the lamp cap		N

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict
	Use of test probe B of IEC 61032: no contact with live parts		P
8.1.2	Use of test probe 13 of IEC 61032 through openings in class 0 appliances and class II appliances/ constructions: no contact with live parts		P
	Test probe 13 also applied through openings in earthed metal enclosures having a non-conductive coating: no contact with live parts		N
8.1.3	For appliances other than class II, use of test probe 41 of IEC 61032: no contact with live parts of visible glowing heating elements		N
8.1.4	Accessible part not considered live if:		
	- safety extra-low a.c. voltage: peak value not exceeding 42.4 V		N
	- safety extra-low d.c. voltage: not exceeding 42.4 V		N
	- or separated from live parts by protective impedance		N
	If protective impedance: d.c. current not exceeding 2 mA, and		N
	a.c. peak value not exceeding 0.7 mA		N
	- for peak values over 42.4 V up to and including 450 V, capacitance not exceeding 0,1 μ F		N
	- for peak values over 450 V up to and including 15 kV, discharge not exceeding 45 μ C		N
8.1.5	Live parts protected at least by basic insulation before installation or assembly:		
	- built-in appliances		N
	- fixed appliances		N
	- appliances delivered in separate units		N
8.2	Class II appliances and constructions constructed so that there is adequate protection against accidental contact with basic insulation and metal parts separated from live parts by basic insulation only		P
	Only possible to touch parts separated from live parts by double or reinforced insulation		P
9	STARTING OF MOTOR-OPERATED APPLIANCES		
	Requirements and tests are specified in part 2 when necessary		N

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict

10	POWER INPUT AND CURRENT		
10.1	Power input at normal operating temperature, rated voltage and normal operation not deviating from rated power input by more than shown in table 1	(see appended table)	P
10.2	Current at normal operating temperature, rated voltage and normal operation not deviating from rated current by more than shown in table 2	(see appended table)	N
11	HEATING		
11.1	No excessive temperatures in normal use		P
	The tests are carried out in a room that is maintained at an ambient temperature of 20 °C ± 2 °C. (EN 60 335-2-96)		P
11.2	Placing and mounting of appliance as described		P
	Heating units intended to be installed in ceilings are positioned in accordance with 11.2.101. (EN 60 335-2-96)		N
	Modular heating units for suspended ceilings are positioned in accordance with 11.2.102. (EN 60 335-2-96)		N
	Heating units intended to be installed in floors are positioned in accordance with 11.2.103. (EN 60 335-2-96)		P
	Test floor according to figure 103(EN 60 335-2-96 A1)		N
	Test floor according to figure 107(EN 60 335-2-96 A1)		N
	Test floor according to figure 104(EN 60 335-2-96 A1)		P
	Test floor according to figure 108(EN 60 335-2-96 A1)		N
	Separate heating units intended to heat a timber floor and the ceiling below it are positioned in accordance with 11.2.104. (EN 60 335-2-96)		N
	If a heating unit is provided with a thermostat having a separate sensor, the sensor is located on the centreline of one of the adjacent heating units but outside the area of the thermal insulation placed on the floor. (EN 60 335-2-96)		P
11.3	Temperature rises, other than of windings, determined by thermocouples		P

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict

	Temperature rises of windings determined by resistance method, unless		N
	the windings makes it difficult to make the necessary connections		N
11.4	Heating appliances operated under normal operation at 1.15 times rated power input	736W, 253V	P
11.5	Motor-operated appliances operated under normal operation at most unfavourable voltage between 0.94 and 1.06 times rated voltage		N
11.6	Combined appliances operated under normal operation at most unfavourable voltage between 0.94 and 1.06 times rated voltage		N
11.7	Operation duration corresponding to the most unfavourable conditions of normal use		P
	Heating units are operated until steady conditions are established. (EN 60 335-2-96)		P
	Heating units for storage heating applications are operated as specified for normal operation or until the charging control operates for the first time if this occurs first. (EN 60 335-2-96)		N
11.8	Temperature rises not exceeding values in table 3	(see appended tables)	P
	Temperature rises not exceeding values in table 101 (EN 60 335-2-96)	(see appended tables)	P
	Protective devices do not operate		P
	Sealing compound does not flow out		P
13	LEAKAGE CURRENT AND ELECTRIC STRENGTH AT OPERATING TEMPERATURE		
13.1	Leakage current not excessive and electric strength adequate		P
	Heating appliances operated at 1.15 times rated power input.....	736W, 253V	P
	Motor-operated appliances and combined appliances supplied at 1.06 times rated voltage.....		N
	Protective impedance and radio interference filters disconnected before carrying out the tests		N
	The heating units are installed as specified in 11.2, the most unfavourable covering material with respect to its electrical insulation characteristics being used. (EN 60 335-2-96)		P

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict
13.2	Leakage current measured by means of the circuit described in figure 4 of IEC 60990		P
	Leakage current measurements	(see appended table)	P
13.3	Electric strength tests according to table 4	(see appended table)	P
	The test is carried out directly on a heating unit and additional electrical insulation. The test voltage is applied after they have been conditioned for a period of 1 h at the temperature determined during the test of clause 11 (EN 60 335-2-96)		P
	No breakdown during the tests		P
14	TRANSIENT OVERVOLTAGES		
	Appliances withstand the transient overvoltages to which they may be subjected		N
	Clearances having a value less than specified in table 16 subjected to an impulse voltage test, the test voltage specified in table 6	(see appended table)	N
	No flashover during the test, unless of functional insulation		N
	In case of flashover of functional insulation, the appliance complies with clause 19 with the clearance short circuited		N
15	MOISTURE RESISTANCE		
15.1	Enclosure provides the degree of moisture protection according to classification of the appliance		P
	The test is carried out directly on a heating unit. (EN 60 335-2-96)		P
	Compliance checked as specified in 15.1.1, taking into account 15.1.2, followed by the electric strength test of 16.3		P
	No trace of water on insulation which can result in a reduction of clearances and creepage distances below values specified in clause 29		P
15.1.1	Appliances, other than IPX0, subjected to tests as specified in IEC 60529.....:	IP X7	P
	IPX7 heating units are immersed for 72 h. (EN 60 335-2-96)		P
15.1.2	Hand-held appliance turned continuously through the most unfavourable positions during the test		N

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict

	Built-in appliances installed according to the instructions		N
	Appliances placed or used on the floor or table placed on a horizontal unperforated support		N
	Appliances normally fixed to a wall and appliances with pins for insertion into socket-outlets are mounted on a wooden board		N
	Heating units, other than IPX7 heating units, are placed horizontally on a perforated support in accordance with IEC 60529, taking into account the marking of orientation. If the orientation is not marked, they are tested in both positions. (EN 60 335-2-96)		P
	For IPX3 appliances, the base of wall mounted appliances is placed at the same level as the pivot axis of the oscillating tube		N
	For IPX4 appliances, the horizontal centre line of the appliance is aligned with the pivot axis of the oscillating tube		N
	However, for appliances normally used on the floor or table, the movement is limited to two times 90° for a period of 5 min, the support being placed at the level of the pivot axis of the oscillating tube		N
	Wall-mounted appliances, take into account the distance to the floor stated in the instructions		N
	Appliances with type X attachment fitted with a flexible cord as described		N
	Detachable parts tested as specified		N
15.2	Spillage of liquid does not affect the electrical insulation		N
	Appliances with type X attachment fitted with a flexible cord as described		N
	Appliances incorporating an appliance inlet tested with or without an connector, whichever is most unfavourable		N
	Detachable parts removed		N
	Overfilling test with additional amount of water, over a period of 1 min (l)..... :		N
	The appliance withstands the electric strength test of 16.3		N

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict

	No trace of water on insulation that can result in a reduction of clearances and creepage distances below values specified in clause 29		N
15.3	Appliances proof against humid conditions		P
	The test is carried out directly on a heating unit and additional electrical insulation (EN 60 335-2-96)		P
	Humidity test for 48 h in a humidity cabinet		P
	The appliance withstands the tests of clause 16		P
16	LEAKAGE CURRENT AND ELECTRIC STRENGTH		
16.1	Leakage current not excessive and electric strength adequate		P
	The tests are carried out directly on a heating unit and additional electrical insulation (EN 60 335-2-96)		P
	Protective impedance disconnected from live parts before carrying out the tests		N
16.2	Single-phase appliances: test voltage 1.06 times rated voltage	244V	P
	Three-phase appliances: test voltage 1.06 times rated voltage divided by $\sqrt{3}$		N
	Leakage current measurements	(see appended table)	P
16.3	Electric strength tests according to table 7	(see appended table)	P
	No breakdown during the tests		P
17	OVERLOAD PROTECTION OF TRANSFORMERS AND ASSOCIATED CIRCUITS		
	No excessive temperatures in transformer or associated circuits in event of short-circuits likely to occur in normal use	(see appended table)	N
	Appliance supplied with 1.06 or 0.94 times rated voltage and the most unfavourable short-circuit or overload likely to occur in normal use applied		N
	Temperature rise of insulation of the conductors of safety extra-low voltage circuits not exceeding the relevant value specified in table 3 by more than 15 K		N
	Temperature of the winding not exceeding the value specified in table 8,		N
	however limits do not apply to fail-safe transformers complying with sub-clause 15.5 of IEC 61558-1		N
18	ENDURANCE		

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict

	Requirements and tests are specified in part 2 when necessary		P
18.101	The connections from the heating element to the supply leads and to interconnection leads shall be reliable. (EN 60 335-2-96)		P
	The heating unit is placed in a heating cabinet at a temperature of 20 °C ± 2 °C and is supplied with a voltage so that the current is equal to the value marked on the heating element or to the rated current, as applicable. The voltage drop at each connection is measured. (EN 60 335-2-96)		P
	<p>The heating unit is heated in cycles. Each cycle has a duration of 1 h and comprises</p> <ul style="list-style-type: none"> – a period of 30 min, during which <ul style="list-style-type: none"> • the heating unit is supplied with the voltage that was applied when the voltage drop was measured; <ul style="list-style-type: none"> • for the first 20 min, the temperature of the heating cabinet is raised to 85 °C or to the temperature of the heating element determined during the test of clause 11, whichever is lower; • for the last 10 min, the temperature of the heating cabinet is maintained within ± 5 K of this temperature. – a period of 20 min, during which the temperature is lowered to approximately 30 °C; – a stabilization period of 10 min. <p>(EN 60 335-2-96)</p>		P
	The test is carried out for 400 cycles. The temperature of the heating cabinet is then reduced to 20 °C ± 2 °C and the voltage drop at each connection is measured again. (EN 60 335-2-96)		P
	The voltage drop shall not exceed 22,5 mV or 1,5 times the first value measured, whichever is lower. (EN 60 335-2-96)		P



IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict

	After the test, inspection shall show no damage to the extent that compliance with this standard is impaired (EN 60 335-2-96)		P
18.102	The electrical connections between the resistance material and electrodes of flexible sheet heating elements shall be reliable (EN 60 335-2-96)		N
	Compliance is checked by tests that are carried out on two heating units, each having a length exceeding 1 m. (EN 60 335-2-96)		N
	One heating unit is subjected to the test of 18.102.2 after which it is subjected to the test of 18.102.5. (EN 60 335-2-96)		N
	The other heating unit is subjected to the tests of 18.102.1 to 18.102.5. (EN 60 335-2-96)		N
	After the tests, the voltage drop of the second heating unit, determined at the location where bending is applied during the tests of 18.102.2, shall not exceed 1,5 times the voltage drop that was determined on the first heating unit. In addition, the average voltage drop determined at the other locations of the second heating unit, shall not exceed 1,5 times the average voltage drop of the first heating unit. (EN 60 335-2-96)		N
	Inspection shall show no contact degradation such as pitting under the electrodes or damage adjacent to the electrodes. (EN 60 335-2-96)		N
18.102.1	The heating unit is wound on a cylindrical mandrel having a diameter equal to twice the minimum radius for bending the flexible sheet heating element specified in the instructions for installation and then unwound. (EN 60 335-2-96)		N
	This is repeated with the other face of the heating element against the mandrel. (EN 60 335-2-96)		N
	The test is carried out three times. (EN 60 335-2-96)		N
	If the instructions for installation state that the heating unit is only to be wound in one direction, the test is carried out six times in this direction (EN 60 335-2-96)		N
18.102.2	Part of the heating unit is held between two boards 100 mm thick and of sufficient size to fully cover the width of the heating element. One pair of edges of the boards is rounded with a radius of 50 mm. (EN 60 335-2-96)		N



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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict

	The assembly is placed in an ambient of -5 °C or the lowest ambient temperature specified for installation, whichever is lower. When the heating element has reached this temperature, its free end is bent over the rounded edges of the boards. It is bent through an angle of 180° and back to its normal position, in both directions. (EN 60 335-2-96)		N
	This bending operation is carried out three times. (EN 60 335-2-96)		N
18.102.3	The heating unit is placed in a humidity cabinet having a relative humidity of 80 % - 5 % and a temperature of 40 °C - 2 °C. It is supplied at rated voltage and operated for 1 h after which the supply is switched off for 1 h. (EN 60 335-2-96)		N
	The test is carried out for 1 000 cycles (EN 60 335-2-96)		N
18.102.4	The heating unit is subjected to the test of 18.101 which is carried out for 2 000 cycles. However, the voltage drop and inspection for damage is not determined. (EN 60 335-2-96)		N
18.102.5	The heating unit is placed on a horizontal surface and supplied at rated voltage. A needle is inserted into the resistance material of the heating element at an angle of 45° and at a distance of 5 mm from the inside edge of the electrode. (EN 60 335-2-96)		N
	The voltage drop is determined at the location where bending is applied during the test of 18.102.2. It is also determined at not less than six other locations and the average value is calculated. (EN 60 335-2-96)		N
18.103	The resistance of the heating unit shall not decrease significantly during use.(EN 60 335-2-96)		P
19	ABNORMAL OPERATION		
19.1	The risk of fire or mechanical damage under abnormal or careless operation obviated		P
	Electronic circuits so designed and applied that a fault will not render the appliance unsafe		N
	Heating units intended to be connected in series in timber floors or ceilings are also subjected to the test of 19.101 (EN 60 335-2-96)		N

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict
19.2	Test of appliance with heating elements with restricted heat dissipation; test voltage (V): power input of 0.85 times rated power input..... :	207V	P
	For ceiling applications, a piece of thermal insulation having a thermal resistance of approximately 0,9 m2 K/W is held against the ceiling covering material (EN 60 335-2-96)		N
	located centrally across the heating units. It has a length of 0,8 m and a width equal to that of the heating unit. (EN 60 335-2-96)		P
	For floor applications, the thermal resistance of the piece of thermal insulation placed on the floor is increased to approximately 1,45 m2 K/W and is placed in the most unfavourable position (EN 60 335-2-96)		P
	For storage heating applications, the heating units are charged for the rated charging period(EN 60 335-2-96)		N
19.3	Test of 19.2 repeated; test voltage (V): power input of 1.24 times rated power input..... :	261V	P
19.4	Test conditions as in cl. 11, any control limiting the temperature during tests of cl. 11 short-circuited	253V	P
19.5	Test of 19.4 repeated on Class 0I and I appliances with tubular sheathed or embedded heating elements. No short-circuiting, but one end of the element connected to the elements sheath		N
	The test repeated with reversed polarity and the other end of the heating element connected to the sheath		N
	The test is not carried out on appliances intended to be permanently connected to fixed wiring and on appliances where an all-pole disconnection occurs during the test of 19.4		N
19.6	Appliances with PTC heating elements tested at rated voltage, establishing steady conditions		N
	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 or until the PTC heating element ruptures		N

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict
19.7	Stalling test by locking the rotor if the locked rotor torque is smaller than the full load torque or locking moving parts of other appliances		N
	Locked rotor, motor capacitors open-circuited or short-circuited, if required		N
	Locked rotor, capacitors open-circuited one at a time		N
	Test repeated with capacitors short-circuited one at a time, if required		N
	Appliances with timer or programmer supplied with rated voltage for each of the tests, for a period equal to the maximum period allowed		N
	Other appliances supplied with rated voltage for a period as specified		N
	Winding temperatures not exceeding values specified in table 8	(see appended table)	N
19.8	Three-phase motors operated at rated voltage with one phase disconnected		N
19.9	Running overload test on appliances incorporating motors intended to be remotely or automatically controlled or liable to be operated continuously		N
	Winding temperatures not exceeding values as specified	(see appended table)	N
19.10	Series motor operated at 1.3 times rated voltage for 1 min.....		N
	During the test, parts not being ejected from the appliance		N
19.11	Electronic circuits, compliance 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		P
19.11.1	Before applying the fault conditions a) to f) in 19.11.2, it is checked if circuits or parts of circuit meet both of the following conditions:		
	- the electronic circuit is a low-power circuit, that is, the maximum power at low-power points does not exceed 15 W according to the tests specified		N
	- the protection against electric shock, fire hazard, mechanical hazard or dangerous malfunction in other parts of the appliance does not rely on the correct functioning of the electronic circuit		N



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IEC/EN 60 335-2-96

Clause	Requirement - Test	Result - Remark	Verdict
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19.11.2	Fault conditions applied one at a time, the appliance operated under conditions specified in cl. 11, but supplied at rated voltage, the duration of the tests as specified:		
	a) short circuit of functional insulation if clearances or creepage distances are less than the values specified in 29		P
	b) open circuit at the terminals of any component		P
	c) short circuit of capacitors, unless they comply with IEC 60384-14		P
	d) short circuit of any two terminals of an electronic component, other than integrated circuits. This fault condition is not applied between the two circuits of an optocoupler		N
	e) failure of triacs in the diode mode		N
	f) failure of an integrated circuit. The possible hazardous situations of the appliance are assessed to ensure that safety does not rely on the correct functioning of such a component		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		P
	During and after each test the following is checked:		
	- the temperature rise of the windings do not exceed the values specified in table 8		P
	- the appliance complies with the conditions specified in 19.13		P
	- any current flowing through protective impedance not exceeding the limits specified in 8.1.4		P
	If a conductor of a printed board becomes open-circuited, the appliance is considered to have withstood the particular test, provided all three of the following conditions are met:		
	- the material of the printed circuit board withstands the burning test of annex E		N
	- any loosened conductor does not reduce the clearances or creepage distances between live parts and accessible metal parts below the values specified in cl. 29		N
	- the appliance withstands the tests of 19.11.2 with open-circuited conductor bridged		N

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict
19.12	If the safety of the appliance for any of the fault conditions specified in 19.11.2 depends on the operation of a miniature fuse-link complying with IEC 60127, the test is repeated, measuring the current flowing through the fuse-link; measured current (A); rated current of the fuse-link (A)		N
19.13	During the tests the appliance does not emit flames, molten metal, poisonous or ignitable gas in hazardous amounts		P
	Temperature rises not exceeding the values shown in table 9	(see appended table)	P
	The temperature of the test framework shall not exceed 150K (EN 60 335-2-96)	(see appended table)	P
	Enclosures not deformed to such an extent that compliance with cl. 8 is impaired		P
	If the appliance can still be operated it complies with 20.2		P
	Insulation, other than of class III appliance, withstand the electric strength test of 16.3, the test voltage specified in table 4:		
	- basic insulation		P
	- supplementary insulation.....		P
	- reinforced insulation		N
19.101	Heating units are installed as specified in clause 11. The heating unit under test is supplied with 1,1 times the nominal voltage with which the installation is supplied. (EN 60 335-2-96)		N
	Clause 19.101 is deleted (EN 60 335-2-96 A1)		P
20	STABILITY AND MECHANICAL HAZARDS		
20.1	Adequate stability		N
	Not applicable (EN 60 335-2-96)		P
	Tilting test through an angle of 10° (appliance placed on an inclined plane/horizontal plane); appliance does not overturn		N
	Tilting test repeated on appliances with heating elements, angle of inclination increased to 15°		N
	Possible heating test in overturned position; temperature rise does not exceed values shown in table 9		N
20.2	Moving parts adequately arranged or enclosed as to provide protection against personal injury		N

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict

	Protective enclosures, guards and similar parts are non-detachable		N
	Adequate mechanical strength and fixing of protective enclosures		N
	Self-resetting thermal cut-outs and overcurrent protective devices not causing a hazard, by unexpected reclosure		N
	Not possible to touch dangerous moving parts with test probe		N
21	MECHANICAL STRENGTH		
	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 $0,5 \pm 0,04$ J		P
	If necessary, supplementary or reinforced insulation subjected to the electric strength test of 16.3		P
	The blows are only applied to rigid parts of the heating unit. (EN 60 335-2-96)		P
	If necessary, repetition of groups of three blows on a new sample		N
21.101	Part of the heating element is held between two boards 100 mm thick and of sufficient size to fully cover the width of the heating element. One pair of edges of the boards is rounded with a radius of 50 mm. (EN 60 335-2-96)		P
	The assembly is placed in an ambient of -5 °C or the lowest ambient temperature specified for installation, whichever is lower (EN 60 335-2-96)	-5 °C	P
	When the heating element has reached this temperature, its free end is bent over the rounded edges of the boards. It is bent through an angle of 180° and back to its normal position, in both directions. This bending operation is carried out three times. (EN 60 335-2-96)		P
	The heating unit shall then withstand the electric strength test of 16.3 and shall not be damaged to such an extent that compliance with this standard is impaired. (EN 60 335-2-96)		P

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict
21.102	This test is carried out on two heating units. The heating unit is placed on a horizontal steel plate having a smooth surface and the surface of the heating element is scratched by means of a hardened steel pin (EN 60 335-2-96)		P
	The pin is loaded so that the force exerted along its axis is 10 N ± 0,5 N for applications in concrete and similar floors (EN 60 335-2-96)		P
	5 N ± 0,5 N for applications in other floors. (EN 60 335-2-96)		N
	The heating unit shall then withstand the electric strength test of 16.3. (EN 60 335-2-96)		P
21.103	The part of the heating unit containing an insulated heating wire is placed on a rigid steel plate. A steel rod, 6 mm in diameter, is placed across the heating wire so that it is only in contact in one location. (EN 60 335-2-96)		P
	600 N for heating units for applications in floors of concrete (EN 60 335-2-96)		P
	300 N for heating units for other floor applications (EN 60 335-2-96)		N
	The heating unit shall then withstand the electric strength test of 16.3. (EN 60 335-2-96)		P
	If the insulated heating wire contains more than one conductor, the test for basic insulation is also carried out between the conductors. (EN 60 335-2-96)		N
	If the sheath of the insulated wire not withstand the requirements for supplementary insulation so shall the sheath be out of position for the test with the rigid steel plate (EN 60 335-2-96 A1)		N
21.104	This test is carried out on the additional insulation. The heating unit is placed on a horizontal steel plate having a smooth surface and the surface of the heating element is scratched by means of a hardened steel pin (EN 60 335-2-96 A1)		N
	The pin is loaded so that the force exerted along its axis is 10 N ± 0,5 N for applications in concrete and similar floors (EN 60 335-2-96 A1)		N
	5 N ± 0,5 N for applications in other floors (EN 60 335-2-96 A1)		N

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict
	There shall be no penetration of the material (EN 60 335-2-96 A1)		N
22	CONSTRUCTION		
22.1	Appliance marked with the first numeral of the IP system, relevant requirements of IEC 60529 are fulfilled		N
22.2	Stationary appliance: means to provide all-pole disconnection from the supply provided, the following means being available:		
	- a supply cord fitted with a plug		N
	- a switch complying with 24.3		N
	- a statement in the instruction sheet that a disconnection incorporated in the fixed wiring is to be provided		P
	- an appliance inlet		N
	Single-pole switches and single-pole protective devices for the disconnection of heating elements in single-phase permanently connected class I appliances, connected in the phase conductor		N
22.3	Appliance provided with pins: no undue strain on socket-outlets		N
	Applied torque not exceeding 0.25 Nm		N
	Pull force of 50N to each pin after the appliance has been placed in the heating cabinet; when cooled to room temperature the pins are not displaced by more than 1mm		N
	Each pin subjected to a torque of 0.4Nm; the pins are not rotating unless rotating does not impair compliance with the standard		N
22.4	Appliance for heating liquids and appliance causing undue vibration not provided with pins for insertion into socket-outlets		N
22.5	No risk of electric shock when touching the pins of the plug		N
22.6	Electrical insulation not affected by condensing water or leaking liquid		N
	Electrical insulation of Class II appliances not affected in case of a hose rupture or seal leak		N
22.7	Adequate safeguards against the risk of excessive pressure in appliances provided with steam-producing devices		N

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict

22.8	Electrical connections not subject to pulling during cleaning of compartments to which access can be gained without the aid of a tool, and that are likely to be cleaned in normal use		N
22.9	Insulation, internal wiring, windings, commutators and slip rings not exposed to oil, grease or similar substances		N
	Adequate insulating properties of oil or grease to which insulation is exposed		N
22.10	Location or protection of reset buttons of non-self-resetting controls is so that accidental resetting is unlikely		N
22.11	Reliable fixing of non-detachable parts that provide the necessary degree of protection against electric shock, moisture or contact with moving parts		N
	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 that are likely to be removed during installation or servicing		N
	Tests as described		N
22.12	Handles, knobs etc. fixed in a reliable manner		P
	Fixing in wrong position of handles, knobs etc. indicating position of switches or similar components not possible		P
	Axial force 15 N applied to parts, the shape being so that an axial pull is unlikely to be applied		N
	Axial force 30 N applied to parts, the shape being so that an axial pull is likely to be applied		N
22.13	Unlikely that handles, when gripped as in normal use, make the operators hand touch parts having a temperature rise exceeding the value specified for handles which are held for short periods only		N
22.14	No ragged or sharp edges creating a hazard for the user in normal use, or during user maintenance		P
	No exposed pointed ends of self tapping screws etc., liable to be touched by the user in normal use or during user maintenance		N
22.15	Storage hooks and the like for flexible cords smooth and well rounded		N



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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict
22.16	Automatic cord reels cause no undue abrasion or damage to the sheath of the flexible cord, no breakage of conductors strands, no undue wear of contacts		N
	Cord reel tested with 6000 operations, as specified		N
	Electric strength test of 16.3, voltage of 1000 V applied		N
22.17	Spacers not removable from the outside by hand or by means of a screwdriver or a spanner		N
22.18	Current-carrying parts and other metal parts resistant to corrosion under normal conditions of use		N
22.19	Driving belts not used as electrical insulation		N
22.20	Direct contact between live parts and thermal insulation effectively prevented, unless material used is non-corrosive, non-hygroscopic and non-combustible		N
	Compliance is checked by inspection and, if necessary, by appropriate test		N
22.21	Wood, cotton, silk, ordinary paper and fibrous or hygroscopic material not used as insulation, unless impregnated		N
22.22	Appliances not containing asbestos		P
22.23	Oils containing polychlorinated biphenyl (PCB) not used		P
22.24	Bare heating elements adequately supported		N
	In case of rupture, the heating conductor is unlikely to come in contact with accessible metal parts		N
22.25	Sagging heating conductors cannot come into contact with accessible metal parts		N
22.26	The insulation between parts operating at safety extra-low voltage and other live parts complies with the requirements for double or reinforced insulation		N
22.27	Parts connected by protective impedance separated by double or reinforced insulation		N
22.28	Metal parts of Class II appliances conductively connected to gas pipes or in contact with water: separated from live parts by double or reinforced insulation		N

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict

22.29	Class II appliances permanently connected to fixed wiring so constructed that the required degree of access to live parts is maintained after installation		N
22.30	Parts serving as supplementary or reinforced insulation fixed so that they cannot be removed without being seriously damaged, or		P
	so constructed that they cannot be replaced in an incorrect position, and so that if they are omitted, the appliance is rendered inoperable or manifestly incomplete		N
22.31	Clearances and creepage distances over supplementary and reinforced insulation not reduced below values specified for supplementary insulation		P
	Creepage distances and clearances over supplementary or reinforced insulation not reduced to less than 50% of values specified in 29 if wires, screws etc. becomes loose		P
22.32	Supplementary and reinforced insulation designed or protected against deposition of dirt or dust		P
	Supplementary insulation of natural or synthetic rubber resistant to ageing, or arranged and dimensioned so that creepage distances are not reduced below values specified in 29.2		N
	Ceramic material not tightly sintered, similar material or beads alone not used as supplementary or reinforced insulation		N
	Oxygen bomb test at 70 °C for 96 h and 16 h at room temperature		N
22.33	Conductive liquids that are or may become accessible in normal use are not in direct contact with live parts		N
	Electrodes not used for heating liquids		N
	For class II constructions, conductive liquids that are or may become accessible in normal use, not in direct contact with basic or reinforced insulation		N
	For class II constructions, conductive liquids which are in contact with live parts, not in direct contact with reinforced insulation		N
22.34	Shafts of operating knobs, handles, levers etc. not live, unless the shaft is not accessible when the part is removed		N

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0 4 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict
22.35	Handles, levers and knobs, held or actuated in normal use, not becoming live in the event of an insulation fault		N
	Such parts being of metal, and their shafts or fixings are likely to become live in the event of an insulation fault, they are either adequately covered by insulation material, or their accessible parts are separated from their shafts or fixings by supplementary insulation		N
	This requirement does not apply to handles, levers and knobs on stationary appliances other than those of electrical components, provided they are either reliably connected to an earthing terminal or earthing contact, or separated from live parts by earthed metal		N
22.36	Handles continuously held in the hand in normal use are so constructed that when gripped as in normal use, the operators hand is not likely to touch metal parts, unless they are separated from live parts by double or reinforced insulation		N
22.37	Capacitors in Class II appliances not connected to accessible metal parts, unless complying with 22.42		N
	Metal casings of capacitors in Class II appliances separated from accessible metal parts by supplementary insulation, unless complying with 22.42		N
22.38	Capacitors not connected between the contacts of a thermal cut-out		N
22.39	Lamp holders used only for the connection of lamps		N
22.40	Motor-operated appliances and combined appliances intended to be moved while in operation, or having accessible moving parts, fitted with a switch to control the motor. The actuating member of the switch being easily visible and accessible		N
22.41	No components, other than lamps, containing mercury		P
22.42	Protective impedance consisting of at least two separate components		N
	Values specified in 8.1.4 not exceeded if any one of the components are short-circuited or open-circuited		N
22.43	Appliances adjustable for different voltages, accidental changing of the setting of the voltage unlikely to occur		N

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict
22.44	Appliances are not allowed to have an enclosure that is shaped and decorated so that the appliance is likely to be treated as a toy by children		N
22.45	When air is used as reinforced insulation, clearances not reduced below the values specified in 29.1.4 due to deformation as a result of an external force applied to the enclosure		N
22.101	The means of connection to the supply shall be securely fixed to the heating element. (EN 60 335-2-96)		P
	The heating unit is laid flat on a horizontal surface and held in position so that approximately 100 mm length of heating element together with the supply leads hang over the edge of the surface. The free length of the supply leads is approximately 300 mm. (EN 60 335-2-96)		P
	A force of 60 N is applied without jerks to each supply lead for 1 min. The test is repeated after a rest period of 1 min. (EN 60 335-2-96)		P
	There shall be no damage to the lead, connection or heating element impairing compliance with this standard (EN 60 335-2-96)		P
	The heating unit shall withstand the electric strength test of 16.3 (EN 60 335-2-96)		P
	The insulation covering the connections and the edges of the heating element shall not affect the material of the heating element. (EN 60 335-2-96)		P
22.102	The heating unit is placed in a cabinet at a temperature of 80 °C or 45 °C plus the temperature rise determined during the test of clause 11, whichever is higher (EN 60 335-2-96).....:	105 °C	P
	The test is carried out for 336 h. (EN 60 335-2-96)		P
	After the heating unit has cooled down to approximately room temperature, it shall withstand the electric strength test of 16.3. (EN 60 335-2-96)		P
22.103	The sheets of electrical insulation of laminated flexible sheet heating elements shall be reliably bonded together. However, if the heating units are for application in a floor of concrete or similar material, only the edges of the heating element have to be bonded. (EN 60 335-2-96)		N

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict
	Two sets of three samples having dimensions approximately 15 mm x 150 mm are cut from a new heating element. The samples for each set are taken from the edge and from the heating surface both perpendicular and parallel to an edge. For applications in floors of concrete or similar material, the set consists of one sample which is cut from the edges. (EN 60 335-2-96)		N
	One set is placed for 336 h in a heating cabinet corresponding to the temperature of the heating element determined during the test of clause 11 (EN 60 335-2-96)		N
	The layers of insulation are then separated at one end of each of the samples and attached to the clamps of a tensile machine in turn. The clamps are separated at a rate of 250 mm/min ± 50 mm/min. The bond strength of each sample shall be at least 1,5 N. (EN 60 335-2-96)		N
	The average bond strength of the conditioned samples shall be not less than 80 % of the average bond strength of the unconditioned samples. (EN 60 335-2-96)		N
22.104	Connecting devices fitted to supply leads and interconnection leads shall be of class II construction. It shall not be possible to separate them without the aid of a tool. (EN 60 335-2-96)		P
22.105	Heating unit for installation under floor in damp location (IEC 60 335-2-96 A1)		N

23	INTERNAL WIRING		
23.1	Wireways smooth and free from sharp edges		N
	Wires protected against contact with burrs, cooling fins etc.		N
	Wire holes in metal well rounded or provided with bushings		N
	Wiring effectively prevented from coming into contact with moving parts		N
23.2	Beads etc. on live wires cannot change their position, and are not resting on sharp edges or corners		N

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Clause	Requirement - Test	Result - Remark	Verdict

	Beads inside flexible metal conduits contained within an insulating sleeve		N
23.3	Electrical connections and internal conductors movable relatively to each other not exposed to undue stress		N
	Flexible metallic tubes not causing damage to insulation of conductors		N
	Open-coil springs not used		N
	Adequate insulating lining provided inside a coiled spring, the turns of which touch one another		N
	No damage after 10 000 flexings for conductors flexed during normal use or 100 flexings for conductors flexed during user maintenance		N
	Electric strength test, 1000 V between live parts and accessible metal parts		N
23.4	Bare internal wiring sufficiently rigid and fixed		N
23.5	The insulation of internal wiring withstanding the electrical stress likely to occur in normal use		N
	No breakdown when a voltage of 2000 V is applied for 15 min between the conductor and metal foil wrapped around the insulation		N
23.6	Sleeving used as supplementary insulation on internal wiring retained in position by positive means		N
23.7	The colour combination green/yellow used only for earthing conductors		N
23.8	Aluminium wires not used for internal wiring		N
23.9	No lead-tin soldering of stranded conductors where they are subject to contact pressure, unless		N
	clamping means so constructed that there is no risk of bad contact due to cold flow of the solder		N
24	COMPONENTS		
24.1	Components comply with safety requirements in relevant IEC standards		P
	List of components	(see appended table)	P
	Components not tested and found to comply with relevant IEC standard for the number of cycles specified are tested in accordance with 24.1.1 to 24.1.6		N

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Clause	Requirement - Test	Result - Remark	Verdict

	Components not tested and found to comply with relevant IEC standard, components not marked or not used in accordance with its marking, tested under the conditions occurring in the appliance		N
24.1.1	Capacitors likely to be permanently subjected to the supply voltage and used for radio interference suppression or for voltage dividing, complying with IEC 60384-14, or		N
	tested according to annex F		N
24.1.2	Safety isolating transformers complying with IEC 61558-2-6, or		N
	tested according to annex G		N
24.1.3	Switches complying with IEC 61058-1, the number of cycles of operation being at least 10 000, or		N
	tested according to annex H		N
24.1.4	Automatic controls complying with IEC 60730-1 with relevant part 2. The number of cycles of operation being:		
	- thermostats: 10 000		P
	- temperature limiters: 1 000		N
	- self-resetting thermal cut-outs: 300		N
	- non-self-resetting thermal cut-outs: 30		N
	- timers: 3 000		N
	- energy regulators: 10 000		N
24.1.5	Appliance couplers complying with IEC 60320-1		N
	However, appliances classified higher than IPX0, the appliance couplers complying with IEC 60320-2-3		N
24.1.6	Small lamp holders similar to E10 lampholders complying with IEC 60238, the requirements for E10 lampholders being applicable		N
24.2	No switches or automatic controls in flexible cords		N
	No devices causing the protective device in the fixed wiring to operate in the event of a fault in the appliance		P
	No thermal cut-outs that can be reset by soldering		P



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Clause	Requirement - Test	Result - Remark	Verdict
24.3	Switches intended for all-pole disconnection of stationary appliances are directly connected to the supply terminals and having 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 heating elements, not 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 marked with their rated voltage and capacitance and used accordingly		N
	Capacitors in appliances for which 30.2.3 is applicable and that are permanently connected in series with a motor winding, are of class P1 or P2 of IEC 60252		N
	Voltage across capacitors in series with a motor winding does not exceed 1,1 times rated voltage, when the appliance is supplied at 1,1 times rated voltage under minimum load		N
24.6	Working voltage of motors connected to the supply mains and having basic insulation that is inadequate for the rated voltage of the appliance, not exceeding 42V.		N
	In addition, the motors are complying with the requirements of Annex I		N
24.101	Thermal cut-outs that are necessary for compliance with clause 19 shall be non-self resetting with a trip-free mechanism. (EN 60 335-2-96)		N
24.102	Controls and other components necessary for the heating unit to comply with this standard shall be supplied with the flexible sheet heating element or sufficient specified in the instruction for installation so they can be obtain separately (EN 60 335-2-96 A1)		P
25	SUPPLY CONNECTION AND EXTERNAL FLEXIBLE CORDS		
25.1	Appliance not intended for permanent connection to fixed wiring, means for connection to the supply:		
	- 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

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Clause	Requirement - Test	Result - Remark	Verdict

	- pins for insertion into socket-outlets		N
25.2	Appliance not provided with more than one means of connection to the supply mains		N
	Stationary appliance for multiple supply may be provided with more than one means of connection, provided electric strength test of 1250 V for 1 min between each means of connection causes no breakdown		N
25.3	Connection of supply conductors for appliance intended to be permanently connected to fixed wiring possible after the appliance has been fixed to its support		P
	Appliance provided with a set of terminals for the connection of cables or fixed wiring, cross-sectional areas specified in 26.6		N
	Appliance provided with a set of terminals allowing the connection of a flexible cord		N
	Appliance provided with a set of supply leads accommodated in a suitable compartment		N
	Appliance provided with a set of terminals and cable entries, conduit entries, knock-outs or glands, allowing connection of appropriate type of cable or conduit		P
	Heating units, other than those that can be cut on site, shall incorporate one of the following means for permanent connection to fixed wiring:		
	A set of terminals (EN 60 335-2-96)		N
	A set of supply leads (EN 60 335-2-96)		N
	A supply cord (EN 60 335-2-96)		N
	Heating units that can be cut on site shall be supplied with a suitable means for connection to the supply mains. Supply leads shall be double insulated or fitted with insulating sleeves. The sleeves shall be at least 300 mm long and have a thickness corresponding to that of a sheath of a supply cord (code designation 60245 IEC 53). (EN 60 335-2-96)		N
25.4	Cable and conduit entries, rated current of appliance not exceeding 16 A, dimensions according to table 10		P
	Introduction of conduit or cable does not reduce clearances or creepage distances below values specified in 29		P

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Clause	Requirement - Test	Result - Remark	Verdict

25.5	Method for assemble supply cord with the appliance:		
	- type X attachment		N
	- type Y attachment		N
	- type Z attachment, allowed in part 2 (EN 60 335-2-96)		N
	Type X attachment, other than those with a specially prepared cord, not used for flat twin tinsel cords		N
25.6	Plugs fitted with only one flexible cord		N
	Supply cords of single-phase portable appliances having a rated current not exceeding 16 A, fitted with a plug complying with the following standard sheets of IEC 60083:1975:		
	- for Class I appliances: standard sheet C2b, C3b or C4		N
	- for Class II appliances: standard sheet C5 or C6.:		N
25.7	Supply cord not lighter than:		
	- braided cord (60245 IEC 51)		N
	- ordinary tough rubber sheathed cord (60245 IEC 53)		N
	- flat twin tinsel cord (60227 IEC 41)		N
	- light polyvinyl chloride sheathed cord (60227 IEC 52), appliance not exceeding 3 kg		N
	- ordinary polyvinyl chloride sheathed cord (60227 IEC 53), appliance exceeding 3 kg		N
	Temperature rise of external metal parts exceeding 75 K, PVC cord not used, unless		N
	appliance so constructed that the supply cord is not likely to touch external metal parts in normal use, or		N
	the supply cord is appropriate for higher temperatures, type Y or type Z attachment used		N
25.8	Nominal cross-sectional area of supply cords according to table 11; rated current (A); cross-sectional area (mm ²).....		N
25.9	Supply cord not in contact with sharp points or edges		N
25.10	Green/yellow core for earthing purposes in Class I appliance		N
25.11	Conductors of supply cords not consolidated by lead-tin soldering where they are subject to contact pressure, unless		N

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Clause	Requirement - Test	Result - Remark	Verdict

	clamping means so constructed that there is no risk of bad contacts due to cold flow of the solder		N
25.12	Moulding the cord to part of the enclosure does not damage the insulation of the supply cord		N
25.13	Inlet opening so shaped as to prevent damage to the supply cord		N
	Unless the enclosure at the inlet opening is of insulation material, a non-detachable lining or bushing complying with 29.3 for supplementary insulation provided		N
	If unsheathed supply cord, a similar additional bushing or lining is required, unless		N
	the appliance is class 0		N
25.14	Supply cords adequately protected against excessive flexing		N
	Flexing test:		
	- applied force (N)		N
	- number of flexings		N
	The test does not result in:		
	- short circuit between the conductors		N
	- breakage of more than 10% of the strands of any conductor		N
	- separation of the conductor from its terminal		N
	- loosening of any cord guard		N
	- damage, within the meaning of the standard, to the cord or the cord guard		N
	- broken strands piercing the insulation and becoming accessible		N
25.15	Conductors of the supply cord relieved from strain, twisting and abrasion by use of cord anchorage		N
	The cord cannot be pushed into the appliance to such an extent that the cord or internal parts of the appliance can be damaged		N
	Pull and torque test of supply cord, values shown in table 10: pull (N); torque (not on automatic cord reel) (Nm)		N

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Clause	Requirement - Test	Result - Remark	Verdict

	Max. 2 mm displacement of the cord, and conductors not moved more than 1 mm in the terminals		N
	Creepage distances and clearances not reduced below values specified in 29.1		N
25.16	Cord anchorages for type X attachments constructed and located so that:		
	- 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 different types of cord		N
	- cord cannot touch the clamping screws of cord anchorage if these screws are accessible, unless 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 securely fixed to the appliance, unless part of a specially prepared cord		N
	- screws which have to be operated when replacing the cord do not fix any other component, if applicable		N
	- if labyrinths can be bypassed the test of 25.15 is nevertheless withstood		N
	- for Class 0, 0I and I appliances: they are of insulating material or are provided with an insulating lining, unless a 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	Adequate cord anchorages for type Y and Z attachment		N
25.18	Cord anchorages only accessible with the aid of a tool, or		N
	so constructed that the cord can only be fitted with the aid of a tool		N
25.19	Type X attachment, glands not used as cord anchorage in portable appliances		N
	Tying the cord into a knot or tying the cord with string not used		N

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Clause	Requirement - Test	Result - Remark	Verdict
25.20	Conductors of the supply cord for type Y and Z attachment adequately additionally insulated		N
25.21	Space for supply cord for type X attachment or for connection of fixed wiring constructed to permit checking of conductors with respect to correct positioning and connection before fitting any cover, no risk of damage to the conductors when fitting the cover, no contact with accessible metal parts if a conductor becomes loose, etc.		P
	For portable appliances, the uninsulated end of a conductor prevented from any contact with accessible metal parts, unless the end of the cord is such that the conductors are unlikely to slip free		N
25.22	Appliance inlet:		
	- live parts not accessible during insertion or removal		N
	- connector can be inserted without difficulty		N
	- the appliance is not supported by the connector		N
	- is not for cold conditions if temp. rise of external metal parts exceeds 75 K, unless the supply cord is not likely to touch such metal parts		N
25.23	Interconnection cords comply with the requirements for the supply cord, except as specified		N
	If necessary, electric strength test of 16.3		N
25.24	Interconnection cords not detachable without the aid of a tool if compliance with the standard is impaired when they are disconnected		N
25.25	Dimensions of pins compatible with the dimensions of the relevant socket-outlet. Dimensions of pins and engagement face in accordance with the relevant plug in IEC 60083		N
26	TERMINALS FOR EXTERNAL CONDUCTORS		
26.1	Appliances provided with terminals or equally effective devices for connection of external conductors		P
	Terminals only accessible after removal of a non-detachable cover		P
	Heating units shall not incorporate screw-type terminal (EN 60 335-2-96)		P

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IEC/EN 60 335-2-96			
Clause	Requirement - Test	Result - Remark	Verdict

26.2	Appliances with type X attachment and appliances for connection to fixed wiring provided with terminals in which connections are made by means of screws, nuts or similar devices, unless the connections are soldered		P
	Screws and nuts serve only to clamp supply conductors, except		P
	internal conductors, if so arranged that they are unlikely to be displaced when fitting the supply conductors		N
	If soldered connections used, the conductor so positioned or fixed that reliance is not placed on soldering alone		N
	Soldering alone used, barriers provided, clearances and creepage distances satisfactory if the conductor becomes free at the soldered joint		P
26.3	Terminals for type X attachment and for connection to fixed wiring so constructed that the conductor is clamped between metal surfaces with sufficient contact pressure and without damaging the conductor		P
	Terminals for type X attachment and those for connection to fixed wiring so fixed that when tightening or loosening the clamping means:		
	- the terminal does not loosen		P
	- internal wiring is not subjected to stress		P
	- clearances and creepage distances are not reduced below the values in 29		P
	Compliance checked by inspection and by the test of subclause 8.6 of IEC 60999-1, the torque applied being equal to two-thirds of the torque specified. Nominal diameter of thread (mm); screw category; torque (Nm).....:		P
26.4	Terminals for type X attachment, except those with a specially prepared cord, and those for connection to fixed wiring, no special preparation of conductors required, and so constructed or placed that conductors prevented from slipping out		N
26.5	Terminals for type X attachment so located or shielded that if a wire of a stranded conductor escapes, no risk of accidental connection to other parts that result in a hazard		P
	Stranded conductor test, 8 mm insulation removed		N

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Clause	Requirement - Test	Result - Remark	Verdict

	No contact between live parts and accessible metal parts and, for class II constructions, between live parts and metal parts separated from accessible metal parts by supplementary insulation only		P
26.6	Terminals for type X attachment and for connection to fixed wiring suitable for connection of conductors with required cross-sectional area according to table 13; rated current (A); nominal cross-sectional area (mm ²)	Max7A 1,0-2,5mm ²	P
	Terminals only suitable for a specially prepared cord		N
26.7	Terminals for type X attachment accessible after removal of a cover or part of the enclosure		P
26.8	Terminals for the connection to fixed wiring, including the earthing terminal, located close to each other		P
26.9	Terminals of the pillar type constructed and located as specified		N
26.10	Terminals with screw clamping and screwless terminals not used for flat twin tinsel cords, unless conductors ends fitted with a device suitable for screw terminals		N
	Pull test of 5 N to the connection		N
26.11	For type Y and Z attachment: soldered, welded, crimped and similar connections may be used		N
	For Class II appliances: the conductor so positioned or fixed that reliance is not placed on soldering, welding or crimping alone		N
	For Class II appliances: soldering, welding or crimping alone used, barriers provided, clearances and creepage distances satisfactory if the conductor becomes free		N
	This requirements is also applies to heating unit fitted with supply leads (EN 60 335-2-96 A1)		N
27	PROVISION FOR EARTHING		
27.1	Accessible metal parts of Class 0I and I appliances, permanently and reliably connected to an earthing terminal or contact of the appliance inlet		N
	Earthing terminals not connected to neutral terminal		P
	Class 0, II and III appliance have no provision for earthing		N

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