TEST REPORT

UL 1278

Movable and Wall- or Ceiling-Hung Electric Room Heaters

Report Number.....:	PTC26072813801S-UL01
Tested by (printed name and signature).....:	Ian Sun/Project Engineer
Approved by (printed name and signature).....:	Rocky Mao/Reviewer
Date of issue.....:	2026-09-03
Total number of pages.....:	155 pages
Testing laboratory name.....:	Precise Testing & Certification (Guangdong) Co., Ltd.
Address.....:	Building 1, No. 6, Tongxin Road, Dongcheng Street, Dongguan, Guangdong, China
Applicant's name.....:	Cixi Xuanke Electrical Appliance Co., Ltd.
Address.....:	No. 216, Changqi Mountain, Daqishan Village, Guanhaiwei Town, Cixi City, Ningbo City, Zhejiang Province
Manufacturer's name.....:	Cixi Xuanke Electrical Appliance Co., Ltd.
Address.....:	No. 216, Changqi Mountain, Daqishan Village, Guanhaiwei Town, Cixi City, Ningbo City, Zhejiang Province
Test specification:	
Standard.....:	UL 1278:2014 Ed.4+R:29May2025
Test procedure.....:	PTC
Non-standard test method.....:	N/A

General disclaimer:

This report is only for applicant use. Any copying this report to/for any other person or entity, and use our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

Test Item description :	Warm Air Blower
Trade Mark ..... :	N/A
Model/Type reference ..... :	XY-801
Ratings ..... :	110V~, 60Hz, 1500W

Summary of construction and testing:

Whether parts of tests for the product have been subcontracted to other labs:

☐ Yes ☒ No

If Yes, list the related test items and lab information:

Test items:

Lab information:

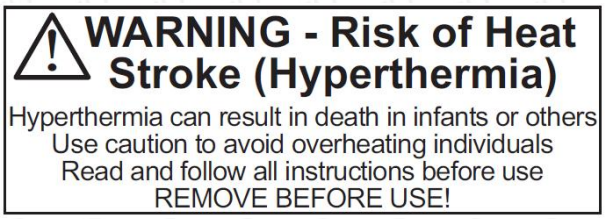
Summary of testing: All tests were measured under the most severe condition and the test conditions.	
Tests performed (name of test and test clause): The sample(s) tested complies with the requirements of UL 1278:2014 Ed.4+R:29May2025 When determining the test conclusion, the Measurement Uncertainty of test has been considered. All full tests were carried out on model XY-801.	**Testing location:** Precise Testing & Certification (Guangdong) Co., Ltd. Building 1, No. 6, Tongxin Road, Dongcheng Street, Dongguan, Guangdong, China
Summary of compliance with National Differences: N/A	

Copy of marking plate:

Warm Air Blower
Model: XY-801
Rated: 110V~, 60Hz, 1500W
Production Date: XXXXXX
Cixi Xuanke Electrical Appliance Co., Ltd.
No. 216, Changqi Mountain, Daqishan Village, Guanhaiwei Town, Cixi City, Ningbo City, Zhejiang Province
Made in China



CAUTION – High temperature, keep electrical cords, drapery, and other furnishings at least 3 feet (0.9 m) from the front of the heater and away from the side and rear.



Cautionary marking:

For Indoor Use Only

DANGER – High temperatures may be generated under certain abnormal conditions. Do not partially or fully cover or obstruct the front of this heater.
WARNING - TO REDUCE THE RISK OF FIRE:
Always plug heaters directly into a wall outlet/receptacle. Never use with an extension cord or relocatable power tap (outlet/power strip).
Check your heater cord and plug connections. A loose fitting outlet can cause the plug to overheat or cause a fire. Be sure plug fits tight in the outlet. Check frequently during use to make sure plug and outlet are not hot. If so, discontinue using heater and have outlet replaced by a qualified electrician.
Always unplug heater when not in use.
Do not operate heater with a damaged cord or plug or after the heater malfunctions, has been dropped or damaged in any manner. Discard heater or return to an authorized service facility for examination and/or repair.

Note:
1. The CAUTION should be visible from a point 5 feet (1.5 m) above the floor and between 1 and 4 feet (0.3 and 1.2 m) away from the front surface of the heater when the heater is placed in the intended use location.

2. The marking shall be in letters not less than 1/8 inch (3.2 mm) in height and shall be of a permanent type and in a color that contrasts with that of the enclosure or background.
3. The heading “WARNING – Risk of Heat Stroke (Hyperthermia)” shall at least 1/4 inch (6.4 mm) in height. The remaining text, “Hyperthermia can result in death in infants or others Use caution to avoid overheating individuals Read and follow all instructions before use REMOVE BEFORE USE!” shall be no less than 1/8 inch (3.175 mm) in height. The “WARNING” and “REMOVE BEFORE USE!” lettering shall be in upper case letters.

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.....:	2026-07-29
Date (s) of performance of tests.....:	2026-07-30 to 2026-09-01

GENERAL REMARKS:

"(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.

General product information and other remarks:

1. The product covered by this report is a Warm Air Blower. It's intended to be indoor used only.

Model Differences –

N/A

Additional application considerations – (Considerations used to test a component or sub-assembly) –

N/A

Name and address of factory (ies): Cixi Xuanke Electrical Appliance Co., Ltd.
No. 216, Changqi Mountain, Daqishan Village, Guanhaiwei Town, Cixi City, Ningbo City, Zhejiang Province

UL 1278			
Clause	Requirement Test	Result Remark	Verdict
	CONTENTS		
	INTRODUCTION		
1	Scope		P
2	General		P
2.1	General		P
2.2	Terminology		P
3	Glossary		P
4	Components		P
4.1	General		P
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4.3	Controls		P
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4.5	Film-coated wire (magnet wire)		P
4.6	Printed wiring boards		P
4.7	Semiconductors and small electronic components		P
4.8	Supplemental insulation, insulating bushings, and assembly aids		P
4.9	Switches		P
4.10	Transformers		N/A
5	Units of Measurement		P
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10.2	Panel-type heaters		P
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12	Polymeric Materials		P
13	Heat Transfer Fluids		N/A
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15	Protection Against Corrosion		P
16	Supply Connections		P
17	Special Protection Devices		N/A
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19	Current-Carrying Parts		P
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22	Heating Element Supports		P
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Clause	Requirement Test	Result Remark	Verdict
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27.2	Heating elements		P
27.3	Motors and motor-circuits		N/A
27.4	Tapped high-voltage control circuits		N/A
27.5	High-voltage transformers		N/A
27.6	Low-voltage transformers		N/A
28	Secondary Circuits		N/A
28.1	General		N/A
28.2	Limited-energy-secondary circuits		N/A
29	Temperature Limiting Means		P
30	Alarms		N/A
31	Lampholders		N/A
32	Pilot Lights		P
33	Switches		P
34	Automatic Controls and Control Circuits		P
34.1	General		P
34.2	Terminals and actuating members of safety and temperature limiting controls		P
35	Spacings		P
36	Grounding		N/A
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37	General		P
38	Power Input Test		P
39	Leakage Current Test		P
40	Normal Temperature Tests		P
40.1	General		P
40.2	Temperature controls		P
40.3	Specified test conditions		P
41	Alarm Device Endurance Test		N/A
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42.2	Overvoltage test		P
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42.4	Tip-over test		P
42.5	Vertical-wall test		P
42.6	Terry cloth drape test		P
42.7	Terry cloth band drape test		P
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42.10	Motor overload and stalled motor – motors protected by a remote protective device		N/A
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42.12	Motor connected across heating elements		P
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49	Insulation Resistance Test		P
50	Water Spray Test		N/A
51	Stability of Movable Heaters		N/A
52	Element Support Impact Tests		N/A
53	Drop Test		P
54	Test for Permanence of Cord Tag		N/A
54.1	General		N/A
54.2	Test conditions		N/A
54.3	Test method		N/A
55	Protection Against Injury to Persons Test		N/A
56	Knob Securement Test		P
57	Strength of Adjustment Stop Test		N/A
58	Hydrostatic Test		N/A
59	Strain Relief Test		N/A
60	Permanence of Marking		P
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61	Production-Line Dielectric Voltage-Withstand		N/A
62	Production-Line Grounding Continuity		N/A
63	Production-Line Tip Over		N/A
64	Production Leakage Test (Fluid-Filled Heaters)		N/A
65	Hydrostatic Test		N/A
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66	Details		P
	MARKINGS		
67	Details		P
68	Instructions for Use and Care		P
68.1	General		P
68.2	Important instructions		P
68.3	User instructions		P
68.4	Grounding instructions		N/A
68.5	Heater carton information		P
69	Cord Tag Markings		N/A
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	CONSTRUCTION		
SA2	Enclosure		P
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SA2.2	Guards		P
SA3	Stability		N/A

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SA4	Supply Connections		P
SA5	Internal Wiring		P
SA6	Automatic Controls and Control Circuits		P
SA7	Spacings		P
	PERFORMANCE		
SA8	General		P
SA9	Normal Temperature Test		P
SA9.1	General		P
SA9.2	Normal temperature		P
SA10	Padded Surface and Blanketing Test		P
SA11	Curtain Drape Test		P
SA12	Shredded Paper Test		P
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	CONSTRUCTION		
SB2	Enclosure		P
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SB4	Thermal Insulation		P
SB5	Immersion Detection Circuit Interrupters (IDCI'S)		N/A
SB6	Ground Fault Circuit Interrupters (GFCI'S)		N/A
SB7	Other Protective Devices		P
SB8	Switches		P
SB9	Grounding		N/A
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SB10	Immersion Leakage Current Tests		N/A
SB10.1	General		N/A
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SB10.3	Drop immersion		N/A
SB10.4	Tip-over immersion test		N/A
SB10.5	Saturation immersion test		N/A
SB11	Dew Point Test		N/A
SB12	Splash Test		N/A

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Clause	Requirement Test	Result Remark	Verdict
	MANUFACTURING AND PRODUCTION TESTS		
SB13	Production Line Trip-Time Measurement		N/A
SB14	Test Button Activation		N/A
	MARKINGS		
SB15	Details		P
SB16	Instructions for Use and Care		P
	SUPPLEMENT SC – MOVABLE ELECTRIC ROOM HEATERS WITH SEMICONDUCTOR HEATING ELEMENTS		
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SC1	Scope		P
	CONSTRUCTION		
SC2	Heating Element		P
SC3	Fan Speed Control, Semiconductor Type		P
SC4	Switches		P
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SC5	General		P
SC6	Input Test		P
SC7	Normal Temperature Test		P
SC8	Low Ambient Temperature Starting Test		N/A
SC9	Restricted Inlet, Abnormal Operation Test		N/A
SC10	DC Offset Voltage Temperature Test		N/A
SC11	Fan Speed Controls, Abnormal Operation Tests		N/A
SC12	Endurance Test		N/A
SC13	Input Current Test		P
SC14	Overload and Endurance Test		P
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SD1	Scope		P
	CONSTRUCTION		
SD2	General		P
SD3	Enclosure		P
SD4	Input Connections		P
SD5	Grounding		N/A
SD6	Blade Secureness Test		P
SD7	Security of Input Contacts Test		P
SD8	Positioning		P
SD9	Abuse Tests – General		P

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SD10	Abuse Tests – Impact Tests		P
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SD13	Abuse Tests – Switch Retainment		P
SD14	Abuse Tests – Rotating Plug Assembly Torque Test		P
SD15	Abuse Tests – Static Load-Retainer Plate		P
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SD17	Limitations		P
SD18	Abnormal Operation Tests		P
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SE2	General		P
	PERFORMANCE		
SE3	Movement Detection Test, Moveable Heaters		N/A
SE4	Ambient Temperature Test		N/A
SE5	Enabled Timeout Test, Initiating a Heating Function		N/A
SE6	Enabled Timeout Test, Increasing a Temperature Setting		N/A
SE7	Resistance to Electro Magnetic Phenomena (Immunity)		N/A
	MARKINGS		
SE8	Details		P
SE9	Instructions		P
	INTRODUCTION		
1	Scope		P
1.1	These requirements cover movable and wall- or ceiling-hung electric room-heating equipment rated 600 volts or less to be employed in ordinary locations in accordance with the National Electrical Code, ANSI/NFPA 70.		P
1.2	These requirements do not cover fixed heaters, location-dedicated heaters, baseboard heaters, duct heaters, central-heating furnaces, fan-coil units, panel- or cable-type radiant-heating equipment, electric boilers, or any other electric heating equipment or appliances that are covered in or as a part of separate, individual requirements.		P
2	General		P
2.1	General		P

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2.1.1	If the operation of a heater involves the generation and confining under pressure of steam or other gas, consideration is to be given to the possibility of risk of explosion incident to such operation. This applies in the case of an appliance having immersed electrodes, if the electrolysis of water may result in the accumulation of oxygen and hydrogen. The appliance is not acceptable unless its strength is such that it will withstand any risk of explosion that may be involved.			P
2.1.2	The requirements of this standard are based upon operation of a heater where it is manually placed by the user. The heater shall not be capable of moving autonomously or via remote control from the location in which it is manually placed by the user.			P
2.2	Terminology			P
2.2.1	Unless indicated otherwise, all voltage and current values mentioned in this standard are rms.			P
3	Glossary			P
3.1	For the purposes of this standard the following definitions apply.			P
3.2	ANGLE OF CRITICAL BALANCE – The minimum angle through which a heater must be tipped to cause it to tip over due solely to the force of gravity.			P
3.3	APPLIANCE COUPLER – A single-outlet, female contact device for attachment to a flexible cord as part of a detachable power-supply cord to be connected to an appliance inlet (motor attachment plug).			N/A
3.4	APPLIANCE INLET (Motor Attachment Plug) – A male contact device mounted on an end product appliance to provide an integral blade configuration for the connection of an appliance coupler or cord connector.			N/A
3.5	APPLIANCE (FLATIRON) PLUG – An appliance coupler type of device having a cord guard and a slot configuration specified for use with heating or cooking appliances.			N/A
3.6	CHARRING WITH CROSSCHECKING – Manifestation of ignition by separation of wood fibers in the direction with the grain and also in the direction across the grain.			N/A
3.7	COMMERCIAL/INDUSTRIAL HEATER – Any heater that is either:			N/A
a) Rated 2	kilowatts or greater and marked as a commercial/industrial heater in accordance with 67.10,			N/A
	b) Rated greater than 250 volts,			N/A
	c) A polyphase heater, or			N/A
	d) Rated greater than 6 kilowatts.			N/A

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3.8	COMPONENT – A device or fabricated part of the appliance covered by the scope of a safety standard dedicated to the purpose. When incorporated in an appliance, equipment otherwise typically field installed (e.g. luminaire) is considered to be a component. Unless otherwise specified, materials that compose a device or fabricated part, such as thermoplastic or copper, are not considered components.		P
3.9	CONTROL CIRCUIT – A circuit that carries the electric signals directing the operation of a controller which, in turn, governs power delivered to a motor or other load. A control circuit does not carry the main power current.		P
3.10	CORD CONNECTOR – A female contact device wired on flexible cord for use as an extension from an outlet to make a detachable electrical connection to an attachment plug or, as an appliance coupler, to an equipment inlet.		P
3.10.1	ELECTRICAL CONNECTION– The physical interface between two points in a circuit such as spade terminals, pin terminals, micro switch contacts, relay contacts, timer contacts, crimped connections, and connections that are welded or soldered.		P
3.11	ELEVATED USE LOCATION – A stationary horizontal surface (for example, table, desk or shelf) where a heater is likely to be used if the heater weighs less than 8 lbs (3.6 kg), and:		N/A
	a) The heater advertised as being suitable for use at an elevated location in literature or operating instructions furnished with the heater or by marking on the heater or its packaging, or		N/A
	b) The overall dimensions of the heater, including any permanently extending handles, grilles, feet or stands do not exceed any one of the following:		N/A
	1) Total added dimensions of length, height, and depth – 30 inches (76.2 cm).		N/A
	2) Length – 24 inches (61 cm).		N/A
	3) Height – 14 inches (35.6 cm).		N/A
3.12	FIXED HEATER – A heater that is fastened or otherwise assigned to a specific location, and is permanently wired to the branch circuit.		N/A
3.13	FLASH POINT – The minimum temperature of a flammable liquid at which sufficient vapor is given off to form an ignitable mixture with the air near the surface of the liquid or within the vessel used, as determined by appropriate test procedure and apparatus.		N/A
3.14	IGNITION – Glowing, emission of embers, or flaming of the materials described in 42.1.9 – 42.1.13. Charring without glowing or without emission of embers is not ignition.		P

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3.15	LINE-VOLTAGE CIRCUIT – A circuit involving a potential of not more than 600 volts, and having circuit characteristics in excess of those of a low-voltage or an isolated-limited-secondary circuit.		P
3.16	LOCATION-DEDICATED HEATER – A cord-connected heater that is normally placed in one location for usage such as:		N/A
	a) Cord-connected wall- or ceiling-mounted heater, or		N/A
	b) Freestanding cord-connected heater that exceeds the weight and/or dimension limitations of a movable heater.		N/A
3.17	LOW-VOLTAGE (SECONDARY) CIRCUIT – A circuit involving a potential of not more than 30 volts alternating-current, (42.4 volt peak or direct-current), and supplied by a primary battery or by a standard Class 2 transformer, or by a combination of transformer and fixed impedance that, as a unit, complies with all the performance requirements for a Class 2 transformer. A circuit derived from a source of supply classified as a line voltage circuit, using resistance in series with the supply circuit as a means of limiting the voltage and current, is not considered to be a low voltage nor an isolated limited secondary circuit.		N/A
3.18	MOVABLE HEATER – A freestanding cord and plug connected heater that does not exceed 65 pounds (29.4 kg) and has no dimension greater than 8 feet (2.4 m). A wall- or ceiling-hung heater which may be used as a movable heater without further guiding or propping, is also considered a movable heater.		P
3.18.1	PRODUCT ENCLOSURES – That part of the product (metallic or nonmetallic) that:		P
	a) Renders inaccessible all or any parts of the equipment that may otherwise present a risk of electric shock, injury to persons, and		P
	b) Retards propagation of flame initiated by electrical disturbances occurring within.		P
3.19	TEMPERATURE CONTROLS – Devices that respond with a change in temperature (thermostatic devices) may be one of the following types:		P
	a) Regulating – Functions only to regulate the temperature of the heater under intended conditions of use, and whose malfunction would not result in a risk of fire.		P
	b) Limiting – Functions only under conditions that produce abnormal temperatures. The malfunction of such a device will result in a risk of fire.		P
	c) Auxiliary – Thermostatic device other than of the regulating or limiting type.		P

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	d) Operating Control – A control intended to start or regulate the heater during normal operation. An example would be a temperature-regulating control. An operating control could provide Type 1 or Type 2 action. (See definitions 3.20 – 3.23).			P
	e) Protective Control – A control intended to reduce the risk of electric shock, fire, or injury to persons during abnormal operation of the heater. An example would be a temperature limiting control. A protective control always provides Type 2 action. (See definitions 3.20 – 3.23).			P
3.20	TYPE 1 ACTION – Automatic action for which the manufacturing deviation and the drift of its operating value, operating time, or operating sequence have not been declared and tested to the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1.			P
3.21	TYPE 2 ACTION – Automatic action for which the manufacturing deviation and the drift of its operating value, operating time, or operating sequence have been declared and tested to the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1.			P
3.22	TYPE 2.H ACTION – So designed that the contacts cannot be prevented from opening and which may automatically reset to the closed position if the reset means is held in the reset position. The control shall not reset automatically at any temperature above -35°C.			P
3.23	TYPE 2.J ACTION – So designed that the contacts cannot be prevented from opening, and the control is not permitted to function as an automatic reset device if the reset means is held in the reset position. The control shall not reset automatically at any temperature above -35°C.			P
3.24	VISIBLY GLOWING HEATING ELEMENT – A heating element whose visible portion attains a temperature of at least 650°C (1202°F) under intended conditions of operation.			N/A
3.25	WALL (OR CEILING) HUNG HEATER – A cord-connected heater having a mass not exceeding 50 pounds (22.7 kg) that is attached to the wall (or ceiling) in such a manner that it can be removed without the use of tools.			N/A
3.26	WALL (OR CEILING) MOUNTED HEATER – A heater that is permanently attached to the wall (or ceiling) in such a manner that tools are necessary for its removal.			N/A
4	Components			P
4.1	General			P
4.1.1	A component of a product covered by this standard shall:			P
	a) Comply with the requirements for that component as indicated in 4.2 – 4.10;			P

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	b) Be used in accordance with its rating(s) established for the intended conditions of use;		P
	c) Be used within its established use limitations or conditions of acceptability;		P
	d) Additionally comply with the applicable requirements of this end product standard; and		P
	Exception No. 1: A component of a product covered by this standard is not required to comply with a specific component requirement that:		P
	a) Involves a feature or characteristic not required in the application of the component in the product;		P
	b) Is superseded by a requirement in this standard; or		P
	c) Is separately investigated when forming part of another component, provided the component is used within its established ratings and limitations.		P
	Exception No. 2: A component that complies with a UL component standard other than those specified in 4.2 – 4.10 is acceptable if:		P
	a) The component also complies with the applicable component standard specified in 4.2 – 4.10; or		P
	b) The component standard:		P
	1) Is compatible with the ampacity and overcurrent protection requirements in the National Electrical Code, ANSI/NFPA 70 where applicable;		P
	2) Considers long-term thermal properties of polymeric insulating materials in accordance with the Standard for Polymeric Materials - Long Term Property Evaluations, UL 746B; and		P
	3) Any use limitations of the other component standard is identified and appropriately accommodated in the end use application. For example, a component used in a household application, but intended for industrial use and complying with the relevant component standard may assume user expertise not common in household applications.		P
4.1.2	Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.		P
4.1.3	A component that is also intended to perform other functions, such as over current protection, ground-fault circuit-interruption, surge suppression, any other similar functions, or any combination thereof, shall comply additionally with the requirements of the applicable UL standard(s) that cover devices that provide those functions.		P

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	Exception: Where these other functions are not required for the application and not identified as part of markings, instructions, or packaging for the appliance, the additional component standard(s) need not be applied.			P
4.1.4	A component not anticipated by the requirements of this end product standard, not specifically covered by the component standards in 4.2 – 4.10, and that involves a risk of fire, electric shock, or injury to persons, shall be additionally investigated in accordance with the applicable UL standard, and shall comply with 4.1.1(b) – (e).			P
4.1.5	With regard to a component being additionally investigated, reference to construction and performance requirements in another UL end product standard is suitable where that standard anticipates normal and abnormal use conditions consistent with the application of this end product standard.			P
4.2	Attachment plugs, receptacles, connectors, and terminals			P
4.2.1	Attachment plugs, receptacles, appliance couplers, appliance inlets (motor attachment plugs), and appliance (flatiron) plugs, shall comply with the Standard for Attachment Plugs and Receptacles, UL 498. See 4.2.2.			P
	Exception: Attachment plugs and appliance couplers integral to cord sets or power supply cords that are investigated in accordance with the Standard for Cord Sets and Power Supply Cords, UL 817 are not required to comply with UL 498.			P
4.2.2	Female devices (such as receptacles, appliance couplers, and connectors) that are intended, or that may be used, to interrupt current in the end product, shall be suitably rated for current interruption of the specific type of load, when evaluated with its mating plug or connector. For example, an appliance coupler that can be used to interrupt the current of a motor load shall have a suitable horsepower rating when tested with its mating plug.			P
4.3	Controls			P
4.3.1	General			P
4.3.1.1	Auxiliary controls shall be evaluated in accordance with the applicable requirements of this end product standard unless otherwise specified; see 4.3.1.7.			P
4.3.1.2	Operating (regulating) controls shall be evaluated in accordance with the applicable component standard requirements specified in 4.3.2 – 4.3.6, if applicable, unless otherwise specified in this end product standard; see 4.3.1.7.			P

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Clause	Requirement Test	Result Remark	Verdict
4.3.1.3	Operating controls that rely upon software for the normal operation of the end product where deviation or drift of the control may result in a risk of fire, electric shock, or injury to persons, such as a speed control unexpectedly changing its output, shall comply with one of the following:		P
	a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991, and the Standard for Software in Programmable Components, UL 1998; or		P
	b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1.		P
4.3.1.4	Protective (limiting) controls shall be evaluated in accordance with the applicable component standard requirements specified in 4.3.2 – 4.3.6, unless otherwise specified in this end product standard.		P
4.3.1.5	Solid-state protective controls that do not rely upon software as a protective component shall comply with one of the following:		P
	a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991; or		P
	b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, except the Controls Using Software requirements, Clause H 11.12.		P
4.3.1.6	Solid-state protective controls that rely upon software as a protective component shall comply with one of the following:		P
	a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991, and the Standard for Software in Programmable Components, UL 1998; or		P
	b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1.		P
4.3.1.7	An electronic, auxiliary or operating control (e.g. a non-protective control), the failure of which would not increase the risk of fire, electric shock, or injury to persons, need only be subjected to the applicable requirements of this end product standard.		P
4.3.2	Electromechanical and electronic controls		P
4.3.2.1	A control, other than as specified in 4.3.3 – 4.3.6, shall comply with one of the following:		P
	a) The Standard for Solid-State Controls for Appliances, UL 244A;		P
	b) The Standard for Temperature-Indicating and -Regulating Equipment, UL 873; or		P
	c) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1.		P
4.3.3	Liquid level controls		N/A
4.3.3.1	A liquid level control shall comply with one of the following:		N/A

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Clause	Requirement Test	Result Remark	Verdict
	a) The Standard for Solid-State Controls for Appliances, UL 244A;		N/A
	b) The Standard for Temperature-Indicating and -Regulating Equipment, UL 873;		N/A
	c) The Standard for Industrial Control Equipment, UL 508; or		N/A
	d) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, and;		N/A
	1) Deleted		N/A
	2) Deleted		N/A
	3) The Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Automatic Electrical Air Flow, Water Flow and Water Level Sensing Controls, UL 60730-2-15.		N/A
4.3.4	Motor and speed controls		P
4.3.4.1	A control used to start, stop, regulate or control the speed of a motor shall comply with one of the following:		P
	a) The Standard for Solid-State Controls for Appliances, UL 244A;		P
	b) The Standard for Temperature-Indicating and -Regulating Equipment, UL 873;		N/A
	c) The Standard for Industrial Control Equipment, UL 508;		N/A
	d) Deleted		P
	e) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1; or		P
	f) The Standard for Adjustable Speed Electrical Power Drive Systems – Part 5-1: Safety Requirements – Electrical, Thermal and Energy, UL 61800-5-1.		P
4.3.5	Pressure controls		N/A
4.3.5.1	A pressure control shall comply with one of the following:		N/A
	a) The Standard for Temperature-Indicating and -Regulating, UL 873;		N/A
	b) The Standard for Industrial Control Equipment, UL 508; or		N/A
	c) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1; and the Standard for Automatic Electrical Controls – Part 2-6: Particular Requirements for Automatic Electrical Pressure Sensing Controls Including Mechanical Requirements, UL 60730-2-6.		N/A
4.3.6	Timer controls		P
4.3.6.1	A timer control shall comply with one of the following:		P
	a) The Standard for Solid-State Controls for Appliances, UL 244A; or		P

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Clause	Requirement Test	Result Remark	Verdict
	b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1; and the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Timers and Time Switches, UL 60730-2-7.		P
4.4	Internal wiring		P
4.4.1	Internal wiring composed of insulated conductors shall comply with the Standard for Appliance Wiring Material, UL 758.		P
	Exception No. 1: Insulated conductors need not comply with UL 758 if they comply with one of the following:		P
	a) The Standard for Thermoset-Insulated Wires and Cables, UL 44;		P
	b) The Standard for Thermoplastic-Insulated Wires and Cables, UL 83;		P
	c) The applicable UL standard(s) for other insulated conductor types specified in Chapter 3, Wiring Methods and Materials, of the National Electrical Code, ANSI/NFPA 70.		P
	Exception No. 2: Insulated conductors for specialty applications (e.g. data processing or communications) and located in a low-voltage circuit not involving the risk of fire, electric shock or injury to persons need not comply with UL 758.		N/A
4.5	Film-coated wire (magnet wire)		N/A
4.5.1	The component requirements for film coated wire and Class 105 (A) insulation systems are not specified.		N/A
4.5.2	Film coated wire in intimate combination with one or more insulators, and incorporated in an insulation system rated Class 120 (E) or higher, shall comply with the magnet wire requirements in the Standard for Systems of Insulating Materials - General, UL 1446.		N/A
4.6	Printed wiring boards		P
4.6.1	Printed wiring boards, including the coatings, shall comply with the Standard for Printed Wiring Boards, UL 796.		P
	Exception: A printed-wiring board in a Class 2 nonsafety circuit is not required to comply with the bonding requirements in UL 796 if the board is separated from parts of other circuits such that loosening of the bond between the foil conductor and the base material will not result in the foil conductors or components coming in contact with parts of other circuits of the control or of the end-use product.		P
4.6.2	A printed-wiring board containing circuitry in a line-connected circuit or a safety circuit shall comply with the direct-support requirements for insulating materials in Electrical Insulation, Section 23 of this end product standard.		P

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Clause	Requirement Test	Result Remark	Verdict
4.6.3	Unless otherwise specified, the flammability class and temperature rating shall be that as specified in Electrical Insulation, Section 23 of this end product standard.		P
4.7	Semiconductors and small electronic components		P
4.7.1	A power switching semiconductor device that is relied upon to provide isolation to ground shall comply with the Standard for Optical Isolators, UL 1577. The Dielectric Voltage Withstand Tests required by UL 1577 shall be conducted applying the requirements of the Dielectric Voltage Withstand Test, Section 48, of this end product standard.		P
4.7.2	An optical isolator that is relied upon to provide isolation between primary and secondary circuits or between other circuits as required by this end product standard shall comply with the Standard for Optical Isolators, UL 1577. The Dielectric Voltage Withstand Tests required by UL 1577 shall be conducted applying the requirements in Dielectric Voltage Withstand Test, Section 48 of this end product standard.		P
4.7.3	Except as specified in 4.7.4, component requirements are not specified for small electronic components on printed wiring boards, including diodes, transistors, resistors, inductors, integrated circuits, and capacitors not directly connected to the supply source.		P
4.7.4	Where an electronic component is determined to be a critical component during the Abnormal Operation Tests, Section 42, one of the following standards shall be applied:		P
	a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991; and as applicable, the Standard for Software in Programmable Components, UL 1998 for controls that rely upon software as a protective component; or		P
	b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1.		P
4.7.5	A critical component, as specified in 4.7.4, is a component that performs one or more safety-related functions whose failure results in a condition, such as the risk of fire, electric shock, or injury to persons, in the end product application.		P
4.7.6	A critical component as specified in 4.7.4, may also be identified using a failure-mode and effect analysis (FMEA) in accordance with the Failure-Mode and Effect Analysis (FMEA) requirements in the Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991.		P

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Clause	Requirement Test	Result Remark	Verdict
4.7.7	Portions of a circuit comprised of a microcontroller or other programmable device that performs a back-up, limiting, or other safety function intended to reduce the risk of fire, electric shock, or injury to persons shall comply with the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, Annex H.		P
4.8	Supplemental insulation, insulating bushings, and assembly aids		P
4.8.1	The requirements for supplemental insulation (e.g. tape, sleeving or tubing) are not specified unless the insulation or device is required to comply with 20.3 or a performance requirement of this end product standard. In such cases, the insulation shall comply with the following applicable standards:		P
	a) Insulating tape shall comply with the Standard for Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape, UL 510;		P
	b) Sleeving shall comply with the Standard for Coated Electrical Sleeving, UL 1441; or		P
	c) Tubing shall comply with the Standard for Extruded Insulating Tubing, UL 224.		P
4.8.2	Wire positioning devices shall comply with the requirements in Electrical Insulation, Section 23. A device that complies with the Standard for Positioning Devices, UL 1565, is considered to comply with this requirement.		P
4.8.3	Insulating bushings that comply with the requirements in General, Section 4.1, of this end product standard, and the Standard for Insulating Bushings, UL 635 are considered to comply with the requirements of this end product standard. Tests specified in this end product standard (e.g. Strain Relief Test, Section 59) may still need to be performed to confirm the combination of the insulating bushing and the supporting part comply with the intent of the requirements.		P
4.9	Switches		P
4.9.1	Switches shall comply with one of the following:		P
	a) Deleted		P
	b) The Standard for Switches for Appliances – Part 1: General Requirements, UL 61058-1;		P
	c) The Standard for General-Use Snap Switches, UL 20; or		P
	d) The Standard for Nonindustrial Photoelectric Switches for Lighting Control, UL 773A.		P
	Exception: Switching devices that comply with the applicable UL standards for specialty applications (e.g. transfer switch equipment), industrial use (e.g. contactors, relays, auxiliary devices), or are integral to another component (e.g. switched lampholder) need not comply with this requirement.		P

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Clause	Requirement Test		Result Remark	Verdict
4.9.2	A clock-operated switch, in which the switching contacts are actuated by a clock-work, by a gear-train, by electrically-wound spring motors, by electric clock-type motors, or by equivalent arrangements shall comply with one of the following:			P
	a) The Standard for Clock-Operated Switches, UL 917; or			P
	b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, and the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Timers and Time Switches, UL 60730-2-7.			P
4.9.3	A timer or time switch, incorporating electronic timing circuits or switching circuits, with or without separable contacts, shall comply with the requirements for an operating control with Type 1 action for 6000 cycles of operation, or as a manual control for 5000 cycles of operation, in accordance with one of the following:			P
	a) The Standard for Solid-State Controls for Appliances, UL 244A; or			P
	b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1; and the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Timers and Time Switches, UL 60730-2-7.			P
4.9.4	A timer or time switch, incorporating electronic timing circuits or switching circuits, with or without separable contacts, that functions as a protective control, shall comply with the requirements for a protective control; see 4.3.1.3.			P
4.10	Transformers			N/A
4.10.1	General-purpose transformers shall comply with the Standard for Low Voltage Transformers – Part 1: General Requirements, UL 5085-1; and the Standard for Low Voltage Transformers – Part 2: General Purpose Transformers, UL 5085-2.			N/A
	Exception No. 1: A transformer that is completely enclosed within the end product enclosure, and that complies with the applicable construction and performance requirements of this end product standard when tested in conjunction with the end product, complies with the intent of this requirement.			N/A
	Exception No. 2: A transformer that complies with the Standard for Transformers and Motor Transformers for Use in Audio-, Radio-, and Television-Type Appliances, UL 1411, and that is used in a circuit involving an audio or video component complies with the intent of this requirement.			N/A

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Clause	Requirement Test	Result Remark	Verdict
4.10.2	Class 2 and Class 3 transformers shall comply with the Standard for Low Voltage Transformers – Part 1: General Requirements, UL 5085-1; and the Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3.		N/A
	Exception: Transformers located in a low voltage circuit, and that do not involve a risk of fire, electric shock or injury to persons need not comply with this requirement.		N/A
5	Units of Measurement		P
5.1	Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.		P
6	References		P
6.1	Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.		P
	CONSTRUCTION		
7	Enclosure		P
7.1	The enclosure of a heater shall be so formed and assembled that it will have the strength and rigidity necessary to resist the abuses likely to be encountered during its intended service. The degree of resistance inherent in the appliance shall preclude total or partial collapse with the attendant reduction of spacings, loosening or displacement of parts, and other serious defects which alone or in combination constitute a risk of fire, electric shock, explosion, or injury to persons.		P
7.2	Among the factors taken into consideration if an enclosure is being judged for acceptability are its:		P
	a) Mechanical strength,		P
	b) Resistance to impact,		P
	c) Moisture-absorption properties,		P
	d) Flammability,		P
	e) Resistance to corrosion, and		P
	f) Resistance to distortion at temperatures		P
	to which the enclosure may be subjected under conditions of intended or abnormal use. For the requirements for a polymeric enclosure or part of an enclosure of a polymeric material, see Polymeric Materials, Section 12.		P
7.3	The enclosure of a heater shall prevent molten metal, burning insulation, flaming particles, or similar material from falling on combustible materials, including the surface upon which the heater is supported.		P
7.4	The requirement in 7.3 necessitates use of a barrier:		P
	a) Under a motor unless:		P

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Clause	Requirement Test	Result Remark	Verdict
	1) The structural parts of the motor or of the heater provide the equivalent of such a barrier.		P
	2) The protection provided with the motor is such that no burning insulation or molten material falls to the surface that supports the heater if the motor is energized under each of the following fault conditions:		P
	i) Open main winding,		P
	ii) Open starting winding, and		P
	iii) Starting switch short-circuited		P
	3) The motor is provided with a thermal motor protector (a protective device that is sensitive to both temperature and current) that will prevent the temperature of the motor windings from becoming more than 125°C (257°F) under the maximum load under which the motor will run without causing the protector to cycle, and from becoming more than 150°C (302°F) with the rotor of the motor locked, or		P
	4) The motor is impedance protected and the locked-rotor temperature of the motor winding is not more than 150°C (302°F) with the heater otherwise operating as intended.		P
	b) Under wiring, unless the wire insulation is of the flame-retardant type, VW-1 (FR-1) or the equivalent.		P
	It will also necessitate that a switch, transformer, relay, solenoid, or similar device be individually and completely enclosed except at terminals, unless it can be shown that malfunction of the component would not result in a risk of fire or unless there are no openings in the bottom of the enclosure. An opening in the bottom of the enclosure is not acceptable if it is located directly below field- or factory-made connections (splices) or overload or overcurrent protective devices.		P
7.5	Except as noted in 7.6, an opening for ventilation in the enclosure, other than in the bottom, of a heater and an opening associated with the dissipation of heated air from the element shall be provided with one or more baffles that will prevent the emission of flame, molten metal, burning insulation, or similar material from the heater.		P
7.6	In a compartment other than one that houses an overload or overcurrent protective device, the baffles mentioned in 7.5 may be omitted if:		P
	a) No ventilating opening in a vertical wall, other than one associated with the dissipation of heated air from the elements during intended operation of the heater, is more than 3/8 inch (9.5 mm) in width, or		P
	b) The heater is constructed to be acceptable for the purpose, as shown by appropriate investigation.		P

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Clause	Requirement Test	Result Remark	Verdict
7.7	Cast- and sheet-metal portions of the enclosure shall not be thinner than indicated in Table 7.1 unless the enclosure is found to be acceptable when judged under considerations such as are mentioned in 7.2 and 7.8.		P
7.8	In addition to being considered with reference to the factors mentioned in 7.2, an enclosure of sheet metal is to be judged with respect to its size and shape, the thickness of metal, and its acceptability for the particular application, considering the intended use of the heater.		P
7.9	At points where the face of an attachment-plug receptacle projects through it, the enclosure of a heater shall have a thickness not less than:		P
a) 0.032	inch (0.81 mm) if of ferrous metal,		P
b) 0.045	inch (1.14 mm) if of nonferrous metal, and		P
c) 0.10	inch (2.5 mm) if of insulating material, except that an enclosure of insulating material may be of lesser thickness if formed or reinforced to provide physical strength. The insulating material shall be noncombustible.		P
7.10	Product enclosures made of non-metallic materials housing current-carrying electrical connections shall have a flammability classification as follows:		P
	a) A minimum of V-0, VTM-0, or HF-1, in accordance with Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, and IEC Test Flames 60695-11-10, or		P
	b) A minimum of SC-0 or SCTC-0, in accordance with Tests for Flammability of Small Polymeric Component Materials, UL 1694.		P
7.11	Product enclosures made of non-metallic materials shall comply with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, Table 4.1, Path II with a Minimum Flammability Rating V-0.		P
8	Accessibility of Live Parts		P
8.1	An electrical part of a heater shall be so located or enclosed that protection against unintentional contact with uninsulated live parts will be provided, except that this requirement does not apply to a visibly glowing open-wire element and the connections immediately adjacent to the element. See 3.1, 8.2, 33.7 and 33.14. Insulated motor brush caps do not require additional enclosures.		P
8.2	The requirement in 8.1 does not apply to the sheath of an isolated metal-clad element in a heater having provision for grounding the enclosure, although such a sheath is considered to be a bare live part when spacings are being measured.		P
8.3	In determining if an opening in an enclosure is acceptable, consideration is to be given to:		P

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Clause	Requirement Test		Result Remark	Verdict
	a) The proximity of uninsulated live parts (as determined by applying 8.1, 8.2, 8.4, 8.5, and 8.15 and			P
	b) The possibility of the emission of burning insulation, molten metal, and similar materials through the opening (as determined by applying 7.3 – 7.6.)			P
8.4	To reduce the likelihood of unintentional contact that may involve a risk of electric shock from an uninsulated live part or film-coated wire, an opening in an enclosure shall comply with either (a) or (b).			P
	a) For an opening that has a minor dimension (see 8.8) less than 1 inch (25.4 mm), such a part or wire shall not be contacted by the probe illustrated in Figure 8.3.			P
	b) For an opening that has a minor dimension of 1 inch or more, such a part or wire shall be spaced from the opening as specified in Table 8.1.			P
	Exception: An integral enclosure of a motor need not comply with these requirements if it complies with the requirements in 8.5.			P
8.5	With respect to a part or wire as mentioned in 8.4, in an integral enclosure of a motor as mentioned in the exception to 8.4:			P
	a) An opening that has a minor dimension (see 8.8) less than 3/4 inch (19.1 mm) is acceptable if:			P
	1) Film-coated wire cannot be contacted by the probe illustrated in Figure 8.2;			P
	2) In a directly accessible motor (see 8.9), an uninsulated live part cannot be contacted by the probe illustrated in Figure 8.4; or			P
	3) In an indirectly accessible motor (see 8.9), an uninsulated live part cannot be contacted by the probe illustrated in Figure 8.1.			P
	b) An opening that has a minor dimension of 3/4 inch (19.1 mm) or more is acceptable if a part or wire is spaced from the opening as specified in Table 8.1.			P
8.6	The probes mentioned in 8.4 and 8.5 and illustrated in Figure 8.1 – Figure 8.4 shall be applied to any depth that the opening will permit; and shall be rotated or angled before, during, and after insertion through the opening to any position that is necessary to examine the enclosure. The probes illustrated in Figure 8.3 and Figure 8.4 shall be applied in any possible configuration; and, if necessary, the configuration shall be changed after insertion through the opening.			P
8.7	The probes mentioned in 8.6 and 8.8 shall be used as measuring instruments to judge the accessibility provided by an opening, and not as instruments to judge the strength of a material; they shall be applied with a force of 1 lb (4.4 N) through any opening.			P

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Clause	Requirement Test	Result Remark	Verdict
8.8	With reference to the requirements in 8.4 and 8.5, the minor dimension of an opening is the diameter of the largest cylindrical probe having a hemispherical tip that can be inserted through the opening.		P
8.9	With reference to the requirements in 8.5, an indirectly accessible motor is a motor:		P
	a) That is accessible only by opening or removing a part of the outer enclosure, such as a guard or panel, that can be opened or removed without using a tool, or		P
	b) That is located at such a height or is otherwise guarded or enclosed so that it is unlikely to be contacted.		P
	A directly accessible motor is a motor:		P
	c) That can be contacted without opening or removing any part, or		P
	d) That is located so as to be accessible to contact.		P
8.10	During the examination of a heater in connection with the requirements in 8.1 – 8.9, a part of the outer enclosure that may be removed without the use of tools by the user of the heater (to permit the attachment of accessories, to allow access to means for making operating adjustments, or for other reasons) is to be disregarded – that is, it will not be assumed that the part in question affords protection against the risk of electric shock. A warning marking such as that specified in 67.4 is not considered to adequately protect against this risk of electric shock.		P
8.11	With reference to the requirements in 8.4 and 8.5, insulated brush caps are not required to be additionally enclosed.		P
8.12	During the examination of a heater in connection with the requirements in 8.1 – 8.9, a part of the outer enclosure that is removed with the use of tools by the user of the heater to permit resetting of the resettable temperature control is to be disregarded – that is, it will not be assumed that the part in question affords protection against the risk of electric shock, or injury to persons. A warning marking such as that specified in 67.4 is not considered to adequately protect against this risk of electric shock, or injury to persons.		P
	Exception: A heater marked in accordance with 67.4 and that complies with 8.13 need not comply with this requirement.		P

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Clause	Requirement Test		Result Remark	Verdict
8.13	A product may employ a resettable temperature control when the reset means is inaccessible if designed in a manner that the product cannot be disassembled with readily available tools, such as screw drivers, wrenches, and similar tools, and the product or instruction sheet is marked in accordance with 67.4. Such fasteners as rivets, one way screws, tamper resistant type screws, fasteners not readily accessible after assembly, and similar fasteners would be considered as causing the product to be not readily disassembled.			P
8.14	Any manual adjustable controls shall be resettable or adjustable so that electrical or moving parts will not cause a risk of fire, or electric shock, to occur during the resetting or adjustment procedure. See 8.10, 8.12, and Figure 8.5.			P
8.15	An uninsulated live part shall not be located behind an opening that may be used to make a user service function such as adjusting or resetting a manual limit control if a 1/8-inch (3.2-mm) diameter straight rod can be made to touch the live part when the rod is inserted through the opening and moved to all positions possible without producing an angle of more than 30 degrees between the rod and the line drawn between the center of the opening and the center of the face of the part to be adjusted. The length of the rod beyond the opening is not to exceed the distance between the opening and the face of the adjustable mechanism by more than 3 inches (76 mm). See Figure 8.5.			P
8.16	The door or cover of an enclosure shall be provided with means for holding it securely in place in the closed position.			P
8.17	The door or cover of an enclosure shall be hinged if it gives access to any fuse, circuit breaker, or manually resettable temperature control and if uninsulated live parts are exposed during the replacement of the fuse or resetting of the manually resettable temperature control. Such a door or cover shall also be provided with a latch or the equivalent and a captive screw to secure the door or cover in place.			P
8.18	A door or cover giving access to any overload-protective device in other than a low-voltage circuit shall be tight fitting and shall suitably overlap the surface of the enclosure around the opening.			P
8.19	A spring latch, a magnetic latch, a dimple, or any other mechanical arrangement that will hold the door in place and would require some effort on the user's part to open it is considered to be an acceptable means for holding the door in place as required in 8.17.			P

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Clause	Requirement Test	Result Remark	Verdict
8.20	A component of a heater that is likely to need inspection, replacement, cleaning, or other servicing shall be as accessible as practicable, and shall be accessible without the use of special tools if it is intended to be manually operated or adjusted or if it will definitely require periodic servicing.		P
9	Accessibility of Moving Parts		P
9.1	The rotor of a motor, a pulley, a belt, a gear, a fan, or other moving parts shall be enclosed or guarded to reduce the risk of injury to persons.		P
	Exception: This requirement does not apply to a part or portion of a part that must be exposed to enable a heater to perform its intended function.		P
9.2	A fan blade shall be constructed of a material and in such a manner to reduce the risk of its breakage or its release of parts that could cause a risk of injury to persons.		P
9.3	The portion of a fan blade that can cause a risk of injury to persons shall be guarded so that the probe shown in Figure 9.1 cannot touch the part when inserted with a force of 1 lb (4.4 N) through any opening in the guard.		P
9.4	If a part used to comply with the requirement in 9.3 is made of a polymeric material, a piece of the material is to be re-examined for compliance with this requirement after being subjected to the Mold Stress-Relief Distortion Test as described in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. See 12.1. While in the oven the part is to be assembled to the heater and the heater is to be in its intended operating position.		P
9.5	A guard employed to comply with the requirement in 9.3 shall be either attached to the heater or shall require the use of a tool or tools for removal.		P
9.6	An enclosure, a frame, a guard, a handle, or other part of the heater that is exposed to contact during intended operation shall not be sufficiently sharp to constitute a risk of injury to persons.		P
9.7	Any manual adjustable controls shall be resettable or adjustable so that moving parts will not cause a risk of injury to persons to occur during the resetting or adjustment procedure. See 8.10, 8.12 and Figure 8.5.		P
10	Guarding of Heating Elements		P
10.1	General		P
10.1.1	The heating element and any part of the element assembly (such as an element support, sheath, and similar parts) shall be so guarded that flammable material as well as persons will be protected against contacting it.		P

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Clause	Requirement Test	Result Remark	Verdict
10.1.2	Any heater projections such as guards or grilles that are intended to guard hot heater surfaces shall be positively secured to the heater such as by screws, rivets or welding or being engaged in slots so that they cannot be removed without the use of tools, breaking or permanent bending or distortion.		P
10.1.3	The acceptability of a guard is judged with respect to its general serviceability and with respect to the shape and size or both of the openings in it, in conjunction with the distance of the guard from the heating element and the other high-temperature parts mentioned in 10.1.1. Except as noted in 10.1.5, an opening in a guard is considered to be acceptable if, with the heater in any intended operating position, the following conditions are met:		P
	a) The shape and size of an opening are such that a test gauge in the form of a right-circular cone having a base diameter of 2-3/4 inches (69.9 mm) and an altitude of 5-1/2 inches (139.7 mm), see Figure 10.1, is prevented from touching the heating element and the other high-temperature parts when the cone probe is inserted, apex first, in any manner. See 10.1.4.		P
	b) The shape and size of an opening which permits the vertically downward entrance of a bar probe 1/2 inch (12.7 mm) wide and 1/16 inch (1.6 mm) thick, see Figure 10.2, are such that a triangle probe 1/16 inch thick and in the form of an isosceles triangle having a base of 2-3/4 inches and an altitude of 5-1/2 inches, see Figure 10.3, is prevented from touching the heating element and the other high-temperature parts when the triangle probe is inserted, apex first, in any manner. The testing of an opening with the triangle probe applies also where the vertically downward insertion of the bar is prevented by the construction of the guard, the use of an additional barrier, or both, unless the vertically applied bar tends to be deflected outward – that is, away from the guard.		P
	c) The area of an opening in a substantially vertical face of a guard is not more than 3-1/4 square inches (2100 mm2) if the size and/or shape of the opening permits the entrance from any horizontal direction of a vertically oriented rod probe 1/16 inch in diameter and 2-3/4 inch long, see Figure 10.4. Also, see Figure 10.5.		P
10.1.4	The fins of a metal-clad element are considered to be element-guarding members, and need not comply with the provisions in 10.1.3(a) if the temperature of the exposed edges (outer perimeter) of the fins is not more than 280°C (536°F).		P
10.1.5	Openings in the guard complying only with of 10.1.3(a) are acceptable for the following:		P

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Clause	Requirement Test	Result Remark	Verdict
	a) Except for a panel-type heater (see 10.2.1), an air heater in which the temperature of the heating element is not higher than 280°C (536°F) under conditions of intended operation, or		P
	b) A fan-type heater in which the fan is always in operation when the heating element is on (energized) and the air current prevents clothing and the like from entering the guard.		P
10.1.6	A guard shall comply with one of the following if the switching arrangement on a grounded heater does not comply with 33.14 or the design employs a through-cord switch as described in 33.15.		P
	a) No opening in the guard will permit passage of a rod having a diameter of 3/8 inch (9.5 mm).		P
	b) No opening in the guard will permit passage of a rod having a diameter of 3/4 inch (19.1 mm) and no uninsulated live part or isolated metal-clad element is less than 4 inches (102 mm) from the nearest point on the guard at any opening which will permit the entrance of a rod having a diameter of 3/8 inch (9.5 mm).		P
10.1.7	If a heater is required to have a guard, and if the guard is readily removable, the heater and the guard shall be contained in the same carton as shipped from the factory. See also 67.17.		P
10.1.8	A heater in which the heating element is constructed for use only in an air current shall be so wired or controlled that the element can be operated only while under the cooling effect of the air stream. A heater in which the cooling effect of the motion of a part is necessary to limit temperatures shall be so wired or controlled that the element cannot be operated without such motion.		P
10.2	Panel-type heaters		P
10.2.1	A panel-type heater shall be provided with a guard that will prevent a test surface, in the form of a 6-inch square (a square 152 mm on a side) parallel to the element panel, from being brought closer than 1/2 inch (12.7 mm) to the plane of the front of the heater, excluding the guard.		P
	Exception No. 1: A heater having an element panel operating at a temperature higher than 280°C (536°F) shall be guarded as described in 10.1.3.		P
	Exception No. 2: A heater that will not cause glowing or flaming of the cheesecloth or the felt when subjected to the padded surface and blanketing test in 42.8.2.		P
11	Parts Subject to Pressure		N/A

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Clause	Requirement Test		Result Remark	Verdict
11.1	Except as noted in 11.2 a pressure vessel having an inside diameter, width, height or cross-section diagonal of more than 6 inches (152 mm) with no limitation on length of vessel and subject to a pressure of more than 15 pounds force per square inch gauge (psig) (103 kilonewtons per square meter or 105 grams force per square millimeter) shall be certified by the National Board of Boiler and Pressure-Vessel Inspectors and marked in accordance with the appropriate boiler and pressure vessel code symbol of the American Society of Mechanical Engineers (ASME) – "H", "M", "S", or "U" – for a working pressure not less than the pressure determined by applying 11.2.		N/A
11.2	Except as noted in 11.3, a part of a heater that is subject to pressure (including the vapor pressure of a superheated fluid) shall comply with the Hydrostatic Test, Section 58.		N/A
11.3	A test need not be performed to determine whether or not a part complies with the requirement in 11.2 if the strength of the part is acceptable for the purpose as a result of its material and dimension – for example, copper or steel pipes of standard sizes and provided with standard fittings might be considered to have the necessary strength if they comply with Table 11.1.		N/A
11.4	A means for safely relieving pressure shall be provided for all parts in which pressure might be generated in the event of fire.		N/A
11.5	Pressure-relief devices (see 11.10), fusible plugs, soldered joints, spot or rolled weld joints, nonmetallic tubing, or other equivalent pressure-relief means may be employed to comply with the requirement in 11.4.		N/A
11.6	There shall be no shut-off valve between the pressure relief means and the parts that it is intended to protect.		N/A
11.7	A vessel having an inside diameter, width, height or cross-section diagonal of more than 3 inches (76.2 mm) and subject to air or steam pressure generated or stored within the appliance shall be protected by a pressure-relief device.		N/A
11.8	The start-to-discharge pressure setting of the pressure-relief device shall not be higher than the maximum working pressure of the vessel. The discharge rate of the device shall be great enough to relieve the pressure.		N/A
11.9	A pressure-relief device shall:		N/A
	a) Be connected as close as possible to the pressure vessel or parts of the system that it is intended to protect,		N/A
	b) Be so installed that it is accessible for inspection and repair and cannot be readily rendered inoperative,		N/A

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Clause	Requirement Test	Result Remark	Verdict
	c) Have its discharge opening so located and directed that the risk of scalding has been reduced to an acceptable degree, and		N/A
	d) Have its discharge opening so located and directed that operation of the device will not deposit moisture on uninsulated live parts, or on insulation or components affected detrimentally by moisture.		N/A
11.10	A pressure-relief device having an adjustable setting is to be judged on the basis of its maximum setting unless the adjusting means is sealed at a lower setting.		N/A
11.11	A pressure-relief device is considered to be a pressure-actuated valve or rupture member designed to relieve excessive pressures automatically.		N/A
11.12	If a pressure-relief device is required, the electrical control responsible for limiting the pressure in the vessel shall be capable of performing under rated load for 100,000 cycles of operation and shall prevent the pressure from exceeding 90 percent of the relief-device setting under any condition of intended operation.		N/A
12	Polymeric Materials		P
12.1	Determination of the acceptability of a polymeric material shall be made based on the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.		P
12.2	For the purposes of conducting the Resistance to Impact Test in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, a heater intended for indoor use that is provided with a polymeric enclosure shall be considered a floor-supported appliance even if it is specifically intended for use at elevated locations and be evaluated for use in locations where the temperature is capable of being less than normal room temperature, such as unheated warehouses or rooms.		P
12.3	Product enclosures shall be subject to the requirements in Section 7.		P
13	Heat Transfer Fluids		N/A
13.1	In a heater which uses a heat transfer fluid in its heating process, the fluid shall have a flash point (see 3.13) that is higher than the maximum operating temperature of the fluid measured during the Normal Temperature Test, Section 40.		N/A
14	Assembly of Components		P
14.1	A switch, a lampholder, a temperature control, an attachment-plug receptacle, a motor-attachment plug, or similar component shall be mounted securely and, except as noted in 14.2 and 14.3, shall be prevented from turning.		P

UL 1278			
Clause	Requirement Test	Result Remark	Verdict
14.2	The requirement that a switch or a temperature control be prevented from turning may be waived if all five of the following conditions are met:		P
	a) The switch or the temperature control is of a plunger or other type that does not tend to rotate when operated. A toggle switch is considered to be subject to forces that tend to turn the switch or the temperature control during operation of the switch,		P
	b) The means for mounting the switch or the temperature control is not subject to loosening as the result of its operation,		P
	c) The spacings are not reduced below the minimum acceptable values if the switch or the temperature control rotates,		P
	d) The operation of the switch or the temperature control is by mechanical means rather than direct contact by persons, and		P
	e) The shifting of the switch or the temperature control in position does not result in false indication of its setpoint with respect to the setpoint markings.		P
14.3	A lampholder of a type in which the lamp cannot be replaced (such as a neon pilot or indicator light in which the lamp is sealed in nonremovable jewel) need not be prevented from turning if rotation cannot reduce spacings below the minimum acceptable values.		N/A
14.4	The means for preventing the turning mentioned in 14.1 is to consist of more than friction between surfaces – for example, a toothed lock washer which provides both spring take-up and an interference lock is acceptable as means to prevent turning of a small stem-mounted switch or other device having a single-hole mounting means.		P
14.5	Uninsulated live parts shall be secured to the base or mounting surface that they will be prevented from turning or shifting in position if such motion may result in a reduction of spacings below the minimum acceptable values indicated in 35.1 – 35.6.		P
14.6	Friction between surfaces is not acceptable as a means to prevent shifting or turning of live parts, but a toothed lock washer which provides both spring take-up and an interference lock is acceptable.		P
15	Protection Against Corrosion		P
15.1	Except as noted in 15.2, iron and steel parts shall be protected against corrosion by enameling, galvanizing, plating, or other equivalent means if the deterioration of such unprotected parts would be likely to result in risk of fire, electric shock, explosion, or injury to persons.		P

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Clause	Requirement Test	Result Remark	Verdict
15.2	In certain equipment where the oxidation of steel is not likely to be accelerated due to the exposure of metal to air and moisture or other oxidizing influence – thickness of metal and temperature also being factors – surfaces of sheet steel within an enclosure may not be required to be protected against corrosion. Cast-iron parts are not required to be protected against corrosion. A sheath employed on a heating element operating in air and terminal parts attached directly to the heating element need not be protected against corrosion.		P
15.3	The aging characteristics of plating or other finish used in a heater shall be such that deterioration of the finish will not result in unacceptable performance of the heater.		P
15.4	The sheath of an immersion-type heating element shall be of a metal resistant to corrosion by the liquid in which the element is intended to be immersed.		P
16	Supply Connections		P
16.1	The mass of a wall or ceiling hung heater shall not exceed 50 pounds (22.7 kg).		P
16.2	Hanging brackets and any necessary fasteners required for hanging the heater shall be provided as part of the product. Optional hanging kits may be available if marked in accordance with 67.10.		P
16.3	A wall-hung heater shall not have provisions for permanent mounting. Keyhole slots, not accessible for tightening of screws, or provisions for hanging on a bracket furnished with a heater would be acceptable for mounting such heaters.		P
16.4	A heater shall be provided with a length of attached flexible cord and an attachment plug for connection to the supply circuit. The length of the attached power-supply cord (including fittings) shall not be less than 6 feet (1.8 m) and not more than 8 feet (2.4 m). All power-supply cords shall comply with the requirements of the Standard for Cord Sets and Power-Supply Cords, UL 817.		P
	Exception No. 1: The length of cord for Types SRDT and SPT-3 is specified in note b of Table 16.1.		N/A
	Exception No. 2: Ceiling-hung heaters may have a cord not more than 17 feet (5.2 m) in length.		N/A
16.5	A power supply cord supplied as part of an appliance as described in Table 16.1, row 1 shall have a suffix -R in accordance with the Standard for Flexible Cords and Cables, UL 62.		P
16.6	The size of the flexible cord, based on the current rating of the heater, shall be in accordance with Table 16.2.		P

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Clause	Requirement Test	Result Remark	Verdict
16.7	The current rating of the attachment plug shall not be less than 125 percent of the current rating of the heater except that a 15-ampere attachment plug is acceptable for a heater rated at not more than 1500 watts at 120 volts, or 3000 watts at 240 volts, and a 20-ampere attachment plug is acceptable for a heater rated at not more than 2000 watts at 120 volts or 4000 watts at 240 volts.		P
16.8	The flexible cord shall be as indicated in Table 16.1 or shall be of type having such properties that it will be at least equally serviceable for the particular application.		P
16.9	The flexible cord provided with a heater intended for outdoor use shall be marked with the suffix letter "W".		N/A
16.10	The attachment plug (of a permanently attached cord or of a cord set) shall be acceptable for its intended use. Some of the more common plug configurations are shown in Figure 16.1.		P
16.11	Supplementary insulation on a flexible cord shall not extend more than 1/2 inch (12.7 mm) outside the heater (unless provided with additional mechanical protection), shall be prevented from fraying or unraveling, and shall not affect adversely the means for providing strain relief.		P
16.12	Strain relief shall be provided to prevent a mechanical stress on a flexible supply cord from being transmitted to terminals, splices, or interior wiring.		P
16.13	Means shall be provided to prevent the flexible cord from being pushed into the enclosure of a heater through the cord-entry hole if such displacement is likely to subject the cord to mechanical damage or to expose the cord to a temperature higher than that for which it is acceptable, or if it is likely to reduce spacings (such as to a metal strain-relief clamp) below the minimum acceptable values.		P
16.14	If a knot serves as strain relief in an attached flexible cord, any surface with which the knot may come in contact shall be free from projections, sharp edges, burrs, fins, and the like, which may cause abrasion of the insulators on the conductors.		P
16.15	If a heater is provided with pin terminals, the heater shall be constructed so that no live parts will be exposed to unintentional contact when the intended plug is in place on the pins.		N/A
16.16	A pin guard is required, such that:		N/A
	a) A straight edge placed in any position, across and in contact with edges of the plug opening without the plug in place, cannot be made to contact any current-carrying pin.		N/A

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Clause	Requirement Test	Result Remark	Verdict
	b) With the plug aligned with the pins and the face of the plug in a plane located perpendicular to the end or ends of the farthest projecting current-carrying pin, the probe shown in Figure 8.3 shall not touch any current-carrying pin while the probe is inserted through any opening with the heater in any position.		N/A
16.17	A pin terminal shall be securely and rigidly mounted and shall be prevented from shifting in position by means other than friction between surfaces.		N/A
16.18	The requirement in 16.17 is intended primarily to provide for the maintenance of spacings in accordance with 35.1 – 35.6 and Table 35.1, and for spacings between pin-type terminals as indicated in Table 16.3. Under this requirement, consideration is also to be given to the means for locking terminals in position to maintain tightness.		N/A
16.19	If a heater employs three or more pin terminals intended for use with a plug that covers all the pins, the terminals shall be so spaced that they will not accommodate a flatiron or appliance plug or a cord connector; and the plug that these pins will accommodate shall be acceptable for the particular application.		N/A
16.20	The dimensions of pins and their center-to-center spacings (including the corresponding spacings of the female contacts of general-use plugs which will accommodate these arrangement of pins) are as indicated in Table 16.3.		N/A
16.21	At point where a flexible cord passes through an opening in a wall, barrier, or enclosing case, there shall be a bushing or the equivalent that shall be secured in place, and shall have a smooth, rounded surface against which the cord may bear. If Type SP-2, SPT-2, or other cord lighter than Type HSJ is employed, if the wall or barrier is of metal, and if the construction is such that the cord may be subjected to strain or motion, an insulating bushing shall be provided. The heat and moisture-resistant properties of the bushing material shall be acceptable for the particular application.		P
16.22	If the cord hole is in wood, porcelain, phenolic composition, or other nonconducting material, a smooth, rounded surface is considered to be equivalent to a bushing.		P

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Clause	Requirement Test	Result Remark	Verdict
16.23	Ceramic materials and some molded compositions are acceptable generally for insulating bushings; but a separate bushing of wood, hot-molded shellac-and-tar composition, or rubber material (other than in a motor) is not acceptable. Vulcanized fiber may be employed if the bushing is not less than 3/64 inch (1.2 mm) thick and if it is so formed and secured in place that it will not be affected adversely by conditions of ordinary moisture.		P
17	Special Protection Devices		N/A
17.1	An AFCI or LCDI provided as part of a cord-connected appliance shall comply with the Standard for Arc Fault Circuit Interrupters, UL 1699.		N/A
17.2	The AFCI or LCDI shall be installed as an integral part of the attachment plug or located in the supply cord within 4 in of the attachment plug.		N/A
17.3	Arc fault detection testing shall include the following, as applicable:		N/A
	a) Carbonized path arc clearing time test;		N/A
	b) Point contact arc test;		N/A
	c) Unwanted tripping test – Load Condition I;		N/A
	d) Unwanted tripping test – Load Condition II – Condition B and C;		N/A
	e) Unwanted tripping test – Load Condition III – Condition A;		N/A
	f) Operation Inhibition - Masking.		N/A
	Exception: The test carbonized path arc clearing time test is not applicable for LCDIs that are provided with shielded power-supply cords.		N/A
17.4	An AFCI or LCDI provided as part of an appliance intended for outdoor use shall comply with the applicable requirements in Section 50.1.		N/A
18	Static Load Test For Hanging Means		P
18.1	When subjected to the test specified in 18.2 – 18.3, a cord-connected wall- or ceiling-surface hung or direct plug-in appliance shall comply with the following:		P
	a) The security of the attachment of the appliance to the wall shall not be adversely affected;		P
	b) There shall be no evidence of a risk of fire or electric shock;		P
	c) The insulation resistance between live and dead-metal parts shall not be less than 50,000 ohms; and		P
	d) The appliance shall withstand for 1 minute without breakdown the application of a 60-hertz essentially sinusoidal potential of 1000 volts between live and dead-metal parts.		P

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Clause	Requirement Test	Result Remark	Verdict
18.2	An appliance that is wall or ceiling surface hung as mentioned in 18.1 is to be hung in accordance with the installation instructions provided by the manufacturer on 3/8-inch-thick plasterboard (dry wall) on nominal 2 by 4-inch wood studs/joists spaced on 24 inch (609 mm) centers. The hanging parts are to be used as specified in the instructions, and the securing screws are to be located between the studs/joists and secured in the plasterboard.		P
	Exception: Commercial/industrial products shall be hung in accordance with the installation instructions provided by the manufacturer.		N/A
18.3	After installation, the appliance is to be subjected to a static load. The load is to be applied so as to transmit the maximum amount of stress to the hanging means and is to be increased during a 5 to 10 second interval, until a load equal to the weight of the product plus a force of three times the weight of the product, but not less than 10 pounds (45 N), is applied to the hanging system. The load is to be maintained for 1 minute.		P
19	Current-Carrying Parts		P
19.1	Plated ferrous materials may be used for current-carrying parts whose temperature during normal operation is more than 100°C (212°F), but plain (unplated) iron or steel shall not be used regardless of temperatures. A copper conductor, unless tinned, nickel-coated, silver-plated, or otherwise protected, shall not be subjected to a temperature rise of more than 125°C (225°F) at a pressure terminal connector or to a temperature rise of more than 175°C (315°F) elsewhere. Stainless steel and other corrosion-resistant alloys may be used for current-carrying parts regardless of temperature.		P
19.2	Ordinary ferrous materials, if provided with a corrosion-resistant coating, may be used for a current-carrying part as follows:		P
	a) Within a motor or associated governor, and		P
	b) On control-devices (such as combination tip-over and temperature controls) if the part has been evaluated as acceptable for use in an ambient temperature in excess of 100°C (212°F).		P
20	Internal Wiring		P
20.1	General		P
20.1.1	The internal wiring of a heater shall consist of wires of a size and type or types that are acceptable for the particular application, when considered with respect to:		P
	a) The temperature and voltage to which the wiring is likely to be subjected,		P
	b) Its exposure to oil or grease,		P

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Clause	Requirement Test	Result Remark	Verdict
	c) The current carried by the individual wires. Wire size AWG shall be based on the current carried by the internal wire (see Table 20.1 for minimum internal wire size guide), and		P
	d) Other conditions of service to which it is likely to be subjected.		P
20.1.2	For the purpose of these requirements, the internal wiring of an appliance is considered to be all the interconnecting wiring beyond the point where the power-supply cord enters the enclosure.		P
20.1.3	There is no temperature limit applicable to a conductor (except as noted in 19.1) provided with beads of noncarbonizable material or the equivalent.		P
20.2	Protection of wiring		P
20.2.1	The wiring and connections between parts of a heater shall be protected or enclosed, except that a length of flexible cord may be employed for external connections, or for internal connections that may be exposed during servicing, if flexibility of the wiring is essential.		P
20.2.2	The internal wiring of a heater in the vicinity of a lampholder that accepts either an infrared lamp or an ordinary lamp:		P
	a) Shall be a jacketed type at least equivalent to Type SP-2 flexible cord. Appliance wiring material is not acceptable unless provided with sleeving or tubing.		P
	b) Shall be routed along the metal surface of the heater enclosure and shall be so secured as to minimize the likelihood of its being hooked or grasped.		P
20.2.3	A conductor utilizing beads for insulation shall not be used outside an enclosure.		P
20.2.4	Internal wiring that is exposed through an opening in the enclosure of a heater is considered to be protected as required in 20.2.1 – 20.2.3 if, when judged as though it were film-coated wire, the wiring would be acceptable according to 8.2 – 8.4. Internal wiring within an enclosure is acceptable if, even though it can be touched with the probe, it is so protected or guarded that it cannot be grasped or hooked in such a manner that it could be subjected to stress.		P
20.2.5	If the wiring of a heater is located where it may be in proximity to combustible material or may be subjected to physical damage, it shall be in armored cable, rigid metal conduit, electrical metallic tubing, metal raceway, or shall otherwise be protected.		P
20.2.6	Wiring shall be protected from sharp edges (including male screw threads), burrs, fins, moving parts, and other agencies that might abrade the insulation on conductors.		P

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Clause	Requirement Test	Result Remark	Verdict
20.2.7	A hole by means of which insulated wires pass through a sheet-metal wall within the overall enclosure of a heater shall be provided with a smooth, rounded bushing or shall have smooth, rounded surfaces upon which the wires may bear, to prevent abrasion of the insulation. A flexible cord used for external interconnection as mentioned in 20.2.1 shall be provided with strain relief and bushings in accordance with 16.12 – 16.14 and 16.21 – 16.23 unless the construction is such that the cord will be protected from stress or motion.		P
20.2.8	Insulated wires may be bunched and passed through a single opening in a metal wall within the enclosure of heater.		P
20.3	Wire connectors		P
20.3.1	All electrical connections, such as wire nuts, splicing wire connectors, quick-connect terminals, terminal connectors, multi-pin and other forms of wire connectors, shall comply with the following standards:		P
	a) The Standard for Electrical Quick-Connect Terminals, UL 310;		P
	b) The Standard for Wire Connectors, UL 486A-486B;		P
	c) The Standard for Splicing Wire Connectors, UL 486C;		P
	d) The Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors, UL 486E; or		P
	e) The Standard for Component Connectors for Use in Data, Signal, Control and Power Applications, UL 1977.		P
	Exception No. 1: This requirement is not applicable to current-carrying connections that are located in a low-voltage circuit (see 3.17).		P
	Exception No. 2: This requirement is not applicable to the following types of connections:		P
	a) Brazed or welded connections;		P
	b) Soldered connections on printed circuit boards located in a low-voltage circuit (see 3.17); or		P
	c) Connections on small components that are mounted on printed circuit boards located in a low-voltage circuit (see 3.17).		P
20.3.2	A splice shall be provided with insulation equivalent to that of the wires involved if permanence of spacing between the splice and other metal parts is not provided.		P

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Clause	Requirement Test		Result Remark	Verdict
20.3.3	The means of connecting stranded internal wiring to a wire-binding screw shall be such that loose strands of wire will be prevented from contacting other live parts not always of the same polarity as the wire and from contacting noncurrent-carrying conductive parts. This may be accomplished by use of pressure terminal connectors, soldering lugs, crimped eyelets, soldering all strands of the wire, or other equivalent means.			P
20.4	Separation of circuits			P
20.4.1	Conductors of different circuits used in internal wiring shall either be:			P
	a) Provided with insulation rated for the highest voltage involved or			P
	b) Shall be separated by a barrier or segregated by adequate spacing from an uninsulated live part connected to a different circuit.			P
20.4.2	Low-voltage and high-voltage circuits, for example, are considered to be different circuits with reference to the requirement in 20.4.1.			P
20.4.3	Segregation, separation, or both, of insulated conductors may be accomplished by clamping, routing, or an equivalent means that provide permanent separation from insulated or uninsulated live parts of a different circuit.			P
20.4.4	A barrier used to provide separation between the wiring of different circuits shall be of metal or of insulating material, of acceptable physical strength if exposed or otherwise likely to subjected to mechanical damage, and secured in place. Unclosed openings in a barrier for the passage of conductors shall not be larger in diameter than 1/4 inch (6.4 mm) and shall not exceed in number, on the basis of one opening per conductor, the number of wires that will need to pass through the barrier. The closure for any other opening shall present a smooth surface wherever an insulated wire may be in contact with it; and the area of any such opening, with the closure removed, shall not be larger than required for the passage of the necessary wires.			P
20.4.5	A metal barrier shall have a thickness at least as great as the required thickness of the enclosure metal. A barrier of insulating material shall not be less than 0.028 inch (0.71 mm) thick and shall be of greater thickness if its deformation may be readily accomplished to defeat its purpose.			P
21	Heating Elements			P
21.1	A heating element shall be securely supported.			P
21.1.1	A sheath type heating element shall comply with the requirements in:			N/A
	a) The Standard for Sheathed Heating Elements, UL 1030; or			N/A
	b) The Standard for Electric Heating Appliances, UL 499.			N/A

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Clause	Requirement Test	Result Remark	Verdict

21.2	In determining if a heating element complies with the requirement in 21.1, consideration is to be given to sagging, loosening, and other adverse conditions of the element resulting from continuous heating or flexing of the element supports or related wiring due to alternate heating and cooling of the element. See Element Support Impact Tests, Section 52, for tests to be conducted on heating elements.		P
22	Heating Element Supports		P
22.1	The supports for an open-type heating element shall be positively secured in position if loosening of the element may result in reduction of electrical spacings between a heating element and a dead metal part. See Spacings, Section 35. The securement of the supports shall not be dependent on tension or pull by the heating element as evaluated by 22.2.		P
22.2	Element supports are evaluated by assuming an expansion of the heating element from its normal position, to any position that will not cause contact of the element with the exposed dead metal parts. The heater is then moved to various positions in an attempt to dislodge an element support.		P
23	Electrical Insulation		P
23.1	Insulating washers, bushings, and the like that are integral parts of a heater, and bases or supports for the mounting of live parts shall be of a moisture-resistant material that will not be damaged by the temperatures to which they will be subjected under conditions of actual use. Molded parts shall be constructed so that they will have the mechanical strength and rigidity necessary to withstand the stresses of actual service.		P
23.2	Insulating material employed in a heating appliance is to be judged with respect to its particular application. Materials such as mica, some molded compounds, and certain refractory materials are usually acceptable for use as the sole support of live parts; and some other materials that are not for general use, such as magnesium oxide, may be acceptable if used in conjunction with other less hygroscopic insulating materials or if located and protected so that they are not subject to mechanical damage and are resistant to the absorption of moisture. When it is necessary to investigate a material to determine whether or not it is acceptable, consideration is to be given to its mechanical strength, dielectric properties, insulation resistance (see 49.1), heat-resistant qualities, the degree to which it is enclosed or protected and any other features having a bearing on the likelihood that a risk of fire, electric shock, or injury to persons may occur, under conditions of actual service. All of these factors are considered with respect to thermal aging.		P

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Clause	Requirement Test	Result Remark	Verdict
23.3	In the mounting or supporting of small, fragile, insulating parts, screw or other fastenings shall not be tight enough to cause cracking or breaking of these parts with expansion and contraction. Generally, such parts should be slightly loose.		P
24	Thermal Insulation		P
24.1	Thermal insulation shall be of such nature and located and mounted or supported so that it will not be adversely affected by any intended operation of the heater.		P
24.2	Thermal insulation that is not rigid shall be mounted or supported so that it will not sag. Adhesive material employed for mounting thermal insulation shall be acceptable for use at the temperature to which it may be subjected.		P
24.3	Determination of the acceptability of an adhesive may be omitted if the thermal insulation is mechanically supported by at least one rivet or the equivalent per square foot of material (at least 11 rivets or the equivalent per square meter of material).		P
24.4	Unless it has been investigated for the purpose, flammable thermal insulation or other flammable material is not acceptable if it is located in the heated air stream of a heater.		P
24.5	Flammable or electrically conductive thermal insulation shall not make contact with uninsulated live parts of a heater.		P
24.6	Some types of mineral-wool thermal insulation contain conductive impurities in the form of slag that make its use unacceptable if in contact with uninsulated live parts. See 49.1.		P
25	Motors		P
25.1	A motor shall comply with the Standard for Rotating Electrical Machines - General Requirements, UL 1004-1.		P
25.2	A motor winding shall be such as to resist the absorption of moisture.		P
25.3	With reference to the requirement in 25.2, film-coated wire is not required to be additionally treated to resist absorption of moisture, but fiber slot liners, cloth coil wrap, and similar moisture-absorptive materials shall be provided with impregnation or be otherwise treated to resist moisture absorption.		P
25.4	A rubber or neoprene boot over the terminal of a motor capacitor that is accessible during user-servicing shall not be less than 1/32-inch (0.79 mm) thick, shall resist thermal degradation, and shall incorporate means to secure the boot in place, such as a molded lip that fits over the flange of the capacitor case.		P

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Clause	Requirement Test	Result Remark	Verdict
25.5	A separate soft-rubber, neoprene, or polyvinyl chloride bushing may be employed in the frame of a motor or in the enclosure of a capacitor attached to a motor (but not elsewhere in a heater, except as indicated in 25.6) provided that:		N/A
	a) The thickness of the bushing is not less than 3/64 inch (1.2 mm) thick, and		N/A
	b) The bushing is so located that it will not be exposed to oil, grease, oily vapor, or other substances having a deleterious effect on the compound employed.		N/A
25.6	A bushing of any of the materials mentioned in 25.5 may be employed at any point in a heater if used with a cord of a type for which an insulating bushing is not required, and if the edges of the hole in which the bushing is mounted are smooth and free from burrs, fins, and similar.		P
25.7	An insulated metal grommet may be accepted in place of an insulating bushing if the insulating material used is not less than 1/32 inch (0.8 mm) thick and fills completely the space between the grommet and the metal in which it is mounted.		N/A
26	Motor Overload Protection		P
26.1	Thermal protection devices integral with the motor shall comply with one of the following:		N/A
	a) The Standard for Overheating Protection for Motors, UL 2111;		N/A
	b) The Standard for Thermally Protected Motors, UL 1004-3; or		N/A
	c) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1; and the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2 Particular Requirements for Thermal Motor Protectors, UL 60730-2-2; in conjunction with the Standard for Thermally Protected Motors, UL 1004-3 (to evaluate the motor-protector combination).		N/A
26.2	Impedance protection shall comply with one of the following:		P
	a) The Standard for Overheating Protection for Motors, UL 2111; or		N/A
	b) The Standard for Impedance Protected Motors, UL 1004-2.		P
26.3	Electronic protection integral to the motor shall comply with the Standard for Electronically Protected Motors, UL 1004-7.		N/A
26.4	Except as indicated in 26.3, electronically protected motor circuits shall comply with one of the following. See 4.3.4 for basic control requirements:		N/A

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Clause	Requirement Test	Result Remark	Verdict
	a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991. When the protective electronic circuit is relying upon software as a protective component, it shall comply with the requirements in the Standard for Software in Programmable Components, UL 1998. If software is relied upon to perform a safety function, it shall be considered software Class 1;		N/A
	b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1. If software is relied upon to perform a safety function, it shall be considered software Class B; or		N/A
	c) The Standard for Adjustable Speed Electrical Power Drive Systems – Part 5-1: Safety Requirements – Electrical, Thermal and Energy, UL 61800-5-1.		N/A
	Exception: Compliance with the above standards is not required for an electronically protected motor circuit if there is no risk of fire, electric shock, or injury to persons during abnormal testing with the motor electronic circuit rendered ineffective; compliance with the applicable requirements of this end product standard is then required.		N/A
26.5	For a multispeed motor that employs a separate overload protective device to provide running protection, the protection is to be effective at all speeds at which the motor is intended to operate.		N/A
26.6	A fuse may be used to provide the necessary overload protection if the construction complies with the requirements with the largest-ampere-rated fuse that can be mounted in the fuseholder or with the intended noninterchangeable fuse. The fuse used to provide this protection need not be of a type required for branch-circuit protection, provided the heater is marked in accordance with 67.9.		N/A
27	Overcurrent Protection		P
27.1	General		P
27.1.1	Overcurrent protection shall be of a type acceptable for branch circuit protection in accordance with the National Electrical Code, ANSI/NFPA 70. The overcurrent protective devices shall be factory installed as an integral part of the heater.		P
27.1.2	An overcurrent protective device or devices shall be provided for all ungrounded conductors and shall have a voltage rating not less than that of the circuit in which it is used. The device shall be:		P
	a) A circuit breaker acceptable for branch circuit protection;		P
	b) A fuse acceptable for branch circuit protection such as a Class CC, G, H, J, K, L, R, or T cartridge fuse or a Type S plug fuse; or		P

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Clause	Requirement Test		Result Remark	Verdict
	c) A supplementary type fuse (a type of fuse other than indicated in (b) provided the fuse has a short circuit rating acceptable for the circuit in which it is used. See the Short Circuit Test, Section 44.			P
	The heater shall be marked in accordance with 67.20 – 67.22.			P
27.1.3	No overcurrent protective device is required as a part of the appliance if equivalent protection will be obtained from the branch-circuit protective device through which the appliance will be supplied.			P
27.1.4	A fuseholder or circuit breaker shall be rated for the particular application and shall not be accessible from outside the enclosure without opening a door or cover. The operating handle of a circuit breaker may project outside the enclosure. A fuseholder with a removable end cap may have the end cap accessible outside the enclosure. A plug fuseholder shall be so installed that uninsulated live parts other than the screw shell will not be exposed to contact by persons removing or replacing fuses.			P
27.1.5	Overcurrent protection at not more than 20 amperes shall be provided for each general use duplex receptacle circuit, and for each lampholder circuit independent of a heating element included in the heater, unless the heater is intended for connection to a branch circuit rated at 20 amperes or less.			P
27.1.6	Overcurrent protection at not more than 15 amperes shall be provided for each general use single receptacle, unless the heater is intended for connection to a branch circuit rated at 15 amperes.			P
27.1.7	Overcurrent protection for a tapped high-voltage control circuit and for a transformer may be omitted from a heater employing one of the attachment plug configurations shown in Figure 16.1 that is supplied by a branch circuit rated 15 amperes or less, provided the heater conductors, other than the supply cord, do not extend beyond the heater enclosure and are not smaller than 18 AWG (0.82 mm2).			P
27.2	Heating elements			P
27.2.1	A heater employing resistance type heating elements and rated at more than 48 amperes shall have the heating elements subdivided. Each subdivided circuit shall not exceed 48 amperes and shall be protected at not more than 60 amperes. The current rating of an overcurrent device for a subdivided circuit shall not be less than 125 percent of that circuit current rating.			P
27.2.2	Air-heating equipment employing infrared heating means shall have overcurrent protection not exceeding 50 amperes.			N/A
27.3	Motors and motor-circuits			N/A

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Clause	Requirement Test		Result Remark	Verdict
27.3.1	A motor and motor circuit, except as indicated in 27.3.2, in a heater rated at more than 16 amperes shall be protected by an overcurrent protective device having a maximum ampere rating in accordance with the National Electrical Code, ANSI/NFPA 70. Such short circuit and ground fault overcurrent protection shall be provided as part of the heater unless it can be determined (in accordance with 27.1.3) that equivalent short circuit and ground fault overcurrent protection will be incorporated as an overcurrent protective device in the branch circuit to which the heater will be connected.			N/A
27.3.2	The requirement in 27.3.1 does not apply to a motor rated at 1/8 horsepower (93 W output) or less connected to a circuit having overcurrent protection at 50 amperes or less.			N/A
27.3.3	A motor having an inherent thermal protector that complies with the requirements for such devices is acceptable with respect to the requirement in 27.3.1 if, in the heater, it will be connected in series with an overcurrent protective device acceptable for branch circuit protection of the same type and having a current rating not more than that with which the motor-protector combination was tested during the investigation of the protector.			N/A
27.4	Tapped high-voltage control circuits			N/A
27.4.1	For the purpose of these requirements, a tapped high-voltage control circuit is a circuit that is tapped within the heater from the load side of the overcurrent device or devices for the controlled load.			N/A
27.4.2	A control circuit that is tapped from the main power supply circuit at a point outside the control equipment enclosure shall be protected as specified in Column A of Table 430-72(b) of the National Electrical Code, ANSI/NFPA 70.			N/A
27.4.3	A tapped high-voltage control circuit conductor shall be provided with overcurrent protection. The rating of the overcurrent protective device or devices shall not exceed the applicable value specified in Table 27.1.			N/A
	Exception No. 1: Overcurrent protection may be omitted as noted in 27.1.7.			N/A
	Exception No. 2: An 18, 16, or 14 AWG (0.82, 1.3, or 2.1 mm2) conductor within the heater enclosure that does not exceed 4 feet (1.2 m) in length between points of opposite polarity may be protected by an overcurrent protective device rated 60 amperes or less.			N/A

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Clause	Requirement Test		Result Remark	Verdict
	Exception No. 3: An overcurrent protective device of a higher rating than specified in Table 27.1 may be used provided the conductor complies with the requirements specified in the Short Circuit Tests, Section 44.			N/A
	Exception No. 4: A lead within the heater enclosure and 12 inches (305 mm) or less in length need not be provided with overcurrent protection.			N/A
	Exception No. 5: A control circuit conductor supplied from the secondary of a single phase transformer that is connected so that only a 2-wire (single voltage) secondary is used, may be protected by an overcurrent protective device or devices located on the primary side of the transformer provided this protection:			N/A
	a) Complies with the requirements for transformer overcurrent protection, 27.5, and			N/A
	b) Does not exceed the applicable value specified in Table 27.1 multiplied by the ratio of secondary to primary rated transformer voltage.			N/A
27.4.4	Overcurrent protection for a tapped high-voltage control circuit conductor shall be provided as part of the heater.			N/A
	Exception: The overcurrent protective device or devices need not be provided as part of the heater if, based on the marked rating or ratings of the heater, the rating of the branch circuit overcurrent protective device does not exceed the applicable value specified in Table 27.1.			N/A
27.5	High-voltage transformers			N/A
27.5.1	A transformer (including an autotransformer), other than one as described in 27.1.7 or 27.6.1, is considered to be a high-voltage transformer and shall:			N/A
	a) Be provided with thermal overload protection in accordance with 27.5.2,			N/A
	b) Be protected by an overcurrent device in accordance with 27.5.4 – 27.5.8, or			N/A
	c) Comply with the Burnout Test – High-Voltage Transformers, Section 46.			N/A
27.5.2	If a high-voltage transformer is provided with a thermal overload protective device, the device shall be arranged to interrupt the primary circuit. The device and the transformer are to be subjected to one of the following tests:			N/A
	a) If the device is other than a nonrenewable thermal cutoff type, the Overload Test – High-Voltage Transformers, Section 45; or			N/A
	b) If the device is a nonrenewable thermal cutoff type, the Burnout Test – High-Voltage Transformers, Section 46.			N/A

UL 1278				
Clause	Requirement Test		Result Remark	Verdict
27.5.3	A thermal-link that is used to provide thermal overload protection shall comply with the Standard for Thermal-Links – Requirements and Application Guide, UL 60691. A manual or automatic reset thermal protector shall have an endurance rating of not less than 6000 cycles when tested in accordance with the Endurance Test, Section 43, and shall comply with the requirements for the calibration of temperature limiting controls in the Standard for Temperature-Indicating and - Regulating Equipment, UL 873.			N/A
	Exception: A type-2 action thermal cut-out, as specified in the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1 and the Standard for Automatic Electrical Controls - Part 2-9: Particular Requirements for Temperature Sensing Controls, UL 60730-2-9, is considered to comply with the requirements of UL 873.			N/A
27.5.4	If a high-voltage transformer is protected by an overcurrent device, such protection shall comply with the requirements specified in 27.5.5 – 27.5.8.			N/A
27.5.5	Except as noted in 27.5.6 – 27.5.8, a high-voltage transformer shall be protected by an overcurrent device or devices, located in the primary circuit and rated not more than 15 amperes or 125 percent of the rated transformer primary current, whichever is greater.			N/A
27.5.6	Overcurrent protection located in the primary circuit of a transformer need not be provided as part of the heater if based on the marked rating of the heater, the rating of the branch circuit overcurrent protective device does not exceed the applicable value specified in 27.5.5. See 67.23.			N/A
27.5.7	For other than an autotransformer, additional overcurrent protection is not required in the primary circuit if the circuit supplying the transformer is provided with overcurrent protection rated or set at not more than 250 percent of the rated primary current of the transformer and the secondary circuit is protected by a protective device that is provided as part of the heater and is rated, or set, at not more than 15 amperes or 125 percent of the rated transformer secondary current, whichever is greater, except as noted in 27.5.8. See 67.20 – 67.23.			N/A
27.5.8	If 125 percent of the current does not correspond to a standard rating of fuse or circuit breaker, the next higher standard rating may be used. Standard ratings are 15, 20, 25, 30, 35, 40, 45, 50, and 60 amperes.			N/A
27.6	Low-voltage transformers			N/A

UL 1278				
Clause	Requirement Test		Result Remark	Verdict
27.6.1	Except as indicated in 27.6.2, a transformer having a rated output of not more than 30 volts and 1000 volt-amperes (National Electrical Code, ANSI/NFPA 70, Class 1, power-limited circuit) shall be protected by an overcurrent device located in the primary circuit. The overcurrent device shall be rated or set at not more than 15 amperes or 167 percent of the primary current rating of the transformer, whichever is greater.			N/A
27.6.2	A transformer that directly supplies a Class 2 circuit shall, in accordance with the Standard for Low Voltage Transformers – Part 1: General Requirements, UL 5085-1 and the Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3, either limit the output current (inherently limited transformer) or be equipped with an overcurrent device (not inherently limited transformer), and need not comply with the requirements in 27.6.1.			N/A
28	Secondary Circuits			N/A
28.1	General			N/A
28.1.1	Each secondary circuit is to be judged under the requirements for line-voltage circuits.			N/A
	Exception: A secondary circuit need not be investigated if:			N/A
	a) It is not a circuit which is designed to prevent unintended operation of a heater, and			N/A
	b) It complies with the requirements for a limited-energy-secondary circuit as described in 28.2.			N/A
28.1.2	Secondary circuits may be connected to the frame of the appliance. Except as noted in 28.1.3 and 28.2.6, the connection shall be made at only one point in the appliance or system.			N/A
28.1.3	A grounding bus of adequate ampacity that is used as the return for a secondary circuit other than as covered by 28.2.6 may be connected to the frame at more than one point.			N/A
28.1.4	If any secondary circuit having an open-circuit potential of more than 42.4 volts peak is connected to the frame of an appliance, all exposed dead metal parts that might become energized, and all dead metal parts within the enclosure that can be touched by a person during operator servicing and that might become energized, shall be reliably connected together.			N/A
28.2	Limited-energy-secondary circuits			N/A
28.2.1	A limited-energy-secondary circuit shall be supplied from:			N/A
a) Class 2	transformer, or			N/A
	b) An isolating transformer having an open-circuit sinusoidal potential of 30 volts, rms (42.4 volts peak) or less, and that includes at least one of the following means, that limits the power available to the levels specified for a Class 2 transformer.			N/A

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Clause	Requirement Test	Result Remark	Verdict
	1) A reliable fixed impedance;		N/A
	2) A noninterchangeable fuse – the largest fuse that fits in the fuseholder provided:		N/A
	3) A nonadjustable manually reset circuit protector; or		N/A
	4) A reliable regulating network.		N/A
28.2.2	The impedance, the fuse, the protector, or the regulating network and the wiring between them and the isolating transformer described in 28.2.1 shall be judged as if they were part of a line-voltage circuit.		N/A
28.2.3	A fuse or a circuit protector used to limit the power as specified in 28.2.1 shall be rated or set at not more than 3.2 amperes for a circuit operating between 15 and 30 volts and at not more than 5.0 amperes for a 0 – 15-volt circuit.		N/A
28.2.4	An impedance or a regulating network that is used to limit the current shall be of such value or design as to limit the current under short-circuit conditions to not more than 8.0 amperes measured after 1 minute.		N/A
28.2.5	The performance of a regulating network or fixed impedance used to limit the power in accordance with 28.2.1 shall not be adversely affected by either short circuit or open circuit between any two terminals of any single rectifier, capacitor, transistor, or similar component in the network.		N/A
28.2.6	The frame may be used as the return for a limited-energy-secondary circuit.		N/A
28.2.7	The wiring in a limited-energy-secondary circuit shall be acceptably routed away from the wiring of other circuits or shall be provided with insulation that is for use at the highest of the voltages in the other circuits.		N/A
28.2.8	The wiring in a limited-energy-secondary circuit shall be acceptably routed away from the uninsulated live components of other circuits.		N/A
28.2.9	Wires and cables that are part of a limited-energy-secondary circuit shall be provided with strain relief in accordance with 16.12 – 16.14 and the Strain Relief Test, Section 59, if stress on the wire or cable could cause the internal wiring of the circuits to contact uninsulated live parts of other circuits.		N/A
29	Temperature Limiting Means		P

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Clause	Requirement Test	Result Remark	Verdict
29.1	With respect to the Normal Temperature Test, Section 40, and Abnormal Operation Tests, Section 42, if operation of the heater in accordance with Subsection 40.2 could result in a risk of fire or electric shock due to overheating of the heater, a thermal-link or a manual reset type temperature limiting control, or a Type 2.J Action protective control shall be provided. The manual reset type temperature limiting control shall be of a type that will not operate as an automatic reset control when the reset means is held in the reset position.		P
	Exception: An automatic reset type temperature limiting control, a manual reset type temperature limiting control that operates as an automatic reset type when the reset means or actuating member is held in the reset position or a Type 2.H Action protective control may be used as a control to limit temperatures for the heaters specified in (a) and (b) below.		P
	a) For a heater in which the manual reset control reset means or actuating member is arranged such that it:		P
	1) Is recessed within the overall appliance enclosure,		P
	2) Cannot be forced to remain in the reset position by likely methods, such as taping down a pushbutton or wedging a pushbutton in an opening through which it protrudes, and		P
	3) Is not jammed in the reset position during the Element Support Impact Tests, Section 52 and Drop Test, Section 53, or		P
	b) For a commercial/industrial heater.		P
29.2	A thermal cutoff shall be secured in place. A thermal cut-off that is field-replaceable shall be used only in a commercial/industrial heater.		P
29.3	If an appliance is provided with a replaceable overcurrent and/or over-temperature protective device, the device shall be secured in place and shall be so located that it will be accessible for replacement without damaging other connections or internal wiring. See 67.5.		P
29.4	A thermal cutoff shall open the circuit in the intended manner without causing the short-circuiting of live parts and without causing live parts to become grounded to the enclosure when the heater is connected to a circuit of voltage in accordance with 40.1.9 and operated in a normal position to cause abnormal heating.		P

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Clause	Requirement Test	Result	Remark	Verdict
29.5	To determine if a thermal cutoff complies with the requirement in 29.4, the heater is to be operated with separate cutoffs five times with any other thermally operated control devices in the heater short-circuited. Each cutoff is required to perform acceptably. During the test, the enclosure is to be connected through a 3-ampere fuse to ground.			P
	Exception: If the thermal cutoff complies with the Standard for Thermal-Links – Requirements and Application Guide, UL 60691, this test does not have to be conducted.			P
29.6	With respect to 29.4, for heaters employing open-type heating elements or series-connected metal-sheathed heating elements, thermal cutoffs shall be used in all ungrounded supply conductors if the thermal cutoff in one side of the supply circuit could be rendered ineffective by faults such as shorting of the heating element or its connection wire to metal parts that are or may become grounded. In determining the likelihood of occurrence of such a fault, conditions such as sagging or breakage of an open-type heating element and breakage or loosening of the connection to a heating element are to be considered. For a 120-volt heater with an unpolarized plug, both sides of the supply circuit are to be considered as being ungrounded.			P
29.7	A temperature-limiting control that is depended upon to reduce a risk of fire or electric shock shall be a calibrated control that is either:			P
	a) A control complying with the Standard for Limit Controls, UL 353, or			P
	b) A temperature-limiting control complying with the Standard for Temperature-Indicating and -Regulating Equipment, UL 873. Compliance with the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, and/or the applicable Part 2 standard from the UL 60730 series fulfills the UL 873 requirements.			P
	See the Endurance Test, Section 43, also.			P
30	Alarms			N/A
30.1	A heater intended for residential use that is provided with an over-temperature limit control shall include an audible or visual alarm to indicate that the limit control has operated. See 30.2 and 30.3. The alarm shall become energized when the limit control functions to de-energize the heating elements. For a manual-reset temperature limiting control that operates as an automatic reset type when the reset means is held, the alarm shall remain energized until the temperature limiting control is reset.			N/A
	Exception: Heaters that use the following types of temperature limit controls:			N/A

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Clause	Requirement Test		Result Remark	Verdict
	a) Manual reset type temperature limit control that will not operate as automatic reset type control when the reset means is held in the reset position. See 29.1; or			N/A
	b) Thermal cutoff.			N/A
30.2	An audible alarm shall consist of a sounding device such as a buzzer, horn, beeper, or bell that generates a continuous distinct signal while it is energized. The alarm shall comply with the Alarm Device Endurance Test, Section 41.			N/A
30.3	A visual alarm shall consist of a light that is red and of a different color than the lamp used in the "power on" pilot light (see 32.1) or of a flashing indicator light that has an "on" time not less than one third of the "off" time and that cycles on and off at least 15 times a minute. The light shall be constructed and located as specified in 32.1 and it shall comply with the visibility requirements in 32.2. The lamp used in the indicator light shall have a minimum rated life of 20,000 continuous hours at rated voltage, or it shall withstand the test specified in the Alarm Device Endurance Test, Section 41.			N/A
30.4	The "Important Instructions" furnished with a heater that includes an alarm shall include instructions in accordance with of 68.2.1(16).			N/A
31	Lampholders			N/A
31.1	If a heater is equipped with a polarized attachment plug, a lampholder supplied as a part of the heater shall be wired so that the screw shell will be connected to the identified grounded conductor.			N/A
31.2	Except as noted in 31.3, a lampholder shall be installed so that uninsulated live parts, other than the screw shell, will not be exposed to contact by persons removing or replacing lamps.			N/A
31.3	The requirement in 31.2 does not apply if, in order to remove or replace a lamp, it is necessary to dismantle the heater by means of tools. See 67.6.			N/A
31.4	A medium-base lampholder or screw-shell receptacle shall not be used as a holder for a heating element rated at more than 6 amperes or 660 watts, except that a screw shell with a left-hand thread may be used with a heating element rated at not more than 10 amperes.			N/A
31.5	A female screw shell used as a holder for a heating element shall be of copper or copper alloy and shall be plated with nickel or equivalent oxidation-resistant metal.			N/A
32	Pilot Lights			P
32.1	A movable heater shall be provided with a pilot light having a lamp or lens that glows red or amber. The light shall:			P
	a) Be located on the front or top surface of the heater; and			P
	b) Comply with 32.2.			P

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Clause	Requirement Test	Result Remark	Verdict
	The light shall be connected to the heater circuit so that it is energized whenever the on-off switch (see 33.12) is in the on position. Compliance of the light shall be determined in all operating modes when the on-off switch is in the on position.		P
	Exception No. 1: A pilot light is not required if a visibly glowing heating element can be considered to serve as an indicator that the heater is energized. A heating element is considered to serve as an indicator if:		P
	a) The heating element for the heater consists of a single element,		P
	b) The element is not cycled by an automatic control,		P
	c) The element cannot be operated by either a manual or automatic control, at a reduced rating so, that it can no longer be considered a visibly glowing element in accordance with 3.24, and		P
	d) The heater complies with the visibility requirement of 32.2.		P
	Exception No. 2: A pilot light is not required on a commercial/industrial heater.		P
	Exception No. 3: A pilot light is not required on a hearth type heater having a flame effect feature. The flame effect feature shall have a majority red or amber color, be illuminated by at least two lamps and shall comply with the visibility requirement of 32.2. The flame effect feature shall be connected to the heater circuit so that it is energized whenever the on-off switch (see 33.12) is in the on position. Compliance of the flame effect feature shall be determined in all operating modes when the on-off switch is in the on position.		P
32.2	The light from a pilot light mentioned in 32.1 shall be visible from a point 10 feet (3 m) in front of the center of the heater and 5 feet (1.5 m) above the floor. Compliance with this requirement shall be determined while the heater is:		P
	a) Standing on the floor if the heater is intended for placement on the floor while in operation, or		P
	b) Elevated from the floor by 3 feet (0.91 m) if the heater is intended for use at an elevated location (see 3.11).		P
	For a heater intended to be used either on the floor or at an elevated location, the light shall be visible while the heater is mounted on the floor and also when it is elevated by 3 feet.		P
33	Switches		P
33.1	A switch or other control device shall be rated for the particular application and shall have a current and voltage rating not less than that of the circuit (load) which it controls.		P

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Clause	Requirement Test	Result Remark	Verdict
33.2	A switching device shall be so located or protected that it will not be subjected to physical damage in use.		P
33.3	A switching device or manual mode control shall be of the indicating type or the switch function, such as "on-off", "high-low", and the like, shall be otherwise indicated. The switch or manual control position indications shall be visible when the heater is located and positioned in the intended use position.		P
	Exception: For a movable heater that may be used in an elevated location, the markings of manual control positions need not be visible for the following controls when the heater is located higher than 2.5 feet above the floor:		P
	a) For a control whose sole function is to regulate the fan speed or the heat output.		P
	b) For a direct-acting on-off control whose actuation position to and from the off position becomes immediately evident to the operator through perception of change in the heater output.		P
33.4	For a movable heater of other than the commercial/industrial type that employs a fan only operating control and that is unlikely to be moved to view the controls when operating the controls, the indications for the fan only selection position and the various heat selector positions shall be visible from a point 5 feet (1.5 m) above the floor and between 1 and 4 feet (0.3 and 1.2 m) away from the front surface of the heater with the lower edge of the heater located at any point between and including 2.5 and 5 feet (0.75 and 1.5 m) above the floor. Heaters complying with the dimensions of 3.11 are considered as likely to be moved to view the control markings when operating the control.		P
33.5	If a switching device (or the pilot device that controls the switching device) has a marked on or off position, when open, it shall disconnect all ungrounded conductors of the power-supply circuit to a heater. See 33.6 and 33.7.		P
33.6	With respect to 33.5, 33.7, and 33.14, for a 120-volt rated heater having a two-prong unpolarized attachment plug, both sides of the supply circuit are to be considered as being ungrounded.		P
33.7	A switching device as described in 33.5, except that it does not have a marked on or off position, shall comply with the requirement in 33.5 unless:		P
	a) There is no uninsulated live part exposed to unintentional contact when the switching device is open, or		P
	b) The fact that such part is live is definitely apparent, such as a visibly glowing open coil heating element.		P

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Clause	Requirement Test	Result Remark	Verdict
33.8	With respect to 33.3 and 33.5, a removable knob, button, or pointer on a switching device that includes an indicated off position shall be keyed to its operating shaft so that it can be installed only in the intended position and it shall be secured in accordance with Knob Securement Test, Section 56.		P
33.9	A switching device or other means of control intended to provide for the use of a limited number of elements at one time shall be so located or of such a type that the user cannot readily change the connections to provide for the use of more elements than intended.		P
33.10	A switching device that controls a medium-base lampholder or other than a pilot or indicating light shall be rated for use with tungsten-filament lamps.		P
33.11	A heater shall be provided with means other than the cord and plug arrangement to manually interrupt all heating elements. This means may be either a manual on-off switch or included as an off position on a temperature regulating control or an operation selector switch. The switch or control used shall comply with 33.1 – 33.10. If included as an off position on a temperature regulating control or on an operation selector switch, the construction shall also comply with 33.12. See also 32.1.		P
33.12	With respect to 33.11, if the off position is included as part of a temperature operating control or an operation selector switch, the off position shall be mechanically defined, such as by a detent feature or as an extreme position against a mechanical stop.		P
33.13	A heater intended for connection to the power-supply circuit by flexible cord and an attachment plug, and a cord-connected heater employing a motor rated at more than 1/3 horsepower (249 W output) shall be provided with a manually operable motor-control switch.		P
33.14	A switching device on a heater that controls an open (uninsulated) heating element or an isolated metal-clad element in a grounded heater shall be such that, in the off position, it will disconnect the element from all conductors of the supply circuit, unless the guard is such that it complies with 10.1.6.		P
33.15	The requirement in 33.14 also applies to a through-cord switch and to a plug with switch comprising a part of a cord set provided with the heater or of a power-supply cord.		P
33.16	A through-cord switch used on the power supply cord of a floor supported heater shall not be located where there is a likelihood of the switch resting upon the floor and being stepped on.		P

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Clause	Requirement Test	Result Remark	Verdict
33.17	A through-cord switch used on a wall-hung or ceiling-hung heater shall be located on the power-supply cord so that it does not contact the floor when the heater is installed as intended.		P
33.18	A switch employed in a heater to de-energize the heating elements in the event the heater is tipped over shall function before the heater has tipped in any direction beyond the angle of critical balance (see 3.2) if compliance with the requirements in 42.4.1 – 42.4.4 is dependent on operation of the switch.		P
34	Automatic Controls and Control Circuits		P
34.1	General		P
34.1.1	A control circuit shall comply with the requirements for separation of circuits, 20.4.		P
34.1.2	If a temperature and/or mode control in a heater has a marked off position, it shall disconnect the element or elements it controls from all ungrounded conductors of the power-supply circuit when placed in that position (that is, when not cycling). See 34.1.3 and 34.1.4.		P
34.1.3	A control as described in 34.1.2, except that it does not have a marked off position, shall comply with the requirement in 34.1.2 unless:		P
	a) There is no uninsulated live part exposed to unintentional contact when the control device has opened the circuit, or		P
	b) The fact that such part is live is definitely apparent.		P
34.1.4	A temperature and/or mode control in a heater that controls an open (uncovered) heating element or an isolated metal-clad element in a grounded heater shall be such that, in the off position, it will disconnect the element from all conductors of the supply circuit, unless the guard is such that it complies with one of the following:		P
	a) No opening in the guard will permit passage of a rod having a diameter of 3/8 inch (9.5 mm).		P
	b) No opening in the guard will permit passage of a rod having a diameter of 3/4 inch (19.1 mm) and no uninsulated live part or isolated metal-clad element is less than 4 inches (102 mm) from the nearest point on the guard at any opening that will permit the entrance of a rod having a diameter of 3/8 inch.		P
34.1.5	When provided, a safety control – one designed to prevent unintended operation of a heater – or a temperature limiting control shall be operative whenever the heater is connected to its power supply and shall interrupt power to all heating elements. (See 34.1.6). If the power to all elements is not interrupted, the power shall be interrupted to the number of the heating elements necessary so that the temperature rises specified in Table 40.1 are not exceeded during abnormal tests.		P

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Clause	Requirement Test	Result Remark	Verdict

34.1.6	With respect to 34.1.5, for heaters employing open-type heating elements or series-connected sheathed heating elements, a temperature limiting control shall interrupt power to all ungrounded supply conductors if the thermal cutoff or the control contacts in one side of the supply circuit could be rendered ineffective by faults such as shorting of the heating element or its connecting wire to metal parts that are or may become grounded. In determining the likelihood of occurrence of such a fault, conditions, such as sagging or breakage of an open-type heating element and breakage or loosening of the connection of a lead wire to a heating element, are to be considered. For a 120-volt heater with an unpolarized plug, both sides of the supply circuit are to be considered as being ungrounded. More than one temperature-limiting control may be used to comply with this requirement.		P
34.1.7	A contactor actuated by a temperature limiting control shall comply with the requirements for such a control.		P
34.1.8	If a temperature and/or mode control has a marked position as described in 34.1.9, it shall not function as a temperature and/or mode control – that is, it shall not respond to temperature changes – while the actuating member is in that position.		P
34.1.9	The requirement in 34.1.8 applies to a temperature and/or mode control that is marked:		P
	a) With an off position, or		P
	b) With another wording (such as "no heat", "cold", or similar wording) that conveys the same meaning as the word "off".		P
34.1.10	A temperature regulating control that does not reclose (remains open) when cooled to a temperature of minus 35°C (minus 31°F) is acceptable with respect to the requirement in 34.1.8.		P
34.2	Terminals and actuating members of safety and temperature limiting controls		P
34.2.1	The terminals of a safety control and temperature limiting controls within the enclosure of a heater shall be so located or further enclosed that they will be protected against unintentional short-circuiting or damage.		P
34.2.2	The bulb, capillary tubing, or other sensing element of a temperature limiting control shall be so located or guarded as to be protected from physical damage during installation and use of the heater.		P
35	Spacings		P
35.1	Except as noted in 35.2 and 35.3, the spacings in a heater shall be in accordance with Table 35.1.		P

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Clause	Requirement Test	Result Remark	Verdict
35.2	The spacings specified in Table 35.1 do not apply to the inherent spacings of a component part, such as a snap switch or motor, of a heater. Such spacings are judged under the requirements for the component in question.		P
35.3	At closed-in points only, such as the screw-and-washer construction of an insulated terminal mounted in metal, a spacing of 3/64 inch (1.2 mm) is acceptable in a heater rated at 250 volts or less. Within a temperature control, except at contacts, the spacing between uninsulated live parts on opposite sides of the contacts is not to be less than 1/32 inch (0.8 mm) through air and 3/64 inch over the surface of insulating material, and the construction is to be such that the spacings will be maintained permanently.		P
35.4	The spacings within a motor connected across a portion of a resistance element or in series with a reactor or an autotransformer shall be acceptable for the full rated voltage of the heater.		P
35.5	Except as indicated in 35.6, an insulating lining or barrier of fiber or similar material employed where spacings would otherwise be less than the required values shall not be less than 1/32 inch (0.8 mm) thick and shall be so located or of such material that it will not be affected adversely by arcing; except that fiber not less than 1/64 inch (0.4 mm) thick may be used in conjunction with an air spacing of not less than 50 percent of the spacing required for air alone.		P
35.6	Insulating material having a thickness less than that specified in 35.5 may be used if, upon investigation, it is found to be acceptable for the application.		P
35.7	Unless protected from physical abuse during assembly and operation of the heater, a barrier of mica shall be at least 0.01 inch (0.25 mm) thick.		P
36	Grounding		N/A
36.1	A heater intended for operation on a circuit involving a potential of more than 150 volts to ground shall have provision for grounding, in accordance with 36.2, of all exposed noncurrent-carrying parts, and all noncurrent-carrying metal parts exposed during any servicing operation (including maintenance and repair), that are likely to be energized.		N/A
36.2	On a heater where grounding is required or provided, the power-supply cord or cord set shall include a grounding conductor which shall be:		N/A
	a) Green, with or without one or more yellow stripes,		N/A
	b) Connected to the grounding blade of an attachment plug of a grounding type, and		N/A

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Clause	Requirement Test	Result Remark	Verdict
	c) Connected to the enclosure of the appliance by means of a screw not likely to be removed during ordinary servicing, or by other equivalent means. Solder alone is not acceptable for making this connection. See 36.4.		N/A
36.3	If a heater intended for operation on a circuit involving a potential of 150 volts or less to ground has provision (although not required) for grounding noncurrent-carrying metal parts by means of a conductor of the cord, a directly attached flexible cord or a cord set provided with the heater shall comply with the requirement in 36.2.		N/A
36.4	With reference to 36.2(c), a grounding connection that is mechanically crimped before being soldered is to be tested for acceptability as a connection without the solder in place.		N/A
36.5	A 2-wire heater, having a voltage rating within the range of 220 to 250 volts is considered as requiring provision for grounding in accordance with 36.1, unless the marked rating on the heater is 120/240 volts or unless the heater is otherwise marked to indicate that it is to be connected only to a 120/240-volt circuit with grounded neutral.		N/A
	PERFORMANCE		
37	General		P
37.1	If a heater is intended to be shipped with the legs or base detached, the tests are to be conducted with the legs or base in place, as well as detached.		P
	Exception No. 1: The requirement for tests with the legs or base detached is not applicable to a heater that will not stand upright without the base or legs installed and is obviously intended for operation in the upright position, or to a heater that cannot be operated with the legs or base detached.		P
	Exception No. 2: The requirement for tests with the legs or base detached is not applicable to a heater that is marked in accordance with 67.19.		P
38	Power Input Test		P
38.1	The power input to a heater shall not be more than 105 percent of its marked rating.		P
38.2	To determine if a heater complies with the requirement in 38.1, the power input is to be measured at the temperature developed under intended operating conditions and under full-load conditions and while connected to a supply circuit of rated voltage in accordance with 40.1.9. If a heater employs a nonmetallic element (such as carbon), the power input is to be determined when the element is new.		P
39	Leakage Current Test		P

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Clause	Requirement Test	Result Remark	Verdict
39.1	The leakage current of a heater rated for a nominal 120-, 208-, or 240-volt supply when tested in accordance with 39.3 – 39.6 shall not be more than:		P
a) 0.5	milliampere for a movable heater, and		P
b) 0.75	milliampere for other than a movable heater employing a standard attachment plug rated 20 amperes or less.		P
	Exception: For a heater having a metal sheathed heating element, during the period beginning 5 seconds after energization (closure of S1), the leakage current may exceed the value specified in (a) or (b) for a period not exceeding 5 minutes, but shall not exceed 2.5 milliamperes. The 5-minute period is measured during the warm-up period and again during the cool-down period from the first excursion above the value of (a) or (b) until the value is less than and remains less than the value in (a) or (b).		P
39.2	Leakage current refers to all currents, including capacitively coupled currents, which may be conveyed between exposed conductive surfaces of a heater and ground or other exposed conductive surfaces of a heater.		P
39.3	All exposed conductive surfaces are to be tested for leakage currents. The leakage currents from the surfaces are to be measured to the grounded supply conductor individually as well as collectively where simultaneously accessible and from one surface to another where simultaneously accessible. Parts are considered to be exposed surfaces unless guarded by an enclosure considered acceptable for protection against the risk of electric shock as defined in 8.1 – 8.10. Surfaces are considered to be simultaneously accessible where they can be contacted by one or both hands of a person at the same time. These measurements do not apply to terminals operating at voltages which are considered to be nonhazardous.		P
39.4	If a conductive surface other than metal is used for the enclosure or part of the enclosure, the leakage current is to be measured using a metal foil with an area of 10 by 20 centimeters in contact with the surface. Where the surface is less than 10 by 20 centimeters, the metal foil is to be the same size as the surface. The metal foil is not to remain in place long enough to effect the temperature of the heater.		P

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Clause	Requirement Test		Result Remark	Verdict
39.5	The measurement circuit for leakage current is to be as shown in Figure 39.1. The measurement is defined in (a) through (d). The meter which is actually used for a measurement need only indicate the same numerical value for a particular measurement as would the defined instrument. The meter used need not have all the attributes of the defined instrument.			P
	a) The meter is to have an input impedance of 1500 ohms resistive shunted by a capacitance of 0.15 microfarad.			P
	b) The meter is to indicate 1.11 times the average of the full-wave rectified composite waveform of voltage across the resistor or current through the resistor.			P
	c) Over a frequency range of 0 to 100 kilohertz the measurement circuitry is to have a frequency response (ratio of indicated to actual value of current) equal to the ratio of the impedance of a 1500 ohm resistor shunted by 0.15 microfarad capacitor to 1500 ohms. At an indication of 0.5 or 0.75 milliampere, the measurement is to have error of not more than 5 percent.			P
	d) Unless the meter is being used to measure leakage from one part of a heater to another, the meter is to be connected between the accessible parts and the grounded supply conductor.			P
39.6	A representative heater is to be tested for leakage current starting with the as-received condition with all switches and temperature controls closed, but with its grounding conductor, if any, opened at the attachment plug. The as-received condition is without prior energization, except as may occur as part of the production line testing. The supply voltage is to be 120, 208, or 240 volts, depending upon the voltage rating of the heater. The test sequence, with reference to the measuring circuit (Figure 39.1), is to be as follows:			P
	a) With switch S1 opened, the heater is to be connected to the measuring circuit. Leakage current is to be measured using both positions of switch S2.			P
	b) Switch S1 is then to be closed, energizing the heater, and within a period of 5 seconds, the leakage current is to be measured using both positions of switch S2 and with the heater operated at the maximum heat setting of controls.			P

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Clause	Requirement Test		Result Remark	Verdict
	c) Leakage current is to be monitored until thermal stabilization under the maximum heat condition. Both positions of switch S2 are to be used. The equivalent of thermal stabilization is considered to be obtained as in any normal temperature test. If any temperature regulating control does not cycle at the maximum heating setting, it is to be adjusted until it does cycle before the final measurements at thermal stabilization are taken. Measurements are to be made with the temperature regulating control, if any, open and closed.			P
	d) If the heater employs a single pole switch or a adjustable temperature control, monitoring of leakage current is to continue until the leakage current stabilizes or decreases after the heater is turned off.			P
40	Normal Temperature Tests			P
40.1	General			P
40.1.1	A heater, when tested under the conditions described in 40.1 – 40.3 shall not attain a temperature at any point high enough to constitute a risk of fire or damage any material employed in the heater, nor show temperature rises at specific points greater than those indicated in Table 40.1.			P
40.1.2	All values in Table 40.1 are based on an assumed ambient (room) temperature of 25°C (77°F), but a test may be conducted at any ambient temperature within the range of 10 – 40°C (50 – 104°F). However, if the operation of a temperature control or thermal link during the test limits the temperatures under observation, no observed temperature higher than 25°C (77°F) plus the specified maximum rise is acceptable.			P
40.1.3	Temperatures are to be measured by thermocouples consisting of wires not larger than 24 AWG (0.21 mm2) and not smaller than 30 AWG (0.05 mm2) except that a coil temperature may be determined by the change-of-resistance method if the coil is inaccessible for mounting thermocouples (see 40.1.6). When thermocouples are used in determining temperatures in electrical equipment, it is standard practice to employ thermocouples consisting of 30 AWG (0.05 mm2) iron and constantan wire and a potentiometer-type instrument; and such equipment is to be used whenever referee temperature measurements by thermocouple are necessary.			P

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Clause	Requirement Test	Result Remark	Verdict
40.1.4	The thermocouples and related instruments are to be accurate and calibrated in accordance with good laboratory practice. The thermocouple wire is to conform with the requirements specified in the Tolerances on Initial Values of EMF versus Temperature tables in the Standard Specification and Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples, ANSI/ASTM E230/E230M.		P
40.1.5	A thermocouple junction and adjacent thermocouple lead wire are to be securely held in good thermal contact with the surface of the material whose temperature is being measured. In most cases, acceptable thermal contact will result from securely taping or cementing the thermocouple in place but, if a metal surface is involved, brazing or soldering the thermocouple to the metal may be necessary.		P
40.1.6	Ordinarily a thermocouple is to be used for determining temperature of a coil or winding if it can be mounted, without removal of encapsulating compound or similar material, on the integrally applied insulation of a coil without a wrap, or on the outer surface of a wrap that is not more than 1/32 inch (0.8 mm) thick and consists of cotton, paper, rayon, or the like. The change-of-resistance method is to be used if the thermocouple measurement cannot be conducted in accordance with the foregoing considerations. For a thermocouple-measured temperature of a motor coil the thermocouple is to be mounted on the integrally applied insulation of the conductor.		P
40.1.7	At a point on the surface of a coil where the temperature is affected by an external source of heat, the temperature rise measured by means of a thermocouple may be higher by the following amount than the maximum indicated in Table 40.1 if the temperature rise of the coil measured by the resistance method is not greater than specified in Table 40.1:		P
40.1.8	To determine whether a heater complies with the requirement in 40.1.1, it is to be operated continuously until constant temperatures have been reached. A temperature is considered to be constant when three successive readings, taken at intervals of 10 percent of the previously elapsed duration of the test (but not less than 5-minute intervals), indicate no change.		P
40.1.9	The test voltage is to be as indicated in Table 40.2, except that, if the application of the indicated test voltage does not result in the measured wattage input to the heater being equal to or more than the marked wattage rating, the test voltage is to be increased until the measured wattage input equals the marked wattage rating.		P

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Clause	Requirement Test	Result Remark	Verdict

40.1.10	With reference to 40.1.9, a heater shall be operated at the maximum rated input. However, for a heater that employs adjustable controls for heater or fan settings, tests at lower heater and fan settings shall also be conducted if the lower settings may produce higher temperatures on heater parts or the test enclosure.		P
40.1.11	If a heater employs a motor in addition to a heating element, the voltage applied to an integrally connected motor is to be the marked voltage rating of the heater, in accordance with 66.1.		P
40.1.12	In conducting a test to determine whether or not a heater complies with the temperature requirements, it is to be hung or supported as in service and tested under conditions approximating those of normal operation, except as otherwise noted. Temperatures are to be taken on nearby surfaces, on the supporting surface, at points of support, on attachment plugs, and at other points as may be necessary.		P
40.1.13	A heater which uses a confined heat transfer fluid shall be fitted with a suitable pressure-measuring instrument, such as a pressure gauge, pressure transducer or similar device, so that the pressure within the heater may be measured during the testing of the heater.		P
40.1.14	The maximum pressure recorded during the testing of the heater (see 40.1.13) shall serve as a basis for determining the suitability of the strength of the vessel under pressure.		P
40.2	Temperature controls		P
40.2.1	The tests are to be performed with any combinations of temperature controls in the circuit and out of the circuit where such combinations may result in higher temperatures or increased risk of electric shock or fire.		P
	Exception: The following controls are to be left in the circuit:		P
	a) A designated temperature limiting control [see 3.19(b)]		P
	b) An auxiliary temperature control evaluated as a temperature limiting control with the temperature limiting control out of the circuit.		P
40.2.2	The temperature limiting control of a heater shall not function when the heater is operated under the Normal Temperature Test, at room ambient temperature. A room ambient temperature of 25°C (77°F) is assumed, but the test may be conducted at a higher ambient temperature provided the temperature limiting control does not operate (open circuit).		P

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Clause	Requirement Test	Result Remark	Verdict
40.2.3	With respect to 29.1, a tip-over switch that actuates the contacts of a temperature regulating control, shall be rendered inoperative during abnormal tests, including the Tip-Over Test, 42.4.1 – 42.4.4, and during the Element Support Impact Tests, Section 52, and Drop Test, Section 53.		P
40.3	Specified test conditions		P
40.3.1	A wall-hung heater is to be supported in the intended manner on the black-painted surface of a wall consisting of 3/8-inch-thick (9.5 mm) plywood fastened to both shorter sides of nominal 2- by 4-inch (38- by 89-mm) vertical wooden studs on 16-inch (406 mm) centers. Two or more such walls are to be fastened together to form a 90-degree angle, and the height and length of the walls are to be such that they extend not less than 2 feet (610 mm) beyond the physical limits of the heater. A ceiling surface is to be added consisting of 3/8-inch (9.5-mm) plywood. The heater is to be located as close to the sides of the wall angle as its construction will permit, and it is to be placed relative to the walls that maximum heating will occur on the latter. Heaters intended to be mounted on the wall at or near ceiling height shall be tested in the corner as close to the side walls and ceiling as construction will permit.		P
40.3.2	A ceiling-hung heater is to be tested in an alcove consisting of the walls described in 40.3.1, with an added ceiling surface of 3/8-inch (9.5-mm) plywood blanketed on top with 4 inches (100 mm) of conventional glass-fiber or mineral-wool insulation having a minimum R factor of 30 or insulation of lesser thickness having a minimum R factor of 30. The heater is to be mounted on or in the ceiling surface as close to the alcove corner as its physical dimensions will permit unless its design and construction are such that other locations would result in more adverse operation, in which case the heater is to be operated in the more adverse location.		P
40.3.3	Rubber or other material similarly subject to deterioration is to be removed from feet or other supports of a movable heater if the removal of the material is likely to result in higher temperatures being attained on the heater.		P
40.3.4	If the removal of feet or other supports results in operation of temperature limiting controls during the Normal Temperature Test, such operation is not considered to be unacceptable if, when the test is repeated with the parts replaced in the intended manner, there is no operation of the controls.		P

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Clause	Requirement Test	Result Remark	Verdict
40.3.5	A movable heater is to be supported on two layers of white tissue paper on a softwood surface and placed in a corner alcove as described in 40.3.1. The heater is to be placed as close to the side walls of the alcove as its configuration will permit. If a temperature limiting control or thermal link operates when the heater is in such position, the test is to be repeated with the heater moved away from the side walls, in one inch increments, until such time that the temperature limiting control or thermal link does not operate, or until a maximum of 18 inches (457 mm) is attained.		P
41	Alarm Device Endurance Test		N/A
41.1	With regard to 30.1 and 30.2, an audible alarm device and a control which activates the alarm shall withstand without malfunction or breakdown, an endurance test consisting of 6000 cycles of operation at the rate of 1 minute on and 30 seconds off. The test is to be conducted at rated voltage and at the maximum ambient temperature determined during the Normal Temperature Test, Section 40.		N/A
41.2	With regard to 30.1 and 30.3, a visual alarm device and a control which activates the alarm shall withstand without burning out or failing to light, an endurance test consisting of 6000 cycles of operation at the rate of 1 minute on and 30 seconds off. The test is to be conducted at the rated voltage and at the maximum ambient temperature determined during the Normal Temperature Test, Section 40.		N/A
42	Abnormal Operation Tests		P
42.1	General		P
42.1.1	If the conditions of normal operation are not representative also of abnormal conditions likely to be obtained in actual service, a heater shall not become a risk of fire, electric shock or injury to persons when operated continuously under such abnormal conditions as specified in 42.2 – 42.12 with the temperature controls arranged as described in 40.2.		P
42.1.2	Unless otherwise specified, abnormal operation tests are to be conducted with the heater operating continuously until the ultimate result has been determined. In most cases, continuous operation for 7 to 8 hours will be necessary in order to prove that the ultimate result has been observed.		P

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Clause	Requirement Test	Result Remark	Verdict
42.1.3	If the temperature-limiting control or thermal link of a wall or ceiling hung heater, operates at 18 inches (457 mm) from the alcove wall when tested as in 40.3.1 or 40.3.2, all of the abnormal operation tests (overvoltage, stalled fan, padded surface and blanketing, curtain drape, terry cloth drape, and similar tests, usually performed on the heater) are to be repeated while the heater is located in a room having an average temperature of 0°C (32°F).		P
42.1.4	If the temperature limiting control or thermal link of a movable heater operates at 18 inches (457 mm) from the alcove wall when tested as in 40.3.5, all of the abnormal operation tests (overvoltage, stalled fan, tip over, terry cloth drape, terry cloth band drape, vertical wall, and similar tests, usually performed on the heater) are to be repeated while the heater is located in a room having an average temperature of 0°C (32°F).		P
42.1.5	The applied voltage and method of hanging or location shall be in accordance with Normal Temperature Tests, Section 40. However, for a heater that employs adjustable controls for heater or fan settings, tests at lower heater and fan settings shall also be conducted if the settings influence operation of a temperature limiting control that operates during any abnormal operation test.		P
42.1.6	When subject to an abnormal operation test, a heater is considered to involve a risk of fire if there is any emission of embers, flame or molten metal, if there is ignition (see 3.14) of the materials described in 42.1.8 – 42.1.13 or if there is glowing or flaming of the combustible material adjacent to or upon which the heater is placed, including, in the case of the vertical wall test, 42.5, charring with crosschecking of the plywood (see 3.6).		P
42.1.7	After having been subjected to an Abnormal Operation Test, a heater is considered to involve a risk of electric shock or injury to persons if it appears to be usable and the insulation resistance is less than 50,000 ohms, or the heater does not comply with the requirements in Sections 8 or 9.		P
42.1.8	Insulation resistance is to be measured between current carrying parts and accessible dead metal parts directly or may be calculated using a circuit that measures voltage drop. In such a circuit, the voltmeter shall have an internal resistance of at least 30,000 ohms and a minimum 250-volt direct-current supply circuit shall be used.		P

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Clause	Requirement Test	Result Remark	Verdict
42.1.9	The cheesecloth mentioned in this standard is bleached cheesecloth 36 inches wide (914 mm), running 14 – 15 yards per pound mass (approximately 28 – 30 m/kg mass), and having what is known to the trade as a count of 32 x 28 – that is, for any square inch, 32 threads in one direction and 28 threads in the other direction (for any square centimeter, 13 threads in one direction and 11 threads in the other direction).		P
42.1.10	The blanket material mentioned in this standard is 100 percent unbleached cotton flannelette sheet blanket, and is generally available in the 80-by-108-inch (2-by-2.7-m) size.		P
42.1.11	The white duck material (cotton) mentioned in this standard is to have a mass of 8 ounces per square yard (0.27 kg/m2).		P
42.1.12	The felt mentioned in this standard is 100-percent standard-weight, all-cattle-hair, punched felt with center reinforcement consisting of burlap having a mass of 5 ounces per square yard (0.17 kg/m2). Felt 1 inch (25 mm) thick has a mass of 105 ±15 ounces per square yard (3.56 ±0.51 kg/m2). Felt 3/4 inch (19 mm) thick has a mass of 79 ±9 ounces per square yard (2.68 ±0.31 kg/m2).		P
	Exception: SAE J314, Grade F-11, minimum 1 inch (25 mm) thick wool felt may be used as a substitute for the all-cattle-hair mat.		P
42.1.13	The terry cloth material mentioned in this standard is white, basically cotton terry cloth untreated fabric with a polyester content not more than 20 percent, and having a pile weave and a nominal weight of 9.5 ounces per square yard (320 g/m2).		P
42.2	Overvoltage test		P
42.2.1	The heater it is to be operated at a voltage in accordance with 40.1.12 until constant temperatures are attained, following which it is to be operated for 2 hours at a 12 percent higher voltage.		P
42.3	Stalled-fan test		P
42.3.1	A heater that employs a motor-driven air circulating fan shall comply with 42.1, and shall not result in opening a nontime-delay 1/2-ampere fuse, when subjected to the test in accordance with 42.3.2 – 42.3.4.		P
42.3.2	A heater is to be positioned or located in accordance with the Normal Temperature Tests, Section 40. A 1/2-ampere fuse of other than the time-delay type is to be connected between the accessible dead metal parts (see 52.10) of the heater and the earth ground. The grounded conductor and a grounding conductor, if provided, are to be treated as described in 52.3.		P

UL 1278			
Clause	Requirement Test	Result Remark	Verdict
42.3.3	The motor is to be stalled and the heater is to be operated for 7 hours unless a manual reset type temperature limiting control or a thermal cut-off operates to de-energize either all or a sufficient number of heating elements so that there is no longer a risk of fire or development of an electric shock.		P
42.3.4	For a heater that employs adjustable heat setting controls, this test shall also be conducted at other than maximum rated input if the other settings influence operation of an auxiliary temperature control or a temperature limiting control.		P
42.4	Tip-over test		P
42.4.1	A movable heater shall be subjected to this test. The heater is to be operated until constant temperatures are attained. It shall be then overturned onto a softwood surface covered with a single layer of terry cloth and shall be operated under the most severe conditions that would result when it comes to rest, without further guiding or propping, after having been pushed over.		P
42.4.2	All orientations are to be tested. However, if a given orientation or position of the heater presents less likelihood of a risk of fire than when the heater is evaluated in accordance with other requirements in the standard, the orientation or position need not be reevaluated under 42.4.1.		P
42.4.3	For a heater which contains a confined heat transfer fluid, and is intended to be shipped with the legs or base detached, the test is to be conducted with the legs or base installed as well as detached.		P
42.4.4	If a heater incorporates a tipover switch of other than the type indicated in 40.2.3, it shall be evaluated according to 33.18 for each orientation or position of the heater in which the switch is relied upon to prevent a risk of fire.		P
42.5	Vertical-wall test		P
42.5.1	A movable heater shall be operated at a distance from the wall that results in the highest temperature on the wall. The highest temperatures are usually encountered at the closest distance a heater can be placed to the wall, except that:		P
	a) A temperature limiting control or an auxiliary temperature control may operate and not permit operation of the heater for sufficient length of time to produce the highest temperatures. In this case additional tests are to be conducted at increased distances between the heater and the wall. The test time at each distance is to be sufficient to observe the ultimate results. See 42.5.2.		P

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Clause	Requirement Test	Result Remark	Verdict
	b) If a radiant type heater is provided with a reflector, the reflector may have a focusing effect that causes higher temperatures at a greater distance than the minimum distance between the heater and the wall. In this case additional tests are to be conducted at increased distances. The test time at each distance is to be sufficient to observe the ultimate results. See 42.5.2.		P
42.5.2	With respect to 42.5.1, to observe the ultimate results, the test is to be continued for 7 hours. However, the test may be discontinued after 2 hours if this duration of testing produces no discoloration of the terry cloth material.		P
42.5.3	The heater is to be supported on a horizontal surface that abuts the vertical wall. The side of the heater that radiates or convects heat is to face the wall. The wall is to consist of 3/4-inch (19.1-mm) thick fir plywood, and is to be covered with one layer of terry cloth material. The wall is to be constructed so the grain of the plywood runs in the horizontal direction. The wall is to extend at least 12 inches (305 mm) beyond the heater on both sides and 12 inches above the heater. Any heater projections such as guards or grilles in the front of the heater that do not require tools for their removal (see 10.1.1) are to be removed.		P
42.5.4	For a heater that includes a stand or feet that project beyond other heater surfaces in front of the heater, the wall is to include a recessed "toe space" next to the floor. The "toe space" shall be 3-1/4 inches (82.6 mm) deep, 4-1/4 inches (107.9 mm) high which, with respect to the heater feet or stand, determines the closest distance the heater can be placed to the wall. The terry cloth material is to be applied to the vertical wall such that it extends to the floor, draping over the "toe space" opening. When the heater is inserted, the terry cloth will contour the stand or feet of the heater.		P
	Exception: For a heater that may be used at an elevated location (see 3.11) and that includes a stand or feet that project beyond other heater surfaces in front of the heater and that is provided with air outlet openings lower than 4-1/4 inches from the floor, the height of the "toe space" is to be adjusted to a minimum height permitted by the stand or feet.		P
42.5.5	For a heater that is not provided with a stand or feet that project beyond other heater surfaces in front of the heater, the wall is to extend straight to the floor without a "toe space" and the heater is to be placed flush against the wall.		P

UL 1278			
Clause	Requirement Test	Result Remark	Verdict
	Exception: A heater that may be used at an elevated location that includes a stand or feet that extend beyond the front of the heater shall be tested using a wall that includes a "toe space" as described in 42.5.4 and also using a wall without a "toe space".		P
42.6	Terry cloth drape test		P
42.6.1	A heater of other than the ceiling-hung type is to be operated until constant temperatures are attained and then covered with a single layer of terry cloth. The test is to be repeated (if acceptable results are obtained for the initial condition) beginning with the heater at room temperature (25 ±3°C). The tests under the two conditions may be combined by initially draping the heater, and after equilibrium conditions are obtained, replacing the terry cloth with a new single layer.		P
	Exception: The temperature-regulating control may be returned to the circuit during the test starting from room temperature if the heater does not employ an automatic reset type temperature limiting control.		P
42.6.2	A heater provided with an auxiliary temperature control or a temperature limiting control or thermal link that does not operate due to partial draping of the heater shall also be subject to the Terry Cloth Drape Test under such partial draping conditions.		P
42.6.3	A heater designed to be supported by and mounted away from a wall or ceiling in a horizontal position is to be tested in the intended position with a single layer of terry cloth draped over the full length of the heater and hanging down approximately 1 foot (305 mm) on each side.		P
42.6.4	In a test to determine whether a combination heater and motor-driven fan complies with the requirement in 42.6.1, the fan is to be operating when the heater is covered with terry cloth. If the motor is separately controlled, the test is to be repeated with the fan motor in the off position.		P
42.6.5	The lower edge, or edges, of the terry cloth shall hang freely without any added constraint so that the heated air discharge may cause the terry cloth to billow away from the heater. If necessary, the uppermost portion of the terry cloth is to be taped or otherwise secured to the top of the heater or the wall above the heater to prevent the terry cloth from being blown off the heater.		P
42.7	Terry cloth band drape test		P

UL 1278				
Clause	Requirement Test		Result Remark	Verdict
42.7.1	A movable heater that is designated for use at an elevated location or because of its size and weight is likely to be used at an elevated location (see 3.11) shall be subjected to the Terry Cloth Band Drape Test before and also after it is subjected to the Drop Test, Section 53, provided it is operational after the drop test.			P
42.7.2	The terry cloth material is to be in accordance with 42.1.13. The terry cloth material is to be folded to form a six-layer band, 6 inches (152 mm) wide. Except as stated in 42.7.8, the layered band is to be of sufficient length to extend vertically over two opposite sides and the top of the heater and include allowance for offset folds and at least a 3 inch (76.2 mm) overlap on the floor at both ends when the band is applied in accordance with 42.7.4 and 42.7.7 – 42.7.9. If the band slides off the heater due to the force of gravity, it is to be supported to maintain its position for test purposes. The support shall not restrict the heater airflow. After the initial positioning the band shall not be repositioned if it is deflected by the heated air discharge.			P
42.7.3	With respect to the draping in accordance with 42.7.4 and 42.7.7 – 42.7.9, the width of the heater is considered that portion of the heater through which heated air is delivered or heat is radiated.			P
42.7.4	The terry cloth band is to be applied so that it contours the heater over two vertical or near vertical sections of the heater and extends across the top of the heater. One of the vertical sections is to extend over the front of the heater to cover the opening or openings through which heated air is delivered or heat is radiated. The other vertical section is to be applied so that it covers one of the following sections of the heater. Depending on the construction of the heater, all of these applications are to be tested, one at a time, unless it can be determined without testing which of the applications will produce the most adverse effects, in which case the most adverse applications only need to be tested.			P
	a) The section in the back of the heater directly opposite the front section covered by the band.			P
	b) A section of the heater which includes air intake openings that may be either on the back of the heater not directly opposite the band section in the front of the heater, or on the side of the heater. Any offsets required in the band, except as indicated in 42.7.8, are to be made by a single fold on top of the heater.			P

UL 1278			
Clause	Requirement Test	Result Remark	Verdict

42.7.5	The heater is to be operated initially at least 15 minutes at maximum rated wattage in accordance with the Power Input Test, Section 38. The heater is then to be draped with the terry cloth band in accordance with 42.7.4 and 42.7.7 – 42.7.9 and operated continuously for 7 hours or until:		P
	a) One half hour after a manual reset type temperature limit control or a thermal cut-off operates to de-energize either all or a sufficient number of heating elements so that there is no longer a risk of fire or development of an electric shock; or		P
	b) Thermal stabilization occurs and there is no discoloration of the terry cloth material.		P
42.7.6	If the heater includes adjustable settings for heat output, other than maximum setting, these other settings are also to be tested, unless it can be determined without testing that the maximum setting will produce the most adverse conditions.		P
42.7.7	With respect to 42.7.5, at least the following test conditions are to be included with the terry cloth band draped over the heater. See 42.7.2.		P
	a) The band placed to cover the center of the width of the heater and extended to cover the top of the heater and the corresponding part of the opposite side.		P
	b) The band placed to cover one half of the width of the heater and extended to cover the top and the corresponding part of the opposite side. For a heater that is more than 12 inches (305 mm) wide so that the 6 inch (152 mm) wide band does not cover one half of the width of the heater, the band is to be placed so that one edge is even with the vertical center line of the width.		P
	c) The band placed to cover one fourth of the width of the heater and extended to cover the top and the corresponding part of the opposite side of the heater. For a heater that is more than 24 inches (609 mm) wide so that the 6 inch wide band does not cover one fourth of the width of the heater, the band is to be placed so that one edge is even with one edge of the width.		P
	d) The tests specified in (b) and (c) are to be repeated with the other half of the heater covered.		P
	e) If the width of the heater is more than 24 inches (61 cm) wide so that placement of the terry cloth band in accordance with (b), (c), and (d) will not cover tests on all sections of the width, additional tests are to be conducted with the band placed so that it is centered on the part of the width of the heater not covered by (b), (c), and (d).		P

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Clause	Requirement Test	Result Remark	Verdict
	f) If a heater includes air intake openings on other sections of the heater that are not included in the width of the heater (see 42.7.3), the test described in (c) and the corresponding test on the other half of the width of the heater are to be repeated with the band extended to cover the top and the section of the heater with these air intake openings, as specified in 42.7.4(b).		P
42.7.8	With reference to 42.7.7, if it is discovered during the testing that a location of the band different than specified in (a – f) may produce more adverse effects due to placement of temperature limiting controls or projecting heater surfaces, the placement of the band is to be modified to cover the more adverse conditions. In heater constructions where the intake openings are in the front section of the heater or to the side of the heater outlet opening or where the intake openings are in the front section of the heater and to the side of the heater outlet opening, this may necessitate a double fold in the terry cloth material. However, except for the folds on the top of the heater, the band placement is to be vertical or near vertical with respect to the heater, contouring the heater enclosure and its projections, if any. The bottom edge of the terry cloth band shall be raised to any position above the supporting surface if doing so produces a more adverse effect than when the edge is touching or laying on the supporting surface.		P
42.7.9	If a heater is provided with vertical guards or grille members in the front of the heater that do not permit placement of the entire width of the 6 inch (152 mm) wide band in parallel with the heater surfaces, tests are to be conducted so that portions of the bands penetrate between the vertical guards as far as permitted by the guards or other parts of the heater.		P
42.7.10	For all drapings specified in 42.7.7 – 42.7.9, the terry cloth is to be allowed to fall naturally over the heater and not forced. However, for testing a heater provided with vertical guards or grille members, the terry cloth can be turned sideways to penetrate between the guards or grille members more easily.		P
42.8	Wall-hung heaters		P
42.8.1	General		P
42.8.1.1	Unless marked in accordance with 67.13 or 67.15, a wall-hung heater, shall be tested in accordance with 42.8.2.1 – 42.8.3.1.		P
42.8.2	Padded surface and blanketing		P

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Clause	Requirement Test	Result	Remark	Verdict
42.8.2.1	A wood surface covered with a 1 inch (25 mm) thick felt pad, and with the pad, in turn, covered by a double layer of cheesecloth, is to be supported in a vertical position as near the heater as the construction of the latter will permit. The heater is to be covered to such an extent as to produce maximum heating of the cheesecloth, and the padded surface is to extend at least 3 inches (76 mm) above the top surface of the heater. During the test, the covered wood surface is to be moved horizontally 1/2 inch (13 mm) away from its initial position and operation continued until temperatures stabilize. If it is determined that its temperature increases when the surface is moved horizontally, the test is to be repeated with the surface in the new position starting with the heater at approximately room ambient temperature. The wood surface is to be of sufficiently rigid construction so that it will not change shape (bow or warp) during the test.			P
42.8.2.2	While still operating as described in 42.8.2.1 with the padded vertical surface in its initial position in front of the heater, four thicknesses of loosely folded cotton blanket material are to be introduced into the space between the vertical padded surface and the vertical wall on which the heater is hung in such a manner that the upper slot of the heater is blocked. The folded blanket material is to be located at any points along the length of the heater installation in such a manner that any sensing device provided is so exposed as to produce the most adverse operating conditions. A length of folded material up to a maximum of 80 inches (2 m) is to be used, but a shorter length of the material may be introduced into the space at any one time to obtain the most adverse operating conditions possible. Operation in any one blocked condition is to be continued until constant temperatures are obtained, or until glowing or flaming of the cotton blanket material results. A typical test setup is shown in Figure 42.1.			P
42.8.3	Curtain drape			P

UL 1278				
Clause	Requirement Test		Result Remark	Verdict
42.8.3.1	The upper edge of a simulated curtain at least 3 feet (0.9 m) high, but long enough to be supported at least 1 foot (300 mm) above the heater in any case, is to be continuously attached to the wall at the base of which the heater is installed. The curtain is to consist of white duck as specified in 42.1.11 and an overlay of a double layer of cheesecloth on the side facing the heater, and is to be hung so that the lower edge just touches the floor. During the test, the entire length of the heater is to be initially covered and the curtain is to be arranged to conform as closely as possible with the contour of the heater. Those sections judged to be least likely to affect the operation of the temperature limiting control are to be covered. This test shall then be repeated with first:			P
a) 3/4	of the heater covered, then with			P
b) 1/2	of the heater covered, and then with			P
c) 1/4	of the heater covered.			P
	Each test shall be conducted with the heater at room ambient at the start of the test.			P
42.9	Abnormal ambient test			P
42.9.1	General			P
42.9.1.1	A heater that employs an automatic reset auxiliary temperature control or a temperature limiting control in accordance with (a) of exception to 29.1 shall be subjected to an abnormal ambient test in accordance with either Condition 1 or Condition 2 as specified in 42.9.2 and 42.9.3, respectively. The test is to be continued for 7 hours with the heater operated at the maximum rated input. Subsequent to this test, the heater shall comply with the Normal Temperature Tests, Section 40.			P
	Exception No. 1: The abnormal ambient test need not be conducted for a heater in which the average "on" time per cycle over four cycles of operation on the auxiliary temperature control or the temperature limiting control, whichever results in actuation of an alarm, during each abnormal operation temperature test does not exceed 5 percent and the average "on" time does not exceed 1 minute.			P
	Exception No. 2: The abnormal ambient test need not be conducted if:			P
	a) The heater completes the full 7 hour terry cloth band drape test,			P
	b) During the full terry cloth band drape test temperatures are measured as noted in the Normal Temperature Tests, Section 40, and			P
	c) The temperatures measured during the normal temperature test are equal to or greater than the temperatures obtained during the terry cloth band drape test with the product operating on the auxiliary temperature control or the limiting control, whichever results in actuation of an alarm.			P

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Clause	Requirement Test	Result Remark	Verdict
	Exception No. 3: The abnormal ambient test need not be conducted if the heater:		P
	a) Complies with the locked rotor test (see 42.3.1 – 42.3.4) and temperatures are measured as noted in the Normal Temperature Tests, Section 40, and		P
	b) If the steady state temperatures measured during the normal temperature test are equal to or greater than the temperatures obtained during the locked rotor test with the product operating on the auxiliary temperature control or temperature limiting control, whichever results in actuation of an alarm. The overshoot temperatures are not to be considered if they last for less than 5 minutes.		P
	Exception No. 4: A heater employing an automatically reset auxiliary temperature control need not be provided with an alarm if the heater complies with 40.1.1 (normal temperature tests) when operated with the auxiliary temperature control operational and with the temperature limiting control bypassed under the abnormal operation conditions specified in 42.2 – 42.12.		P
42.9.2	Abnormal ambient test – condition 1		P
42.9.2.1	The heater is to be placed in an enclosure where the ambient can be elevated and accurately maintained while the heater is operating. The ambient is to be raised slowly until the auxiliary temperature control or the temperature limiting control operates. The control is then to be shunted out of the circuit and the heater is to be operated at the ambient at which the control operated, plus or minus 10°F (5.6°C) for 7 hours.		P
42.9.3	Abnormal ambient test – condition 2		P
42.9.3.1	Air heated by a controlled temperature source is to be directed to the air intake openings of the heater using air ducts or other similar means. The temperature of the air is to be gradually increased until the auxiliary temperature control or the temperature limiting control operates. The control is then to be shunted out of the circuit and the heater is to be operated for 7 hours with the intake air maintained at the temperature at which the control operated, plus or minus 10°F (5.6°C).		P
42.10	Motor overload and stalled motor – motors protected by a remote protective device		N/A
42.10.1	A motor protected by a remote protective device in accordance with 26.1(b) shall not burn out nor shall there be other evidence of risk of fire when tested in accordance with 42.10.2 – 42.10.6.		N/A
42.10.2	The motor and its protective device are to be connected in the intended manner to a supply circuit having a voltage in accordance with 40.1.9. Temperatures are to be measured by thermocouples secured to the surface of the motor coils.		N/A

UL 1278				
Clause	Requirement Test	Result	Remark	Verdict
42.10.3	The motor and its protective device are to be tested in the ambient encountered in the operation of the heater in which the motor and its protective device are employed as determined during the applicable normal temperature test.			N/A
	Exception No. 1: A motor that encounters an ambient higher than normal room ambient, 25 – 26°C (77 – 79°F), during the applicable normal temperature test may be tested in a lower ambient. However, the maximum allowable temperatures specified in 42.10.4 and 42.10.5 are to be reduced by the difference between the ambient encountered in intended operation and the test ambient.			N/A
	Exception No. 2: An ambient compensated protective device may be tested in any ambient from 25 – 50°C (77 – 122°F).			N/A
42.10.4	When a motor is operating under the maximum load that it can carry without causing the protective device to function, the winding temperature shall not exceed 140°C (284°F) for a Class A insulated motor or 165°C (329°F) for a Class B insulated motor.			N/A
	Exception: A motor moving air only by means of a fan or blower directly attached to the motor shaft need not comply with this requirement.			N/A
42.10.5	When the rotor of a motor is locked, the winding temperature for a Class A insulated motor shall not exceed 200°C (392°F) during the first hour of operation and 175°C (347°F) thereafter. After the first hour of operation, the average temperature (that is, the average of (1) the arithmetic mean of the maximum temperatures and (2) the arithmetic mean of the minimum temperatures) shall not exceed 150°C (302°F). For a Class B insulated motor, the corresponding temperatures shall not exceed 225°C (437°F) for the first hour, 200°C after the first hour, and 175°C for the average temperature.			N/A
	Exception: A motor employing a thermal cutoff as a remote protective device need not comply with this requirement.			N/A
42.10.6	The locked rotor test on a manually reset device is to be continued for four operations of the protective device, with the device being reset as quickly as possible after it is opened. For an automatically reset device, the locked rotor test is to be continued for 72 hours unless the equipment includes other controls – such as a timer– that will demonstrably limit the duration of the operation to a shorter interval.			N/A
42.11	Impedance-protected motors			P

UL 1278				
Clause	Requirement Test		Result Remark	Verdict
42.11.1	An impedance-protected motor shall comply with the applicable requirements in the overheating protection for motors, UL 2111, under the conditions to which the motor is exposed in the heater, with the rotor locked. Compliance with this requirement is to be determined in accordance with:			P
a) 42.11.2	for wall-hung and ceiling-hung heaters that are intended to be operated in a specific fixed position, and			N/A
b) 42.11.2	for movable heaters.			P
	See 42.11.4.			P
	Exception: If a temperature limiting control, including a thermal cutoff, in the heater operates when the rotor is locked, the applicable temperature limits in the Standard for Overheating Protection for Motors, UL 2111 may be applied. Such temperature limiting controls and thermal cutoffs shall comply with the requirements in UL 2111 concerning the number of such devices to be tested and the test time.			P
42.11.2	A wall-hung or ceiling hung heater, intended to be operated in a specific fixed position, is to be installed and operated in accordance with Normal Temperature Tests, Section 40, with the rotor of the motor locked.			N/A
42.11.3	A movable heater is to be arranged as specified in the Normal Temperature Tests, Section 40. The heater and the motor are to be energized in accordance with 40.1.9 and 40.1.11. The heater is to be operated with the rotor of the motor locked with the heater located in a test alcove described in 40.3.1 under the conditions described in 40.3.5.			P
42.11.4	If a motor has been previously tested in accordance with the Standard for Overheating Protection for Motors, UL 2111, this testing can be discontinued if the winding temperature is no higher than the previous test results.			P
42.12	Motor connected across heating elements			N/A
42.12.1	A heater provided with a motor connected across a portion of a resistance element shall be subject to the applicable tests of 42.12.2 – 42.12.5.			N/A
42.12.2	Compliance with 42.12.1 is to be determined by testing three representative heaters. The heaters are to be tested in accordance with the conditions specified in Normal Temperature Tests, Section 40 or as described in 42.12.5. The heating element connected in parallel with the motor is to be open-circuited (see 42.12.4) and two layers of cheesecloth are to be draped to cover all air inlet and outlet openings of the heater. The heater is to be operated continuously until either motor burnout or stabilized motor temperature occurs.			N/A
42.12.3	With respect to 42.12.2, any of the results listed (a) – (c) are considered to comply with 42.12.1:			N/A

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Clause	Requirement Test		Result Remark	Verdict
	a) Motor burnout within 1 hour without emission of flaming particles, molten metal, or ignition or glowing of the cheesecloth.			N/A
	b) If the thermal protector of a thermally protected motor operates, the operation is to be continued for 15 days in accordance with the Standard for Overheating Protection for Motors, UL 2111. The temperature limits for locked rotor conditions specified in UL 2111 shall not be exceeded. It is acceptable for the protector to permanently open-circuit during the test.			N/A
	c) If no burnout or no operation of a thermal protector occurs, the operation is to be continued until the temperatures stabilize. The temperature rise of the motor winding shall not exceed the rise specified in Table 40.1 for the motor coil.			N/A
	Exception: If the temperature rise of the motor exceeds the rise specified in Table 40.1, the operation is to be continued for 15 days and temperatures are to be monitored. The measured temperatures shall not exceed the temperature limits for locked rotor conditions specified in the Standard for Overheating Protection for Motors, UL 2111.			N/A
42.12.4	For a heater that includes more than one heating element in parallel with the motor, the test described in 42.12.2 is to be conducted by first opening one of the elements. If the opening of one element does not manifest itself in the heater operation, the temperature of the motor windings shall not exceed the limits specified in Table 40.1 and the test shall be repeated with other elements in parallel with the motor opened.			N/A
42.12.5	At the manufacturer's option, certain motor or motor and thermal protector combinations as described in (a) and (b) can be tested as specified in 42.12.2 and 42.12.3 except independent of the heater. The test voltage is to be that to which they will be subjected if the parallel-connected heating element opens. During the test, two layers of cheesecloth are to be draped over the motor and there shall be no ignition of the cheesecloth and no emission of molten or flaming particles, and the temperature of the motor shall comply with 42.12.3.			N/A
	a) A motor and the thermal protector combination if the thermal protector operates at the increased voltage and it is not ambient compensated.			N/A
	b) An impedance-protected motor that is expected to burn open within 1 hour.			N/A
43	Endurance Test			P
43.1	Temperature Control			P

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Clause	Requirement Test	Result	Remark	Verdict
43.1.1	A temperature control and related contactor shall withstand an endurance test consisting of the number of cycles indicated in Table 43.1. Unless it is specified that the test be made without load, the current-rupturing device shall make and break at least the rated current of the heater while connected to a circuit of at least the voltage specified in 40.1.9. There shall be no electrical or mechanical malfunction of the control or associated contactor or undue burning, pitting, or welding of contacts.			P
43.2	Electrical wiring			N/A
43.2.1	An air heater in which a normal function causes movement of the power supply cord, electrical wiring or other insulated live parts, such as a base which adjusts the air heater to direct heated air to a desired position, shall withstand an endurance test for the number of cycles described in 43.2.2. Upon completion of the test:			N/A
	a) There shall be no electrical or mechanical malfunction of the air heater,			N/A
	b) There shall be no exposure of an uninsulated conductor strand either within or outside of the enclosure,			N/A
	c) The air heater shall comply with the Dielectric Voltage-Withstand Test, Section 48,			N/A
	d) There shall be no breakage of more than ten percent of the strands of any conductor, and			N/A
	e) There shall be no signs of oscillation cord or wire insulation abrasion.			N/A
43.2.2	The endurance test required by 43.2.1 is to consist of:			N/A
a) 750,000	cycles of operation for an air heater in which the movement of the power-supply cord, electrical wiring or other insulated live parts occurs as a result of the operation of an automatic mechanical feature, such as a motorized base not prohibited from being separately activated; or			N/A
b) 6000	cycles of operation for an air heater in which the movement of the power-supply cord, electrical wiring or other insulated live parts occurs only as a result of the operation of a manual feature, such as a swivel base that requires a user to manipulate the air heater.			N/A

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Clause	Requirement Test	Result Remark	Verdict
43.2.3	Where movement of electrical wiring or other insulated live parts occurs, six representative air heaters shall be subject to this test. Throughout the test the air heater shall be continuously energized at maximum rated input in accordance with 40.1.9 by short-circuiting any and all temperature controls. The movable member shall be operated so that it will reach the limits of travel in both directions during each cycle by either the automatic mechanical feature of the heater or by a separate mechanical arrangement that operates the movable member. The cycling rate shall be approximately one of the following:		N/A
	a) Twelve cycles per minute.		N/A
	b) At the rate at which the automatic mechanical feature in the air heater operates, if the rate is less than 12 cycles per minute, or		N/A
	c) Greater than 12 cycles per minute using the mechanical arrangement, if agreeable to all concerned, or as controlled by the automatic mechanical feature.		N/A
43.2.4	The endurance test described in 43.2.2 shall be conducted on six representative power-supply cords assembled to heaters, simulated mounting surfaces, or test fixtures so as to not interfere with the test procedure. If an oscillating heater has a tilting head assembly, two samples are to be oriented in the head fully forward position, two are to be oriented in the head straight up position, and two are to be oriented in the head fully back position. Each assembly is to be mounted so that rotation is centered through the normal operating position of the air heater. For the start of the test, the axis of the power supply cord is to be positioned vertically with the attachment plug end down. The cord is to be passed through a fixed horizontal plane, having a smoothly rounded, 1-inch (25-mm) diameter opening, located 2 feet (610 mm) below the power supply cord entry into the air heater. The free end of the cord is to be attached to a 1/4-pound (110-gram) unsupported weight. If the cord is attached to fixed base of the heater the 1/4 pound (110-gram) unsupported weight is not considered necessary. One or more complete air heaters of the maximum rating intended for use with the power supply cord and with any and all temperature controls short-circuited, or the leads of each assembly that are normally connected to the air heater are to be connected to a load that draws the same current. The six assemblies are to be flexed through an angle of approximately 180 degrees for each cycle. A cycle consists of 90-degree rotation of the test assembly in one direction, 180-degree rotation in the opposite direction and then return to the starting point.		N/A

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Clause	Requirement Test	Result Remark	Verdict
44	Short Circuit Tests		P
44.1	Devices and conductors referenced in 27.1.2(c) and Exception No. 3 to 27.4.3 shall withstand short circuit and ground fault conditions when protected by:		P
	a) A device that is acceptable for branch circuit protection and is located in the heater, or		P
	b) A branch circuit overcurrent protective device of the type and maximum rating specified on the heater nameplate.		P
	There shall be no damage to the conductor or its termination, no ignition of the cheesecloth surrounding the enclosure housing the components under test, and no arc-over between line- and low-voltage circuits.		P
44.2	For the purpose of these tests:		P
	a) Circuit breakers and fuses are not considered to be interchangeable,		P
	b) Fuses of the same rating are considered to be interchangeable,		P
	c) HACR type circuit breakers of the same rating are considered to be interchangeable, and		P
	d) Circuit breakers of other than the HACR type are not considered to be interchangeable with each other or with HACR type circuit breakers.		P
44.3	Each device and each conductor is to be connected in a circuit having a minimum capacity based on the maximum rated current and voltage of the heater in accordance with Table 44.1. Each concurrent load condition is to be considered separately, and the maximum resulting current employed as the basis of selection of the capacity of the test circuit. The voltage source for the test circuit is to be an alternating voltage and the circuit capacity is to be measured without the devices or the conductors in the circuit.		P
44.4	Each of three representative specimens of each conductor is to be subjected to each test condition. A new protective device is to be used for each test condition. Consideration is to be given to both short-circuit and ground-fault conditions.		P
45	Overload Test – High-Voltage Transformers		N/A
45.1	This test applies to a high-voltage transformer provided with thermal protection of other than the nonrenewable thermal cutoff type. See 27.5.2.		N/A
45.2	Temperatures measured on the surface of the windings of a thermally protected high-voltage transformer shall not exceed the temperature indicated in 45.4 when the transformer is tested as indicated in 45.3 and 45.4.		N/A

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Clause	Requirement Test		Result Remark	Verdict
45.3	A variable resistance load is to be connected to the output terminals and the transformer is to be operated continuously at the test voltage indicated in 40.1.9. If the protective device controls a switching device that, in turn, interrupts primary current to the transformer, the switching device is to be included in the circuit. The test ambient temperature is to be approximately 25°C (77°F). The resistance load is to be adjusted so that the transformer winding is brought to a stabilized temperature of approximately 10°C (18°F) below its insulation rating. The load is then to be gradually increased until operation of the protector occurs.			N/A
45.4	Each of three of the transformer-protective device combination is to be tested. Average temperatures of the three representative devices shall not exceed the winding insulation rating and the temperature of any one representative device shall not exceed the insulation rating by more than 5°C (9°F).			N/A
45.5	Upon completion of this test, each representative device shall comply with the Dielectric Voltage-Withstand Test, Section 48.			N/A
46	Burnout Test – High-Voltage Transformers			N/A
46.1	There shall be no emission of flame or molten metal from the heater enclosure when a high-voltage transformer is operated under the conditions described in 46.2 and 46.3.			N/A
	Exception: This test does not apply to a high-voltage transformer that is provided with thermal overload protection of other than the nonrenewable thermal cutoff type (see 27.5.2) or that is protected by an overcurrent device or devices complying with the requirements in 27.5.4 – 27.5.8.			N/A
46.2	Three transformers shall be operated continuously at the normal test voltage indicated in Table 40.2 and at rated frequency with the enclosure grounded. The test ambient temperature is to be approximately 25°C (77°F) and operation is to be continued until constant temperature is indicated by a thermocouple on the enclosure or until burnout occurs. The circuit on which the transformer is tested is to be protected by fuses rated not less than that required for the heater.			N/A
46.3	The load connected to the output terminals is to be the highest of the following and is to be readjusted to the specified value after 2 minutes of operation if necessary, with no further readjustment during the test.			N/A
	a) A resistance load to provide a current equal to three times the full rated transformer secondary current, or			N/A

UL 1278			
Clause	Requirement Test	Result Remark	Verdict
	b) If the transformer supplies a motor with or without additional loads, a resistance load to provide a current equal to the motor locked rotor current plus any additional loads, or		N/A
	c) If the transformer supplies an inductive load (other than a motor), such as the coils of relays, solenoids, and the like, a resistance load to provide a current equal to the sum of such loads with the armature of the largest blocked open.		N/A
	Exception: The test may be conducted with the output terminals short circuited if this results in less than three times rated secondary current.		N/A
47	Component Failure Test		P
47.1	If a heater employs one or more rectifiers, transistors, or similar solid-state components, no risk of fire or electric shock shall develop when the circuit between any two terminals of any such component is open-circuited or short-circuited. If the heater employs a capacitor in combination with one or more of the above-mentioned components, no risk of fire or electric shock shall develop when the capacitor is short-circuited. Only one of the simulated fault conditions described above is to be imposed at one time. See 47.2 – 47.5.		P
	Exception: Components located on the secondary of a Class 2 transformer need not comply with these requirements.		P
47.2	If a semiconductor rectifier is employed, three representative devices shall be tested with the rectifier terminals connected together. Three additional devices shall be tested with the terminals of the electrolytic capacitor connected together.		P
47.3	Three complete tests are to be made under each of the conditions described in 47.2 using new components in each test. The equipment to be tested is to be operated as indicated in 42.1.2.		P
47.4	An unacceptable condition is considered to exist if flame is emitted from the overall enclosure of the equipment or if a permanently conductive path is established between live parts and exposed dead metal.		P
47.5	The tests described in 47.1 – 47.3 may be omitted if one or both of the following conditions exist:		P
	a) There is 10,000 ohms or more of additional series impedance in a circuit in which the voltage is 125 or less.		P
	b) There is 20,000 ohms or more of additional series impedance in a circuit in which the voltage is more than 125 but is no more than 250.		P
48	Dielectric Voltage-Withstand Test		P

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Clause	Requirement Test		Result Remark	Verdict
48.1	A heater shall withstand for 1 minute without breakdown the application of a 60-hertz essentially sinusoidal potential between live parts and noncurrent-carrying metal parts, with the heater at its maximum normal operating temperature. The test potential (rms) shall be 1000 volts for a heater rated at 250 volts or less and 1000 volts plus twice rated voltage for a heater rated at more than 250 volts.			P
48.2	To determine whether or not a heater complies with the requirement in 48.1, it is to be tested by means of a 500-volt-ampere or larger capacity transformer, the output voltage of which can be regulated and is essentially sinusoidal. The increase in the applied potential is to be at a uniform rate and as rapidly as consistent with its value being correctly indicated by a voltmeter.			P
49	Insulation Resistance Test			P
49.1	A heater employing thermal insulation such as mineral wool in contact with uninsulated live parts or electrical insulating material that is likely to be affected adversely by moisture under the conditions of intended use shall have an insulation resistance of not less than 50,000 ohms when tested as specified in 42.1.8 after exposure for 24 hours to moist air having a relative humidity of 85 ±5 percent at a temperature of 34.0 ±2.0°C (89.6 ±3.6°F). See 20.2.			P
50	Water Spray Test			N/A
50.1	When tested as described in 50.2 – 50.4, a heater intended for outdoor use shall:			N/A
	a) Have an insulation resistance of not less than 50,000 ohms between live parts and interconnected noncurrent-carrying metal parts;			N/A
	b) Withstand without breakdown for 1 minute the application of a 60-hertz essentially sinusoidal potential between live parts and interconnected noncurrent-carrying metal parts. The test potential (rms) shall be 1000 volts if the heater is rated 250 volts or less, and shall be 1000 volts plus twice rated voltage if it is rated more than 250 volts; and			N/A
50.2	During the test, the heater is to be mounted or supported as it would be in actual service. If a heater is provided with a shelter, shield, or similar device (see 67.17), is to be mounted therein. A radiant reflector-type heater is to be suspended in any intended operating position.			N/A
50.3	The heater is to be subjected for 4 hours to a water spray as described in 50.4 applied at an angle of 45 degrees from the vertical. The insulation-resistance and dielectric voltage-withstand tests are to be conducted immediately upon conclusion of exposure to the water spray.			N/A

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Clause	Requirement Test	Result	Remark	Verdict
50.4	The water-spray-test apparatus is to consist of three spray heads mounted in a water supply pipe rack as illustrated in Figure 50.1. Spray heads are to be constructed in accordance with the details illustrated in Figure 50.2. The heater is to be positioned in focal area of the spray heads so that the greatest quantity of water is likely to enter the heater. The water pressure is to be maintained at 5 pounds per square inch (34.5 kPa) at each spray head.			N/A
51	Stability of Movable Heaters			N/A
51.1	A movable heater shall return to its intended at-rest position on a level surface after being tipped in any direction to an angle of 10 degrees from horizontal.			N/A
51.2	The test is to be conducted on the unit when placed under the most unfavorable conditions. The heater is to be arranged with all doors and other appurtenances in the position tending to decrease stability. The legs or other points of support may be blocked to prevent the unit from sliding.			N/A
52	Element Support Impact Tests			N/A
52.1	A movable heater shall neither:			N/A
	a) Emit sparks, flames, or molten metal, nor			N/A
	b) Cause the terry cloth to ignite, nor			N/A
	c) Open a 1/2 ampere fuse of other than the time-delay type installed in accordance with 52.2, when tested as described in 52.5 – 52.7.			N/A
	Exception: A heater need not be tested if it employs either rigid heating elements, such as resistive elements encased in rigid dead metal tubing, or heating elements that can be determined without test not to involve a risk of fire or electric shock when broken, such as heating lamps.			N/A
52.2	The 1/2-ampere fuse is to be connected between the accessible dead metal parts (see 52.10) of the heater and the earth ground through a manual switch arranged to permit remote opening and closing of the circuit to the fuse.			N/A
52.3	One representative movable heater is to be subjected to the test described in 52.5 and 52.6 and another is to be subjected to the test described in 52.7 – 52.9. For a heater employing a grounded (neutral) conductor, an additional representative heater for each of the tests is to be tested with the supply conductors reversed. A grounding conductor, if provided, is to be open during the tests. Each heater is to be operated at rated voltage and maximum rated input for 15 minutes immediately prior to being tested.			N/A

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Clause	Requirement Test	Result Remark	Verdict
52.4	The hardwood surface mentioned in 52.5 and 52.7 is to consist of a layer of nominal 1-inch thick tongue-and-groove oak flooring nailed onto a layer of nominal 3/4-inch plywood or nominal 1-inch thick tongue-and-groove pine board subflooring. The complete surface is to rest on a concrete or equivalently nonresilient surface during the tests.		N/A
52.5	While the heater is energized and the switch to the fuse circuit is in the open position, the heater is to be lifted by its intended carrying means to a height of 2 feet (0.6 m) as measured from the hardwood test surface to the lowest point of the lowest point of the heater.		N/A
	Exception: If the overall height of the heater is 2 feet or more (including its extended carrying handle, if any), the lowest point of the heater may be less than 2 feet but not less than 6 inches (75 mm) from the test surface, provided the top of such heater or the intended carrying means, whichever is the higher, is at least 4 feet (1.2 m) from the test surface.		N/A
52.6	The heater is to be held in the intended carrying position and is then to be dropped onto the hardwood test surface that is covered with one layer of terry cloth. The switch to the fuse circuit is then to be closed and the fuse is to be observed for opening prior to and while being uprighted. This procedure is to be repeated two times, for a total of three drops.		N/A
52.7	The representative heater in the as-received condition is to rest on the hardwood surface covered with two layers of terry cloth. While energized at the rated voltage, the heater is to be tipped over five times in the manner specified in 52.8. The first tipover is to be onto the front face of the heater and then subsequent tipovers are to proceed in the clockwise or counterclockwise direction, one tipover onto face or side, with the last tipover again onto its front face. If the angle of critical balance (see 33.18) exceeds 60 degrees, the heater is not to be tipped over in this direction, but a total of five tipovers are to be made with each heater tested.		N/A
52.8	Each tipover is to be accomplished by tilting the heater quickly (in not more than 1 second), in one steady motion, to an angle greater than the angle of critical balance. The heater is then to be immediately released and allowed to fall freely by the force of gravity. While being tipped over, the switch to the fuse circuit is to be in the open position. After the heater comes to rest, the switch is to be closed and the fuse is to be observed for open circuiting prior to and while the heater is being uprighted.		N/A

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Clause	Requirement Test	Result Remark	Verdict
52.9	If a part of the heater is structurally or functionally damaged by a tipover, described in 52.7 and 52.8, onto a face or side other than the front, but the damage has not caused the fuse to open, a second heater is to be subjected to five tipover tests with the first tipover in the direction that caused damage in the first test.		N/A
52.10	With reference to 52.2, a dead metal part is to be considered accessible if it does not comply with the accessibility requirements for uninsulated live metal parts in 8.4 and 8.10, and if the dead metal part can become energized by direct or indirect contact with a broken heating element.		N/A
53	Drop Test		P
53.1	A movable heater that is likely to be used in an elevated location, such as on a table, desk, or shelf (see 3.11) shall not:		P
	a) Emit sparks, flames, or molten metal,		P
	b) Cause the terry cloth to ignite,		P
	c) Open a 1/2-ampere nontime delay fuse, or		P
	d) Become a risk of fire or electric shock – see 42.7.4 – when subjected to a drop test in accordance with 53.3 – 53.8. If the heater is operational after the drop tests it shall be subjected to the Terry Cloth Band Drape Tests, 42.7.1 – 42.7.10.		P
53.2	If the heater is inoperative after the drop test with no adverse effects occurring in accordance with 53.1, three additional heaters are to be tested.		P
53.3	The heater is to be dropped three times through a distance of 3 feet (0.91 m) to strike a hardwood surface in the positions most likely to produce adverse results. The drop height is to be measured from the lowest point of the heater to the hardwood surface.		P
53.4	The hardwood surface mentioned in 53.4 is to be as described in 52.4, but additionally covered with two layers of terry cloth material.		P
53.5	Before conducting the drop, a nontime delay, 1/2-ampere fuse is to be connected between the accessible dead metal parts (see 52.10) of the heater and earth ground through a manual switch arranged to permit remote opening and closing of the circuit to the fuse. The grounded conductor and a grounding conductor, if provided, are to be treated as described in 52.3.		P
53.6	The heater is to be operated at maximum rated input for 15 minutes immediately prior to the drop. While energized and with the switch to the fuse circuit in the open position the heater is to be dropped so that it strikes the surface in a different position for each of the drops.		P

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Clause	Requirement Test	Result	Remark	Verdict
53.7	Following each drop, the heater is to be left energized in the position in which it comes to rest and the switch to the fuse circuit is to be closed. The heater is to be observed for the potential to ignite the terry cloth material and the fuse is to be observed for opening. The observation is to last for 15 minutes after which the heater is to be uprighted while energized and observed for opening of the 1/2 ampere fuse.			P
53.8	After completion of the last drop in accordance with 53.3 – 53.7, an evaluation is to be made concerning which of the positions in which the heater came to rest is most likely to produce the most adverse condition if left to lay in that position for a longer period of time. The heater is then to be placed in that position with the heater energized and the switch to the fuse circuit closed. The heater is to be observed for 7 hours for ignition of the terry cloth or opening of the fuse unless:			P
	a) No opening of the fuse and no discoloration of the terry cloth material is observed in 30 minutes after the drop. For this situation, it is assumed that no ignition will occur and the heater is to be uprighted in accordance with 53.7.			P
	b) Discoloration occurs, but no smoking or charring is observed in the next 2 hours. For this situation it is assumed that no ignition will occur and the heater is to be uprighted in accordance with 53.7.			P
	c) A manual reset type temperature limiting control or thermal cutoff de-energizes the heater circuits so that there is no longer a risk of fire or development of an electric shock.			P
	Exception: This test need not be conducted if for each of the drops conducted in accordance with 53.3 – 53.7 it was observed that a tipover switch had de-energized the heater circuits.			P
54	Test for Permanence of Cord Tag			N/A
54.1	General			N/A
54.1.1	To determine compliance with 69.1, or SB15.2, as applicable, representative lengths of power supply cord each with a tag that have been subjected to the tests described in 54.2.2 – 54.3.1 shall comply with the following requirements:			N/A
	a) The tag shall resist tearing for longer than 1/16 inch (1.6 mm) at any point;			N/A
	b) The tag shall not separate from the power supply cord;			N/A
	c) There shall be no permanent shrinkage, deformation, cracking, or any other condition that will render the marking on the tag illegible; and			N/A
	d) Overlamination shall remain in place and not be torn or otherwise damaged. The printing shall remain legible.			N/A
54.2	Test conditions			N/A

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Clause	Requirement Test		Result Remark	Verdict
54.2.1	For each type of conditioning mentioned in 54.2.2 – 54.2.4, three representative lengths of power supply cord having a tag applied in the intended manner are to be used. If tags are applied by an adhesive, tests are to be conducted no sooner than 24 hours after application of the tag.			N/A
54.2.2	Three representative lengths of power supply cord each with a tag are to be tested as received.			N/A
54.2.3	Three lengths of power supply cord each with a tag are to be tested at the end of 30 minutes of conditioning at a room temperature of 23 ±2°C (73.4 ±3.6°F) and 50 ±5 percent relative humidity, following conditioning in an air-circulating oven at 60 ±1°C (140 ±1.8°F) for 240 hours.			N/A
54.2.4	Three lengths of power supply cord each with a tag are to be tested within 1 minute after exposure for 72 hours to a relative humidity of 85 ±5 percent at 32 ±2°C (89.6 ±3.6°F).			N/A
54.3	Test method			N/A
54.3.1	Each representative device is to consist of a length of power supply cord to which the tag has been applied. The power supply cord, with the attachment plug pointing up, is to be held tautly in a vertical plane. A force of 3 pounds (13.3 N) is to be applied for 1 minute to the upper most corner of the tag farthest from the power supply cord, within 1/4 inch (6.4 mm) of the vertical edge of the tag. The force is to be applied vertically downward in a direction parallel to the major axis of the cord. In determining compliance with 54.1.1(c), manipulation is permissible, such as straightening of the tag by hand. To determine compliance with 54.1.1(d), each tag is to be scraped ten times across printed areas and edges, with a force of approximately 2 pounds (8.9 N), using the edge of a 5/64 inch (2.0 mm) thick steel blade held at a right angle to the test surface.			N/A
55	Protection Against Injury to Persons Test			N/A
55.1	Unless it is intended for hanging in a location (such as a ceiling) where it is not likely to be exposed to physical abuse, a panel of glass or similarly brittle material employed in a heater shall withstand, without cracking or breaking, the impact resulting from the test described in Figure 55.1.			N/A
	NOTE:			N/A
	The point of suspension is one inch (25.4 mm) in front of the panel, h is 16.25 inches (412.8 mm), the diameter of the steel sphere is 2 inches (50.8 mm), and the mass of the steel sphere is 1.18 lbs (0.535 kg mass) and it is to be released from rest.			N/A
55.2	A panel of glass or similarly brittle material employed in a heater shall withstand, without cracking or breaking, while in a fully heated condition, the application of:			N/A

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Clause	Requirement Test		Result Remark	Verdict
	a) A wet cloth, fully saturated with water at room temperature, wiped across the surface of the panel; and			N/A
	b) After the panel has returned to normal operating temperature, a fine spray of cold, tap water played across the surface of the panel.			N/A
55.3	A ceiling-hung heater employing glass or similarly brittle material integral with the element shall be provided with a guard that will prevent dropping of glass particle having:			N/A
	a) A weight of more than 1-1/2 ounces (43 grams),			N/A
	b) Any dimension larger than 1 inch (25.4 mm).			N/A
56	Knob Securement Test			P
56.1	A removable knob, button, or pointer mentioned in 33.8 that is attached to its operating shaft by friction and not additionally secured by mechanical means, such as a set screw, shall not separate from the intended position on its operating shaft by application of a force of 3 pounds (13.34 N) applied for 1 minute as a straight pull in line with the shaft.			P
57	Strength of Adjustment Stop Test			N/A
57.1	A control or a switch on a heater intended for commercial/industrial use that is operated by a push, pull, slide, toggle or lever adjustment shall withstand a force of 20 pounds (89 N) for 15 seconds.			N/A
57.2	A control or a switch on a heater intended for use other than that of 57.1 that is operated by a push, pull, slide, toggle, or lever adjustment shall withstand a force of 10 pounds (45 N) for 15 seconds.			N/A
57.3	The heater shall not be damaged so as to cause a reduction of electrical spacings, erroneous indications of the control setpoint, or other conditions that may result in a risk of fire, electric shock, or injury to persons. The force is to be applied to the free end of the adjustment means, in line with the direction of its intended movement, and it is to be applied in each direction of the movement with the control adjustment set at the extreme position in the direction of the movement.			N/A
57.4	Switches and controls operated by a rotary adjustment when mounted in the product, shall withstand the torque specified in 57.5 and shall not be damaged so as to cause a reduction of electrical spacings, an increase in a temperature setting, displacement of the control with respect to the mounting surface, or other condition that may result in a risk of fire, electric shock, or injury to persons.			N/A
57.5	With reference to 57.4, a torque is to be applied for 15 seconds to the adjustment knob in the direction of intended operation in accordance with the following:			N/A

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Clause	Requirement Test		Result Remark	Verdict
	a) For a control provided with a knob where D1 is 1 inch (25.4 mm) or less, the applied torque is to be 9 pound inches (1.0 N·m) if the heater is intended for commercial/industrial use or 7 pound-inches (0.8 N·m) if it is intended for all other uses.			N/A
	b) For a control provided with a knob where D1 is more than 1 inch, the torque applied is to be determined in accordance with the following formula:			N/A
	In which:			N/A
	T is the torque to be applied in pound inches (N·m),			N/A
D1	is the actuator diameter for a round actuator or grip length for a nonround actuator in inches (mm),			N/A
D is 1	inch (25.4 mm), and			N/A
K is 9	pound-inches (1.0 N·m) for a heater intended for commercial/industrial use or 7 pound-inches (0.8 N·m) for a heater intended for all other uses.			N/A
58	Hydrostatic Test			N/A
58.1	With regard to 11.1, a part that is subjected to pressure (including the vapor pressure of a superheated fluid) during intended or abnormal operation shall withstand without failure, a pressure equal to five times the working pressure.			N/A
58.2	Two representative parts are to be filled with water to exclude air and are to be connected to a hydraulic pump. The pressure is to be raised gradually to the specified test value, and is to be held at that value for 1 minute. The results are not acceptable if either part bursts or leaks, except as indicated in 58.3.			N/A
58.3	Leakage at a gasket during the hydrostatic-pressure test is not considered to constitute a failure unless it occurs at a pressure 40 percent or less of the required test value.			N/A
59	Strain Relief Test			N/A
59.1	With regard to 16.12, strain relief shall be provided to prevent mechanical stress on a flexible supply cord from being transmitted to terminals, splices or interior wiring.			N/A
59.2	When tested in accordance with 59.3, the strain-relief means provided on the flexible cord shall withstand for 1 minute, without displacement, a direct pull of 35 pounds force (155 N force) applied to the cord, with the connections within the heater disconnected.			N/A
59.3	A 35-pound (15.9 kg) weight is to be suspended on the cord and so supported by the heater that the strain-relief means will be stressed from any angle which the construction of the heater permits. The strain relief is not acceptable if, at the point of disconnection of the conductors, there is movement of the cord that indicates stress on the connection would have resulted.			N/A
60	Permanence of Marking			P

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Clause	Requirement Test	Result Remark	Verdict
60.1	The marking in Section 61 shall, unless otherwise indicated, be permanently applied by means such as:		P
	a) Etched, molded, die-stamped or paint-stenciled on the enclosure,		P
	b) Stamped or etched on metal, or		P
	c) Indelibly stamped lettering on pressure-sensitive labels secured by adhesive.		P
60.2	Pressure-sensitive labels secured by adhesive shall comply with the Standard for Marking and Labeling Systems, UL 969.		P
60.3	Usage of the heater shall be considered when determining the permanence of a marking.		P
	MANUFACTURING AND PRODUCTION TESTS		P
61	Production-Line Dielectric Voltage-Withstand		P
61.1	Each heater shall withstand without electrical breakdown, as a routine production-line test, the application of a potential at a frequency within the range of 40 – 70 hertz;		P
	a) Between the primary wiring, including connected components, and accessible dead metal parts that are likely to become energized, and		P
	b) Between primary wiring and accessible low-voltage (42.4 volts peak or less) metal parts, including terminals.		P
61.2	The production-line test shall be in accordance with either Condition A or Condition B of Table 61.1.		P
61.3	The heater may be in a heated or unheated condition for the test.		P
61.4	The test shall be conducted when the heater is complete (fully assembled). It is not intended that the heater be unwired, modified, or disassembled for the test.		P
	Exception No. 1: A part such as a snap cover that would interfere with conducting the test need not be in place.		P
	Exception No. 2: The test may be performed before final assembly if the test represents that for the completed heater.		P
61.5	The test equipment shall include a transformer having an essentially sinusoidal output, a means of indicating the test potential, an audible or visible indicator of electrical breakdown, and either a manual reset device to restore the equipment after electrical breakdown or an automatic reject feature activated by a dielectric breakdown.		P
61.6	If the output of the test equipment transformer is less than 500 volt-amperes, the equipment shall include a voltmeter in the output circuit to directly indicate the test potential.		P
61.7	If the output of the test equipment transformer is 500 volt-amperes or larger, the test potential may be indicated by:		P

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Clause	Requirement Test	Result Remark	Verdict
	a) A voltmeter in the primary circuit or in a tertiary winding circuit,		P
	b) By a selector switch marked to indicate the test potential, or		P
	c) In the case of equipment having a single test-potential output, by a marking in a readily visible location to indicate the test potential. When marking is used without an indicating voltmeter, the equipment shall include a positive means, such as an indicator lamp, to indicate that the manual-reset switch has been reset following a dielectric breakdown.		P
61.8	Test equipment other than that described in 61.5 – 61.7 may be used if found to accomplish the intended factory control.		P
61.9	During the test, the primary switch is to be in the on position, both sides of the primary circuit of the heater are to be connected together and to one terminal of the test equipment, and the second test-equipment terminal is to be connected to the accessible dead metal.		P
	Exception: A heater (resistive, high-impedance winding, and the like) having circuitry not subject to excessive secondary-voltage build-up in case of electrical breakdown during the test may be tested:		P
	a) With a single-pole primary switch, if used, in the off position, or		P
	b) With only one side of the primary circuit connected to the test equipment when the primary switch is in the on position, or when a primary switch is not used.		P
62	Production-Line Grounding Continuity		N/A
62.1	The manufacturer shall test each heater provided with a power-supply cord incorporating a grounding conductor to determine that electrical continuity exists between an exposed dead metal part of the heater and the grounding blade of the attachment plug as required by 36.2.		N/A
62.2	For the test mentioned in 62.1, the manufacturer is to employ an indicating device (an ohmmeter, a low-voltage battery-and-buzzer combination, or similar device).		N/A
63	Production-Line Tip Over		N/A
63.1	The manufacturer shall test each heater that employs a tip-over switch to determine that the switch functions as intended after assembly in the heater. The heater shall be energized during this test.		N/A
64	Production Leakage Test (Fluid-Filled Heaters)		N/A

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Clause	Requirement Test	Result	Remark	Verdict
64.1	Each fluid-filled heater body shall be tested and proved tight at two times the working pressure determined during the Normal Temperature Test. The pressure shall be raised gradually until the required pressure is reached and shall be maintained for 1 minute.			N/A
	Exception: A method other than pressure testing may be employed if it can be demonstrated that the alternate test method produces results that are at least equivalent to the pressure test method.			N/A
65	Hydrostatic Test			N/A
65.1	One heater of each size and type shall be selected for every 5,000 products manufactured or a heater shall be selected and tested at least once every month.			N/A
65.2	The heater shall be filled with air or the heat transfer fluid used for the heater and is to be connected to a pneumatic or hydraulic pump, as applicable. The pressure is to be raised gradually to five times the maximum pressure recorded during the abnormal operation tests, and is to be held at that value for one minute. The results are not in compliance if a part ruptures or leaks.			N/A
	Exception: A method other than pressure testing may be employed if it can be demonstrated that the alternate test method produces results that are at least equivalent to the pressure test method.			N/A
	RATINGS			
66	Details			P
66.1	A heater shall be rated in amperes, volt-amperes, or watts and also in volts; and may be rated for alternating current only. The rating shall include the number of phases if the heater is designed for use on a polyphase circuit, and shall include the frequency if necessary because of motors, relay coils, or other control devices. The voltage rating shall be any appropriate single voltage or voltage range such as: 100 – 120, 208, 220 – 240, 254 – 277, 440 – 480 and 600.			P
66.2	If a heater includes an attachment-plug receptacle that is not intended as a disconnecting means for any part of the heater or necessary accessory and that may, therefore, serve as a general-use outlet, the added load that the receptacle may impose on the heater and its supply connections (not less than 660 watts or 6 amperes per pair of slots) shall be taken into consideration in determining the electrical rating of the heater.			P
66.3	The requirement in 66.2 does not apply to an attachment-plug receptacle for general use.			P
	MARKINGS			

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Clause	Requirement Test	Result Remark	Verdict
67	Details		P
67.1	A heater shall be permanently marked, in such location that the marking will be plainly visible with:		P
	a) Listee's name, trade name or trademark,		P
	b) The catalog number or the equivalent,		P
	c) The date or other dating period of manufacture not exceeding any three consecutive months, and		P
	d) The complete electrical rating (in accordance with 66.1). A heater intended for use on alternating current only or direct current only shall be marked to so indicate.		P
	Exception No. 1: The manufacturer's identification may be in a traceable code when the heater is identified by a brand or trademark owned by a private labeler.		P
	Exception No. 2: The date of manufacturer may be abbreviated or in a nationally accepted conventional code or a code affirmed by the manufacturer. The code shall not require reference to the manufacturer's records to determine when the heater was manufactured. A ten year recycle period for the date code is acceptable for household products and a twenty year recycle period is acceptable for other products.		P
67.2	If a manufacturer produces or assembles heaters at more than one factory, each finished heater shall have a distinctive marking – which may be in code – to identify it as the product of a particular factory.		N/A
67.3	Each individual heating element or unit that is a part of a heater and is replaceable in the field shall be plainly marked with its electrical ratings in amperes or watts, and also in volts.		N/A
67.4	A heater shall bear the cautionary marking shown in Figure 67.1. The marking shall be located so that it is clearly visible if servicing is attempted on the heater and shall have the minimum dimensions specified in 67.15. The height of the symbols shall be at least 1 inch (25.4 mm) and they shall be a color that contrasts with that of the background and that matches the lettering.		P
	Exception No. 1: A heater that complies with 8.10 and 8.12 need not comply with this requirement.		P
	Exception No. 2: A heater that complies with 8.13 may have the Cautionary marking located in the instruction manual under the IMPORTANT INSTRUCTIONS section.		P
67.5	A heater whose acceptable performance depends upon its proper location or position shall be marked (such as "Top" or "Bottom") to indicate the way in which it is to be installed or used, unless such position is obvious from the external appearance of the heater.		P

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Clause	Requirement Test		Result Remark	Verdict
67.6	If the design of a heater contemplates disassembly by means of a tool for the purpose of cleaning or similar servicing by the user (including replacement of a thermal cutoff on a commercial-industrial heater), and if such disassembly involves the exposure of persons to unintentional contact with any normally enclosed or protected live part, the heater shall be plainly marked with a warning, that such servicing should be done only while the heater is disconnected from the supply circuit. See also 8.10.			N/A
67.7	If the servicing or replacement of a component of a heater in the field requires the removal or disconnection of any safety device, a caution marking shall appear on or adjacent to the device, calling attention to the fact that it should be repositioned in the proper location. The manufacturer's instructions provided with the heater shall call specific attention to this feature.			P
67.8	If compliance of a commercial-industrial type heater with any of the requirements in this standard depends upon the functioning of a field-replaceable thermal cutoff (fusible link):			N/A
	a) The thermal cutoff (fusible link) shall be marked with the name or trademark of the manufacturer of the link, and its catalog designation or the equivalent, and			N/A
	b) The heater shall be marked with a statement that a replaceable link should be as indicated in (a).			N/A
	c) The letter size shall be as indicated in 67.15.			N/A
67.9	If a supplementary type fuse is used for motor-overload protection, the heater shall be marked with the type and rating of the fuse to be used including the fuse manufacturer's or private labeler's name and catalog designation. The letter size shall be as indicated in 67.15.			N/A
67.10	A heater that is rated between 2 kilowatts and 6 kilowatts and less than 250 volts and is intended only for commercial/industrial use shall be marked with the word "WARNING" and the following or the equivalent: "Risk of fire. Do not use as a residential or household heater." This statement shall be legible and located so that it is visible during and after the heater is installed in accordance with the manufacturers instructions. The marking shall also appear on the heater carton (see 68.5.2). The letter size shall be as indicated in 67.15.			N/A
	Exception: A heater that complies with the requirements for both residential and commercial/industrial heaters need not comply with this marking requirement.			N/A

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Clause	Requirement Test	Result Remark	Verdict
67.11	The hanging-bracket kit for a wall-hung or ceiling-hung heater, mentioned in 16.2 shall be identified by a model, catalog, or part number. The kit shall also be marked "For use with heater Model . . . . ." to indicate the heater or heaters with which the kit is intended for use and the heater shall be permanently marked "For wall hanging (or ceiling-hanging), use wall-hanging (or ceiling-hanging) accessory kit No. . . . . ;" except that an equivalent marking may be used in either case.		N/A
	Exception: If the hanging brackets are shipped with the heater and clear hanging instructions are provided, the marking may be eliminated.		N/A
67.12	An inherently thermally protected motor provided on a heater shall be marked "Thermally protected," except that if the inherent protection is for locked rotor only the marking shall be "Thermally protected L." An impedance-protected motor provided on a heater shall be marked "Impedance protected." Motors rated 100 Watts, or less, may use the abbreviations T.P. or Z.P. , as appropriate.		P
67.13	Except for a ceiling-hung heater, a heater of the radiant type having a visibly glowing element shall employ the following permanent marking on a surface of the heater that is visible from the front of the heater, with the word "WARNING" and the following or equivalent wording: "To Reduce the Risk of Fire – keep combustible material such as furniture, papers, clothes, and curtains at least 3 feet (0.9 m) from the front of the heater and away from the sides and rear." This marking shall be readily visible and shall have the minimum dimensions specified in 67.15.		N/A
	Exception: The marking of "3 feet" in the above markings may be reduced if the marking is revised to replace the words "WARNING – TO REDUCE THE RISK OF FIRE" with "DANGER – TO AVOID FIRE."		N/A
67.14	A movable or wall-hung heater of a type other than covered in 67.13 shall be marked on a surface that is visible from the front of the heater with the following wording: "CAUTION – High temperature, keep electrical cords, drapery, and other furnishings at least 3 feet (0.9 m) from the front of the heater and away from the side and rear." The marking shall be readily visible and shall have the minimum dimensions specified in 67.15.		N/A
	Exception No. 1: The following marking may be substituted for the marking described above, if during intended operation, the temperature at any point on the surface of the heater does not exceed 121°C (249.8°F). "DANGER – High temperatures may be generated under certain abnormal conditions. Do not partially or fully cover or obstruct the front of this heater."		P

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Clause	Requirement Test	Result Remark	Verdict
	Exception No. 2: The caution marking described above is not required on a heater if, during the Normal Temperature Tests and Abnormal Operation Tests, Sections 40 and 42, the temperature at any point on the surface of the heater does not exceed 121°C (249.8°F).		P
	Exception No. 3: A wall-hung heater need not be marked with the cautionary marking provided it complies with the requirements in 42.8.2.1 – 42.8.3.1.		N/A
	Exception No. 4: The marking of "3 feet" in the above marking may be reduced if the marking is revised to replace the word "CAUTION" with "DANGER – TO AVOID FIRE."		P
67.15	With respect to 67.8, 67.9, 67.13, 67.14, 67.16, and 67.17 readily visible means visible from a point 5 feet (1.5 m) above the floor and between 1 and 4 feet (0.3 and 1.2 m) away from the front surface of the heater when the heater is placed in the intended use location. The marking shall be in letters not less than 1/8 inch (3.2 mm) in height and shall be of a permanent type and in a color that contrasts with that of the enclosure or background.		P
	Exception No. 1: The location of the marking on a wall-supported heater provided with an adjustable decorative fire curtain shall be considered acceptable if it complies with 67.13 with the fire curtain in the full open position.		N/A
	Exception No. 2: The word "CAUTION " or "WARNING" shall be readily visible on the front of the heater but the remainder of the wording may be in an adjacent location clearly connected to the "CAUTION" or "WARNING" word.		P
67.16	For a movable heater that is considered likely to be used in an elevated location (see 3.6), the markings specified in 67.13 and 67.14 shall be readily visible with the heater in the intended use location, which is assumed to be on the floor and also at any point between and including 2.5 and 5 feet (0.75 and 1.5 m) above the floor.		P
67.17	If the guard of a heater is removable (for example, if it is intended to be removed for shipping, storage, and the like), the heater shall be plainly and legibly marked, in a location where the marking will be readily visible after the heater has been installed as intended, with a warning that it should not be operated unless the guard is in place. The letter size shall be as indicated in 67.15.		N/A
67.18	If a drive-in-theater heater for outdoor use (as described in 50.2) is provided with a shelter, the heater shall be plainly marked "Replace heater in shelter when not in use."		N/A

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Clause	Requirement Test		Result Remark	Verdict
67.19	A heater referenced in Exception No. 2 of 37.1 shall be marked with the word "CAUTION" and the following or equivalent: "Risk of Fire – Do Not Operate Without Legs (Base) Attached." The marking shall comply with the requirements in 67.15.			N/A
67.20	If required overcurrent protective devices or contactors are provided as a separate assembly, the heater shall be marked to indicate that it is to be used only with this separate assembly.			P
67.21	If replaceable fuses are provided for overcurrent protection of a control circuit conductor or transformer (see 27.1.2), the heater shall be marked with the maximum current rating of the fuse. The marking shall be visible when the cover or door of the fuse compartment is opened. If a supplementary type fuse is provided, the marking shall also include the fuse manufacturer's or private labeler's name, catalog designation, and fuse voltage rating.			P
67.22	If a Class G fuse is provided, or if the fuseholder will accept a Class H fuse, but a different class of fuse was used during the temperature test on the equipment, the marking specified in 67.21 shall also include the fuse class.			P
67.23	With reference to 67.21 and 67.24, the type of overcurrent protective device shall also be specified in the marking if required in order to comply with the requirement in 44.1.			P
67.24	If in accordance with the exception to 27.4.4 or with 27.5.6, overcurrent protection is not provided as part of the equipment, the equipment shall be marked with the maximum rating of the overcurrent device or devices for the supply circuit. The rating of the overcurrent device shall be based on the ampacity of the supply circuit conductors, as determined from ampacity tables contained in the National Electrical Code, ANSI/NFPA 70. The marking shall appear on the wiring diagram, adjacent to the field wiring terminals, or on the unit nameplate. See 67.23.			P
68	Instructions for Use and Care			P
68.1	General			P
68.1.1	The requirements in this section are applicable only to freestanding heaters.			P

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Clause	Requirement Test	Result	Remark	Verdict
68.1.2	An instruction manual or the equivalent, shall be provided with each heater. The manual shall specifically warn the user against potential risk of fire, electric shock, and injury to persons and state the precaution that should be taken to guard against each such risk. The instructions relating to the risk of fire, electric shock, and injury to persons shall be a permanent part of the manual, but separated in format from the other instructions and shall appear before the operating instructions in the manual. The upper case letters in the instructions relating to the risk of fire, electric shock, and injury to persons shall be not less than 1/12 inch (2.1 mm) high and the lower case letters shall not be less than 1/16 inch (1.6 mm) high.			P
68.1.3	The instruction manual shall include instructions or illustrations to identify important features related to reducing the risk of fire, electric shock, and injury to persons.			P
68.1.4	The instruction manual shall include the instructions specified in 68.2.1; and the words "IMPORTANT INSTRUCTIONS" and "SAVE THESE INSTRUCTIONS" shall be in upper case letters not less than 3/16 inch (4.8 mm) high.			P
68.1.5	Unless otherwise indicated, the text of the instructions shall be verbatim, or in equally definitive terminology.			P
	Exception: If a specific conflict in the application to a product exists, or if the wording would be inappropriate, appropriate variations from the specified wording may be used.			P
68.1.6	Wording in parentheses is intended to be explanatory, indicating such factors as options, alternatives, exceptions, or cross-references.			P
68.1.7	The items may be numbered. In the list of items the first shall be "Read all instructions before using the heater," and the last shall be "SAVE THESE INSTRUCTIONS." Other important instructions relating to the risk of fire, electric shock, and injury to persons considered appropriate by the manufacturer may be inserted.			P
68.2	Important instructions			P
68.2.1	The instruction manual shall incorporate all required cautionary markings for the heater specified in the Marking Details, Section 67, and shall also include at least the following general instructions, as appropriate.			P
	IMPORTANT INSTRUCTIONS			P
	When using electrical appliances, basic precautions should always be followed to reduce the risk of fire, electric shock, and injury to persons, including the following:			P
	1) Read all instructions before using this heater.			P

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Clause	Requirement Test		Result Remark	Verdict
	2) This heater is hot when in use. To avoid burns, do not let bare skin touch hot surfaces. If provided, use handles when moving this heater. Keep combustible materials, such as furniture, pillows, bedding, papers, clothes, and curtains at least a __ feet (a __ m) from the front of the heater and keep them away from the sides and rear.			P
	a Clearance distance is to be determined in accordance with 67.13 or 67.14.			P
	3) Extreme caution is necessary when any heater is used by or near children or invalids and whenever the heater is left operating and unattended.			P
	4) Always unplug heater when not in use. (This item may be omitted if the heater is provided with a clock-operated switch).			P
	5) Do not operate any heater with a damaged cord or plug or after the heater malfunctions, has been dropped or damaged in any manner. Discard heater, or return to authorized service facility for examination and/or repair.			P
	6) Do not use outdoors. (Omitted if the heater is intended for outdoor use.)			P
	7) This heater is not intended for use in bathrooms, laundry areas and similar indoor locations. Never locate heater where it may fall into a bathtub or other water container.			P
	8) Do not run cord under carpeting. Do not cover cord with throw rugs, runners, or similar coverings. Do not route cord under furniture or appliances. Arrange cord away from traffic area and where it will not be tripped over.			P
	9) To disconnect heater, turn controls to off, then remove plug from outlet.			P
	10) Connect to properly grounded outlets only. (This item may be omitted if the heater is not provided with a grounding type attachment plug.)			P
	11) Do not insert or allow foreign objects to enter any ventilation or exhaust opening as this may cause an electric shock or fire, or damage the heater.			P
	12) To prevent a possible fire, do not block air intakes or exhaust in any manner. Do not use on soft surfaces, like a bed, where openings may become blocked.			P
	13) A heater has hot and arcing or sparking parts inside. Do not use it in areas where gasoline, paint, or flammable liquids are used or stored.			P
	14) Use this heater only as described in this manual. Any other use not recommended by the manufacturer may cause fire, electric shock, or injury to persons.			P
	15) Always plug heaters directly into a wall outlet/receptacle. Never use with an extension cord or relocatable power tap (outlet/power strip).			P

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Clause	Requirement Test	Result Remark	Verdict
	16) This heater may include an audible (a visual) alarm to warn that parts of the heater are getting excessively hot. If the alarm sounds (flashes), immediately turn the heater off and inspect for any objects on or adjacent to the heater that may cause high temperatures. DO NOT OPERATE THE HEATER WITH THE ALARM SOUNDING (FLASHING). (Omitted if an alarm is not required per Alarms, Section 30.)		P
	17) "SAVE THESE INSTRUCTIONS"		P
68.2.2	The important safety instructions for an appliance provided with an AFCI or LCDI shall include the following statement, “This product employs an AFCI/LCDI. If the AFCI/LCDI is de-activated this indicates an arcing fault, unplug and check the supply cord and product. If no damage is visible, reset the device by pressing the reset button. If the AFCI/LCDI de-activates again, a hazardous condition may be present and the product should be discarded or returned to an authorized service facility for examination and/or repair.”		P
68.3	User instructions		P
68.3.1	The instruction manual shall also include the following in a separate section or sections:		P
	a) Instructions and cautionary statements for usage cleaning, user-maintenance, operations recommended by the manufacturer, such as lubrication or nonlubrication, and a warning to the user that any other servicing should be performed by an authorized service representative.		P
	b) The function of indicator lights and symbols used for switches or manually operated controls shall be explained.		P
	c) Any heater employing a manually reset control shall be provided with instructions to the user regarding its operation.		P
	d) Specific instructions for the proper method of cord storage, total heater storage, and the like when the heater is not in use.		P
68.3.2	For products that employ an AFCI or LCDI, the following or equivalent instructions shall be provided and shall include illustrations to assist the user:		N/A
	a) This appliance is provided with a protective device that may make the appliance inoperable under some abnormal conditions. If the appliance becomes inoperable, discard the appliance or return the appliance to a service center for examination and repair. For appliances provided with user- resettable protective devices, the instructions shall:		N/A
	1. Describe the purpose of the test and reset buttons;		N/A
	2. Specify the frequency of the testing;		N/A

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Clause	Requirement Test	Result Remark	Verdict
	3. Describe the indication of proper functioning of the protective device; and		N/A
	4. Indicate that an appliance that does not operate in the proper functioning condition is to be discarded or returned to a service center for examination and repair.		N/A
68.3.3	A product employing a AFCI, or LCDI shall include the following instructions: "Risk of fire. Do not replace attachment plug. Contains a safety device (AFCI, LCDI) that should not be removed. Discard product if the attachment plug is damaged."		N/A
68.4	Grounding instructions		N/A
68.4.1	The instruction manual of grounded heaters shall include the following or equivalent wording:		N/A
	(In the case of a heater rated for a nominal 120 volts.) This heater is for use on 120 volts. The cord has a plug as shown at A in Figure 68.1. An adapter as shown at C is available for connecting three-blade grounding-type plugs to two-slot receptacles. The green grounding lug extending from the adapter must be connected to a permanent ground such as a properly grounded outlet box. The adapter should not be used if a three-slot grounded receptacle is available.		N/A
	(In the case of a heater rated for a nominal 240 or 208 volts.) This heater is for use on 240 (or 208) volts. The cord has a plug as shown in D in Figure 68.1. No adapter is available for this blade configuration, and none should be used. The type outlet is a 240 (or 208) volt grounding outlet. When properly installed, it provides a ground connection through the cord to the heater to protect the operator from electric shock.		N/A
68.5	Heater carton information		P
68.5.1	At least the following information pertaining to the heater features and its use conditions shall be included on the external surface of the packaging of a heater. All information shall be grouped together and appear on one side, except the bottom, of the packaging.		P
	a) Voltage and ampere or wattage rating.		P
	b) The specific location, if the intended location of the heater is specific (such as floor only, wall mounted only, wall insert, and the like).		P
	c) Information indicating that heaters should always be plugged directly into a wall outlet/receptacle, and that an extension cord or relocatable power tap (outlet/power strip) should never be used. See 68.2.1(15).		P
	d) The type of cord and plug receptacle configuration (can be described or shown pictorially), if other than standard 120 volts/15 or 20 amperes configuration.		P

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Clause	Requirement Test	Result Remark	Verdict
	e) Clearances to be maintained from combustibles, giving examples of combustibles. See 68.2.1(2).		P
	Exception: This information need not be provided if Exception No. 1, 2, or 3 to 67.14 apply.		P
	f) A statement specifying that the heater is not to be used in wet or moist locations [see 68.2.1(7)], unless the heater is identified as suitable for such use.		P
68.5.2	If a heater is marked according to 67.10, the heater carton shall be marked with the word "WARNING" and the following or equivalent: "Risk of fire. Do not use as a residential or household heater."		P
	Exception: A heater that complies with the requirements for both residential and commercial/industrial heaters need not comply with this marking requirement.		P
69	Cord Tag Markings		P
69.1	The markings specified in this section shall be permanently affixed to the power-supply cord, shall be no more than 6 inches (152 mm) from the attachment plug and shall be made of substantial material (cardboard, cloth, plastic, or the equivalent) to provide mechanical strength and to prevent easy removal. The tag shall be of a size that facilitates legibility of the required markings, and all exposed surfaces shall have a clear plastic overlay, or the equivalent, to protect the markings. The information on the tag shall to be legibly printed and shall contrast with the background. If both sides of the tag are utilized to incorporate the required marking, the text of the marking shall be arranged so that it is obvious that the marking is started on one side and is continued on the other side of the tag. The statements "WARNING - TO REDUCE THE RISK OF FIRE" and "DO NOT REMOVE THIS TAG!" shall be in letters at least 3/16 inch (4.8 mm) in height. The remaining text shall be in letters of at least 1/16 inch (1.6 mm) in height. The tag shall be either of the following forms:		P
	a) A flag tag having a hole to permit securement to the power-supply cord by a plastic strap or equivalent means. The strap shall not be removable without cutting.		P
	b) A flag-type cord tag with an adhesive back. The tag is to be wrapped tightly once around and is to adhere to the supply cord. The ends of the tag are to adhere to each other and project as a flag. The required markings are to be positioned on the projecting flag portion of the tag.		P
	The permanence of the warning tag shall be determined in accordance with Test for Permanence of Cord Tag, Section 54.		P

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Clause	Requirement Test	Result Remark	Verdict
69.2	Except for a ceiling-hung heater, a heater of the radiant type having a visibly glowing element shall employ the following or equivalent instructions:		N/A
	"WARNING – TO REDUCE THE RISK OF FIRE:		N/A
	1) Do not place any objects such as furniture, papers, clothes, and curtains closer than 3 feet (0.9 m) to the front of the heater and keep them away from the sides and rear when the heater is plugged in.		N/A
	2) Do not place the heater near a bed because objects such as pillows or blankets can fall off the bed and be ignited by the heater.		N/A
	3) Always unplug heater when not in use.		N/A
	4) Always plug heaters directly into a wall outlet/receptacle. Never use with an extension cord or relocatable power tap (outlet/power strip).		N/A
	5) Check your heater cord and plug connections. A loose fitting outlet can cause the plug to overheat or cause a fire. Be sure plug fits tight in the outlet. Check frequently during use to make sure plug and outlet are not hot. If so, discontinue using heater and have outlet replaced by a qualified electrician.		N/A
	Note: Heaters draw more current than small appliances, overheating of the outlet may occur even if it has not occurred with the other appliances.		N/A
	DO NOT REMOVE THIS TAG!"		N/A
	Exception: The marking of "3 feet" in the above marking may be reduced if the marking is revised to replace the words "WARNING - TO REDUCE THE RISK OF FIRE" with "DANGER - TO AVOID FIRE."		N/A
69.3	A heater, of other than the radiant type having a visibly glowing element, shall employ the following or equivalent instructions:		P
	"WARNING - TO REDUCE THE RISK OF FIRE:		P
	1) Always plug heaters directly into a wall outlet/receptacle. Never use with an extension cord or relocatable power tap (outlet/power strip).		P
	2) Check your heater cord and plug connections. A loose fitting outlet can cause the plug to overheat or cause a fire. Be sure plug fits tight in the outlet. Check frequently during use to make sure plug and outlet are not hot. If so, discontinue using heater and have outlet replaced by a qualified electrician.		P
	Note: Heaters draw more current than small appliances, overheating of the outlet may occur even if it has not occurred with the other appliances.		P
	3) Always unplug heater when not in use.		P
	4) Do not operate heater with a damaged cord or plug or after the heater malfunctions, has been dropped or damaged in any manner. Discard heater or return to an authorized service facility for examination and/or repair.		P

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Clause	Requirement Test		Result Remark	Verdict
	5) Do not run cord under carpeting. Do not cover cord with throw rugs, runners, or similar coverings. Do not route cord under furniture or appliances. Arrange cord away from traffic area and where it will not be tripped over. (This item may be omitted for ceiling-hung heaters).			N/A
	SUPPLEMENT SA – CERTAIN RADIANT ROOM HEATERS			
	INTRODUCTION			
SA1	Scope			N/A
SA1.1	These requirements apply to movable electric room heaters of the radiant type as described in SA1.2. These requirements add to the applicable requirements in the body of this Standard.			N/A
SA1.2	A heater covered by these additional requirements shall comply with all of the following items:			N/A
	a) The enclosure, excluding a projecting guard or support, shall be less than 5 inches (127 mm) in depth.			N/A
	b) The ratio of the heater's overall length to height, excluding handles, shall be more than 2 to 1, or 3 to 1 for a heater higher than 2 feet (610 mm).			N/A
	c) A heater shall have a visibly glowing heating element as defined in 3.24.			N/A
	d) The heater shall not be sold or recommended for use as a baseboard heater.			N/A
	CONSTRUCTION			
SA2	Enclosure			N/A
SA2.1	General			N/A
SA2.1.1	An electrical part shall be so located or enclosed that protection against unintentional contact with any uninsulated live part is provided. Insulated motor brush caps do not require additional enclosures.			N/A
SA2.1.2	In determining if an opening in an enclosure is acceptable, consideration is to be given to:			N/A
	a) The proximity of any uninsulated live part and			N/A
	b) The possibility of the emission of burning insulation, molten metal, and the like through the opening.			N/A
SA2.1.3	A moving part such as a fan blade, blower wheel, pulley, or belt that may cause injury shall be enclosed or guarded.			N/A
SA2.1.4	If the removal of a door, panel, or shield exposes a moving part that involves risk or injury to persons:			N/A
	a) The opening or removal of the door, panel, or shield shall require the use of a tool,			N/A
	b) An interlocking device shall shut off the mechanism, or			N/A

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Clause	Requirement Test	Result Remark	Verdict
	c) A warning marking shall be displayed in letters not less than 1/8 inch (3.2 mm) high that reads essentially as follows:		N/A
	DANGER – Moving parts inside that involve risk or injury to persons. Shut off the (equipment) before (removing-opening) this (cover-door).		N/A
SA2.1.5	The distance from an opening in a required guard or enclosure to the moving part mentioned in SA2.1.3 shall be in accordance with Table SA2.1 but the minor dimension of the opening shall not in any case exceed 1 inch (25.4 mm). For an opening having a minor dimension intermediate between two of the values included in Table SA2.1, the distance from the opening to the moving part shall be not less than that found by appropriate interpolation between the corresponding values in the right-hand column of Table SA2.1. The minor dimension of the opening is determined by the largest hemispherically tipped cylindrical probe that can be inserted through the opening with a force of 5 pounds (22.2 N).		N/A
SA2.1.6	If a moving part cannot be contacted through the opening because of fixed components, including baffles, compliance with SA2.1.3 and SA2.1.5 is not required.		N/A
SA2.1.7	A part of a heater such as an enclosure, frame, guard, or handle that is subject to contact in operation and user servicing shall be free of sharp corners, edges, or projections.		N/A
SA2.1.8	A handle intended to support or carry more than 20 pounds (9.10 kg) shall have a gripping surface at least 4 inches (102 mm) long.		N/A
SA2.1.9	A handle shall be fastened so that it cannot be partly or completely removed without the use of a tool.		N/A
SA2.1.10	A handle used for support of a movable heater shall be able to sustain four times the weight of the heater. The appropriate load shall be uniformly applied over a 3-inch (76-mm) length at the center of the handle, gradually increased to the test value over a period of 5 to 10 seconds, and maintained at the test value for 1 minute. The load shall be supported with no evidence of damage to the handle such as separation, cracking, or permanent deformation. For this test the heater may be inverted and supported so that the test weight can be applied directly to the handle.		N/A
SA2.1.11	If more than one handle is furnished on the heater, the load indicated in SA2.1.10 shall be distributed between the handles. The distribution of the load shall be determined by measuring the percentage of the weight of the heater supported by each handle with the heater in the normal carrying condition.		N/A

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Clause	Requirement Test		Result Remark	Verdict
SA2.1.12	If a heater is furnished with more than one handle and the heater can be carried by one handle alone, each handle shall be capable of supporting the load described in SA2.1.10.			N/A
SA2.2	Guards			N/A
SA2.2.1	A slot opening in the outer enclosure of a heater, if more than 6 inches (152 mm) in length, shall be provided with wire guards or the equivalent at intervals such that no section of the slot is uninterrupted for a distance of more than 6 inches (152 mm).			N/A
	Exception: The guard is not required on a heater that complies with the requirement in SA14.1.			N/A
SA3	Stability			N/A
SA3.1	A movable heater shall return to its intended at-rest position on a level surface after being:			N/A
	a) Tipped in any direction to an angle of 10 degrees from horizontal, or			N/A
	b) Subjected to a force of 25 percent of the weight of the heater externally applied in a horizontal direction to the point on the heater providing the greatest tendency to overturn it.			N/A
SA3.2	The test is to be conducted on the unit when placed under the most unfavorable conditions. The heater shall be arranged with all doors and other appurtenances in the position tending to decrease stability. The legs or other points of support may be blocked to prevent the unit from sliding during the application of the externally applied force.			N/A
SA4	Supply Connections			N/A
SA4.1	A movable heater shall be provided with a directly attached flexible cord and an attachment plug. The exposed length of the cord (including fittings) shall not be less than 6 feet (1.8 m) and not more than 8 feet (2.4 m).			N/A
SA4.2	The flexible cord shall be as indicated in Table SA4.1 or shall be of an equivalent type.			N/A
SA5	Internal Wiring			N/A
SA5.1	The internal wiring shall consist of wires of the size and type rated for the particular application, when considered with respect to the temperature and voltage to which the wiring is likely to be subjected, with respect to its exposure to oil or grease, and with respect to other conditions of service to which it is likely to be subjected. The thickness of the insulation shall be 1/32 inch (0.8 mm) except that it may be not less than 1/64 inch (0.4 mm) if the wire is provided with a braid or jacket not less than 1/64 inch (0.4 mm).			N/A
SA5.2	The temperature limit marked on the insulation of an insulated conductor shall not exceed the temperature limit applicable to that material.			N/A
SA6	Automatic Controls and Control Circuits			N/A

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Clause	Requirement Test	Result Remark	Verdict
SA6.1	If a temperature control, mode control, or both in a heater has a marked "off" position, or another wording (such as "no heat,""cold,""O" or similar wording) that conveys the same meaning as the word "off," it shall disconnect the element or elements it controls from all ungrounded conductors of the power-supply circuit when placed in that position, that is, when not cycling.		N/A
SA6.2	If a temperature control has a marked position as described in SA6.3, it shall not function as a temperature control – that is, it shall not respond to temperature changes – while the actuating members is in that position.		N/A
SA6.3	The requirement in SA6.2 applies to a temperature control that is marked:		N/A
	a) With an "off" position, or		N/A
	b) With another wording (such as "no heat,""cold,""O" or similar wording) that conveys the same meaning as the word "off."		N/A
SA6.4	A temperature regulating control that does not reclose (remains open) when cooled to a temperature of minus 35°C (minus 31°F) is acceptable with respect to the requirements in SA6.2.		N/A
SA6.5	A temperature-limiting control shall be acceptable for use with baseboard heaters and shall not function during the temperature test.		N/A
SA7	Spacings		N/A
SA7.1	Spacings in a heater shall be in accordance with Table SA7.1 and Table SA7.2.		N/A
	Exception: The spacings specified in Table SA7.1 and Table SA7.2 do not apply to the inherent spacings of a component part of a heater. Such spacings are judged under the requirements for the component in question. See 4.1.		N/A
	Table SA7.2		N/A
	Minimum acceptable spacings through air or over surface at points other than fuseholders, thermal cutoffs, or inside motorsa		N/A
	PERFORMANCE		
SA8	General		N/A
SA8.1	With respect to footnote b to Table SA9.1, if a heater is intended to be shipped with the legs detached, the tests are to be conducted with the legs in place, as well as detached.		N/A
SA8.2	If the removal of feet or other supports results in operation of protective devices during the temperature test, such operation is not considered to be unacceptable if, when the test is repeated with the parts replaced in the intended manner, there is no operation of the protective devices.		N/A
SA9	Normal Temperature Test		N/A

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Clause	Requirement Test	Result	Remark	Verdict
SA9.1	General			N/A
SA9.1.1	For both normal temperature and abnormal operation tests, the heater is to be located in a wall angle as described in SA9.1.2.			N/A
SA9.1.2	A heater is to be placed in the intended manner against the black-painted surface of a wall consisting of 3/8 inch (9.5 mm) thick plywood fastened to both shorter sides of trade size 2 by 4 inch vertical wooden studs on 16 inch (0.4 m) centers. Two or more such walls are to be fastened together to form a 90 degree angle, and the height and length of the walls are to be such that they extend not less than 2 feet (0.6 m) beyond the physical limits of the heater. The heater is to be located as close to the sides of the wall angle as its construction permits, and it is to be so placed relative to the walls that maximum heating occurs on the latter.			N/A
SA9.1.3	The temperature limiting control of a heater shall not function when the heater is operated in accordance with SA9.1.4.			N/A
SA9.1.4	A heater shall be tested under the applicable conditions in accordance with SA9.1.2 and the following.			N/A
	a) If carpeting or equivalent material can be laid flat on the floor under the heater between the supporting legs, the heater shall be tested with such materials so placed and pushed as far back as the construction permits.			N/A
	b) If guards or other design features prevent carpeting or equivalent material from being laid flat on the floor under the heater, the test shall be made with such material as close to the heater as the heater construction permits.			N/A
SA9.1.5	To simulate carpeting, 3/4 inch (19 mm) thick felt pads are to be used and are to be located as specified in SA9.1.4.			N/A
SA9.2	Normal temperature			N/A
SA9.2.1	A heater, when tested under the conditions described in this section, shall not attain a temperature at any point sufficiently high to constitute a risk of fire or to affect injuriously any material employed in the heater, nor show temperature rises at specific points greater than those indicated in Table SA9.1.			N/A
SA9.2.2	All values in Table SA9.1 are based on an assumed ambient (room) temperature of 25°C (77°F), but a test may be conducted at any ambient temperature within the range of 10 – 40°C (50 – 104°F).			N/A
SA10	Padded Surface and Blanketing Test			N/A
SA10.1	When tested in accordance with SA10.2 and SA10.3, a heater shall not cause the cheesecloth, felt, blanket material, or wood to glow or flame.			N/A

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Clause	Requirement Test	Result Remark	Verdict
SA10.2	A wood surface covered with a 1 inch (25.4 mm) thick felt pad, and with the pad, in turn, covered with a double layer of cheesecloth, is to be supported in a vertical position as near the heater as the construction of the latter permits. The heater sections are to be covered to such an extent as to produce maximum heating of the cheesecloth, and the padded surface is to extend at least 3 inches (76 mm) above the top surface of the heater. During the test, the covered wood surface is to be moved horizontally 1/2 inch (12.7 mm) away from its initial position to determine the effect of further ventilation. The wood surface is to be sufficiently rigid construction so that it does not change shape (bow or warp) during the test.		N/A
SA10.3	While still operating as described in SA10.2 with the padded vertical surface in its initial position in front of the heater, four thicknesses of loosely folded cotton blanket material are to be introduced into the space between the vertical padded surface and the vertical wall on which the heater is mounted so that the upper slot of the heater is blocked. To produce the most adverse operating condition, the folded blanket material is to be located so that any sensing device provided is exposed. A length of folded material up to a maximum of 80 inches (2.03 m) is to be used, but a shorter length of the material may be introduced into space at any one time to obtain the most adverse operating conditions possible. Operation in any one blocked condition is to be continued until constant temperatures are obtained, or until glowing or flaming of the cotton blanket, material results. A typical test setup is shown in Figure SA10.1.		N/A
SA11	Curtain Drape Test		N/A
SA11.1	When tested in accordance with SA11.2, a heater shall not cause a curtain draped in front of it to glow or flame.		N/A
SA11.2	The upper edge of a simulated curtain at least 3 feet (0.9 m) high, but long enough to be supported at least 1 foot (305 mm) above the heater in any case, is to be continuously attached to the wall at the base of which the heater is installed. The curtain is to consist of white duck as specified in SA9.1.5 and an overlay of a double layer of cheesecloth on the side facing the heater, and is to be hung so that the lower edge just touches the floor. During the test, the entire length of the heater is to be initially covered and the curtain is to be arranged to conform as closely as possible with the contour of the heater. Those sections judged to be least likely to affect the operation of the limit control are to be covered. This test shall then be repeated with first:		N/A
a) 3/4	of the heater covered, then with		N/A

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Clause	Requirement Test	Result Remark	Verdict
b) 1/2	of the heater covered, and then with		N/A
c) 1/4	of the heater covered.		N/A
	Each test shall be conducted with the heater at room ambient at the start of the test.		N/A
SA12	Shredded Paper Test		N/A
SA12.1	If the guard described in SA2.2.1 is not provided, there shall be no glowing or flaming of dry, shredded newspaper while a heater is in operation under otherwise intended conditions. The newspaper is to be introduced in any quantity and position in the open slots to attain the most adverse operating conditions.		N/A
	MANUFACTURING AND PRODUCTION TESTS		
SA13	General		N/A
SA13.1	Each heater shall be subjected to the tests indicated in SA13.2 – SA13.8.		N/A
SA13.2	The current (or power) input to each heater when connected to rated voltage shall not be more than 105 percent of the rated current (or power).		N/A
SA13.3	The input may be determined by direct measurement of current (or power), or it may be determined indirectly by measurements of resistance and appropriate computation.		N/A
SA13.4	Each heater shall withstand without breakdown the test potential specified in SA13.5, applied between live parts and dead metal parts.		N/A
SA13.5	The test potential is to be applied for 1 minute and is to be 1000 volts if the heater is rated at 250 volts or less and is to be 1000 volts plus twice rated voltage if the heater is rated at more than 250 volts; except that the duration may be reduced to 1 second if the value of the test potential is 120 percent of that specified above.		N/A
SA13.6	Periodically, two samples of the heater shall be tested for compliance with SA13.2 using instruments that comply with the following:		N/A
	a) The accuracy is to be 1 percent of full-scale value or better.		N/A
	b) The instrument is to have a full-scale deflection not more than 3-1/3 times the value to be measured.		N/A
	c) The smallest scale division of the instrument is to be in accordance with Table SA13.1.		N/A
	d) The instrument is to be calibrated at least once per year by comparison with a Standard that is traceable to the National Institute of Standards and Technology.		N/A

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Clause	Requirement Test	Result Remark	Verdict
SA13.7	The manufacturer shall test each heater provided with a power-supply cord incorporating a grounding conductor to determine that electrical continuity exists between an exposed dead metal part of the heater and the grounding blade of the attachment plug.		N/A
SA13.8	For the test mentioned in SA13.7, the manufacturer is to employ an indicating device such as an ohmmeter or a low-voltage battery-and-buzzer combination.		N/A
	MARKING		
SA14	Details		N/A
SA14.1	Each heater shall be marked in accordance with the following:		N/A
	a) A permanent marking on the heater where it is readily visible from the exterior of the heater (see SA14.2) after the heater is positioned as intended. The marking shall include the word "WARNING" and the following or equivalent wording– "Risk of fire, keep electrical cords, draping, and other furnishings at least 3 feet (0.9 m) from the front of the heater and away from the side and rear." The marking shall be letters not less than 1/8 inch (3.2 mm) in height and shall be of a permanent type and a color that contrasts with that of the enclosure and background.		N/A
	b) A tag in accordance with 67.13 and 67.14.		N/A
SA14.2	"Readily visible" in SA14.1(a), means visible from a point 5 feet (1.5 m) above the floor and between 1 and 4 feet (0.3 and 1.2 m) away from the front surface of the heater.		N/A
	SUPPLEMENT SB – HEATERS INTENDED FOR USE IN BATHROOMS, LAUNDRY AREAS AND SIMILAR INDOOR LOCATIONS		N/A
	INTRODUCTION		
SB1	Scope		N/A
SB1.1	These requirements cover movable electric heaters intended for use in bathrooms, laundry areas and similar indoor locations. These requirements add to the applicable requirements in the body of this Standard.		N/A
SB1.2	The determination of whether this supplement applies to a particular heater shall include a review of the product packaging, instruction manuals, stuffer sheets or other literature packaged with the product.		N/A
	CONSTRUCTION		

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Clause	Requirement Test		Result Remark	Verdict
SB2	Enclosure			N/A
SB2.1	There shall be no wetting of uninsulated live parts when tested as outlined in SB10.1 – SB12.3. The attachment plug of the power supply cord is excluded from this requirement.			N/A
	Exception No. 1: Heaters incorporating integral IDCI protection need not comply with this requirement.			N/A
	Exception No. 2: Heaters incorporating integral GFCI protection need not comply with this requirement.			N/A
	Exception No. 3: Heaters incorporating an integral protective device designed to de-energize all current carrying parts within the heater except the power supply cord when the heater is tested as outlined in SB10.1 – SB12.3.			N/A
SB2.2	If water enters the heater enclosure during the tests described in SB10.1 – SB12.3, the water shall drain from the heater without collecting when the heater is repositioned to the normal operating position.			N/A
SB3	Current-Carrying Parts			N/A
SB3.1	A heater shall not employ current-carrying parts of dissimilar metals that, when used in combination with each other, may deteriorate or corrode due to galvanic action.			N/A
	Exception: A connection of current-carrying parts that is within a hermetically sealed enclosure is not considered to be exposed to moisture.			N/A
SB4	Thermal Insulation			N/A
SB4.1	Thermal insulation used in a heater shall not contact uninsulated live parts of that heater.			N/A
SB5	Immersion Detection Circuit Interrupters (IDCI'S)			N/A
SB5.1	If a heater is provided with a resettable IDCI, the IDCI shall include a supervisory circuit that provides for testing of the ability of the IDCI to interrupt all power to the heater. The supervisory circuit shall be such that the entire sensor circuit (including sensor conductors within the heater enclosure and the sensor conductors in an interconnecting cord between the heater and the IDCI) and the IDCI would be tested. The supervisory circuit shall be suitable for a minimum 6000 cycles of operation.			N/A
	Exception: If actuation of the supervisory circuit is intended to occur when the heater is moved, shaken or otherwise manipulated in a deliberate manner, the supervisory circuit shall be suitable for a minimum 30,000 cycles of operation.			N/A
SB5.2	Parallel connection of individual sections of the sensor circuit may be provided if each connection is mechanically secure and provides reliable electrical contact. Lock washers or other equivalent means to prevent loosening are required if wire-binding screws and nuts are used. Soldered connections are not acceptable.			N/A

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Clause	Requirement Test	Result Remark	Verdict
SB5.3	With respect to SB5.1, operation of the supervisory circuit shall not require the use of a tool.		N/A
SB5.4	The results of the test required in SB5.1 shall be indicated by means of an audible, visible, or audible and visible signal.		N/A
SB5.5	A resettable IDCI shall be trip-free such that automatic tripping is independent of the manipulation or position of the reset button, handle, lever, or the like of the IDCI.		N/A
SB5.6	The sensor conductor within the heater shall be considered an uninsulated live part, and electrical spacings from it to uninsulated live parts of opposite polarity and to accessible dead metal parts shall be maintained as specified in 35.1.		N/A
SB5.7	The interconnecting cord between an IDCI and the heater enclosure shall comply with Table 16.1.		N/A
	Exception: The size of the conductor used as the sensor conductor may be smaller than 18 AWG, but no smaller than 24 AWG.		N/A
SB5.8	The material, construction, and location of a sensor shall be such that the intended functioning of the IDCI will not be adversely affected by corrosion, exposure to abnormal operating conditions, and the like as determined in accordance with SB10.1 – SB12.1.		N/A
SB5.9	A metal sensor shall not be fabricated of iron or steel.		N/A
	Exception: Stainless steel or other corrosion-resistant alloys may be used.		N/A
SB6	Ground Fault Circuit Interrupters (GFCI'S)		N/A
SB6.1	If a heater is provided with a GFCI, the GFCI shall comply with the requirements for a Class A cord connected GFCI described in the Standard for Ground Fault Circuit Interrupters, UL 943.		N/A
SB7	Other Protective Devices		N/A
SB7.1	A protective device provided to de-energize current-carrying parts as described in SB10.1 shall be reliable and suitable for the application with respect to its electrical ratings, ambient operating temperature, resistance to electrical transients, resistance to moisture and resistance to mechanical abuse.		N/A
SB7.2	If a heater is provided with a resettable protective device, the device shall incorporate a supervisory circuit as described in Section SB5 for IDCI's or in the Standard for Ground Fault Circuit Interrupters, UL 943.		N/A
SB8	Switches		N/A
SB8.1	A switch included for the testing of a resettable protective device shall be marked "test", "test switch", or the equivalent.		N/A
SB8.2	A through-cord switch shall not be included.		N/A

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Clause	Requirement Test		Result Remark	Verdict
	Exception: A through-cord switch may be employed, provided that it is located no more than 12 inches (30.5 cm) from the end of the power supply cord. The distance shall be measured from the face of the attachment plug to the plane surface of the switch enclosure closest to the heater.			N/A
SB9	Grounding			N/A
SB9.1	All exposed dead metal parts of a heater that are likely to become energized shall be electrically connected to the equipment grounding conductor of the power supply cord. The articulate probe (Figure 8.3) shall be used to determine accessibility of exposed dead metal parts.			N/A
SB9.2	With respect to SB9.1, dead metal parts rendered inaccessible by covers, knobs, buttons and the like secured by friction or snap fit shall be tested as described in SB9.3.			N/A
SB9.3	Parts described in SB9.2 shall be subject to a direct pull of 3 pounds (13.34 N) force applied for a period of one minute. The force is to be applied to the points most likely to result in displacement of the part. The part shall not separate from its intended position or render the dead metal parts accessible as determined in SB9.1.			N/A
	PERFORMANCE			
SB10	Immersion Leakage Current Tests			N/A
SB10.1	General			N/A
SB10.1.1	Heaters shall be subjected to the tests described in SB10.1.4 – SB12.1. The results are acceptable if the leakage current is no more than 5 mA or if a protective device trips, causing the flow of current to ground to cease within the time interval, T, in accordance with the relationship:			N/A
	when the current to ground, I, is within the range of 6 milliamperes to 264 milliamperes. In the relationship, I is the current to ground in milliamperes rms, and T is the interval in seconds. Unless otherwise specified, leakage current is to be measured throughout the test as described in SB10.1.2 and SB10.1.3 until stabilized conditions are attained.			N/A
SB10.1.2	A protective device which de-energizes current carrying parts as described in SB10.1.1 shall not reset automatically.			N/A

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Clause	Requirement Test	Result	Remark	Verdict
SB10.1.3	A heater is to be tested while connected to a power supply adjusted to a voltage as determined by Table 40.2. The tests are to be conducted with the heater in various configurations (including the orientation that results in the most unfavorable condition of use) as follows: with the heater switch in the off position, with the heater switch in the on position, and with the heat/fan switches in the most disadvantageous settings. Each test is to be conducted with the supply circuit in one polarity and then with the polarity reversed.			N/A
SB10.1.4	Each sample is to be tested in a tank made of nonconductive material and isolated from earth ground. A nominal 0.005 inch (0.13 mm) thick, 1 inch (25.4 mm) wide copper electrode is to be placed in the base of the tank in the vicinity of the heater under test. The length of the electrode on the tank base shall be equal to the largest longitudinal distance on the base of the heater. The overall length of the electrode and its associated wiring is not specified. Unless otherwise specified, the position of the electrode is to be adjusted to yield the highest leakage current and the longest trip time for any protective device that may be provided. Leakage current is to be measured through a 500 ohm resistor shunted by a 0.47 uF capacitor connected in series with the electrode and the grounded conductor of the power supply. If a protective device is provided to de-energize the heater under the following test conditions, the trip time of the device is also to be measured. These tests shall be conducted two times, with water having a resistivity of 300 ohm-cm and 20,000 ohm-cm.			N/A
SB10.2	Rising water immersion			N/A
SB10.2.1	A heater is to be placed in the bottom of the tank within 1 inch (25.4 mm) of the copper electrode. Water is to be introduced into the tank through a nonconducting tube at a rate of approximately 17 ounces (0.5 liter) per minute until the heater is completely immersed, begins to float or until an integral protective device of the type described in Section SB5, SB6, or SB7 de-energizes the heater.			N/A
SB10.2.2	The test described in SB10.5 is to be conducted using an untested heater with each unit resting on a different external surface for each test. A six-sided heater would be tested using a total of six heaters.			N/A
SB10.3	Drop immersion			N/A

UL 1278				
Clause	Requirement Test	Result	Remark	Verdict
SB10.3.1	The tank is to be filled with water to a depth equaling the height of the heater plus 1 inch (2.54 cm) with a minimum depth of 12 inches (30.5 cm). The height of the heater is to be determined with the product in its normal intended position and measured from the plane surface on which the heater rests to the plane surface intersecting the uppermost point of the heater enclosure.			N/A
SB10.3.2	An untested unit is to be used for each drop immersion. The unit is to be individually dropped from a height of 6 inches (152.4 mm) above the water surface on each external enclosure surface and at other orientations which may yield less advantageous results.			N/A
SB10.4	Tip-over immersion test			N/A
SB10.4.1	The tank is to be filled with water to a depth of 3/8 inch (0.95 cm). The test is to be performed with an untested heater energized and tipped to its critical angle of balance and permitted to fall over in each possible direction from its normal standing position.			N/A
SB10.5	Saturation immersion test			N/A
SB10.5.1	This test is to be performed on two previously untested unenergized heaters. Each heater is to be placed in a water reservoir filled with 300 ohm-cm water to a height that completely covers the heater. Following one hour of immersion, the heater is to be removed from the water, dried externally and manipulated to allow water to leave its interior, and then stored for a minimum of 23 hours at 25 ±3°C. The process is to be repeated for a total of 10 cycles. The attachment plug of the heater is not to be immersed for this test.			N/A
SB10.5.2	For the test method described in SB10.5.1, the test unit is to be subjected to a Leakage Current Test following each cycle and a Dielectric Voltage-Withstand Test at the conclusion of the tenth cycle. The Leakage Current Test is to be conducted in accordance with Section 39. The Dielectric Voltage-Withstand Test is to be conducted in accordance with Section 48, except that the test potential shall be 2500 volts. Electrical contacts of safety devices and mechanical operating members of the devices shall be functional at the conclusion of this test.			N/A
SB11	Dew Point Test			N/A

UL 1278				
Clause	Requirement Test	Result	Remark	Verdict
SB11.1	Two previously untested heaters are to be conditioned in a cold chamber at 5.0 ±2°C (41.0 ±3.6°F) for 4 hours and then transferred immediately into a humidity chamber at 88% ±2% relative humidity at 32 ±2°C (89.6 ±3.6°F) for 15 minutes. The transfer time is not to exceed one minute. Immediately after being placed in the humidity chamber, the leakage current is to be measured as described in Leakage Current Test, Section 39, with each heater connected to the intended branch circuit but not operating. At the conclusion of the Leakage Current Test, each heater is to be removed from the humidity chamber and immediately is to be subjected to a Dielectric Voltage-Withstand Test as described in Section 48 except that the test potential is to be 2500 volts.			N/A
SB12	Splash Test			N/A
SB12.1	A heater is to be mounted as intended on a flat insulating surface for this test. Water with a resistivity of 300 ohms-cm is to be splashed in one motion onto the heater in a manner which is most likely to cause wetting of electrical components. The splashing is to include a direct splash onto any openings in the heater enclosure and an indirect splash where the water first strikes an adjacent surface. Leakage current is to be measured as described in Leakage Current Test, Section 39, except that the resistor is to be 500 ohms and the capacitor 0.47 uF.			N/A
SB12.2	The test described in SB12.1 is to be conducted using untested heaters. Three test quantities of water are to be splashed onto the heater: 6 ounces (175 ml), 1 gallon (3.75 liters), and 20 gallons (75.7 liters).			N/A
SB12.3	If the heater is intended for wall mounting, the Splash Test is also to be conducted with the heater mounted as intended.			N/A
	MANUFACTURING AND PRODUCTION TESTS			
SB13	Production Line Trip-Time Measurement			N/A
SB13.1	The manufacturer shall test each heater which incorporates a resettable protective device provided to comply with the tests described in Sections SB10 – SB12, to determine that the device interrupts power to the heater within 25 ms when the water immersion sensor is contacted by a probe connected to earth ground.			N/A
	Exception: This test does not apply to heaters incorporating a GFCI or ALCI located in the attachment plug of the power supply cord.			N/A
SB14	Test Button Activation			N/A

UL 1278			
Clause	Requirement Test	Result Remark	Verdict
SB14.1	The manufacturer shall test each heater which incorporates a resettable protective device provided to comply with the tests described in Sections SB10 – SB12, to verify that the test circuit is functional.		N/A
	MARKINGS		
SB15	Details		N/A
SB15.1	A heater incorporating a resettable protective device, provided to comply with the tests described in Sections SB10 – SB12, shall be marked in accordance with the following:		N/A
	a) A permanent marking on the heater or protective device adjacent to the test button indicating "Test".		N/A
	b) A permanent type hang tag attached to the flexible cord near the protective device housing. The tag is to include the word "WARNING" a minimum 1/8 inch (3.2 mm) high letters. Following that, the hang tag is to provide instructions regarding the operation of the test button, including identifying its location, and to make reference to the operating instruction manual. It should state "To reduce the risk of electric shock, do not immerse, remove, modify or replace this plug and do not place your heater where it could easily fall into water ."		N/A
SB15.2	With respect to SB15.1(b), the hang tag shall comply with the Test for Permanence of Cord Tags, Section 54.		N/A
SB16	Instructions for Use and Care		N/A
SB16.1	The instruction manual is to include instructions regarding the safety test circuit operation and the following statement. "CAUTION: ALTHOUGH THIS DEVICE IS PROVIDED WITH PROTECTION WHICH REDUCES THE RISK OF ELECTRIC SHOCK, THIS PRODUCT SHOULD NEVER BE USED NEAR WATER."		N/A
SB16.2	The instruction manual shall not include Part 7 of 68.2.1.		N/A
	SUPPLEMENT SC – MOVABLE ELECTRIC ROOM HEATERS WITH SEMICONDUCTOR HEATING ELEMENTS		
	INTRODUCTION		
SC1	Scope		P

UL 1278			
Clause	Requirement Test	Result Remark	Verdict
SC1.1	These requirements cover movable electric room heaters employing semiconductor heating elements having a positive resistance/temperature coefficient (PTC) and self-limiting temperature characteristic. They typically employ electronic fan and/or temperature controllers. These requirements add to the applicable requirements in the body of this Standard.		P
	CONSTRUCTION		
SC2	Heating Element		P
SC2.1	A semiconductor heating element shall comply with the requirements for thermistor-type devices.		P
	Exception: A device employed in a heater which complies with the requirements of the Endurance Test, Section SC12 need not comply with the requirements for the thermistor-type devices.		N/A
SC2.2	If the leads or electrode connections to the semiconductor heating element are not an integral part of the element, or are different from those employed during any prior investigation of the element, then the heater shall be subject to the requirements of the Endurance Test, Section SC12.		P
SC3	Fan Speed Control, Semiconductor Type		P
SC3.1	A fan speed control that uses semiconductors to regulate the speed of a motor shall comply with the requirements of the Standard for Solid-State Fan Speed Controls, UL 1917. Refer to Section SC9.		P
SC4	Switches		P
SC4.1	A switch that directly controls a semiconductor heating element shall have either:		P
	a) A suitable "T", "L", or "TV" rating, or		P
	b) A current rating more than six (for alternating-current) or ten (for direct-current) times the rating of the load, or,		P
	c) A current rating equal to or greater than the values determined when the product is tested in accordance with Input Current Test, Section SC13.		P
SC4.2	A switch that does not have one of the ratings specified in SC4.1 shall be subjected to the tests described in Overload and Endurance Test, Section SC14. There shall not be any electrical or mechanical malfunction of the switch. At the conclusion of the test, the switch shall be capable of performing its normal function and there shall not be any loosening of parts or any other defect that will appreciably diminish the usefulness and reliability of the switch.		P
	PERFORMANCE		
SC5	General		P

UL 1278			
Clause	Requirement Test	Result Remark	Verdict
SC5.1	During the Normal Temperature and Abnormal Operations Tests, the room heater shall be energized in accordance with 40.1.9.		P
	Exception: Air heaters which are not marked with a fixed wattage such as "1500 watts" but are marked to reflect a variable maximum input, such as "1500 watt maximum" or "up to 1500 W", shall be tested at the applied voltage value which results in maximum input to the heater, but not less than 95 percent of the marked maximum wattage rating. See 40.1.2 for allowable ambient temperature conditions.		P
SC6	Input Test		P
SC6.1	To determine if a heater complies with the requirements of Section 36, the power input is to be measured both with and without any filter, which is provided by the manufacturer and which is removable by the user.		P
SC7	Normal Temperature Test		P
SC7.1	Temperatures shall comply with 40.1 when the Normal Temperature Test is conducted in accordance with 40.3 and as noted in SC7.2.		P
SC7.2	The test is to be conducted with the back of the air heater against the alcove wall. The test is to be conducted both with and without a removable filter in place. If maximum input is not obtained with the air heater in the corner, the test is to be repeated with the heater moved away from the corner by the minimum distance needed to obtain the maximum wattage required by SC5.1. For an air heater that employs adjustable controls for heat or fan speed settings, tests at lower heat and fan speed settings shall also be conducted if the lower settings may produce higher temperatures within the air heater or on the test enclosure. The fan speed shall be recorded for each heat and fan speed setting.		P
SC8	Low Ambient Temperature Starting Test		P
SC8.1	When tested in accordance with SC8.2, a fuse placed in series with the heater and power supply shall not open.		P
SC8.2	In order to determine compliance with SC8.1, three representative air heaters are to be tested. Each heater is to be connected to the power supply through a nontime delay type fuse with a rating equal to that of the attachment plug on the heater supply cord. It is then to be placed in a cold chamber adjusted to produce an air temperature of minus 17.7°C (0°F). The air heater shall be maintained at this temperature until thermal equilibrium. It is then to be energized at rated voltage and observed for operation of the fuse. The test is to be repeated with the heater maintained at a temperature of 0°C (32°F).		P
SC9	Restricted Inlet, Abnormal Operation Test		P

UL 1278			
Clause	Requirement Test	Result Remark	Verdict
SC9.1	The heater shall not show evidence of:		P
	a) Emission of flame, molten metal, flaming or glowing particles, or flaming drops,		P
	b) Risk of electric shock (see Accessibility of Live Parts, Section 8, and Internal Wiring, Section 20), or		P
	c) Injury to persons (see Protection Against Injury to Persons, Section 9, and Guarding of Heating Elements, Section 10) when placed on a softwood surface covered by white tissue paper and operated as described in SC9.2.		P
SC9.2	With the heater operating at rated voltage, the air-inlet opening is to be gradually and uniformly restricted until the opening is completely blocked at the end of 30 minutes or until a temperature limiting control opens the circuit, whichever occurs first. Operation is to continue until temperatures of electrical components, wiring, enclosure surface, and the like, have stabilized.		P
SC10	DC Offset Voltage Temperature Test		N/A
SC10.1	Temperatures shall comply with 40.1 when the DC offset voltage test is conducted in accordance with SC10.2.		N/A
SC10.2	A heater having an AC motor that includes or that is intended for use with a solid-state speed control is to be operated under each of the following conditions. The integral appliance speed control shall be bypassed while the offset potential is applied to the motor. The heating element and other electrical components in the heater shall be connected to the supply source and not to the offset voltage supply:		N/A
	a) At the speed and, if applicable, the rotation direction resulting in maximum motor temperatures. During this test the heater is to be connected to the load side of a triac. The triac is to be provided with associated circuitry allowing it to be triggered during each half-cycle of the ac input to the heater. Speed control is to be accomplished by varying the trigger points.		N/A
	b) Connected and tested as described in (a) with a 2 volt dc offset potential applied to the ac heater input voltage by a suitable method. The 2 volt dc offset potential may be obtained by using a modified speed control having routing diodes and dual triggering circuits to allow independent adjustment of the positive and negative 1/2 cycle triac triggering points. The triggering points are to be adjusted so that a 2 volt dc bias is measured on the switched ac output waveform. The dc bias may be measured by a dc volt meter having a frequency damped response in the range of 0 – 120 hertz.		N/A

UL 1278				
Clause	Requirement Test	Result	Remark	Verdict
	c) With the heater connected to an ac supply modified to produce half-wave output. The supply is to be switched from sinusoidal to half-wave output after the heater is operating at its maximum rating. This test is to be conducted in the rotation direction, if reversible, and speed control setting resulting in maximum motor temperatures. If the fan motor shaft will not continue to rotate in a manner considered to be a possible normal condition after the supply is switched from sinusoidal to half-wave operation, the locked-rotor temperature requirements described in SC10.3 shall be used instead of the maximum temperature rises specified in Table 40.1.			N/A
SC10.3	If the fan motor shaft does not rotate or rotates in a manner not considered to be normal after the supply is switched from sinusoidal to half-wave operation as described SC10.2(c) or, the motor will not restart when operated from a half-wave source after the motor is de-energized, the motor shall comply with the applicable temperature requirements as follows:			N/A
	a) The temperature of an impedance-protected motor shall comply with the Locked-Rotor Temperature Test requirements in the requirements for overheating protection for motors, UL 2111,			N/A
	b) The temperature of a thermally-protected motor shall comply with the Locked-Rotor Temperature Test requirements in the Standard for Overheating Protection for Motors, UL 2111, except:			N/A
	1) For a motor with an automatic reset type protective device, the temperature criteria shall not be applied during the initial cycle of the thermal protector operation and there shall be no emission of flame or molten metal, or			N/A
	2) For a motor with a nonreplaceable thermal cutoff, the temperature criteria shall not be applied if the thermal cutoff opens within the first hour and there shall be no emission of flame or molten metal.			N/A
SC11	Fan Speed Controls, Abnormal Operation Tests			N/A
SC11.1	During the applicable tests of the Abnormal Operation Tests, Section 42, there shall be no evidence of:			N/A
	a) Emission of flame, molten metal, flaming or glowing particles, or flaming drops,			N/A
	b) Risk of electric shock (see Accessibility of Live Parts, Section 8, and Internal Wiring, Section 20), or			N/A
	c) Injury to persons (see Protection Against Injury to Persons, Section 9, and Guarding of Heating Elements, Section 10) when an air heater is operated with its discrete electronic components open-circuited and short-circuited, taken one at a time.			N/A

UL 1278			
Clause	Requirement Test	Result Remark	Verdict
	Exception: The Abnormal Operation Tests of Section 42 need not be repeated if the component failures introduced into the speed control do not cause fan speed to exceed or be less than the speeds permitted by the control. Refer to SC7.2		N/A
SC11.2	A heater employing a fan speed control for which a control component failure could result in a half wave output to a motor, shall be subjected to this test. The heater shall be operated with the half wave output applied to the motor for twelve days for an impedance protected motor, or fifteen days for a thermally protected motor. During the test, the motor temperatures shall not exceed the values specified for the Locked-Rotor Endurance Test for thermally and impedance protected motors in the Standard for Overheating Protection for Motors, UL 2111. The heater shall then be subjected to the Dielectric Voltage Withstand Test of Section 48, after which the motor is to disassembled and examined for flaking, embrittlement or charring of the winding insulation.		N/A
SC12	Endurance Test		N/A
SC12.1	An air heater employing a semiconductor heating element having electrode or lead connections not previously investigated is to be subjected to the test specified in SC12.2.		N/A
SC12.2	The air heater is to be operated at maximum input as specified in SC5.1 until temperatures stabilize. The air heater is then operated by an external tandem timer control which alternately energizes the air heater and then de-energizes it. The control timer is to be adjusted so that the heating element is energized until it reaches the stabilized temperature previously observed. The air heater is then de-energized until the heating element approaches but is not less than 150°F, at which time the cycle is repeated. A total of 100,000 cycles is to be conducted in this manner. The Normal Temperature Test, Section SC7, is to be repeated under the condition which results in the higher temperature.		N/A
SC13	Input Current Test		P
SC13.1	When required in accordance with SC4.1(c), an air heater employing a switch that directly controls a semiconductor heating element shall be subjected to the test in SC13.2. An alternative test measuring circuit may be employed if it is shown to be equivalent.		P

UL 1278			
Clause	Requirement Test	Result Remark	Verdict
SC13.2	The heater is to be connected to a power supply that is switched through a zero voltage cross solid state switch with a series connected reliable fixed resistance. The resistance value is not to exceed 0.1 ohms. The load current is to be measured using a dual channel storage oscilloscope connected across the power supply and the fixed resistance. The complete air heater is then to be placed in a cold chamber adjusted to provide an air temperature of 0°C (32°F). The air heater is to be maintained at this temperature until thermal equilibrium is achieved. It is then to be energized at rated voltage and the voltage across the resistor is to be measured until thermal equilibrium. The test is to be repeated with the heater initially conditioned at a temperature of 20 – 25°C (68– 77°F).		P
SC13.3	When the tests described in SC13.1 are completed, the input steady state current is to be the calculated RMS value of the steady state voltage measured across the fixed resistance divided by the resistance value after the first 4.2 milliseconds of operation (1/4 cycle). The peak inrush current is to be calculated the same way except that the voltage peak up to and including the first 4.2 milliseconds of operation is to be used. Neither the peak inrush current nor the end steady state current shall exceed the current rating of the switch.		P
SC14	Overload and Endurance Test		P
SC14.1	Where required by SC4.2, an overload and endurance test shall be conducted on a switch that directly controls a semiconductor heating element. For these tests, the actual end product load, semiconductor heater and fan motor, is to be used. For testing convenience, the switch may be removed from the end product.		P
SC14.2	For the overload test, the air heater is to be energized from a supply source adjusted to 125 percent of rated voltage. The switch is to be operated manually by means of its actuating member or by an acceptable mechanical means for 50 cycles of making and breaking the load at a rate of 6 – 10 cycles per minute. For the endurance test the air heater is to be energized from a supply source of rated voltage. The switch is to be operated by means of its actuating member either manually or by an acceptable machine for 6000 cycles of making and breaking the load at a rate of 6 – 10 cycles per minute. The switch shall then be examined to determine compliance with paragraph SC4.2.		P
	SUPPLEMENT SD – DIRECT PLUG-IN HEATERS		
	INTRODUCTION		

UL 1278			
Clause	Requirement Test	Result Remark	Verdict
SD1	Scope		N/A
SD1.1	These requirements cover air heaters that are provided with an integral attachment plug assembly for direct plug-in of the heater to a wall mounted receptacle. These requirements add to the applicable requirements in the body of this Standard.		N/A
	CONSTRUCTION		
SD2	General		N/A
SD2.1	A unit shall be formed and assembled so that it will have the strength and rigidity necessary to resist the abuses to which it is likely to be subjected, without producing or increasing a risk of fire, electric shock, or injury to persons due to total or partial collapse with resulting reduction of spacings, loosening or displacement of parts, or other serious defects.		N/A
SD2.2	A unit shall have all parts reliably secured in place.		N/A
SD2.3	A unit shall be constructed so that it will not be necessary to open or remove the enclosure when the unit is used as intended.		N/A
SD2.4	The maximum acceptable moment, center of gravity, dimensions, and weight of a unit shall comply with the requirements specified in (a) – (d). See SD2.6:		N/A
	a) The quotient of WY/Z shall not exceed 48 ounces (1361 g).		N/A
	b) The quotient of WY/S shall not exceed 48 ounces.		N/A
	c) The product of WX shall not exceed 80 ounce-inches (0.56 N·m).		N/A
	d) The weight of a unit shall not exceed 28 ounces (794 g).		N/A
SD2.5	Definitions for the symbols used in SD2.4 are as follows:		N/A
	W is the weight of the unit in ounces (g).		N/A
	Y is the distance illustrated in Figure SD2.1 in inches (mm).		N/A
	Z is the lesser of the two distances, Z1 or Z2, as illustrated in Figure SD2.1 in inches (mm).		N/A
	S is the lesser of the two distances, S1 or S2, as illustrated in Figure SD2.1 in inches (mm).		N/A
	X is the greater of the two distances, X1 or X2, as illustrated in Figure SD2.1 in inches (mm).		N/A
SD2.6	When inserted in a parallel-blade duplex receptacle, any part of a unit, including a mounting tab or output wiring, shall not interfere with full insertion of an attachment plug into the adjacent receptacle. See Figure SD2.2.		N/A

UL 1278			
Clause	Requirement Test	Result Remark	Verdict
	Exception: A unit that renders the adjacent receptacle completely unusable in any one mounting position is acceptable.		N/A
SD2.7	A mounting tab shall not be provided with a unit unless all of the following conditions are met:		N/A
	a) The unit is intended for use on a 15-ampere, 125-volt receptacle;		N/A
	b) A screw is provided and constructed so as to secure the mounting tab of the unit to a parallel-blade duplex receptacle that has a center screw. See Figure SD2.2;		N/A
	c) For a unit without a grounding pin, the mounting tab is constructed so that the unit may be mounted to both grounding and nongrounding receptacles.		N/A
SD2.8	The moment and weight specified in SD2.4 are to be determined as follows:		N/A
	a) For units with directly mounted accessories, the values are to be measured with the accessories in place.		N/A
	b) A mounting tab is not to be included in measurements of the linear dimensions for the purpose of determining moments unless:		N/A
	1) The tab and enclosure withstand the impact described in SD10.1 with one impact on the tab itself, without deformation, and		N/A
	2) For a polymeric-enclosed unit having an integral tab, the tab and enclosure do not distort at temperatures to which the material may be subjected under conditions of normal and abnormal use as determined by the mold stress-relief distortion test in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.		N/A
SD3	Enclosure		N/A
SD3.1	A unit shall be provided with an enclosure that shall house all current-carrying parts other than primary blades. The enclosure shall have the strength and properties necessary to reduce the risk of mechanical damage to the various parts.		N/A
SD3.2	The enclosure of a unit shall be capable of being gripped for removal from the receptacle to which it is connected, and the perimeter of the face section from which the blades project shall not be less than 5/16 inch (7.9 mm) from any point on either blade.		N/A
	Exception: For tab-mounted units intended for use with fixed systems, the perimeter of the face section may be not less than 1/4 inch (6.4 mm) from any point on either blade.		N/A
SD4	Input Connections		N/A
SD4.1	The integral blade assembly shall comply with the construction requirements in the Standard for Attachment Plugs and Receptacles, UL 498.		N/A
SD5	Grounding		N/A

UL 1278				
Clause	Requirement Test	Result	Remark	Verdict
SD5.1	All dead metal parts that are exposed or that are likely to be touched by a person during intended operation or adjustment of the unit, and that are likely to become energized through electric fault, shall be conductively connected to the grounding member (pin). For units intended for semipermanent installation, a metal mounting tab may serve as the grounding member.			N/A
	Exception: A metal part, such as an adhesive-attached metal foil marking, a screw, or a rivet separated from wiring and spaced from uninsulated live parts as if it were a grounded part need not be connected to the grounding member.			N/A
SD5.2	A grounding pin, if employed on the unit, shall be conductively connected to accessible metal parts. For units not having accessible dead metal parts, the grounding pin shall be connected to:			N/A
	a) The core of a transformer or motor and			N/A
	b) Other internal dead metal parts.			N/A
SD6	Blade Secureness Test			N/A
SD6.1	Each blade and the grounding pin, if provided, shall withstand a direct pull of 20 pounds (89 N) for 2 minutes without loosening. The two blades tested together shall also withstand a direct pull of 20 pounds for 2 minutes without loosening. Three samples are to be tested.			N/A
SD7	Security of Input Contacts Test			N/A
SD7.1	The plug-in blades and the grounding pin shall not loosen to a degree that would introduce a risk of fire or electric shock as a result of the tests described in SD7.2 and SD7.3.			N/A
SD7.2	A unit is to be rigidly supported in the blades-up position. Each blade, in turn, is to be individually subjected to a force of 30 pounds (133 N) applied gradually along the longitudinal axis of the blade in a direction towards the face of the unit. The 30-pound force is to be maintained for 1 minute. Three samples are to be tested.			N/A
SD7.3	The same samples are to be retested by being positioned as described in SD7.2 and subjecting both blades and the grounding pin, if provided, in combination, to a single applied force of 40 pounds (178 N) for 1 minute.			N/A
SD8	Positioning			N/A
SD8.1	A direct plug-in heater whose acceptable performance and visibility of controls depends upon its proper location or position shall be marked (such as "Top " or "Bottom") to indicate the way in which it is to be installed or used and shall have provision for rotation about its plug assembly so that the heater is mounted with its top surface facing up.			N/A
SD9	Abuse Tests – General			N/A

UL 1278				
Clause	Requirement Test	Result	Remark	Verdict
SD9.1	The enclosure of a unit shall withstand the applicable mechanical abuse tests described in SD10.1 – SD12.1 without:			N/A
	a) Making live parts accessible, or			N/A
	b) Producing any other condition that would result in a risk of electric shock.			N/A
SD10	Abuse Tests – Impact Tests			N/A
SD10.1	Three samples are to be subjected to this test. Each unit is to be dropped (free fall) four times in succession from a height of 3 feet (914 mm) onto a concrete floor at least 2-1/2 inches (63.5 mm) thick covered with a nominal 1/8 inch thick vinyl tile. The impact area is to be at least 3 square feet (0.3 m2) in area. Each of the drops is to result in the impact occurring at a point on the unit different from the impact points on the other drops.			N/A
SD11	Abuse Tests – Rod Pressure			N/A
SD11.1	Any point on the product that is accessible to the rod described in SD11.2 shall be subjected to a force of 20 pounds (89 N) for 1 minute.			N/A
SD11.2	The force specified in SD11.1 is to be increased from 0 to 20 pounds (0 to 89 N) over a period of 5 seconds applied through the axis of a 1/2 inch (12.7 mm) diameter metal rod, having a flat contact end with the edge rounded to a radius of 1/32 inch (0.8 mm) to eliminate sharp edges. The force is then to be maintained at 20 pounds for 1 minute. The axis of the rod is to be perpendicular to the surface under test. During the test, the unit is to rest on a flat surface in any convenient position, and is to be energized. Leakage current between the enclosure and ground, and between any parts of the enclosure between which such currents may exist, shall not exceed the limits noted in the Leakage Current Test, Section 39.			N/A
SD11.3	Following the rod-pressure test, the unit is to be subjected to the Dielectric Voltage-Withstand Test, Section 48, and to an examination for evidence of the development of a risk of electric shock.			N/A
SD12	Abuse Tests – Resistance to Crushing			N/A
SD12.1	One sample of the unit shall withstand for 1 minute a steady crushing force of 75 pounds (334 N) applied at right angles to the mounting surfaces. The enclosure is to be tested between two parallel, flat, maple blocks, each not less than 1/2 inch (12.7 mm) thick. One block is to contain slots into which the blades of the device are to be fully inserted. The crushing force is to be applied gradually in a direction normal to the mounting surface.			N/A
SD13	Abuse Tests – Switch Retainment			N/A
SD13.1	The test in SD13.2 shall not:			N/A
	a) Cause damage to the heater's on/off switch or to the receptacle,			N/A

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Clause	Requirement Test	Result Remark	Verdict
	b) Cause the attachment pins of the plug to distort, and		N/A
	c) Cause the heater to become dislodged from the receptacle.		N/A
SD13.2	The following test shall be conducted on two samples. The maximum force necessary to operate the switch of the heater, F1, is to be determined. With the heater plugged into a receptacle, a force of four times F1 is to be applied to the switch for 1 minute. The test is to be repeated at eight times F1 for 1 minute. The force is to be applied to the free end of the switch, in line with the direction of its intended movement, and it is to be applied in each direction of the movement with the switch set at the extreme position in the direction of movement.		N/A
SD14	Abuse Tests – Rotating Plug Assembly Torque Test		N/A
SD14.1	The mechanical stop which prevents a rotating type plug from rotating shall not distort or break when the test described in SD14.2 is conducted.		N/A
SD14.2	The plug assembly shall be mounted as intended in the heater without any securement screws which are used to prevent rotation of the plug assembly. A lever 1 foot long is to be placed over the blades and secured to the blades by notches cut into the end of the lever. A 15 pound load is to be suspended from the end of the lever for a period of 1 minute in the clockwise direction. The test is to be repeated in a counter clockwise direction.		N/A
SD15	Abuse Tests – Static Load-Retainer Plate		N/A
SD15.1	The plug retainer plate shall not become dislodged when the following test is conducted: The heater is to be placed on a level surface with the front grille facing down. Any attachment plug securement screws that prevent the plug from rotating are to be removed. A small bucket containing 15 pounds of lead shot is to be applied over the plug face. The test is to be repeated with 25 and 50 pounds.		N/A
SD16	Marking		N/A
SD16.1	A unit provided with a grounding pin shall be marked with the word "CAUTION" and the following or the equivalent: "To reduce the risk of fire or electric shock connect directly to a grounding receptacle – 3-prong." This marking may be on the unit, a marking tag, or an instruction sheet packed with the unit.		N/A
SD16.2	A direct plug-in heater shall be marked with the word "WARNING" and the following or equivalent: "To reduce the risk of fire or electric shock do not use with an extension cord."		N/A
SD17	Limitations		N/A
SD17.1	A direct plug-in heater shall not be supplied with an extension cord or an extension cord set and shall be provided with the marking specified in SD16.2.		N/A
SD18	Abnormal Operation Tests		N/A

UL 1278			
Clause	Requirement Test	Result Remark	Verdict
SD18.1	Even though a direct plug-in heater shall not be used with an extension cord, the heater shall be connected to an extension cord, positioned so the top is up, if constructed according to SD8.1, and tested in accordance with Section 42, Abnormal Operation Tests.		N/A
	SUPPLEMENT SE – CONNECTED HEATERS		
	INTRODUCTION		
SE1	Scope		N/A
SE1.1	These requirements apply to connected (smart enabled) appliances with a control to receive and respond to a command from a wireless or remote location control device. These requirements add to the applicable requirements in the body of this Standard.		N/A
SE1.2	These requirements are not applicable to handheld wireless controls that can only transmit commands within line-of-sight, such as infrared transmitters.		N/A
	CONSTRUCTION		N/A
SE2	General		N/A
SE2.1	The appliance shall require the main power switch at the appliance to be in the ON position after connection to the source of supply before enabling a control at the appliance to receive and respond to a wireless or remote location command.		N/A
SE2.2	Controls of Table SE2.1 shall be incorporated at the appliance. See Table SE2.1.		N/A
SE2.3	Controls of Table SE2.1 shall be automatic, except where manual activation is indicated. See Table SE2.1.		N/A
SE2.4	A control at the appliance shall require a momentary-contact manual activation prior to enabling the appliance to receive and respond to a wireless or remote location command that initiates a heating function or increases a temperature setting. The control shall be independent of a power ON switch.		N/A
SE2.5	A manually activated control or switch shall be provided to disable any wireless or remote commands that initiate a heating function or increase a temperature setting, until manually enabled per SE2.4. This control or switch and the control of SE2.4 are permitted to be a single control.		N/A

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Clause	Requirement Test		Result Remark	Verdict
SE2.6	A visual indicator shall be provided to indicate when the appliance is in the enabled mode. The visual indicator color shall be other than red or amber. The visual indicator shall be located on the front or top surface of the heater. The visual indicator shall be visible from a point 10 feet (3 m) in front of the center of the heater and 5 feet (1.5 m) above the floor. Compliance with this requirement shall be determined while the heater is:			N/A
	a) Standing on the floor if the heater is intended for placement on the floor while in operation;			N/A
	b) Elevated from the floor by 3 feet (0.91 m) if the heater is intended for use at an elevated location (see 3.11); or			N/A
	c) Standing on the floor and also when it is elevated by 3 feet (0.91 m) for a heater intended to be used either on the floor or at an elevated location.			N/A
SE2.7	Manual activation of any control at the appliance shall disable the appliance from receiving and responding to a wireless or remote command that initiates a heating function or increases a temperature setting.			N/A
SE2.8	A movement detection system shall be provided with a moveable heater that senses if the enclosure of the appliance has moved. Upon detection of movement, the appliance shall disable any wireless or remote commands that initiate a heating function or increase a temperature setting. The movement detection system shall not be readily defeatable.			N/A
SE2.9	A control shall not permit the appliance to initiate a heating function or increase a temperature setting from a wireless or remote command at any time if any of the following are detected at the appliance:			N/A
	a) Actuation of a control of SE2.5;			N/A
	b) Activation of a protective control;			N/A
	c) An ambient temperature in excess of 30°C (86°F); or			N/A
	d) Detection of movement of the enclosure per SE2.8.			N/A
SE2.10	If any condition of SE2.9 is detected in the enabled mode, a control shall disable any wireless or remote commands that initiate a heating function from a wireless or remote control device. If a condition of SE2.9(b) or (c) is detected at any time, the appliance shall additionally disconnect the heating element from its source of supply without automatic reset. The control shall not permit the appliance to initiate a heating function or increase a temperature setting from a wireless or remote command until the condition of SE2.9 is no longer detected and the appliance is manually enabled per SE2.4.			N/A

UL 1278			
Clause	Requirement Test	Result Remark	Verdict
SE2.11	Once a wireless or remote command has activated a heating function, a control shall continue to monitor the conditions of SE2.9 and comply with SE2.10.		N/A
SE2.12	If a wireless or remote command has not been received at the appliance within 24 hours after manually enabling per SE2.4, a control shall not permit the appliance to initiate a heating function or increase a temperature setting from the a wireless or remote command. See SE5.		N/A
SE2.13	A wireless or remote command to reset (refresh) the 24 hour period of SE2.12 is permitted if the user manually selects a reset function at the wireless or remote control device or at the appliance before 24 hours has elapsed. An automatic timer reset function is not permitted.		N/A
SE2.14	Within 24 hours of initiating a heating function or increasing temperature setting as a result of a wireless or remote command:		N/A
	a) The appliance shall disconnect the heating element from its source of supply; and		N/A
	b) The appliance shall become disabled from receiving and responding to a wireless or remote location command. See SE6.		N/A
SE2.15	Operation of the appliance per SE2.14 is permitted to be extended for an additional 24 hours if the user manually selects a wireless or remote command within that time period. An automatic timer reset function is not permitted.		N/A
SE2.16	Controls for connected functions are considered operating controls with respect to 3.19 but shall be evaluated as and comply with the applicable requirements for operating or protective controls as indicated in Table SE2.1 in accordance with Controls, Section 4.3.		N/A
SE2.17	All controls of Table SE2.1 that rely on software to comply with the requirements of this Standard shall not be programmable or adjustable by individuals or through communication after its factory setting. See SE9.1.		N/A
	PERFORMANCE		
SE3	Movement Detection Test, Moveable Heaters		N/A
SE3.1	For each condition of SE3.2 – SE3.3, a movement detection system of SE2.8 shall:		N/A
	a) Sense when the enclosure of the appliance has moved; and		N/A
	b) Disable any wireless or remote commands that initiate a heating function or increase a temperature setting.		N/A

UL 1278			
Clause	Requirement Test	Result Remark	Verdict
SE3.2	The appliance shall be enabled in accordance with SE2.1 while under a non-heated state. The appliance shall be placed on a supporting surface and then lifted a minimum 4 inches (102 mm) vertically above the supporting surface within one second. A wireless or remote command to initiate a heating function shall then be selected to confirm the command was not accepted at the appliance.		N/A
SE3.3	The appliance shall then be operated in accordance with the Normal Temperature Test. The appliance shall then be enabled in accordance with SE2.1. The appliance shall be placed on a supporting surface and then lifted a minimum 4 inches (102 mm) vertically above the supporting surface within one second. A wireless or remote command to increase a temperature setting shall be selected to confirm the command was not accepted at the appliance.		N/A
SE4	Ambient Temperature Test		N/A
SE4.1	When tested under the conditions of SE4.2 – SE4.4 under any mode of operation, an automatic control of SE2.9(c) shall:		N/A
	a) Sense when the ambient environment exceeds 30°C (86°F);		N/A
	b) Disable any wireless or remote command that initiates a heating function or increase a temperature setting; and		N/A
	c) Disconnect the heating element from its source of supply without automatic reset.		N/A
SE4.2	The heating element of the appliance shall be substituted with an equivalent non-heating resistive load or equivalent method so that the appliance does not thermally affect the test environment. All other circuits and controls shall be operable for the purpose of this test.		N/A
SE4.3	The appliance shall be placed in a suitable conditioning chamber with the temperature maintained within ±1.0°C (±1.8°F) of the temperatures specified for the test. Uniform temperatures of the appliance are to be maintained by holding the ambient temperature at 25°C (77°F) or 9°C (13°F) less than the set-point temperature of the automatic control of SE2.9(c), whichever is less, until conditions of equilibrium have been established.		N/A
SE4.4	The ambient temperature is then to be raised at a rate of not more than 0.5°C (1.0°F) per minute until the automatic control of SE2.9(c) disconnects the heating element load without automatic reset and does not permit the appliance to initiate a heating function or increase a temperature setting from the a wireless or remote command or until an ambient temperature of 30°C (86°F) is exceeded, whichever occurs first.		N/A

UL 1278				
Clause	Requirement Test	Result	Remark	Verdict
SE5	Enabled Timeout Test, Initiating a Heating Function			N/A
SE5.1	When tested under the conditions of SE5.2 – SE5.3 under any mode of operation, an automatic control of SE2.12 shall:			N/A
	a) Sense when a wireless or remote command has not been received at the appliance within 24 hours after manually enabling per SE2.4 and SE2.12; and			N/A
	b) Disable any wireless or remote command that initiates a heating function.			N/A
SE5.2	The appliance shall be connected to its source of supply and manually enabled per SE2.4. The appliance shall continuously remain in this condition without receiving a remote command until 24 hours has been exceeded.			N/A
SE5.3	Within 5 minutes of exceeding 24 hours of operation, a wireless or remote command shall be transmitted to initiate a heating function to confirm the command was not accepted at the appliance.			N/A
SE6	Enabled Timeout Test, Increasing a Temperature Setting			N/A
SE6.1	When tested under the conditions of SE6.2 – SE6.3 under any mode of operation, an automatic control of SE2.12 shall:			N/A
	a) Sense when a wireless or remote command has not been received at the appliance within 24 hours after manually enabling per SE2.4 and SE2.12; and			N/A
	b) Disable any wireless or remote command that increases a temperature setting.			N/A
SE6.2	The appliance shall be connected to its source of supply and manually enabled per SE2.4. The appliance shall be operated with the heating element energized at a setting that does not permit the automatic control of SE2.9(c) from activating. The appliance shall continuously remain in this condition without transmitting a remote command until 24 hours has been exceeded.			N/A
SE6.3	Within 5 minutes of exceeding 24 hours of operation, a wireless or remote command shall be transmitted to increase the temperature setting to confirm the command was not accepted at the appliance.			N/A
SE7	Resistance to Electro Magnetic Phenomena (Immunity)			N/A
SE7.1	The appliance operating control and protective control functions shall remain operable when tested in accordance with SE7.2 – SE7.3.			N/A

UL 1278				
Clause	Requirement Test	Result	Remark	Verdict
SE7.2	Compliance with SE7.1 is determined using the communication circuit source(s) adjusted to its maximum factory setting(s) in addition to any intermediate settings that are determined to present a risk to the acceptable operation of the protective control and operating control functions. Control functions shall be tested in accordance with H.26.4 – H26.14 of the Standard for Automatic Electrical Controls - Part 1: General Requirements, UL 60730-1, as appropriate.			N/A
SE7.3	With respect to SE7.2, if it is determined that the source within the appliance or its accessory(ies) produces emissions addressed by the standard test conditions of H.26 of the Standard for Automatic Electrical Controls - Part 1: General Requirements, UL 60730-1, it is not necessary to repeat the tests.			N/A
	MARKINGS			
SE8	Details			N/A
SE8.1	The manual means of actuating the enabled mode of operation of SE2.4 on the appliance shall be clearly indicated via marking on or adjacent to the user actuator.			N/A
SE9	Instructions			N/A

UL 1278				
Clause	Requirement Test	Result	Remark	Verdict

TABLE: Critical components information

Object/part no.	Manufacturer/ Trademark	Type/Model	Technical Data	Standard	Mark(s) of Conformity
Plug	YUYAO SENHAO CABLE CO LTD	SH-2	AC 125V, 13A	UL 817	UR E522161
Power cord	YUYAO SENHAO CABLE CO LTD	HPN-R	2*16AWG, 300V, T105, VW-1 Length: >1.8m	UL 62	UR E520238
Internal wire	NINGBO HAOCHEN WIRE & CABLE CO LTD	3135	600V, T200, 16AWG	UL 758	UR E490469
Micro switch	NINGBO JIALIN ELECTRON CO LTD	KW3-OZ	16(6)A,125/250VA T120	UL1054	UR E250611
PCB	KINGBOARD LAMINATES HOLDINGS LTD	KB-5152	V-0, 130°C	UL 796	UR E123995
Current fuse	DONGGUAN REOMAX ELECTRONICS TECHNOLOGY CO LTD	MTS	T2A, 250VAC	UL 248	UR E340427
X capacitor	Shenzhen Tenta Electrical Appliance Ltd.	MEX	Rated: AC 275V, 0.1μF, X2, 100°C	UL 60384-14	UR E222911
Alternative	CHANGZHOU DEJIE OPTOELECTRONICS TECHNOLOGY CO LTD	MPX/MKP	Rated: AC 275V, 0.1μF, X2, 100°C	UL 60384-14	UR E339764
Relay	Ningbo Yongwei Electronics Co Ltd	Y3F-112DM	125/250VAC, 10A 28VDC, 10A	UL 508	UR E497292
Alternative	ANHUI MINGGUANG LIFE ELECTRIC CO LTD	BRD-SS-112LM	15A, 125VAC	UL508	UR E333244
Alternative	NINGBO HUILONGCANG ELECTRONICS CO LTD	973-12VDC-SL-A	10A, 250VAC	UL508	UR E215689
Varistor	HONGZHI ENTERPRISES LTD	HEL 7D471K	AC 275V, 40/85/21	UL1449	UR E324904
Alternative	SUZHOU XINHONGGAO ELECTRONIC CO., LTD	HXR 07D471K	AC 300V	UL1449	UR E324904
Inductor	Cixi Kaijin Electrical Appliances Co., Ltd.	EE13-0.20mH	N1: 0.33mm, 100turns	UL1278	Tested with appliance
Bobbin	CHANG CHUN PLASTICS CO LTD	T375HF	94V-0, 150°C, Min.thickness: 0.43mm	UL746C	UR E59481
Magnet wire	ZHEJIANG HONGBO TECHNOLOGY CO LTD	QA-1 155°C	155°C	UL1446	UR E221719
Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT281	130°C	UL510A	UR E165111

UL 1278			
Clause	Requirement Test	Result Remark	Verdict

Thermal cut-out	Zhong Xin Da Electrical Appliance (Shenzhen) Co., Ltd.	CH-005	125V~, 15A, Max.Tf: 85°C	UL873	UR E221650
Thermal link	Zhongshan YUANSHUN Thermal Protectors Co., LTD.	M108	AC 250V, 10A, Tf:109°C	UL 60691	UR E307315
Mica plate	HUBEI ZHONGTIAN MICA PRODUCTS CO LTD	HP5M	200°C, min thickness: 0.8mm	UL746C	UR E248686
PTC heater	CIXI ZHIDA ELECTRIC APPLIANCE CO LTD	ZD-15	120V, 1500W	UL1434	UR E313047
Synchronous motor	CIXI YOUYI MOTOR FACTORY	49TYJ	AC 110-127V, 2.5/3RPM 50/60Hz, 4W	UL1004-1	UR E498390
DC motor	Cixi Yuanyi Electrical Appliance Factory	300Y-05Y-90-2.5	DC 12V	UL 1278	Tested with appliance
DC Fan	Cixi Hongfan Electrical Appliance Co., Ltd.	RDM9025S	DC 12V, 0.20A	UL 1278	Tested with appliance
Close-end connector	HEAVY POWER CO LTD	CE2	150°C	UL 758	UR E113650
Plastic enclosure / Bottom cover	CHI MEI CORPORATION	PA-765A	Rated 94V-0, 80°C, Min. thickness: 2.1mm	UL94	UR E56070
PTC Support / Motor Support	CHI MEI CORPORATION	FR50(+)(f1)	PA66, Rated 94V-0, 105°C, Min. thickness: 0.75mm	UL94	UR E171666
Viewing window / Flame window	NINGBO ZHETIE DAPHOON CHEMICAL CO.LTD.	PC02-10R	Rated 94V-0	UL94	NGBML1604234101

Photograph Document



Overall view (Model No. XY-801)



Overall view (Model No. XY-801)

Photograph Document



Overall view (Model No. XY-801)



Overall view (Model No. XY-801)

Photograph Document

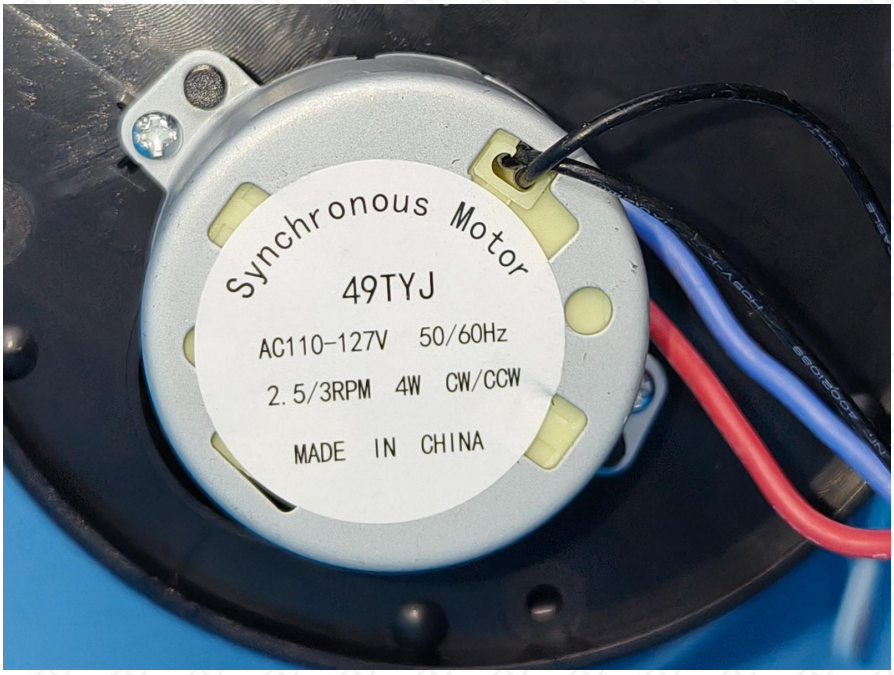


Overall view (Model No. XY-801)

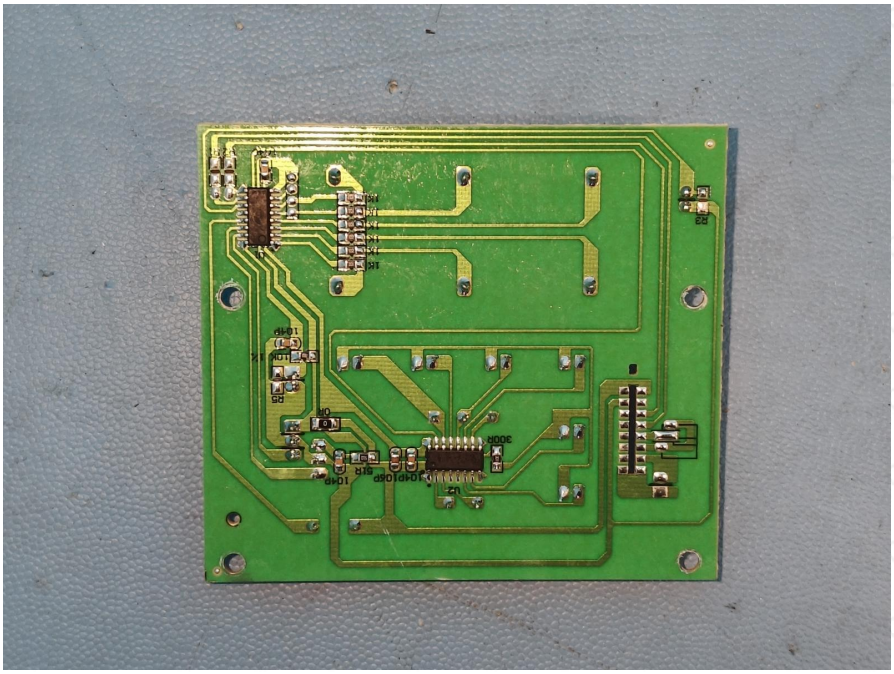


Internal view (Model No. XY-801)

Photograph Document

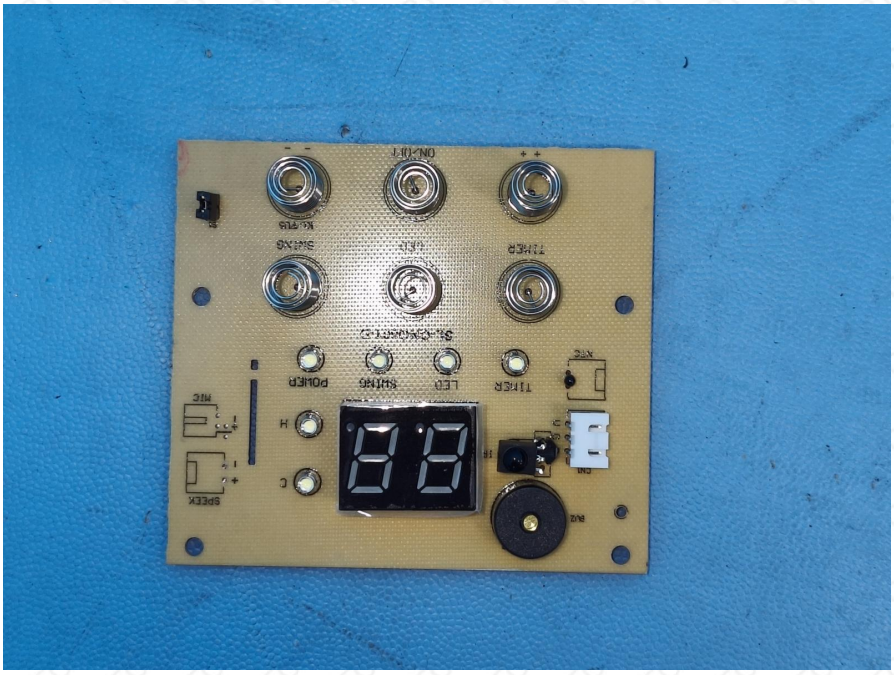


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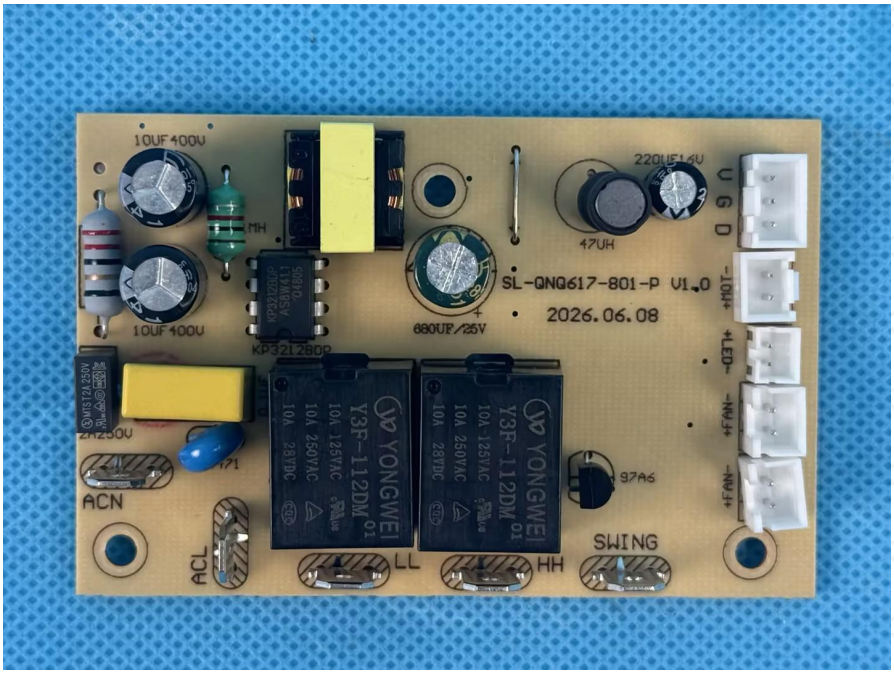


PCB view (Model No. XY-801)

Photograph Document

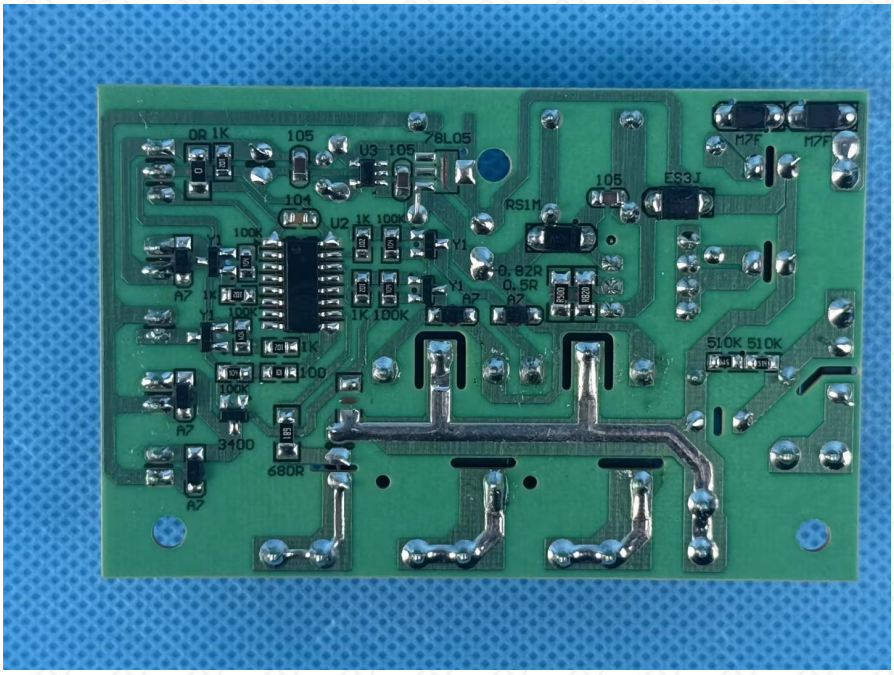


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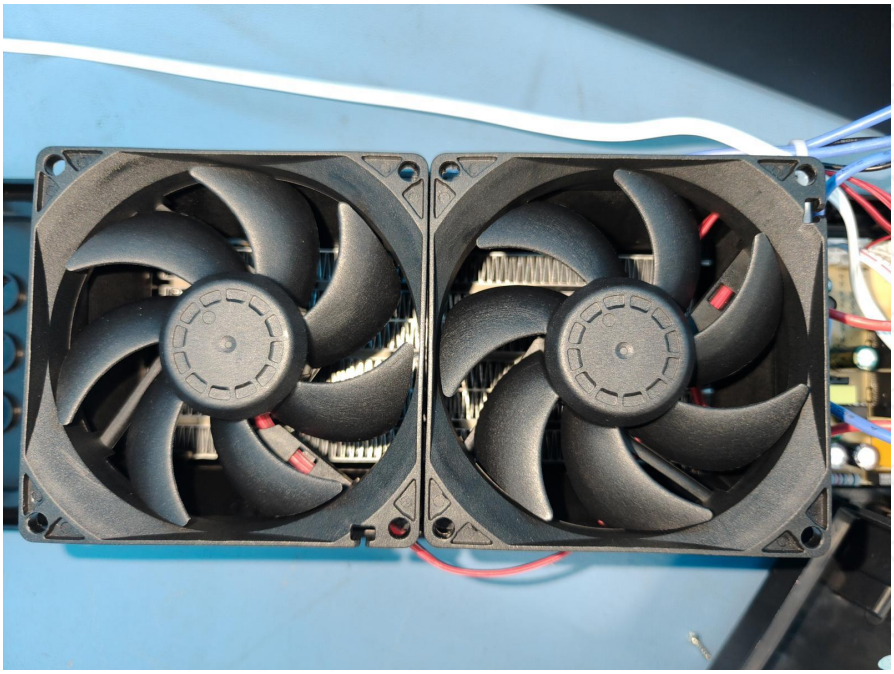


PCB view (Model No. XY-801)

Photograph Document



PCB view (Model No. XY-801)



DC fan view (Model No. XY-801)

Photograph Document

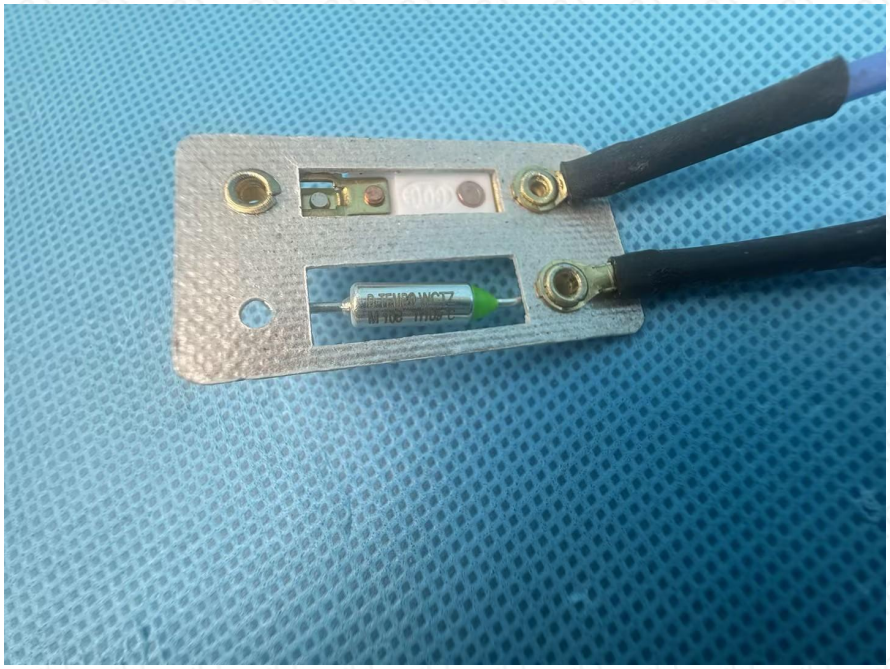


Internal view (Model No. XY-801)

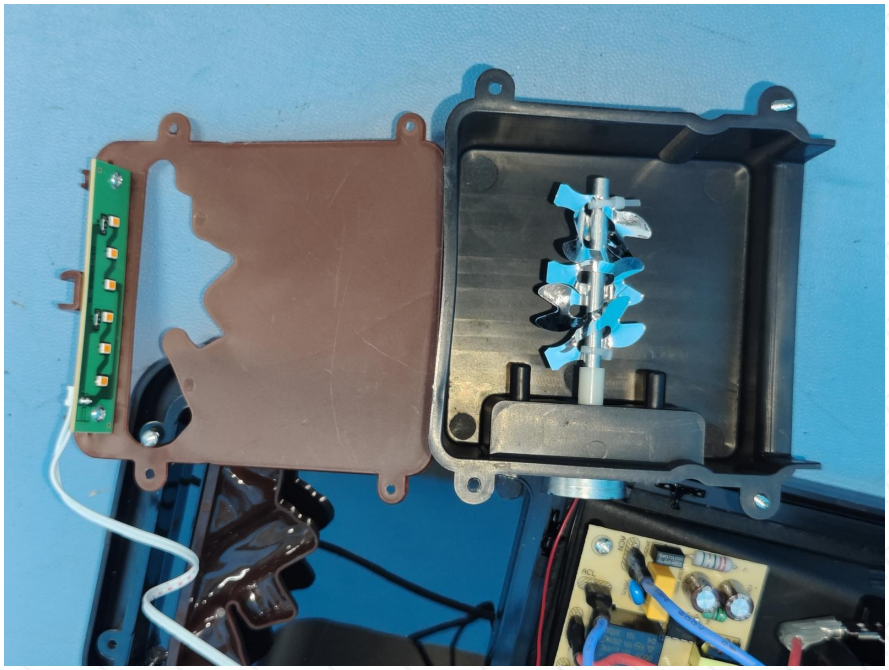


Thermal link and thermal cut-out view (Model No. XY-801)

Photograph Document

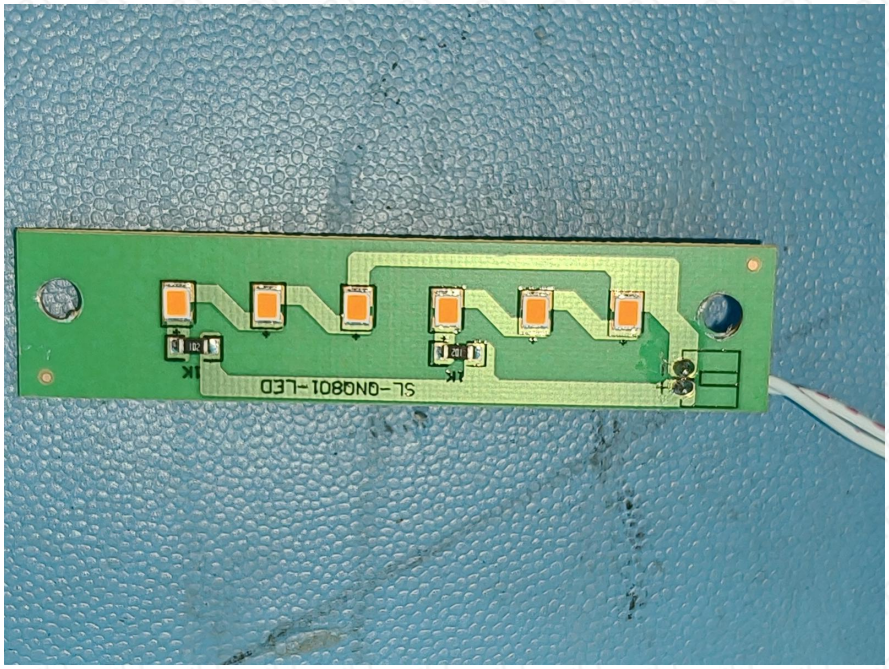


Thermal link and thermal cut-out view (Model No. XY-801)

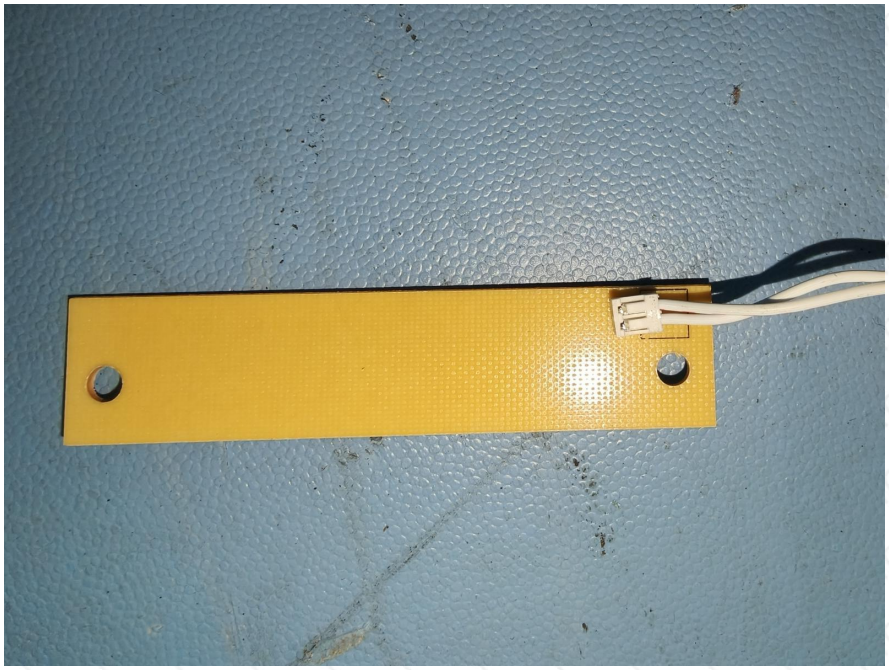


Internal view (Model No. XY-801)

Photograph Document



PCB view (Model No. XY-801)



PCB view (Model No. XY-801)

******END OF TEST REPORT******