UL 474

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Dehumidifiers

Underwriters Laboratories Inc. (UL)
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UL Standard for Safety for Dehumidifiers, UL 474

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The following table lists the future effective dates with the corresponding item.

Future Effective Date	References
March 18, 2004	Paragraph 8.9 and Section 40A

The new and revised requirements are substantially in accordance with UL's Bulletin(s) on this subject dated July 13, 2001. The bulletin(s) is now obsolete and may be discarded.

The revisions dated March 18, 2002 include a reprinted title page (page1) for this Standard.

As indicated on the title page (page 1), this UL Standard for Safety is an American National Standard. Attention is directed to the note on the title page of this Standard outlining the procedures to be followed to retain the approved text of this ANSI/UL Standard.

As indicated on the title page (page1), this UL Standard for Safety has been adopted by the Department of Defense.

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the note following the affected item. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a ″SUPERSEDED REQUIREMENTS″ notice.

New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if

the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

This Standard consists of pages dated as shown in the following checklist:

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American National Standard

JUNE 3, 1993 **ANSI/UL 474-2001**

(Title Page Reprinted: March 18, 2002)

1

UL 474

Standard for Dehumidifiers

First Edition – August, 1957
Second Edition – November, 1969
Third Edition – June, 1973
Fourth Edition – September, 1978
Fifth Edition – July, 1981
Sixth Edition – August, 1987

Seventh Edition

June 3, 1993

The most recent designation of ANSI/UL 474 as an American National Standard (ANSI) occurred on November 26, 2001.

This ANSI/UL Standard for Safety, which consists of the seventh edition (with revisions through March 18, 2002), is under continuous maintenance, whereby each revision is ANSI approved upon publication. Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Written comments are to be sent to the UL-Northbrook Standards Department, 333 Pfingsten Road, Northbrook, IL 60062.

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc. and is not part of the ANSI Standard.

The Department of Defense (DoD) has adopted UL 474 on January 18, 1994. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

Revisions of this Standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements.

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FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire or of electric shock or injury to persons shall be evaluated using appropriate additional component and end-product requirements to maintain the level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard does not comply with this standard. Revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

INTRODUCTION

1 Scope

1.1 These requirements cover movable, household, self-contained dehumidifiers employing hermetic refrigerant motor-compressors and intended for connection to single-phase, alternating-current (ac) circuits rated not more than 20 amperes, 125 volts or 15 amperes, 208 or 230 volts. The requirements also cover dehumidifiers which incorporate electric air heaters.

1.1 revised March 18, 2002

1.2 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire or of electric shock or injury to persons shall be evaluated using appropriate additional component and end-product requirements to maintain the level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard does not comply with this standard. Revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

1.2 revised March 18, 2002

2 General

2.1 Components

2.1.1 Except as indicated in 2.1.2, a component of a value covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the valves covered by this standard.

2.1.2 A component is not required to comply with a specific requirement that:

a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or

b) Is superseded by a requirement in this standard.

2.1.2 revised March 18, 2002

2.1.3 A component shall be used in accordance with its rating established for the intended conditions of use.

2.1.3 revised March 18, 2002

2.1.4 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.

2.1.4 revised March 18, 2002

2.2 Units of measurement

2.2.1 Values stated without parentheses are the requirement. Values in parentheses are explanatory or approximate information.

2.2.1 revised March 18, 2002

2.3 Undated references

2.3.1 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.

3 Operating Instructions

3.1 A dehumidifier shall be provided with instructions containing directions and information which the manufacturer considers necessary for use and maintenance of the appliance.

3.2 A copy of the manufacturer's instructions, or equivalent information, intended to accompany each dehumidifier, is to be furnished with the sample submitted for investigation. These instructions are to be used as a guide in the examination and test of the dehumidifier. For this purpose, a printed edition is not required initially if rough draft instructions or information as to what the instructions will include are submitted for review as part of the investigation.

CONSTRUCTION

4 General

4.1 Ferrous metal parts used to support or retain electrical components in position shall be protected against corrosion by metallic or nonmetallic coatings, such as plating or painting.

Exception: This requirement does not apply to parts, such as washers, screws, bolts, and the like, where corrosion of such unprotected parts would not affect compliance with the requirements of this standard.

5 Assembly

5.1 Opening in the enclosure of a dehumidifier shall be designed and located to reduce the risk of unintentional contact with;

a) Uninsulated live parts,

b) Parts which may cause injury to persons, such as fan blades and blower wheels, and

c) Electric heater elements.

The minor dimension of such openings shall not permit passage of a 1 inch (25.4 mm) diameter hemispherically-tipped rod, applied with a force of 2.5 pounds (11.1 N). In evaluating openings, parts of the enclosure, such as covers, panels, and grilles are to be removed unless tools are required for their removal or when exposed, a moving part is made inoperative or an uninsulated electrical part is de-energized through the use of interlocking devices.

5.2 An opening is acceptable if the probe illustrated in Figure 5.1 cannot contact uninsulated live parts, film coated wire, moving parts, and heater elements. The probe is to be applied:

a) With a force of 2.5 pounds (11.1 N) and

b) In any possible configuration and to any depth that the size of an opening will permit.

The probe is to be rotated or angled to any possible position before, during, or after insertion through the opening; and, if necessary, the configuration of the probe may be changed after the probe has been inserted through the opening.

Exception: For film-coated wire, an opening in the motor enclosure of 3/4 inch (19.0 mm) or less is acceptable if the probe illustrated in Figure 5.2 cannot contact the wire.

5.2 revised April 23, 1996

Figure 5.1
Accessibility probe

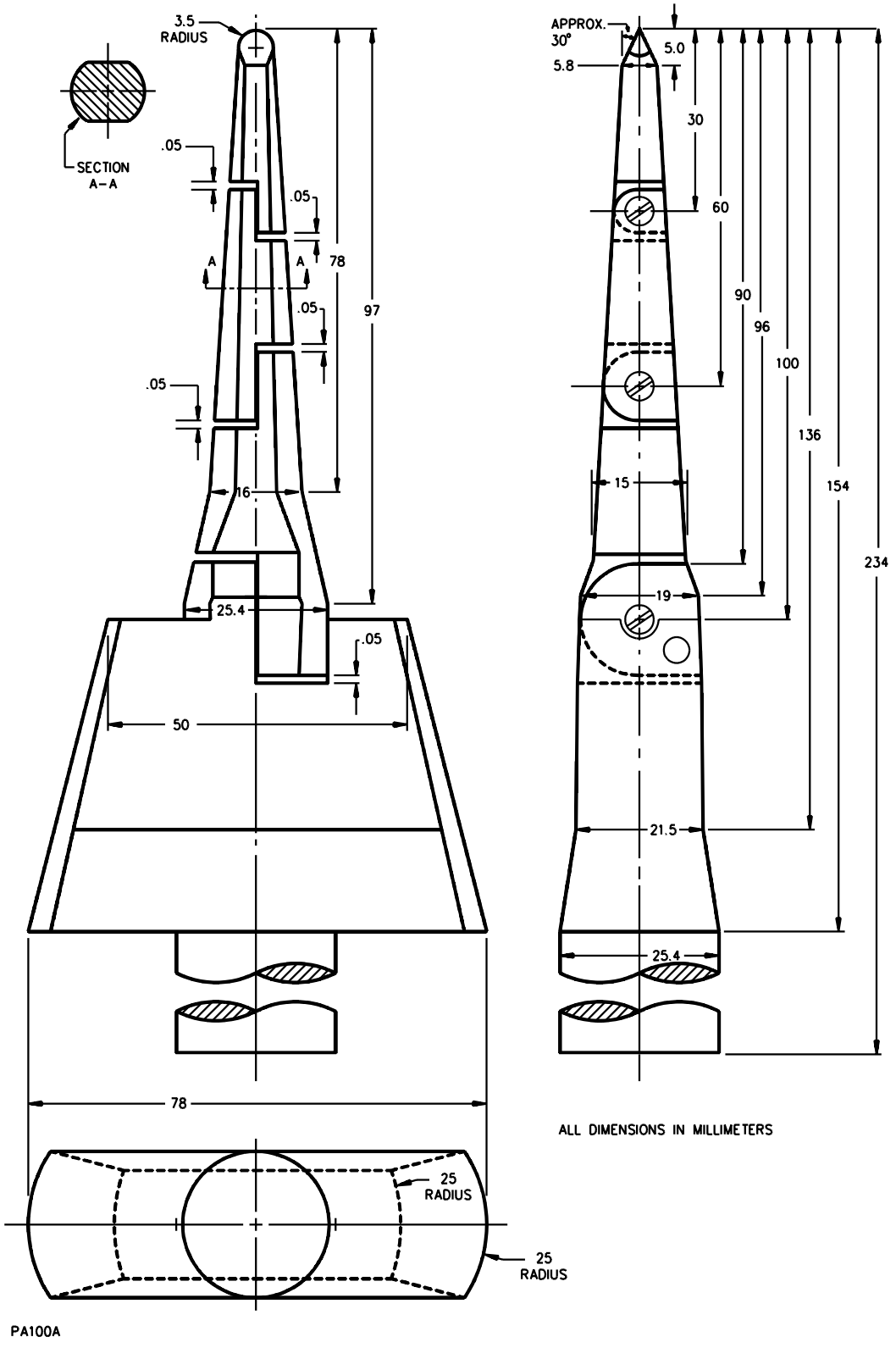
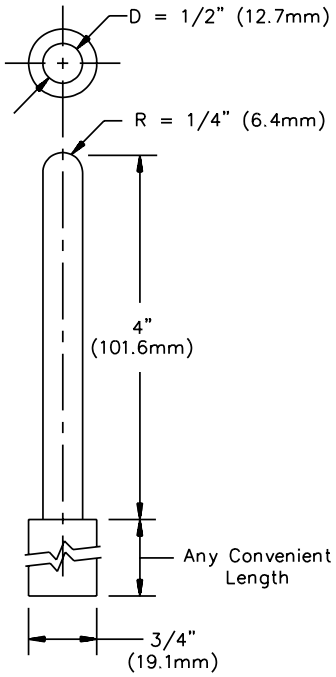


Figure 5.2
Probe



PA170B

5.3 In addition to the requirements of 5.1 and 5.2, uninsulated live parts inside the enclosure which are likely to be contacted by persons performing operations, such as adjusting controls or oiling motors, shall be located, guarded, or enclosed to reduce the risk of unintentional contact. See 53.8.

5.4 Electrical components shall be located or enclosed so that water will not impinge on uninsulated live parts as a result of splashing, leakage, or condensation. See Leakage Current Test, Section 24, and Dielectric Voltage Withstand Test, Section 28, conducted following the Temperature and Pressure Test, Section 26.

5.5 A condensate drain pan and a condensate receptacle shall be constructed and located so that overflow will not wet uninsulated live parts or film-coated wire. An Overflow Test, Section 31, is to be conducted if it is not evident that the dehumidifier complies with this requirement.

5.6 A switch, lampholder, receptacle, plug connector, or other electrical component shall be secured in position and prevented from turning. See 5.7.

Exception No. 1: The requirement that a switch be prevented from turning will be waived if all of the following conditions are met:

a) The switch 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 during operation of the switch.

b) Means of mounting the switch make it unlikely that intended operation of the switch will loosen it.

No Text on This Page

c) Electrical spacings are not reduced below the required values if the switch rotates.

d) Operation of the switch is by mechanical means rather than direct contact by persons.

Exception No. 2: 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 a nonremovable jewel, need not be prevented from turning if rotation cannot reduce electrical spacings below the minimum acceptable values.

5.7 The means for preventing rotation mentioned in 5.6 is to consist of more than friction between surfaces. A toothed lock washer that provides both spring take-up and an interference lock is acceptable as means for preventing a small stem-mounted switch or other device having a single-hole mounting means from turning.

5.8 Uninsulated live parts shall be secured to the mounting surface so that they will be prevented from turning or shifting in position if such motion may result in a reduction of electrical spacings below the minimum acceptable values. Friction between surfaces is not acceptable as a means to prevent shifting or turning of live parts but a lock washer as described in 5.7 is acceptable.

5.9 Flammable or electrically conductive thermal or acoustical insulation shall not contact uninsulated live parts. See 36.2.1.

5.10 Exposed unimpregnated asbestos material shall not be used in an air handling compartment. The unprotected edge of a gasket sandwiched between two parts is considered to be exposed.

6 Enclosures

6.1 A dehumidifier enclosure shall be formed and assembled so that it will have the strength and rigidity necessary to resist the abuses to which it may be subjected without total or partial collapse resulting in reduction of electrical spacings below those specified in Section 17, or exposure of moving parts or uninsulated live parts as judged by the requirements of Assembly, Section 5. An enclosure complying with the requirements of the Impact Test – Enclosures, Section 32, and Static Load Test, Section 33, is considered to comply with this requirement. For polymeric enclosures, see Polymeric Materials – Application, Section 7.

6.2 Enclosures for individual electrical components, outer enclosures, and combinations of the two are to be considered in determining compliance with the requirement of 6.1.

6.3 Openings in the bottom of a dehumidifier shall be located or provided with barriers or baffles to reduce the risk of burning insulation, flaming particles, molten metal, and the like, from falling out of the unit. Also see 15.8 – 15.10.

6.4 Steel enclosures shall be protected against corrosion by metallic or nonmetallic coatings, such as plating or painting.

7 Polymeric Materials – Application

7.1 General

7.1.1 The requirements in 7.1.2 – 7.6.1 cover parts made of polymeric materials for use in dehumidifiers. These requirements do not apply to materials used as electrical insulation, sole support of current-carrying parts, nor to small parts, such as control knobs, buttons, insulating bushings, resilient mounts, clamps, and wiring straps.

7.1.2 Among the factors taken into consideration when judging the suitability of a polymeric material are:

a) Flame resistance,

b) Mechanical strength,

c) Resistance to impact,

d) Moisture absorptive properties, and

e) Resistance to distortion at temperatures to which the material may be subjected under conditions of use. All of these factors are considered with respect to aging.

7.2 Material classification

7.2.1 Materials are designated with respect to flammability characteristics and are identified as 5V, V-0, V-1, or V-2, HF-1, or HF-2, HB, and HBF materials. Flammability characteristics are to be established by tests specified in Sections 41 – 44.

7.2.1 revised March 31, 1998

7.3 Ignition sources

7.3.1 As used in 7.4.1 – 7.6.1, possible ignition sources within the unit are considered to be arcing parts and film-coated wire not enclosed in metal or in 5V material.

7.3.1 revised March 31, 1998

7.4 Enclosures

7.4.1 An enclosure is to be considered as that part of the dehumidifier which, by itself or in conjunction with barriers:

a) Renders inaccessible any or all uninsulated and insulated live parts and moving parts, and/or

b) Prevents propagation of the flame due to electrical disturbances occurring within.

7.4.2 Polymeric Materials used as enclosures shall comply with the requirements of Table 7.1 and Sections 41 – 49.

7.5 Functional and structural parts

7.5.1 For the purpose of these requirements, a functional or structural part is a part used to maintain the intended relative position of fixed or moving parts, or to maintain the integrity of the assembly.

Table 7.1
Polymeric enclosures

Table 7.1 revised March 31, 1998

	Material is used to enclose insulated live parts[a]	Material is used to enclose insulated live parts
Flammability tests[b] Section 43 or 44	X	–
Flammability test[c] Section 41	–	X
Impact test, Section 32	X	X
Static load test, Section 33	X	X
Volume resistivity test Section 47	X [d]	–
Mold stress, Section 45	X	X
High current arc		
Ignition test Section 48	X [e]	–
Water absorption test Section 46	X	–
Air-oven aging, Section 49	X	X

[a] Film-coated wire is considered as an uninsulated live part.

[b] A material classed as 5V, V-0, V-1, or V-2.

[c] A material classed as HB.

[d] Not required if the spacings between uninsulated live parts and the material complies with the spacing requirements of Table 17.1.

[e] Not required if uninsulated arcing parts are located 1/2 inch (12.7 mm) minimum from the enclosure and if uninsulated nonarcing parts are located 1/4 inch (6.4 mm) from the enclosure.

X-Required test

7.5.2 Polymeric materials used as functional parts or structural parts shall be subjected to the following:

a) Flammability tests according to the methods described for 5V, V-0, V-1, or V-2 materials, Sections 43 and 44.

Exception: A material classified as HB (see Section 42) may be employed if it is not exposed to ignition sources or if it is isolated from ignition sources in accordance with the requirements in 7.5.3 and 7.5.4.

b) Mold Stress Relief Test, Section 45.

c) Impact test of 5 foot-pounds (6.8 J) if the part is not located within the confines of the cabinet.

d) Water Absorption Test, Section 46.

e) Volume Resistivity Test, Section 47, if the material is used as indirect support of uninsulated live parts.

Exception: This test need not be conducted if the spacings between uninsulated live parts and the polymeric part comply with the requirements for Electrical Spacings, Section 17.

f) High Current Arc Ignition Test, Section 48, if the material is used as indirect support of live parts.

Exception: This test need not be conducted if uninsulated arcing parts are located at least 1/2 inch (12.7 mm) from the polymeric part and if uninsulated nonarcing parts are located at least 1/8 inch (3.2 mm) from the polymeric part.

g) Air Oven Aging, Section 49.

7.5.2 revised March 18, 2002

7.5.3 A HB material located below an ignition source and within Space A of Figure 7.1 may be isolated by means of a horizontal barrier, extending at least to the boundary surface of the space. A material located above the ignition source and within Space B of Figure 7.1 may be isolated by means of a barrier, extending at least to the boundary surface of the space, and located so that the minimum distance between the material and ignition source of 4 inches (102 mm).

7.5.3 revised March 31, 1998

7.5.4 A HB material located essentially in the vertical plane and adjacent to an ignition source is considered isolated from the ignition source if it is separated from it by a distance of 4 inches (102 mm). A barrier may be used for the isolation provided the size of the barrier is such that the minimum straight-line distance between the material and ignition source is 4 inches. See Figure 7.1.

7.5.4 revised March 31, 1998

7.5.5 If required by 7.5.3 or 7.5.4, a barrier shall be formed of metal or of a 5V material and shall be mechanically secured in place.

7.5.5 revised March 31, 1998

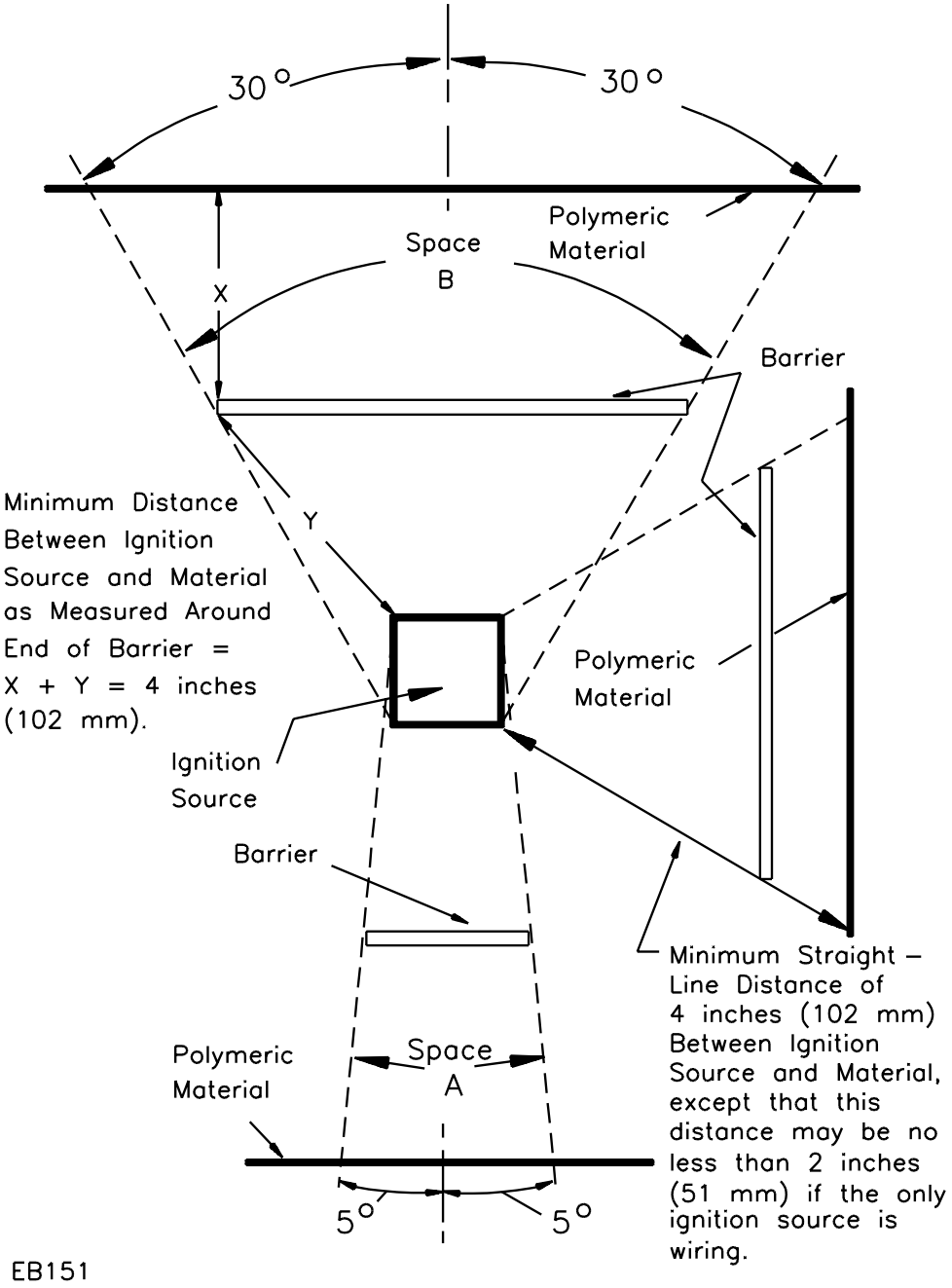
7.6 Nonfunctional parts

7.6.1 Polymeric materials used for parts that do not serve as electrical insulation, or to support or enclose electrical components, or to maintain electrical spacings, shall comply with the requirements of the flammability tests according to the methods 5V, V-0, V-1, V-2, HF-1, or HF-2.

Exception: A material classified as HB may be employed if it is not exposed to ignition sources or if it is isolated from ignition sources in accordance with 7.5.3 and 7.5.4.

7.6.1 revised March 31, 1998

Figure 7.1
Exposure to ignition source



Space A – Represents the volume below the ignition source determined by a straight line that moves about the ignition source while remaining at an angle of 5 degrees from the vertical and is always so oriented that the volume is a maximum.

Space B – Represents the volume above the ignition source determined in the same manner as Space A, except that the angle is 30 degrees from the vertical.

8 Supply Connections

8.1 A dehumidifier shall be equipped with a flexible power-supply cord having an equipment grounding conductor and with a grounding-type attachment plug.

8.2 A dehumidifier shall employ a grounding-type attachment plug that complies with the American National Standards designated in Table 8.1. The marked ampere rating of a dehumidifier shall not exceed 80 percent of the ampere rating of the attachment plug.

Table 8.1
Attachment plug rating

Amperes,–volts	ANSI designation[a]
15,125	C73.11–1972
20,125	C73.12–1972
15,250	C73.20–1972

[a] As part of the Standard for Plugs and Receptacles, C73–1973 Series.

8.3 A dehumidifier shall employ a Type S, SO, ST, STO, SJ, SJO, SJT, SJTO, SE, SEO, SEOO, SOO, STOO, SJE, SJEO, SJEOO, SJOO, or SJTOO power supply cord rated for use at a voltage not less than the rated voltage of the dehumidifier. The ampacity of the cord as given in the National Electrical Code, ANSI/NFPA 70, shall be not less than that required by the ampere input measured during the Temperature and Pressure Test, Section 26, and during the Temperature Test – Electric Heat, Section 27.

8.3 revised March 18, 2002

8.4 The grounding conductor of a power supply cord shall be finished a continuous green color or a continuous green color with one or more yellow stripes, and no other conductor of the power supply cord shall be so identified. The grounding conductor shall be secured to the frame or enclosure of the dehumidifier by a positive means (see 10.4) that is not likely to be removed during any servicing operation not involving the power supply cord. The grounding conductor shall be connected to the grounding pin of the attachment plug cap.

8.4 revised March 18, 2002

8.5 The length of the power supply cord shall be not less than 6 feet (1.83 m) nor more than 10 feet (3.0 m). The length is to be measured between the attachment plug and the point at which the cord exits the dehumidifier cabinet.

8.6 The power supply cord shall be provided with strain relief means so that a stress on the cord will not be transmitted to terminals, splices, or internal wiring. If a metallic strain relief means is provided, it shall not contact uninsulated live parts or reduce electrical spacings within the enclosure if the cord is moved inward.

8.7 To determine the acceptability of the strain relief means required by 8.6, a 35 pounds-mass (15.9 kg) weight is to be suspended from the cord and supported by the dehumidifier so that the strain relief means will be stressed from any angle which the design of the dehumidifier permits. The load is to be applied for 1 minute. The strain relief is not acceptable if there is such movement of the cord as to indicate that stress would have resulted on the connections.

8.8 The edges of the entry hole for the power supply cord, including the cord entry hole in a bushing, shall be smooth and rounded without burrs, fins, or sharp edges which might damage the cord insulation. Within the dehumidifier, the power supply cord shall be routed to prevent damage to the cord insulation.

8.9 Means shall be provided to prevent a flexible cord from being pushed into the product through the cord-entry hole when such displacement results in:

a) Subjecting the cord to mechanical damage,

b) Exposing the cord to a temperature higher than that for which the cord is rated,

c) Reducing spacings, such as to a metal strain-relief clamp, below the minimum required values; or

d) Damaging internal connections or components.

The cord shall comply with the Push-Back Relief Test, Section 40A.

Added 8.9 effective March 18, 2004

9 Internal Wiring

9.1 All wires and cords used in a dehumidifier shall be routed and supported to reduce the risk of damage due to:

a) Sharp edges,

b) Surfaces and parts which operate at temperatures in excess of that for which the wire insulation is rated,

c) Moving parts, and

d) Parts which can be expected to vibrate, such as motors, motor-compressors, refrigerant lines, and the like. Clamping means shall have smooth, rounded surfaces.

Exception: Wires and cords may contact a vibrating part provided:

a) The wiring is securely fastened to the part at the point of contact so as to restrict movement,

b) The part does not have burrs, fins, or sharp edges which might abrade the insulation, and

c) Vibration does not place a stress on the wiring or wiring connections.

9.2 All wires and cords shall be routed and supported so that they will not be immersed in water unless the insulation is specifically intended for this purpose. The wiring arrangement shall prevent water caused by condensation from entering wiring enclosures and electrical enclosures.

9.3 All splices and connections shall be mechanically secured and electrically bonded. A soldered connection shall be made mechanically secure before being soldered.

9.4 Splices shall:

a) Be secured in position and located within the confines of the dehumidifier enclosure or

b) Located in a separate enclosure so that they are not subject to flexing, motion, or vibration due to air movement.

Strain relief shall be provided on the conductors if the wiring is likely to be moved during routine service operations, such as oiling motors.

9.5 In determining compliance with 9.4, grilles, covers, panels, and the like, which may be removed without the use of tools are not considered as forming part of the splice enclosure.

9.6 A splice shall be provided with electrical insulation equivalent to that of the wires involved. Thermoplastic tape wrapped over sharp ends of conductors is not acceptable. Splicing devices, such as pressure wire connectors, may be employed if they comply with the Standard for Wire Connectors and Soldering Lugs for Use With Copper Conductors, UL 486A.

9.7 Quick-connecting assemblies shall form a secure electrical connection, such as by detents in the mating parts, and shall be capable of carrying the current as determined during the Temperature and Pressure Test, Section 26, and the Temperature Test – Electric Heat, Section 27. Securement of the connections may be determined by engagement/disengagement tests specified in the Standard for Electrical Quick-Connect Terminals, UL 310.

9.8 Wire binding screws shall thread into metal. At terminals, stranded conductors shall be secured by soldered or pressure-type terminal connectors, or the conductors shall be soldered or otherwise assembled to prevent loose strands after assembly. Soldered connections shall be made mechanically secure before being soldered. Open-slot type connectors shall not be used unless they are constructed to prevent disconnection resulting from loosening of the clamping means. The shanks of terminal connectors shall be protected by electrical insulation if the spacings may be reduced below the minimum acceptable values by loosening of the clamping means. The insulating material shall be secured in position. The thickness of the insulation on the shanks shall be not less than 0.028 inch (0.71 mm) except as permitted by 17.1.6.

9.8 revised March 18, 2002

9.9 Holes in walls, panels, or barriers through which insulated wires or cords pass and on which they may bear shall be provided with smoothly rounded bushings or shall have smooth, rounded surfaces upon which the wires or cords may bear to reduce the risk of abrasion of the insulation. Bushings shall be fabricated from materials, such as ceramic, phenolic, thermoset, thermoplastic, or fiber.

9.9 revised March 18, 2002

9.10 A dehumidifier shall employ conductors of not less than No. 18 AWG (0.82 mm^2) size, except for short integral leads of small electrical components, such as relay coils and indicator lights.

9.11 Wiring that is color-coded green or green with one or more yellow stripes shall be used only for grounding conductors. Wiring used for other purposes shall not be identified with these color codes.

9.12 Wire insulation shall be rated for the potential involved and for the temperature to which it may be subjected in intended use. The required temperature rating for wiring is based on the temperatures measured in the Temperature and Pressure Test, Section 26, and Temperature Test – Electric Heat, Section 27.

9.13 Parallel conductor appliance wiring material of the integral type shall not be ripped more than 3 inches (76 mm) unless the minimum thickness of the conductor insulation after ripping is at least 0.058 inch (1.47 mm) in thickness. If the material has conductor insulation not less than 0.028 inch (0.71 mm) after ripping and is within a separate metal enclosure or equivalent, the length of rip is not limited.

9.14 The internal wiring of a dehumidifier shall be Type SJ, SJO, SJT, SJTO, SP-3, SPT-3, S, SO, ST, STO, SE, SEO, SEOO, SOO, STOO, SJE, SJEO, SJEOO, SJOO, SJTOO, or SPE-3 flexible cord or appliance wiring material recognized for refrigeration use. Also see 9.16 and 9.17.

9.14 revised March 18, 2002

9.15 The insulation of wires or cords connected to fan motors shall be of an oil-resistant type, such as Type SJO, SJTO, SPT-3 cord or appliance wiring materials having oil-resistant insulation.

9.15 revised March 18, 2002

9.16 Except as indicated in 9.17, No. 16 or 18 AWG (1.3 or 0.82 mm^2) appliance wiring material shall have an insulation thickness not less than 0.058 inch (1.47 mm) and No. 14 AWG (2.1 mm^2) appliance wiring material shall have an insulation thickness not less than 0.070 inch (1.78 mm).

9.17 Rubber, neoprene, or thermoplastic insulated fixture wire and thermoplastic insulated appliance wiring material having an insulation thickness not less than 0.028 inch (0.71 mm), or rubber insulated appliance wiring material having an insulation thickness not less than 0.043 inch (1.1 mm) may be used if

a) Contained in separate metal enclosures, conduit, or electrical metallic tubing or

b) Contained in electrical insulating tubing having a wall thickness not less than 0.028 inch for No. 16 or 18 AWG (1.3 or 0.82 mm^2) conductors and 0.043 inch for No. 14 AWG (2.1 mm^2) conductors.

Wires not longer than 3 inches (76 mm) may extend outside of such protective enclosures to facilitate connection to electrical components.

Exception: Neoprene or thermoplastic insulated appliance wiring material having 1/32 inch (0.8 mm) conductor insulation need not be provided with protective enclosures or additional insulation if all of the following conditions are met:

a) Wiring is not subject to movement by air or vibration. See 9.1.

b) Individual leads are bunched together to form a cable, if practicable.

c) Wiring is secured to fixed surfaces at intervals to reduce the likelihood of hooking slack wiring during routine service, such as oiling motors, adjusting controls, and the like.

d) Wiring is located in a compartment that is provided with a complete base pan or similar bottom closure. See 6.3.

e) Wiring cannot be contacted through openings in the outer enclosure or cabinet when judged in accordance with 5.1 and 5.2.

10 Bonding for Grounding

10.1 A dehumidifier shall have provision for the grounding of all exposed or accessible noncurrent-carrying metal parts which are likely to become energized and which may be contacted by the user or by service personnel during service operations which are likely to be performed while the dehumidifier is energized.

Exception: The following need not be grounded:

a) Adhesive-attached metal-foil markings, screws, and the like, which are located on the outside of cabinets and isolated from electrical components or wiring by grounded metal parts so that they are not likely to become energized.

b) Isolated metal parts, which are positively separated from wiring and uninsulated live parts.

c) Panels and covers which are insulated from electrical components and wiring by an insulating barrier of vulcanized fiber, varnished cloth, phenolic composition, or similar materials not less than 0.028 inch (0.71 mm) thick, and secured in place. if material having a lesser thickness is used, consideration shall be given to such factors as its electrical, mechanical, and flammability properties when compared with materials in thicknesses specified above.

10.2 If a component such as a switch can become separated from its normal grounding means for purposes of testing or adjustment while the equipment is energized, it shall be provided with a grounding conductor not requiring removal for such service.

10.3 A separate component bonding conductor shall be of copper, a copper alloy, or other material suitable for use as an electrical conductor. Ferrous metal parts in the grounding path shall be protected against corrosion by metallic or nonmetallic coatings, such as enameling, galvanizing, plating, or painting. A separate bonding conductor or strap shall:

a) Be protected from mechanical damage or be located within the confines of the outer enclosure or frame and

b) Not be secured by a removable fastener used for any purpose other than bonding for grounding unless the bonding conductor is unlikely to be omitted after removal and replacement of the fastener.

10.4 The bonding shall be by a positive means, such as clamping, riveting, bolted or screwed connection, welding, or brazing. The bonding connection shall penetrate nonconductive coatings, such as paint or vitreous enamel. Bonding around a resilient mount shall not depend on the clamping action of rubber or other nonmetallic material except as indicated in 10.7.

10.5 With reference to 10.4, a bolted or screwed connection that incorporates a star washer under the screwhead or a serrated screwhead is acceptable for penetrating nonconductive coatings. If the bonding means depends upon screw threads, two or more screws or two full threads of a single screw shall engage the metal.

10.6 An internal connection for bonding internal parts to the enclosure for grounding (but not for the grounding wire in a power supply cord) may employ a quick-connect terminal of the specified dimensions provided the connector is not likely to be displaced.

Terminal dimensions, inch (mm)

0.020 by 0.187 by 0.250

(0.51 by 4.75 by 6.4)

0.032 by 0.187 by 0.250

(0.81 by 4.75 by 6.4)

0.032 by 0.205 by 0.250

(0.81 by 5.2 by 6.4)

0.032 by 0.250 by 0.312

(0.81 by 6.4 by 7.9)

10.7 A connection that depends upon the clamping action exerted by rubber or other nonmetallic material may be acceptable if it complies with the provisions of the Current Overload Test – Bonding Conductors and Connections, Section 35, and the Limited Short-Circuit Test, Section 37, under any intended degree of compression permitted by a variable clamping device and also following exposure to the effects of oil, grease, moisture, and thermal degradation which may occur in service. Also, the effect of assembling and disassembling such a clamping device for maintenance purposes is to be considered with particular emphasis on the likelihood of the clamping device being reassembled in its intended fashion.

10.8 A bonding conductor or strap shall have a cross-sectional area not less than No. 18 AWG (0.82 mm^2).

Exception: A smaller conductor may be used if the bonding conductor and connection comply with the provisions of the Current Overload Test – Bonding Conductors and Connections, Section 35, and the Limited Short-Circuit Test, Section 37.

ELECTRICAL COMPONENTS

11 Capacitors

11.1 A motor starting or running capacitor shall be housed within an enclosure or container which will protect the plates against mechanical damage and which will reduce the risk of emission of flame or molten material resulting from malfunction of the capacitor. The container shall be of metal providing the strength and protection not less than that of uncoated steel having a thickness of 0.020 inch (0.51 mm).

Exception: The individual container of a capacitor may be of sheet metal having a lesser thickness or may be of material other than metal if the capacitor is mounted within the enclosure of the dehumidifier or within an enclosure which houses other parts of the dehumidifier.

11.2 If the container of an electrolytic capacitor is metal, the container shall be considered to be a live part and shall be provided with moisture-resistant electrical insulation to isolate it from dead metal parts and to reduce the risk of contact during servicing operations. The insulating material shall be not less than 1/32 inch (0.8 mm) thick except as indicated in 17.1.6.

11.2 revised March 18, 2002

11.3 A capacitor employing a liquid dielectric medium more combustible than askarel shall be protected against expulsion of the dielectric medium when tested in accordance with the applicable performance requirements of this standard, including faulted overcurrent conditions based on the circuit in which it is used. See Short Circuit Test, Section 37.

Exception: If the available fault current is limited by other components in the circuit, such as a motor start winding, the capacitor may be tested using a fault current less than the test current specified in Table 37.1 but not less than the current established by dividing the circuit voltage by the impedance of the other component(s).

12 Current-Carrying Parts

12.1 All current-carrying parts of a dehumidifier shall be of silver, copper, a copper alloy, or other material acceptable for use as an electrical conductor.

Exception: Multimetallic thermal elements and heater elements of a thermal protector need not be inherently resistant to corrosion.

12.2 Aluminum may be used as a current-carrying part if investigated and found to be treated to resist oxidation and corrosion.

12.3 Ferrous metal parts, if provided with a corrosion resistant coating, or stainless steel may be used for a current-carrying part:

a) If permitted in accordance with 2.1 or

b) Within a motor, but the use of ferrous materials not inherently protected or provided with a corrosion resistant coating is not acceptable for current-carrying parts elsewhere in the dehumidifier.

13 Electric Heaters

13.1 Heater elements

13.1.1 A heater element shall be protected against mechanical damage and shall be guarded so that flammable material will be protected against coming in contact with it.

13.1.2 A sheath-type element employing a copper or steel sheath at least 0.016 inch (0.41 mm) thick is considered to be protected.

13.1.3 The supporting means for an open type element shall not permit sagging or loosening due to:

a) Continuous heating of the element or

b) Flexing of the element supports or related wiring due to alternate heating and cooling of the element that many result in a reduction of required electrical spacings, contact with flammable materials, or short circuiting to dead metal parts.

13.1.4 Metal tubing forming a heater element enclosure shall be constructed of corrosion resistant material or shall be plated, dipped, or coated to resist external corrosion, and shall be acceptable for the temperatures to which it is subjected. See 13.1.5.

13.1.5 Uncoated copper tubing may be employed for temperatures of 200°C (392°F) and lower; metallic coated copper tubing is acceptable for temperatures below the melting temperature of the coating. Uncoated or oxide-coated steel tubing is not considered acceptable as a heater sheath. Plated steel tubing may be employed if the coating is determined to be corrosion resistant and will withstand the temperatures to which it may be subjected. Aluminum tubing may be employed if the alloy withstands a burnout test without melting or other failure. Stainless steel tubing of the austenitic grades, such as ASTM Type 304, is generally acceptable.

13.1.6 Insulating materials, such as washers and bushings, which are integral parts of a heating element shall be of a moisture resistant material which will not be damaged by the temperatures to which they may be subjected in the dehumidifier.

13.1.7 Insulating material employed in a heating element shall be acceptable as the sole support of live parts. Magnesium oxide may be used in conjunction with other insulating materials if located and protected so that the risk of mechanical damage is reduced and if not subjected to the absorption of moisture. When it is necessary to investigate a material, consideration is to be given to such factors as mechanical strength, dielectric voltage withstand, insulation resistance, heat resistant qualities, and the degree to which it is enclosed or protected. All of these factors are to be considered with respect to thermal aging. See 14.1.

13.1.8 A heater case or terminal seal of rubber, neoprene, or thermoplastic materials shall have acceptable aging properties for temperatures measured during heating tests. See Accelerated Aging Test – Electric Heaters, Section 38.

13.1.9 A sheath-type heater shall be sealed to reduce the risk of entrance of moisture. See Insulation Resistance Test, Section 36. Molded seal caps vulcanized to the heater leads and heater sheath shall have a wall thickness equivalent to that required for the heater leads.

13.1.10 Humidity and temperature controls shall not permit the heating element to be energized when the refrigeration system is in operation.

13.2 Heater over-temperature control

13.2.1 If malfunction could result in the risk of fire or electric shock, an electric heater in a dehumidifier shall be provided with a temperature-limiting control or a replaceable thermal cutoff. See Burnout Test – Heater, Section 30, and Heater – Temperature-Limiting Control Tests, Section 34.

13.2.2 With reference to 13.2.1, a temperature-limiting control is defined as a control which is intended to prevent abnormal temperatures and is not designed to function during intended operation of the heater.

13.2.3 Thermal cutoffs shall comply with the requirements for thermal cutoffs for use in electrical appliances and components, UL 1020.

13.2.4 A thermal cutoff shall be secured in place and wiring to a thermal cutoff shall be secured so that replacement of the thermal cutoff will not result in damage to internal wiring or connections.

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14 Insulating Material

14.1 Material for the mounting of uninsulated live parts shall be of moisture resistant material, such as porcelain, phenolic, or cold-molded composition, or other materials which comply with the requirements for materials used as direct support of live parts as specified in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

14.2 Vulcanized fiber may be used for insulating bushings, washers, separators, and barriers, but not as the sole support for uninsulated live parts where shrinkage, current leakage, or warpage may introduce a risk of fire or electric shock.

15 Motors and Motor Overload Protection

15.1 All motors shall be protected by thermal or overcurrent protective devices.

Exception: Direct-drive motors employing impedance protection and which comply with the locked-rotor requirements for motor-operated appliances, UL 73, may be used if it is determined that the motor will not overheat under intended conditions of use.

15.2 For a motor other than a hermetic refrigerant motor-compressor, overcurrent protection is obtained if the protection is provided by a separate overcurrent device that is responsive to motor current and is rated or set to trip at no more than the percentage of the motor nameplate full-load current rating shown in column A of the following table. For an overload relay, if the percentage protection indicated in column A does not correspond to the percentage value resulting from selection of a standard size relay, the next higher size of overload relay may be used, but not higher than will provide the percentage protection indicated in column B.

	Maximum percentage protection	
	A	B
Motors with a service factor of 1.15 or greater	125	140
Motor with a marked temperature rise no more than 40°C (104°F)	125	140
Any other motor	115	130

15.2 revised April 23, 1996

15.3 A hermetic refrigerant motor-compressor is considered to comply with the requirement in 15.1 if the protection complies with item A, B, C, or D below.

a) A separate overload relay that is responsive to motor-compressor current and will trip at no more than 140 percent of the rated-load current of the motor-compressor.

b) A thermal protector integral with the motor-compressor that complies with the Standard for Hermetic Refrigerant Motor-Compressors, UL 984.

c) A fuse or circuit breaker responsive to motor current and rated at no more than 125 percent of the rated-load current of the motor-compressor. The dehumidifier shall be capable of starting and operating as intended with the fuse or circuit breaker provided.

d) A protective system that complies with the Standard for Hermetic Refrigerant Motor-Compressors, UL 984. All components of the protective system shall be provided as part of the dehumidifier.

15.4 Thermal protective devices used with nonhermetic motors shall comply with the Standard for Overheating Protection for Motors, UL 2111.

Exception: Motors, such as direct-drive fan motors, which are not subjected to running overloads and which are determined to be protected against overheating due to locked-rotor current by a thermal or overcurrent protective device may be accepted provided it is determined that the motor will not overheat under intended conditions of use.

15.4 revised March 31, 1998

15.5 Fuses shall not be used as motor overload protective devices unless the motor is protected by the largest size fuse which can be inserted in the fuseholder.

15.6 Overcurrent protective devices and thermal protective devices for motors shall comply with applicable short-circuit requirements for the class of protective device and shall, in addition, comply with the requirements of the Limited Short-Circuit Test, Section 37.

15.7 Nonhermetic motors shall comply with the Standard for Electric Motors, UL 1004. Motor-compressors shall comply with the Standard for Hermetic Refrigerant Motor-Compressors, UL 984.

15.8 Motors having openings in the enclosure or frame shall be arranged to reduce the risk of particles falling out of the motor onto flammable material within or under the assembly.

15.9 The requirement in 15.8 will necessitate the use of a barrier of metal or Type 5V polymeric material under an open-type motor unless:

a) The structural parts of the motor or of the dehumidifier, such as the bottom closure, provide the equivalent of such a barrier, or

b) The overload protective device provided with a motor is such that no burning insulation or molten material falls to the surface that supports the dehumidifier when the motor is energized under each of the following fault conditions applicable to the motor type:

1) Open main winding,

2) Open starting winding,

3) Starting switch short-circuited,

4) Capacitor shorted (permanent split capacitor type), or

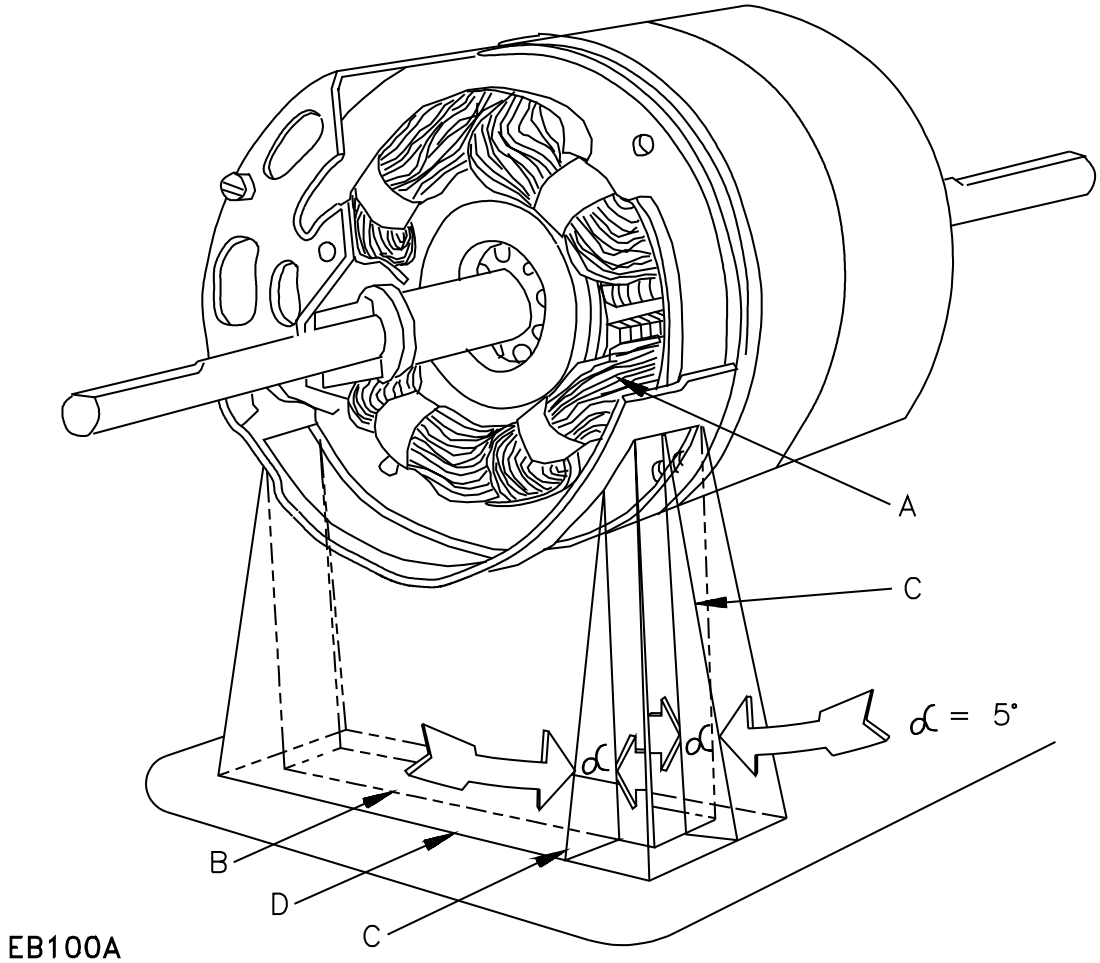
c) The motor is provided with a thermal motor protector (a protective device that is sensitive to temperature and current) that will prevent the temperature of the motor windings from becoming more than 125°C (257°F) under the maximum load at which the motor will run without causing the protector to cycle and from becoming more than 150°C (302°F) with the rotor of the motor locked.

15.9 revised March 31, 1998

15.10 The barrier mentioned in 15.9 shall be horizontal, shall be located as indicated in Figure 15.1, and shall have an area not less than that described in that illustration. Openings for drainage, ventilation, and the like, may be employed in the barrier provided that such openings would not permit molten metal, burning insulation, or the like, to fall onto flammable material.

Figure 15.1
Location and extent of barrier

Figure 15.1 revised March 31, 1998



A – Motor winding to be shielded by barrier. This is to consist of the entire motor winding if it is not otherwise shielded, and is to consist of the unshielded portion of a motor winding which is partially shielded by the motor enclosure or equivalent.

B – Projection of outline of motor winding on horizontal plane.

C – Inclined line which traces out minimum area of the barrier. When moving, the line is to be always:

a) Tangent to the motor winding,

b) 5 degrees from the vertical, and

c) So oriented that the area traced out on a horizontal plane is maximum.

D – Location (horizontal) and minimum area for barrier. The area is to be that included inside the line of intersection traced out by the inclined line C and the horizontal plane of the barrier.

16 Switches and Controllers

16.1 A dehumidifier shall be provided with a motor controller which will shut off the complete dehumidifier or any motor load exceeding the values shown in 16.2. A motor controller is defined as any device intended to start and stop a motor, such as a switch, humidistat, or the like.

16.2 The attachment plug and receptacle may serve as the controller if the marked ampere rating does not exceed the values shown below for the indicated voltage:

Voltage	Amperes
115	7.2
208	4.0
230	3.6

16.3 A switch or other control device shall be rated for the load it controls as determined by the Temperature and Pressure Test, Section 26, and the Temperature Test – Electric Heat, Section 27.

16.4 A switching device that may be called upon to break a motor load under locked-rotor conditions shall have a current interrupting capacity not less than the locked-rotor current of the motor.

16.5 If a switching device controls a compressor motor and fan motor and/or other loads, it shall have a current interrupting capacity not less than the locked-rotor current of the compressor motor plus the full-load current of the fan motor and/or other loads.

16.6 Switching devices shall be housed within an enclosure which will protect coils and contacts against mechanical damage, dirt, and moisture. Protection of the switching device may be provided by its method of mounting within the dehumidifier enclosure, by inherent construction of the component, or by means of a separate enclosure.

16.7 A single-pole switching device shall not be connected to the grounded conductor.

Exception: An automatic control which does not have a marked OFF position is not required to comply with this requirement.

17 Electrical Spacings

17.1 High-voltage circuits

17.1.1 A high-voltage circuit is one involving a potential of not more than 600 volts and having circuit characteristics in excess of those of a low-voltage circuit as defined in 17.2.1.

17.1.1 added April 23, 1996

17.1.2 Unless specifically noted otherwise, the spacings between uninsulated live parts of opposite polarity and between an uninsulated live part and a dead metal part shall be not less than the values indicated in Table 17.1.

17.1 revised and relocated as 17.1.2 April 23, 1996

Table 17.1
Electrical spacings in refrigerated and/or air-handling compartments

Table 17.1 revised April 23, 1996

Ratings		Minimum spacings in inches (mm)					
Volt-amperes	Volts	Through air[a]		Over surface[a]		To enclosure[c]	
2000 or less	300 or less	1/8[b]	(3.2)	1/4	(6.4)	1/4	(6.4)
	301–600	3/8	(9.5)	1/2	(12.7)	1/2	(12.7)
More Than 2000	150 or less	1/8[b]	(3.2)	1/4	(6.4)	1/2	(12.7)
	151–300	1/4	(6.4)	3/8	(9.5)	1/2	(12.7)
	301–600	3/8	(9.5)	1/2	(12.7)	1/2	(12.7)

[a] At points other than field-wiring terminals, the spacings for heater elements only may be as indicated below provided the elements are not subject to moisture, such as may result from condensation on cooled surfaces:

1/16 inch (1.6 mm) Through Air and Over Surface for heaters rated 0 – 300 volts.

1/4 inch (6.4 mm) Through Air and Over Surface for heaters rated 301 – 600 volts.

[b] The spacings between wiring terminals of opposite polarity, or between a wiring terminal and ground shall not be less than 1/4 inch (6.4 mm), except that if short-circuiting or grounding of such terminals will not result from projecting strands of wire, spacing need not be greater than that given in the above table. Wiring terminals are those connected in the field and not factory wired.

[c] Includes fittings for conduit or metal-clad cable.

17.1.3 The ″Through Air″ and ″Over Surface″ spacings specified in Tables 17.1 and 17.2 at an individual component part are to be based on the total volt-ampere (VA) consumption of the load or loads which the component controls. For example, spacings at a component which controls only the compressor motor are based on the VA of the compressor motor. Spacings at a component which simultaneously controls several concurrent loads are based on the sum of the VA of the loads so controlled. Spacings at a component which controls several nonconcurrent loads are based on the VA of the largest load. The VA values for the load referred to above are to be determined by the marked rating of the loads, except that for loads which are not required to have a marked rating, the measured input is to be used in determining the volt-ampere values.

17.2 revised and relocated as 17.1.3 April 23, 1996

17.1.4 With reference to 17.1.2 and 17.1.3 the ″To Enclosure″ spacings are not to be applied to an individual enclosure of a component part within an outer enclosure or cabinet of the dehumidifier.

17.3 revised and relocated as 17.1.4 April 23, 1996

17.1.5 The spacings indicated in Table 17.2 are applicable only to electrical components mounted in totally enclosed nonrefrigerated and/or nonair handling compartments which are free of moisture, including that caused by condensation. At wiring terminals and for circuits over 250 volts or over 2000 volt-amperes, spacings in Table 17.1 apply.

17.1.5 added April 23, 1996

Table 17.2
Spacings in non-refrigerated and/or non-air handling compartments

Table 17.2 added April 23, 1996

Ratings		Minimum spacing in inches (mm)					
Volt-amperes	Volts	Through air		Over surface		To enclosure[a]	
0 – 2000	0 – 125	1/16	(1.6 mm)	1/16	(1.6 mm)	1/4	(6.4 mm)
	125 – 250	3/32	(2.4 mm)	3/32	(2.4 mm)	1/4	(6.4 mm)

Note – See paragraph 17.1.5.

[a] Includes fittings for conduit or metal-clad cable.

17.1.6 An insulating liner or barrier of fiber or similar material employed where spacings would otherwise be less than the required values shall be not less than 0.028 inch (0.7 mm) in thickness and shall be so located or of such material that it will not deteriorate when subjected to arcing.

Exception No. 1: Fiber not less than 0.013 inch (0.3 mm) in thickness may be used in conjunction with an air spacing of not less than 50 percent of the spacing required for air alone.

Exception No. 2: Material having a lesser thickness may be used if it has equivalent insulating, mechanical, and flammability properties when compared with materials in thicknesses specified above.

17.4 revised and relocated as 17.1.6 April 23, 1996

17.1.7 All uninsulated live parts connected to different circuits shall be spaced from one another as though they were parts of opposite polarity in accordance with the requirements indicated above and shall be based on the highest voltage involved.

17.1.7 added April 23, 1996

17.1.8 The above spacing requirements do not apply to the inherent spacings of a component part of the equipment, such as a hermetic motor-compressor, motor, snap switch, controller, attachment-plug cap, and the like, for which spacing requirements are given in a standard for the component. However, the electrical clearance resulting from the assembly of a component into the complete machine, including clearance to dead metal or enclosures, shall be as indicated herein.

17.1.8 added April 23, 1996

17.1.9 If higher than rated potential is developed in a motor circuit through the use of capacitors, the rated voltage of the system shall be employed in applying the spacings indicated in this section.

Exception: If the developed steady-state potential as determined in the Temperature and Pressure Test exceeds 500 volts, the developed potential is to be used in determining spacings for the parts affected.

17.1.9 added April 23, 1996

17.1.10 The spacing between uninsulated live terminals of the components in an electric-discharge lamp circuit and dead metal part or enclosure shall be not less than 1/2 inch (12.7 mm) if the potential is 600 volts or less and not less than 3/4 inch (19.1 mm) if the potential is 601 – 1000 volts.

17.1.10 added April 23, 1996

17.2 Low-voltage circuits

17.2.1 A low-voltage circuit is one involving a potential of not more than 30 volts alternating current, 42.4 volts peak or direct current, and supplied by a standard Class 2 transformer or by a suitable combination of transformer and fixed impedance having output characteristics in compliance with those required for a Class 2 transformer.

17.2.1 added April 23, 1996

17.2.2 A circuit derived from a source of supply classified as a high-voltage circuit, by connecting resistance in series with the supply circuit as a means of limiting the voltage and current, is not considered to be a low-voltage circuit.

17.2.2 added April 23, 1996

17.2.3 The spacings for low-voltage electrical components which are installed in a circuit which includes a pressure-limiting device, motor overload protective device, or other protective device, where a short or grounded circuit may result in unsafe operation of the equipment shall comply with the following:

a) The spacing between an uninsulated live part and the wall of a metal enclosure, including fittings for the connection of conduit or metal-clad cable, shall be not less than 1/8 inch (3.2 mm).

b) The spacing between wiring terminals, regardless of polarity, and between the wiring terminal and a deal metal part, including the enclosure and fittings for the connection of conduit, which may be grounded when the device is installed, shall be not less than 1/4 inch (6.4 mm).

c) The spacing between uninsulated live parts, regardless of polarity, and between an uninsulated live part and a dead metal part, other than the enclosure, which may be grounded when the device in installed, shall be not less than 1/32 inch (0.8 mm) provided that the construction of the parts is such that spacings will be maintained.

17.2.3 added April 23, 1996

17.2.4 The spacings in low-voltage circuits which do not contain devices such as indicated in the previous paragraph are not specified.

17.2.4 added April 23, 1996

REFRIGERATION SYSTEM

18 Refrigerants

18.1 The kind and quantity of refrigerant employed in the system shall comply with the Standard for Refrigerants, UL 2182.

18.1 revised November 5, 1997

18.2 Deleted April 23, 1996

19 Refrigerant Tubing and Fittings

19.1 Tubing shall be constructed of corrosion resistant material, such as copper, or shall be plated, dipped, coated, or otherwise treated to resist external corrosion. Aluminum may be used where the material is not subject to galvanic corrosion.

19.2 Copper or steel tubing used to connect refrigerant-containing components shall have a wall thickness not less than indicated in Table 19.1.

Exception: Capillary tubing protected against mechanical damage by the cabinet or assembly shall have a wall thickness not less than 0.020 inch (0.51 mm).

19.3 Tubing forming part of components, such as evaporators or condensers, where protection is afforded by inherent construction shall be judged in accordance with the requirements of the Strength Tests – Pressure Containing Components, Section 40.

19.3 revised April 23, 1996

Table 19.1
Minimum wall thickness for copper and steel tubing

Table 19.1 revised March 18, 2002

Outside Diameter		Copper				Steel	
		Protected[a]		Unprotected			
Inch	(mm)	Inch	(mm)	Inch	(mm)	Inch	(mm)
1/4	(6.4)	0.0245	(0.622)	0.0265	(0.673)	0.025	(0.64)
5/16	(7.9)	0.0245	(0.622)	0.0265	(0.673)	0.025	(0.64)
3/8	(9.5)	0.0245	(0.622)	0.0265	(0.673)	0.025	(0.64)
1/2	(12.7)	0.0245	(0.622)	0.0285	(0.724)	0.025	(0.64)

NOTE – Nominal wall thickness of tubing will have to be greater than the thickness indicated to maintain the minimum wall thickness.

[a] Within the product.

19.4 Special alloys or constructions used in refrigerant-containing components, including tubing with a wall thickness less than indicated in 19.2, may be acceptable. Among the factors taken into consideration when judging the acceptability are its:

a) Resistance to mechanical abuse,

b) Strength against internal pressure,

c) Resistance to corrosion,

d) Protection against refrigerant contamination, and

e) Conformity with requirements of safety codes, such as the Safety Code for Mechanical Refrigeration, ANSI/ASHRAE 15–1992, as compared to tubing of the minimum wall thicknesses indicated in Table 19.1.

19.4 revised April 23, 1996

19.5 Tubing connections shall be made by means of flare-type fittings with steel or forged-brass nuts, by soldering or brazing, or by other equivalent means. Flare-type fittings shall comply with the Standard for Refrigeration Tube Fittings, ANSI/SAE J513–1990. Tubing connections of dissimilar metals, such as aluminum and copper, shall be protected against moisture to minimize galvanic action.

20 Refrigerant-Containing Parts

20.1 Parts of a dehumidifier subject to refrigerant pressure shall withstand the pressures indicated in the Strength Tests – Pressure Containing Components, Section 40.

20.2 Parts of a dehumidifier subjected to refrigerant pressure shall be constructed of corrosion resistant material, such as copper or stainless steel, or shall be plated, dipped, coated, or otherwise treated to resist external corrosion.

21 Pressure Relief

21.1 A dehumidifier shall be constructed so that pressure due to fire will be relieved. Pressure-relief devices, fusible plugs, or soldered joints may be employed for this purpose.

No Text on This Page

21.2 A pressure-relief device is a pressure-actuated valve or rupture member designed to relieve excessive pressures automatically.

21.3 Fusible plugs and rupture members shall comply with the applicable Standard for Refrigerant-Containing Components and Accessories, UL 207.

PERFORMANCE

22 Instrumentation

22.1 Temperature measurements

22.1.1 Temperatures are to be measured by thermocouples, except that the change-in-resistance method may be used to measure the temperature of motor windings or of coils. See 22.1.4. Thermocouples are to consist of No. 24 – 30 AWG (0.21 – 0.5 mm^2) wires. Thermocouple wire is to comply with the requirements for ″special thermocouples″ as listed in the Table of Limits of Error of Thermocouples in the Standard for Temperature Measurement Thermocouples, ANSI MC96.1–1975.

22.1.2 A thermocouple junction and adjacent thermocouple lead wire are to be held in positive thermal contact with the surface of the material whose temperature is being measured. In most cases, thermal contact will result from securely taping or cementing the thermocouples in place, but where a metal surface is involved, brazing or soldering the thermocouple to the metal may be necessary.

22.1.3 If thermocouples are used in the determination of temperatures in connection with the heating of electrical equipment, it is a standard practice to employ thermocouples consisting of No. 30 AWG (0.05 mm^2) iron and constantan wires and a potentiometer type of indicating instrument. This equipment will be used whenever referee temperature measurements by means of thermocouples are necessary.

22.1.4 If the temperature of a copper motor winding or coil is to be determined by the change-in-resistance method, the following formula is to be used:

$$T = \frac{R}{r}(234.5 + t) - 234.5$$

In which:

T is the temperature to be determined in degrees C,

t is the known temperature in degrees C,

R is the resistance in ohms at the temperature to be determined,

r is the resistance in ohms at the known temperature.

22.1.5 When it is necessary to de-energize the winding before measuring R, the value of R at shutdown is to be determined by taking several resistance measurements at short intervals, beginning as quickly as possible after the instant of shutdown. A curve of the resistance values as a function of time is to be plotted and extrapolated to give the value of R at shutdown.

22.2 Pressure measurements

22.2.1 Pressure gauges are to be attached in a manner to prevent leakage. Special fittings for direct connection to the system or minimum lengths of 1/8 inch (3.2 mm) outside diameter commercial capillary tubing may be employed for gauge connections. The volume of the pressure-measuring gauge and lines is to be held to a minimum. All joints in the gauge system are to be tested for leakage.

22.2.2 Opening of the gauge line valves shall not cause a significant change in the electrical input of the system that would prevent the appliance from performing in its intended manner. High-side gauges and lines may be heated above the saturation temperature corresponding to the expected pressure or may be precharged with a liquid refrigerant of the same type as used in the system to minimize the effect of opening the gauge line valves.

23 Test Voltage

23.1 Dehumidifiers are to be tested at 60 hertz (Hz) voltages maintained at the unit supply connections in accordance with Table 23.1.

Exception: Dehumidifiers rated at frequencies other than 60 Hz are to be tested at their rated voltages and frequencies.

Table 23.1
Test voltages

Nameplate Voltage Rating	Test Voltage[a]
110 to 120	120
208	208
220 to 240	240

[a] These voltages are nominal for the Fan Motor Failure Test, Section 29.

24 Leakage Current Test

24.1 The leakage current of a dehumidifier shall not exceed 0.75 milliampere (mA) when tested in accordance with 24.6–24.8.

24.2 Leakage current refers to all currents, including capacitively coupled currents, which may be conveyed between exposed conductive surfaces of a dehumidifier and ground or other exposed conductive surfaces.

24.3 All exposed conductive surfaces are to be tested for leakage currents. The leakage currents from these surfaces are to be measured to the grounded supply conductor individually as well as collectively and from one surface to another where simultaneously accessible. Parts are considered to be exposed surfaces unless they are guarded by an enclosure providing protection in accordance with 5.1 and 5.2. Surfaces are considered to be simultaneously accessible when they can be readily contacted by one or both hands of a person at the same time.

24.4 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 metal foil with an area of 3.9 by 7.8 inches (10 by 20 cm) in contact with the surface. Where the surface is less than 3.9 by 7.8 inches, the metal foil is to be the same size as the surface. The metal foil is not to remain in place long enough to affect the temperature of the dehumidifier.

24.5 The measurement circuit for leakage current shall be as shown in Figure 24.1. The measurement instrument is defined in items a – c and, unless it is being used to measure leakage from one part of a dehumidifier to another, the meter is to be connected between the accessible parts and the grounded supply conductor. The meter which is used for a measurement need only indicate the same numerical value for a particular measurement as would the defined instrument and need not have all the attributes of the defined instrument.

a) The meter is to have an input impedance of 1500 ohms resistive shunted by a capacitance of 0.15 microfarad.

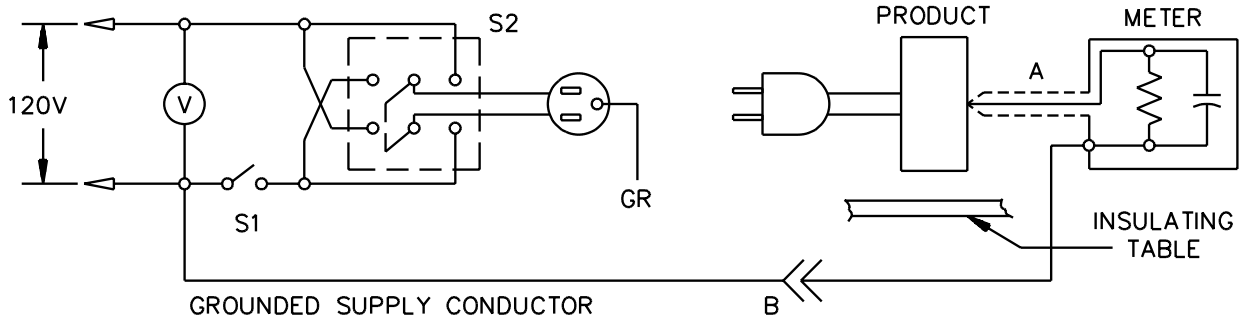
b) The meter is to indicate 1.11 times the average of the full-wave rectified composite waveform of voltage across the resistor or current through the resistor.

c) Over a frequency range of 0 – 100 kHz, the measurement circuitry is to have a frequency response (ratio of indicated to actual value of current) that is equal to the ratio of the impedance of a 1500 ohm resistor shunted by a 0.15 microfarad capacitor to 1500 ohm. At an indication of 0.75 mA, the measurement is to have an error of not more than 5 percent.

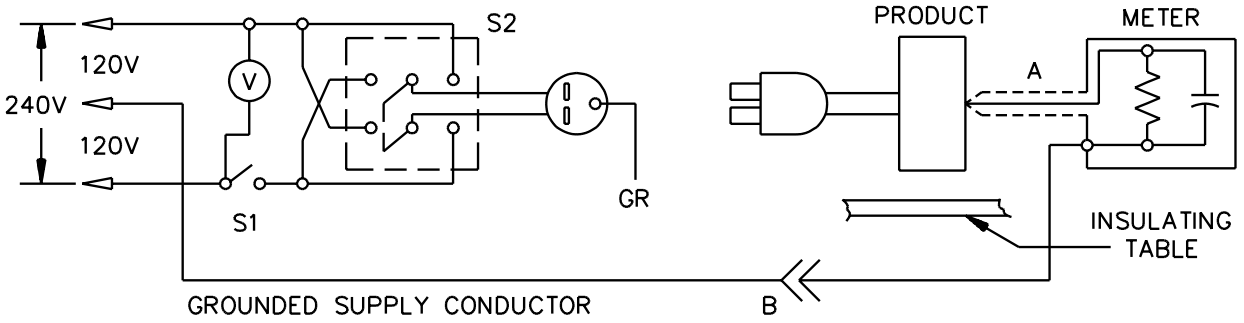
24.5 revised March 18, 2002

Figure 24.1
Leakage current measurement circuits

Figure 24.1 revised March 31, 1998



Product intended for connection to a 120 or 208 volt power supply.



240 or 208 volt product intended for connection to a 3 wire grounded neutral power supply.

LC200Q

A. Probe with shielded lead. Under some circumstances where higher frequency components are present, shielding of measuring instrument and its leads may be necessary.

B. Separated and used as clip when measuring currents from one part of a product to another.

24.6 A sample of the dehumidifier is to be prepared and conditioned for leakage current measurement as follows:

a) The grounding conductor is to be open at the attachment-plug and the dehumidifier isolated from ground.

b) The sample is to be conditioned in an ambient temperature of 80±2°F (26.7±1°C) dry bulb, 69.6±1°F (20.9±0.5°C) wet bulb for not less than 8 hours.

24.7 The dehumidifier is to be operated in an ambient temperature of 80±2°F (26.7±1°C) dry bulb, 69.6±1°F (20.9±0.5°C) wet bulb. The supply voltage is to be as indicated in Table 23.1.

24.8 With reference to the measuring circuit in Figure 24.1, the leakage current test sequence shall be as described in (a) – (b) below. If the compressor stalls during sequence (b) or (c) due to changing the position of switch S2, the sequence is to be conducted in its entirety in one position of switch S2 and then repeated in the second position of switch S2.

a) With switch S1 open, the unit is to be connected to the measuring circuit. The leakage current is to be measured using both positions of switch S2 and with manually-operated unit switching devices successively placed in each mode (dehumidifying, heating, and the like).

b) With unit controls set for maximum dehumidification and maximum fan speed, switch S1 is to be closed to energize the unit. Within 5 seconds, leakage current is to be measured using both positions of switch S2. Following this and using both positions of switch S2, manual switching devices are to be operated as quickly as possible through all dehumidifying modes, but not in the ″off″ position, to determine the maximum leakage current condition.

c) With switching devices set at the position which causes the highest leakage current, the unit is to be operated continuously until the measured leakage current stabilizes or decreases. Both positions of switch S2 are to be used.

d) Following (c), switch S1 is to be opened to de-energize the unit. Measurement of leakage current is to continue, using both positions of switch S2, until values stabilize or begin to decrease.

24.9 A unit with provisions for electric heating shall also be tested in all modes of heating operation. The test sequence shall be in accordance with (b) – (d) of 24.8 except that unit switching devices shall be set for the heating mode. It may be necessary to shunt some unit controls in order to energize the electric heater.

25 Input Test

25.1 Dehumidifying load

25.1.1 The measured ampere input to a dehumidifier shall not exceed the marked ampere rating of the appliance by more than 10 percent.

25.1.2 If a dehumidifier is rated in watts in addition to amperes, both the wattage and ampere markings are to be limited to the tolerance specified in 25.1.1.

25.1.3 The unit is to be continuously operated in an ambient temperature of 80±2°F (26.7±1°C) dry bulb, 69.6±1°F (20.9±0.5°C) wet bulb until stabilized input conditions are obtained. The test is to be conducted with rated nameplate voltage and frequency maintained at the unit supply connections.

25.2 Heating load

25.2.1 The measured ampere or wattage input to a dehumidifier equipped with a heater shall not exceed the marked ampere or wattage rating of the appliance by more than 5 percent.

25.2.2 This test may be conducted in any convenient ambient. With the selector switch in the maximum heating position, the unit is to be operated at rated nameplate voltage and frequency maintained at the supply connections. If the unit employs a multispeed fan motor, the motor is to be operated at the speed which results in the highest total input to the dehumidifier under heating conditions.

26 Temperature and Pressure Test

26.1 Temperature rises measured on components of a dehumidifier shall not exceed those specified in Table 26.1.

26.2 The maximum pressure developed in a dehumidifier, tested as described in 26.3–26.5, shall be used as a basis for the requirements of the Strength Tests – Pressure Containing Components, Section 40, and for establishing minimum high- and low-side design pressures for the appliance. See 53.6.

26.3 A motor-compressor shall be capable of operating continuously with the motor protective device in the circuit.

Exception: An automatic-reset protective device may cycle at the start of the test. A manual-reset protective device shall not trip during the test.

26.4 For this test, the dehumidifier is to be fitted with pressure gauges on the high- and low-pressure sides of the refrigeration system. Thermocouples are to be secured to various surfaces and electrical components, including the motor-compressor enclosure, fan-motor windings, starting relay coil, capacitors, and wiring insulation. The temperature of motor windings or of coils may be measured by the change-in-resistance method; see 22.1.1. The electrical input is to be measured with a voltmeter and an ammeter.

26.5 The dehumidifier is to be placed in a room maintained at 104±2°F (40±1°C) dry bulb and 80±1°F (26.7±0.5°C) wet bulb and then started and operated until temperatures and pressures have stabilized. The test potential is to be as indicated in 23.1.

26.6 The dehumidifier shall comply with the Dielectric Voltage Withstand Test, Section 28, following this test.

Table 26.1
Maximum temperature rises

Device or material	Degrees C	Degrees F
A. Motors		
1. Class A insulation systems on coil windings of alternating-current motors having a frame diameter of 7 inches (178 mm) or less (not including hermetic motor-compressors)[a]		
a. In open motors –		
Thermocouple or		
Resistance method	75	135
b. In totally enclosed motors –		
Thermocouple or		
Resistance method	80	144
2. Class B insulation systems on coil windings of alternating-current motors having a frame diameter of 7 inches (178 mm) or less (not including hermetic motor-compressors)		
a. In open motors –		
Thermocouple or		
Resistance method	95	171
b. In totally enclosed motors –		
Thermocouple or		
Resistance method	100	180
B. Components		
1. Capacitors		
Electrolytic type[c]	40	72
Other types[d]	65	117
2. Hermetic motor-compressor enclosure[e]	150	302
3. Relay, solenoid, and other coils (except motor coil windings) with[b]		
a. Class 105 insulated winding –		
Thermocouple method	65	117
Resistance method	85	153
b. Class 130 insulation –		
Thermocouple method	85	153
Resistance method	105	189
4. Solid contacts	65	117
5. Wood or other flammable material	65	117

Table 26.1 Continued on Next Page

Table 26.1 Continued

Device or material			Degrees C	Degrees F
C.	Insulated conductors			
	1. Flexible cords and wires with rubber, thermoplastic, or neoprene insulation unless recognized as having special heat-resistant properties as follows:			
	Temperature rating			
	Degrees C	Degrees F		
	60	140	35	63
	75	167	50	90
	80	176	55	99
	90	194	65	117
	105	221	80	144
D.	Surfaces of product contacted by persons in operating it (control knobs, pushbuttons, enclosure, grille, and the like)[e]			
	Metal		60	140
	Nonmetallic		85	185
E.	Electrical insulation – general			
	1. Fiber used as electrical insulation or cord bushings		65	117
	2. Phenolic composition used as electrical insulation or as parts where failure will result in a hazardous condition		125	225
	3. Thermoplastic material. Rise based on temperature limits of material		–	–

[a] Thermocouple applied directly to the integral insulation of the coil conductor.

[b] Thermocouple applied as in note a or applied to conventional coil wrap.

[c] For an electrolytic capacitor which is physically integral with or attached to a motor, the temperature rise on insulating material integral with the capacitor enclosure may be not more than 65°C (117°F).

[d] A capacitor which operates at a temperature higher than a 65°C (117°F) rise may be judged on the basis of its marked temperature rating.

[e] Maximum – not rise.

27 Temperature Test – Electric Heat

27.1 If a dehumidifier is equipped with an electric air heater, operation in the heating mode shall not result in temperatures of wiring, motors, and other electrical components and materials in excess of those permitted by Table 26.1.

27.2 Thermocouples are to be applied to the fan motor winding, to conductor insulation near the heater element and fan motor and, in general, to electrical insulation, thermal or acoustical insulation and other flammable material in the unit.

27.3 The dehumidifier is to be operated continuously until constant temperatures have been reached. The test ambient temperature is to be approximately 77°F (25°C). The test voltage is to be maintained as indicated in 23.1. If a dehumidifier employs a multispeed fan motor, the motor is to be operated at the speed which results in the highest temperatures on the components under heating conditions.

27.4 The dehumidifier is to comply with the Dielectric Voltage Withstand Test, Section 28, following this test.

28 Dielectric Voltage Withstand Test

28.1 A product shall withstand, without breakdown, a test potential applied for 1 minute between high-voltage live parts and dead metal parts and between live parts of high-voltage and low voltage circuits. The test potential shall be 1000 V plus twice rated voltage at any frequency between 40 and 70 hertz.

Exception No. 1: The test potential for units rated at not more than 1/2 horsepower (373 watts output) shall be 1000 V.

Exception No. 2: If the steady-state voltage developed in a motor circuit through the use of capacitors exceeds 500 V, as measured during the temperature and pressure test, the test potential for the parts affected shall be 1000 V plus twice the developed capacitor voltage.

28.1 revised April 23, 1996

28.1.1 Equipment employing a low-voltage circuit shall withstand, without breakdown, a test potential of 500 volts applied for 1 minute between low-voltage live parts and dead metal parts. The test potential shall be at any frequency between 40 and 70 hertz. If components specified in paragraph 17.2.3 are employed in the low-voltage circuit, the dielectric voltage withstand test shall also be conducted between live parts of opposite polarity.

28.1.1 added April 23, 1996

28.1.2 With reference to the previous paragraph, the test between low-voltage parts of opposite polarity is to be conducted on magnet coil windings of the transformer after breaking the inner coil lead where it enters the layer. This opposite polarity test may be waived on the complete assembly provided that the components have been separately subjected to this test.

28.1.2 added April 23, 1996

28.2 A 500 volt-ampere or larger transformer, the output voltage of which is essentially sinusoidal and can be varied, is to be used to determine compliance with the previous paragraphs. The applied potential is to be increased gradually from zero until the required test value is reached and is to be held at that value for 1 minute.

Exception: The requirement of a 500 volt-ampere or larger transformer can be waived if the high potential testing equipment maintains the specified high potential voltage at the equipment during the duration of the test.

28.2 revised April 23, 1996

28.3 If the charging current through a capacitor or capacitor-type filter connected across the line, or from line to earth ground, is large enough to make it impossible to maintain the required alternating-current test potential, the capacitors and capacitor-type filters may be tested as described in 28.4.

28.3 added April 23, 1996

28.4 The capacitors and capacitor-type filters mentioned in the previous paragraph are to be subjected to a direct-current test potential of 1414 volts for equipment rated 250 volts or less or 1414 volts plus 2.828 times the rated circuit voltage for equipment rated at more than 250 volts. The direct-current test potential is to be maintained for 1 minute without breakdown.

28.4 added April 23, 1996

28.5 Components providing a d.c. path in parallel with the insulation to be tested, such as discharge resistors for filter capacitors and voltage limiting devices (transient voltage supressors), may be disconnected during the test.

28.5 added April 23, 1996

29 Fan Motor Failure Test

29.1 A dehumidifier shall not leak refrigerant nor develop pressures or temperatures in excess of those indicated in (a) and (b), below, if the fan motor locks or fails to start.

a) The maximum high- and low-side pressures shall not exceed one-third of the ultimate strength of high- and low-side parts, respectively, as determined by Strength Tests – Pressure Containing Components, Section 40.

b) The maximum temperature of the compressor enclosure, of the fan motor winding (open type) or of the fan motor enclosure (enclosed type) shall not exceed 150°C (302°F). Compressors and fan motors equipped with thermal protective devices as specified in Motors and Motor Overload Protection, Section 15, are considered to comply with this requirement.

29.2 A sample of the assembly, fitted with pressure gauges on the high- and low-pressure sides of the refrigeration system and provided with thermocouples on the compressor motor enclosure and fan motor winding (open type) or fan motor enclosure (enclosed type), is to be operated with the fan motor locked. Operation is to continue until maximum stabilized temperatures and pressures are reached or until representative maximum temperatures and pressures are attained under cycling load. The low-side pressure is also to be recorded after compressor shutdown. The compressor motor overload device and/or the fan motor overload device may operate during this test. The test ambient temperature is to be approximately 77°F (25°C). The test potential is to be maintained as specified in 23.1.

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30 Heater Burnout Test

30.1 Operation of a heater employed in a dehumidifier shall not result in a risk of fire or electric shock if the fan motor locks or fails to start.

30.2 A risk of fire is considered to exist if there is emission of flame or molten metal from the dehumidifier or glowing or flaming of flammable material.

30.3 A risk of electric shock is considered to exist if the insulation resistance of the dehumidifier is less than 50,000 ohms.

30.4 Opening of a sheath-type heater element is acceptable if the risk of fire and electric shock does not exist. If a sheath-type heater element opens, three samples are to be tested to determine that the heater is designed to function in this manner.

30.5 The test arrangement is to be as described in the Temperature Test – Electric Heat, Section 27, except that the fan motor is to be locked. For detecting emission of flame or molten metal, a double layer of cheesecloth is to be placed around the dehumidifier so that it adheres closely to the enclosure near all openings. The cloth is to be bleached cheesecloth, 36 inches (0.91 m) wide, running 14 to 15 square yards per pound (25.8 – 27.7 m^2/kg) and having what is known in the trade as a ″count of 32 x 28.″ The test is to be continued until stabilized temperatures are reached on flammable materials, including the cheesecloth.

30.6 If a temperature-limiting control is employed which does not comply with the endurance test requirement of 34.1.2, it is to be shunted out of the circuit. If an automatic-reset temperature-limiting control has complied with the endurance test requirement of 100,000 cycles, the test is to terminate when the temperatures of components and materials, such as conductor insulation, electrical insulation, thermal insulation, and flammable materials near the heater element have stabilized. If a manual-reset temperature-limiting control is employed and has met the endurance test requirement of 34.1.2, the test is to terminate when the device opens the heater circuit.

30.7 If a replaceable thermal cutoff is employed, the test is to be conducted five times using different samples of the thermal cutoff in each test. The thermal cutoff is to open the circuit in the intended manner without causing the short-circuiting of live parts and without causing live parts to become grounded. During the test, the enclosure is to be connected through a 3 ampere fuse to ground, and any thermally operated control devices in the heater circuit other than the thermal cutoff are to be short-circuited. The 3 ampere fuse shall not open during the test.

31 Overflow Test

31.1 With reference to 5.5, a dehumidifier in which collected condensate may overflow shall not allow the water to wet uninsulated live parts or the windings of motors or coils.

31.2 The dehumidifier is to be positioned as intended in operation, and any drains provided in condensate drain pans and/or condensate receptacles or both are to be blocked. The pan or receptacle or both is to be filled to its capacity. Water then is to be added until overflowing water accumulates in the bottom of the unit or on the surface beneath it.

31.3 Compliance with 31.1 shall be determined by visual examination. Where visual examination is not practical, the Insulation Resistance Test, Section 36, and the Dielectric Voltage Withstand Test, Section 28, are to be conducted immediately after overflow has occurred. The dehumidifier shall have an insulation resistance of not less than 50,000 ohms measured between current-carrying parts and dead metal parts and shall comply with the requirement of the Dielectric Voltage Withstand Test.

32 Impact Test

32.1 An outer enclosure shall withstand an impact of 5 foot pounds (6.8 J) without denting, breaking, or cracking in a manner which would:

a) Reduce electrical spacings below those specified in Section 17 or

b) Expose uninsulated live parts as judged by the requirements of Assembly, Section 5.

32.2 An outer enclosure shall withstand an impact of 1.5 foot-pounds (2.0 J) without denting, breaking, or cracking in a manner which would expose moving parts as judged by the requirements of Assembly, Section 5.

32.3 An outer enclosure or part of an outer enclosure which does not serve as the enclosure of uninsulated live parts or moving parts need not comply with the requirements of 32.1 and 32.2.

32.3 revised March 18, 2002

32.4 Deleted March 18, 2002

32.5 The impacts are to be produced by a steel ball weighing 1.18 pounds (0.54 kg) and approximately 2 inches (50.8 mm) in diameter. The ball may be swung through an arc as a pendulum or allowed to fall freely to produce the impact. A vertical distance of 4.24 feet (1290 mm) is required to produce a 5 foot-pound (6.8 J) impact and 1.27 feet (390 mm) is required to produce a 1.5 foot-pound (2.0 J) impact. Three complete as-received samples shall be used for this test. Each sample is to be subjected to a single impact directed at a different location. If the manufacturer so elects, fewer samples may be used if the sample can withstand repeated impacts.

33 Static Load Test

33.1 A dehumidifier shall withstand the test described in 33.2 without denting, breaking, or cracking in a manner which would result in:

a) Damage to the refrigeration system as evidenced by release of refrigerant;

b) Reduction of electrical spacings below those specified in Section 17;

c) Exposure of moving parts or uninsulated live parts as judged by the requirements of Assembly, Section 5; and

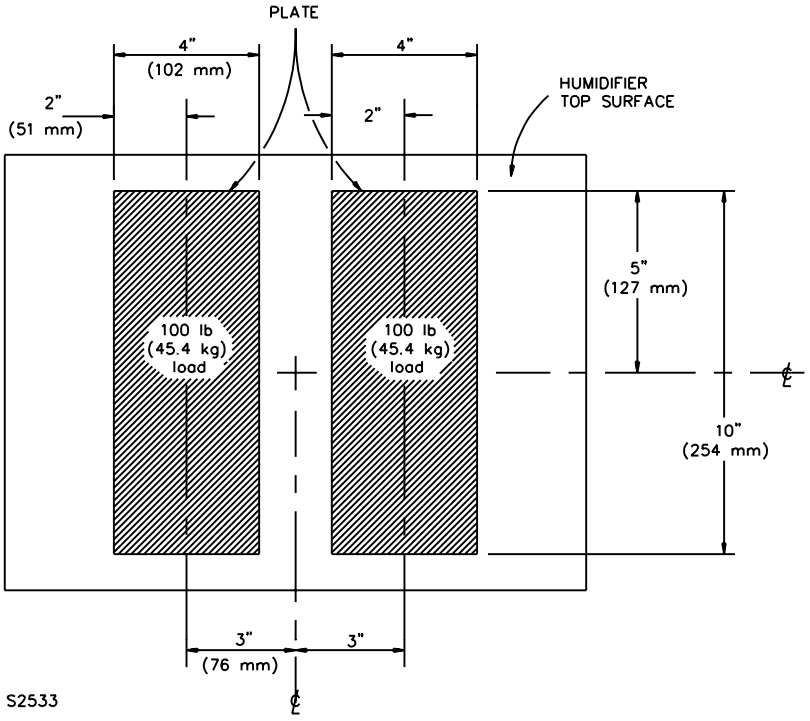
d) Reduction of the insulating properties of the internal wiring as judged by the requirements of the Dielectric Voltage Withstand Test, Section 28.

33.2 A dehumidifier is to be positioned as intended in use. Casters if provided are to be in place. A load of 100 pounds (45 kg) is to be applied to each of two flat metal plates simultaneously. The plates are to be 4 by 10 by 1/4 inch (102 by 254 by 6.4 mm) and are to be positioned on the top surface of the cabinet with the major axes parallel to each other and to any side of the cabinet as illustrated in Figure 33.1.

Exception No. 1: If a dehumidifier employs an electrical control mounted in the top surface so that the actuating member extends above the surface, the plates are to be arranged so that the loads do not bear on the actuating member.

Exception No. 2: If a dehumidifier employs louvered air openings in the top surface, and deformation or breakage of the louvers does not affect compliance with 33.1, the plates may be arranged so that the loads do not bear on the louvers, or the louvers may be removed or replaced with 1/4 inch (6.4 mm) thick metal before the loads are imposed.

Figure 33.1
Static-load test arrangement



34 Heater Temperature-Limiting Control Tests

34.1 Endurance test

34.1.1 If a dehumidifier must be equipped with a temperature-limiting control in order to comply with the requirements of the Heater Burnout Test, Section 30, the control shall withstand an endurance test under the load which it controls for the number of cycles indicated in 34.2. There shall be no electrical or mechanical failure of the control.

34.1.2 The number of cycles for the test is to be as follows:

a) An automatic-reset temperature-limiting control shall withstand 100,000 cycles of operation under load.

b) A manual-reset temperature-limiting control shall withstand 1000 cycles of operation under load and an additional 5000 cycles without load.

34.1.3 The test is to be conducted with the control connected either to the heater element load or to an equivalent noninductive load. The frame of the control is to be connected through a 3 ampere fuse to ground or to the grounded conductor of the supply circuit. The fuse shall not open during the test.

34.2 Calibration test

34.2.1 A temperature-limiting control shall comply with the Standard for Temperature-Indicating and -Regulating Equipment, UL 873, pertaining to the calibration of temperature-limiting controls.

35 Current Overload Test – Bonding Conductors and Connections

35.1 When required by 10.7 and 10.8, bonding conductors and connections shall not open when carrying a load of 40 amperes if used on 115 volt units or 30 amperes if used on 208 or 230 volt units. The load is to be applied for 2 minutes.

36 Insulation Resistance Test

36.1 Electric heaters

36.1.1 An electric heater of the metallic sheath type which is exposed to moisture shall maintain an insulation resistance of not less than 50,000 ohms when cycled in the presence of water and shall comply with the Dielectric Voltage Withstand Test, Section 28, following exposure.

36.1.2 If a heater terminal seal is in contact with water as it is used in the dehumidifier, the heater with the terminal seal is to be alternately cycled ON and OFF while submerged in water for 30 days. The water is to be maintained at a temperature not less than that measured on the heater terminal seal during heater operation, but not more than 90°C (194°F). The heater is to be cycled four times per hour with an ON time of approximately 1-1/2 minutes and an OFF time of approximately 13-1/2 minutes.

36.1.3 If a heater terminal seal is not wetted but is exposed to moisture in the dehumidifier, the heater assembly is to be alternately cycled ON and OFF in an atmosphere of not less than 98 percent relative humidity. The heater is cycled in a controlled-humidity test chamber. The cycle is to be initiated by a time switch and terminated by a control set to disconnect the heater when a temperature rise on the sheath or case is equivalent to the rise measured during the heater operation. The rate of cycling is to be maintained between 3 to 10 cycles per hour for 1000 cycles.

36.2 Thermal and acoustical insulating material

36.2.1 To determine that a dehumidifier does not employ electrically conductive insulating material (see 5.9), the dehumidifier is to be exposed for 24 hours to moist air having a relative humidity of 85±5 percent at a temperature of 90±4°F (32±2°C). Following exposure, the dehumidifier is to have an insulation resistance of not less than 50,000 ohms between live parts and interconnected dead metal parts.

37 Limited Short-Circuit Test

37.1 General

37.1.1 Motor overload protective devices connected in the motor circuit and bonding conductors and connections not exempted by 10.7 and 10.8, shall withstand short-circuiting when protected by a fuse of the size required by the dehumidifier.

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37.1.2 The motor overload protective device and bonding conductor and/or connection is to be connected in a circuit having a capacity based on the rated load current and voltage rating of the dehumidifier. See Table 37.1. When the rated load current of the dehumidifier is between two values in the table, the larger value is to be used in determining the circuit capacity. The voltage for the test circuit is to be an ac supply, and the circuit capacity is to be measured without the device in the circuit. The power factor of the test circuit is to be 0.9 – 1.0 unless a lower power factor is agreeable to those concerned.

Table 37.1
Short-circuit test currents

Dehumidifier rated-load amperes			
110–120 Volts	208 Volts	220–240 Volts	Capacity, Amperes
9.8 or less	5.4 or less	4.9 or less	200
9.9 – 16.0	5.5 – 8.8	5.0 – 8.0	1000
–	8.9 – 12.0	8.1 – 12.0	2000

37.1.3 A nonrenewable cartridge fuse is to be connected in series with the component being tested. A new fuse and component are to be used for each test.

37.2 Motor overload protective device

37.2.1 A motor overload protective device on a dehumidifier shall withstand short circuiting when protected by a 20 ampere fuse for a dehumidifier rated 125 volts or less and 15 ampere fuse for a dehumidifier rated 126 – 250 volts. There shall be no ignition of cheesecloth surrounding the enclosure of the protective device.

37.3 Bonding conductors and connections

37.3.1 Bonding conductors and connections shall not open when samples are subjected to the conditions of this test.

38 Accelerated Aging Test – Electric Heaters

38.1 The requirement in 38.2 applies to the cases of heater assemblies and terminal seals of metallic sheath heaters.

38.2 Rubber, neoprene, or thermoplastic compounds, used as a heater casing or for the seal of terminals shall withstand accelerated aging as indicated in Table 38.1 for the maximum temperature rise measured on the device during a temperature test conducted in an ambient from 25 to 40°C (77 to 104°F) without deteriorating to a degree which will affect its intended use.

Table 38.1
Accelerated aging test criteria

Table 38.1 revised April 23, 1996

Measured temperature rise			
°C	°F	Material	Test program
35	63	Rubber or neoprene	Air oven aging for 70 hours at 100°C ±2°C (212°F ±3.6°F)
35	63	Thermoplastic	Aged in full-draft, air-circulating oven for 168 hours at 100.0 ± 1.0°C (212.0 ± 1.8°F)
50	90	Rubber or neoprene	Air oven aging for 70 hours at 100°C ±2°C (212°F ±3.6°F)
50	90	Thermoplastic	Aged in full-draft, air-circulating oven for 240 hours at 100.1 ± 1.0°C (212.0 ± 1.8°F)
55	99	Rubber, neoprene or thermoplastic	Aged in full-draft, air-circulating oven for 168 hours at 113.0 ± 1.0°C (235.4 ± 1.8°F)
65	117	Rubber or neoprene	Aged in full-draft, air-circulating oven for 240 hours at 121.0 ± 1.0°C (249.8 ± 1.8°F)
65	117	Thermoplastic	Aged in full-draft, air-circulating oven for 168 hours at 121 ± 1°C (249.8 ± 1.8°F) or 1440 hours at 97.0 ± 1.0°C (206.6 ± 1.8°F)
80	144	Rubber, neoprene or thermoplastic	Aged in full-draft, air-circulating oven for 168 hours at 136.0 ± 1.0°C (276.8 ± 1.8°F)
100	180	Rubber, neoprene or thermoplastic	Aged in full-draft, air-circulating oven for 1440 hours at 136.0 ± 1.0°C (276.8 ± 1.8°F)
125	225	Rubber, neoprene or thermoplastic	Aged in full-draft, air-circulating oven for 1440 hours at 158 ± 1.0°C (316.4 ± 1.8°F)
175	315	Rubber, neoprene or thermoplastic	Aged in full-draft, air-circulating oven for 1440 hours at 210°C (410°F)

39 Reliability Test – Heater Terminations

39.1 Electric heaters employing integrally molded leads or molded terminal assemblies shall withstand a test load of 20 pounds-force (89.0 N) applied for 1 minute. The load is to be applied in the same direction at which the lead exits the heater case or molded connection and is not to result in displacement of insulation or separation of the connection between the lead and heater.

40 Strength Tests – Pressure Containing Components

40.1 High-side parts of a dehumidifier shall withstand a pressure at least equal to the highest of the following:

a) Five times the maximum high-side pressure developed in the Temperature and Pressure Test, Section 26, or

b) Five times the marked high-side design pressure, 53.6, or

c) Three times the maximum high-side pressure developed in the Fan Motor Failure Test, Section 29, or

d) One and one-half times the vapor pressure of the refrigerant at 140°F (60°C).

40.2 Low-side parts of a dehumidifier shall withstand a pressure at least equal to the highest of the following:

a) Three times the maximum low-side pressure developed in the Temperature and Pressure Test, Section 26, or

b) Three times the marked low-side design pressure, 53.6, or

c) Three times the maximum low-side pressure developed in the Fan Motor Failure Test, Section 29, including equalization pressures after compressor shutdown, or

d) One and one-half times the vapor pressure of the refrigerant at 140°F (60°C).

40.3 With reference to 40.1(d) and 40.2, the vapor pressures of R12, R22, and R134a at 140°F (60°C) are 207, 337, and 229 pounds per square inch gauge (psig) (1427, 2323, and 1579 kPa), respectively.

40.3 revised March 18, 2002

40.4 With reference to 40.1–40.3, sections of the refrigerant system constructed of continuous tubing or of lengths of tubing connected by hard-soldered, brazed, or welded joints are acceptable provided the tubing employed in the assembly complies with the requirements in 19.2.

40.5 Two samples of each refrigerant-containing part are to be tested to determine compliance with these requirements. The test medium is to be any nonhazardous liquid, such as water. The test samples are to be filled with the test medium to exclude air and are to be connected in a hydraulic pump system. The pressure is to be raised gradually until the required pressure is reached. This pressure is to be maintained for 1 minute during which time the samples are not to burst or leak. Leakage is to be determined visually; for example, by examination of the sample for release of the test medium or as evidenced by a decreasing hydrostatic gauge pressure.

40A Push-Back Relief Test

Added 40A effective March 18, 2004

40A.1 When tested as described in 40A.2, a flexible cord shall not attain any condition specified in 8.9 (a) – (d).

40A.2 The supply cord is to be held 1 inch (25.4 mm) from the point where the cord emerges from the product and is then to be pushed back into the product. The cord is to be pushed back into the product in 1-inch (25.4-mm) increments until the cord buckles or the force to push the cord into the product exceeds 6 lbf (26.7 N). The supply cord within the product is to be manipulated to determine compliance with 8.9.

POLYMERIC MATERIAL TESTS

41 Horizontal Burning Test – HB Materials

41.1 This test is to be conducted for the purpose of classifying polymeric materials as HB. The test is to be conducted on specimens obtained from the finished part and is to employ the apparatus and test method described in the requirements for the horizontal burning test for classifying materials HB in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

41.1 revised March 31, 1998

41.2 If the material is used as an enclosure or as a structural part, the test is to be conducted on specimens in the as-received condition and after Air Oven Aging, Section 49.

41.3 Test specimens, 5 inches (127 mm) long, 1/2 inch (12.7 mm) wide and in the thickness obtained from the finished part [minimum thickness of 0.05 inch (1.30 mm)], are to be provided for this test. The edges of the test specimen are to be smooth.

41.4 Where specimens of HB materials undergo significant longitudinal shrinkage during the burning test, due to relief of strains or molecular orientation by heat from the burning portion, as may be the case with specimens taken from finished parts, the dimensional change may be taken into account in determining the rate of burning. Measurements may be made of the changes in dimensions of representative specimens of the material after annealing between glass plates at an appropriate temperature and a correction for such dimensional changes applied to the observed rate of burning, or the burning tests may be conducted on specimens which have been annealed.

41.4 revised March 31, 1998

42 Horizontal Burning Test – HBF, HF-1, or HF-2 Foamed Materials

42.1 General

42.1.1 This test is to be conducted for the purpose of classifying foamed polymeric materials as HBF, HF-1, or HF-2.

42.1.1 revised March 31, 1998

42.1.2 Materials classed HBF shall: (Also see retest 42.1.5.)

a) Not have any specimens with a burning rating exceeding 1.5 inch (38.1 mm) per minute over a 4.0 inch (101.6 mm) span, or

b) Cease to burn (each specimen) before the flaming or glowing reaches the 5.0 inch (127 mm) reference mark (see 42.5.3), but not comply with the requirements in 42.1.3 and 42.1.4 for HF-1 or HF-2.

42.1.2 revised March 31, 1998

42.1.3 Materials classed HF-1 shall: (Also see retest 42.1.6.)

a) Not have more than one specimen out of each set of five specimens continue to flame for more than 2 seconds after the test flame is removed. However, this one specimen shall not flame for more than 10 seconds.

b) Not have any test specimen affected for a distance greater than 2.25 inches (57.2 mm) from the end exposed to the test flame.

c) Not have any of the specimens drip flaming particles which ignite dry absorbent surgical cotton placed 12 inches (305 mm) below the specimen.

d) Not have any test specimens with glowing combustion which:

1) Persists for more than 30 seconds after removal of the test flame.

2) Travels past the 2.25 inch mark.

42.1.3 revised March 31, 1998

42.1.4 Materials classed HF-2 shall: (Also see retest 42.1.6.)

a) Not have more than one specimen out of each set of five specimens continue to flame for more than 2 seconds after the test flame is removed. However, this one specimen shall not flame for more than 20 seconds.

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b) Not have any specimens affected for a distance greater than 2.25 inches (57.2 mm) from the end exposed to the test flame.

c) Be permitted to have specimens that drip flaming particles which burn only briefly, some of which ignite dry absorbent surgical cotton placed 12 inches (305 mm) below the test specimen.

d) Not have any specimens with glowing combustion which:

1) Persists beyond 30 seconds after removal of the test flame.

2) Travels past the 2.25 inch mark.

42.1.4 revised March 31, 1998

42.1.5 If only one specimen from a set of five specimens fails to comply with the requirements in 42.1.2, another set of five specimens, subjected to the same conditioning, shall be tested. All specimens from this second set of specimens shall comply with the requirements in 42.1.2 for the material in that thickness and density in order for the material to be classified as HBF.

42.1.5 revised March 31, 1998

42.1.6 If a set of five specimens fails to comply with the requirements in 42.1.3 or 42.1.4 because of one of the following situations, another set of five specimens subjected to the same conditioning shall be tested:

a) A single specimen, out of a set of five specimens, flames for more than 10 seconds, or

b) Two specimens, out of a set of five specimens, flames for more than 2 seconds, but less than 10 seconds, or

c) One specimen, out of a set of five specimens, flames for more than 2 seconds, but less than 10 seconds and a second specimen, out of the set, flames for more than 10 seconds, or

d) One specimen, out of a set of five specimens, fails to comply with (b), (c), or (d) of 42.1.3 or 42.1.4.

All specimens from this second set shall comply with the requirements in order for the foamed plastic material in that thickness and density to be classified HF-1 or HF-2.

42.1.6 revised March 31, 1998

42.2 Apparatus

42.2.1 The apparatus employed is to consist of the following:

a) Draft-free test chamber, enclosure, or laboratory hood.

b) Laboratory Burner – A Bunsen or Tirrill burner, having a tube with a length of 4.0 inch (101.1 mm) and an inside diameter of 3/8 inch (9.5 mm) provided with a wing tip [dimensions of slit approximately 1-7/8 by 0.05 inch (47.6 by 1.27 mm)].

c) Ring Stands – Two laboratory ring stands with clamps adjustable to the desired angles and heights, or equivalent equipment.

d) Gas Supply – A supply of technical grade methane gas with suitable regulator and meter for uniform gas flow [natural gas having a heat content of approximately 1000 Btu per cubic feet (37 MJ/m^3) has been found to provide similar results].

e) Wire Cloth (Plain Weave, Low Carbon, Plain Steel) – Four mesh (four openings per 25.4 mm), 0.035±0.002 inch (0.89±0.05 mm) diameter steel wire. An 8.5 by 3.0 inch (216 by 76 mm) piece of wire cloth is to be formed to provide a 90 degree upward bend, 0.5 inch (13 mm) high, at one end. The cloth mesh and wire diameter are to be determined as described in the Standard for Specification for Industrial Wire Cloth and Screens (Square Opening Series), ASTM E437–85, Appendix A3. The wire diameter is to be measured perpendicular to its corrugations using a micrometer or caliper to the nearest 0.001 inch (0.03 mm).

f) Stopwatch or other timing device.

g) A supply of dry absorbent surgical cotton.

h) A desiccator containing anhydrous calcium chloride.

i) Conditioning room or chamber capable of being maintained at a temperature of 23±2°C (73±3.6°F) and a relative humidity of 50±5 percent.

j) Conditioning Oven – A full draft circulating air-oven capable of being maintained at 70±1°C (158±1.8°F).

42.3 Test specimens

42.3.1 Test specimens are to be obtained from the finished part and in the thickness used in the part. The specimens are to be 6.0 inches (152 mm) long, 2.0 inches (50.8 mm) wide with a maximum width of 2.05 inches (52.1 mm). Edges are to be smooth and the radius on the corners is not to exceed 0.05 inch (1.27 mm). Any loose particles are to be removed from the specimen surfaces.

42.4 Specimen conditioning

42.4.1 Specimen sets are to be conditioned as follows:

a) Each set of five specimens are to be conditioned for at least 48 hours at a temperature of 23±2°C (73±3.6°F) and a relative humidity of 50±5 percent prior to testing.

b) Each set of five specimens are to be conditioned in a circulating air-oven for a duration of 168 hours at 70±1°C (158±1.8°F) and then cooled in a desiccator, over anhydrous calcium chloride, for at least 4 hours at room temperature prior to testing.

42.5 Test method

42.5.1 The burning test is to be conducted in a chamber, enclosure, or laboratory hood that is free from drafts. An enclosed laboratory hood with a heat resistant glass window, and an exhaust fan for removing products of combustion after the test, is recommended.

42.5.2 The formed steel wire cloth is to be held by the clamps and ring stands so that the 8 by 3 inch (203 by 76mm) section is horizontal, 1/2 inch (12.7 mm) above the top of the burner wing tip, and 12 inches (305 mm) above a horizontal layer of dry absorbent surgical cotton 3 by 3 inches (76 by 76 mm), thinned to a maximum freestanding thickness of 1/4 inch (6.4 mm). The cotton is to be located under the front portion of the wire cloth having the upturned end.

Note: The wire cloth may be mounted in place by securing it to a 4 inch (102 mm) diameter ring support so that the upturned end extends approximately 3 inches (76 mm) past the end of the ring.

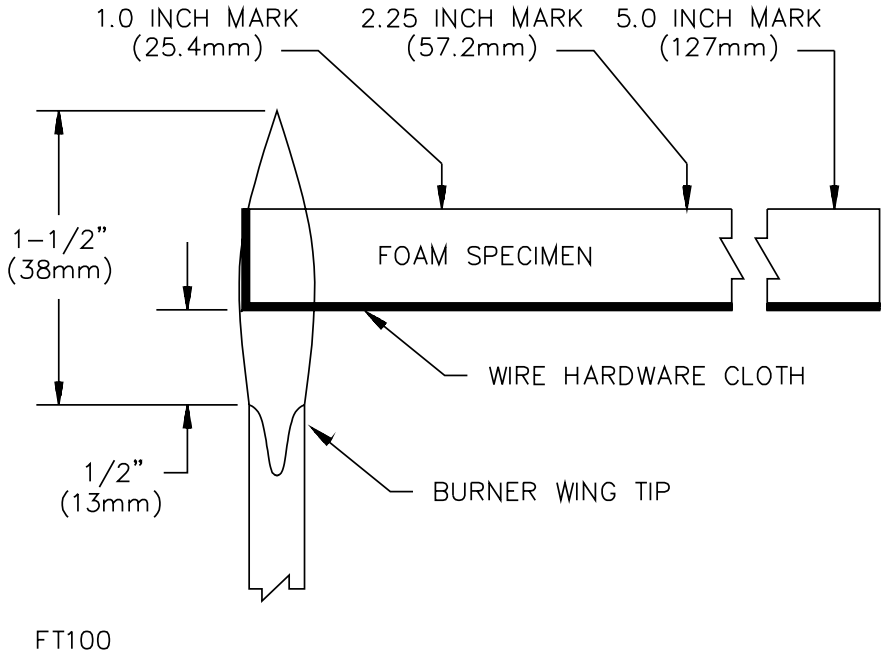
42.5.3 Each specimen is to be marked across its width with three lines: 1.0, 2.25, and 5.0 inches (25.4, 57, and 127 mm) from one end. The test specimen is to be placed flat on the wire cloth with a 6.0 by 2.0 inch (152.4 by 50.8 mm) surface of the specimen horizontal. The front end of the specimen (the end closest to the 2.25 inch mark) is to be placed in contact with the upturned end of the wire cloth. Specimens with a high density exterior on one side are to be tested with the exterior facing down. Specimens with adhesive on one side are to be tested with the adhesive side facing up.

42.5.4 If a new wire cloth is not used for each test, any material remaining on the wire cloth from previous tests is to be burned off, and the wire cloth is to be allowed to cool before conducting the test.

42.5.5 The burner, with wing tip, is to be placed remote from the specimen, ignited, and adjusted to provide a blue flame with a maximum height of 1-1/2 inches (38 mm) when measured in subdued light. The flame is to be obtained by adjusting the gas supply and the air port of the burner until a 1-1/2 inch yellow-tipped blue flame is produced. The air supply then is to be increased until the yellow tip disappears. The height of the flame is to be measured again and corrected, if necessary. The burner then is to be placed quickly in position beneath the wire cloth under the upturned end of the specimen support so that one edge of the flame is in line with the upturned end of the wire cloth and the other edge of the flame extends into the front end of the specimen. See Figure 42.1. The center of the width of the wing tip is to be in line with the longitudinal axis of the specimen.

Figure 42.1
Horizontal burning test for HBF, HF-1 or HF-2 classification

Figure 42.1 revised March 31, 1998



42.5.6 The flame is to be applied for 60 seconds and then removed from the specimen. If the material continues to burn after removal of the test flame, the time for the flame to travel from the 1 inch (25.4 mm) mark to the 5 inch (127 mm) mark is to be determined. If the specimen ceases to burn before the 5 inch mark is reached, both the duration of burning after removal of the test flame and the distance of burning from the end exposed to the test flame are to be recorded.

42.5.7 For specimens considered to be HBF material:

a) The duration of burning between the 1 inch (25.4 mm) and the 5 inch (127 mm) mark is to be observed and recorded or, if the burning ceases before the 5 inch mark, the duration of burning after removal of the test flame is to be observed and recorded.

b) The distance the specimen burned is to be observed and recorded.

c) The rate of burning between the 1 and 5 inch marks is to be calculated.

42.5.7 revised March 31, 1998

42.5.8 For specimens considered to be HF-1 or HF-2 material and where the specimen ceases to burn before the 5 inch (127 mm) mark is reached by the flame front:

a) The duration of flaming and glowing after removal of the test flame is to be observed and recorded.

b) The distance affected by burning, melting, charring, and the like is to be observed and recorded.

c) The dry absorbent surgical cotton placed 12 inches (305 mm) below the test specimen is to be recorded, whether or not it was ignited by flaming particles.

42.5.8 revised March 31, 1998

43 Vertical Burning Test – V-0, V-1, or V-2 Solid Materials

43.1 This test is to be conducted for the purpose of classifying polymeric materials as V-0, V-1, or V-2. The test is to be conducted on specimens obtained from the finished part and is to employ the apparatus and test method described in the vertical burning test for classifying materials V-0, V-1, or V-2 in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94. Test samples are to be 5 inches (127 mm) long, 1/2 inch (12.7 mm) wide, and in the thickness obtained from the finished part. Two sets of five samples each are required for test.

43.1 revised March 31, 1998

43.2 If the material is used as an enclosure or as a structural part, the test is to be conducted on specimens in the as-received condition and after Air-Oven Aging, Section 49.

44 Vertical Burning Test – 5V

44.1 This test is to be conducted for the purpose of classifying polymeric materials as 5V. The test is to be conducted employing the specimen samples, apparatus and test method described in the requirements for the vertical burning test for classifying materials 5V in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

Exception: Specimens of the complete finished part are to be tested with the flame applied to areas of the part determined to be most critical with respect to ignition.

44.1 revised March 31, 1998

44.2 Sets of at least three specimens each are to be provided for the test. One set is to be tested in the as-received condition, and the other sets are to be tested after Air-Oven Aging, Section 49, if the polymeric material is used as an enclosure or as a structural part.

44.3 Two of the three specimens from each set shall not continue to flame or exhibit consuming combustion for more than 1 minute following the fifth application of the test flame. Particles shall not drip from the specimen at any time during the test. The material is not acceptable if it is destroyed in the area of the test flame to such an extent as to produce a condition that would increase the risk of fire, electric shock, or injury to persons.

45 Mold Stress-Relief Test

45.1 Conditioning of polymeric materials used as enclosures or as functional or structural parts shall not cause softening of the material as determined by handling immediately after the conditioning, nor shall there be shrinkage, warpage, or other distortion of the enclosure, as determined after cooling to room temperature, that results in any of the following:

a) Reduction of electrical spacings below those specified in Section 17.

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b) Making uninsulated live parts or moving parts accessible to contact as judged by the requirements of Assembly, Section 5.

c) Defeating the integrity of the enclosure so that acceptable mechanical protection is not afforded to internal parts of the equipment.

d) Causing interference with the intended operation or servicing of the appliance.

Exception: This test is not required for rigid thermosetting materials.

45.2 One sample of the complete dehumidifier or an appropriate section of the assembly is to be placed in a full-draft circulating-air oven maintained at a uniform temperature at least 10°C (18°F) higher than the maximum temperature of the material measured during the Temperature and Pressure Test, Section 26, or Temperature Test – Electric Heat, Section 27, but not less than 70°C (158°F) in any case. The sample is to remain in the oven for 7 hours. After its removal from the oven and return to room temperature, the sample is to be investigated for compliance with the requirements of 45.1.

46 Water Absorption Test

46.1 The dimensional change of a polymeric material used to enclose uninsulated live parts or used as a functional or structural part shall not exceed 2 percent.

46.2 The percentage of dimensional change is to be determined using samples obtained from the finished part and in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.

47 Volume Resistivity Test

47.1 This test is conducted on polymeric materials that:

a) Enclose uninsulated live parts where electrical spacings between the enclosure and live part are less than required by Table 17.1 or

b) Provide indirect support of uninsulated live parts where electrical spacings between the support and live part are less than required by Table 17.1.

The volume resistivity of such materials shall be:

1) Not less than 50 megohm-centimeters after conditioning for 40 hours at 23±2.0°C (73.4±3.6°F) and 50±5 percent relative humidity.

2) Not less than 10 megohm-centimeters after exposure for 96 hours to moist air having a relative humidity of 90±5 percent at a temperature of 35.0±2.0°C (95.0±3.6°F).

47.2 The volume resistivity is to be determined in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.

48 High-Current Arc Ignition Test

48.1 A polymeric material used to enclose uninsulated live parts or to provide indirect support for such parts shall resist ignition by a high-current arc. See Table 7.1 and 7.5.2(f). The material is to be tested in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A. There shall be no ignition of:

a) An enclosure within 60 arcs.

b) A functional or structural part within:

1) 15 arcs for materials classed as V-0,

2) 30 arcs for materials classed as V-1 and V-2, or

3) 60 arcs for materials classed as HB.

48.1 revised March 31, 1998

49 Air-Oven Aging

49.1 Polymeric enclosures that operate at temperatures of 65°C (149°F) or more and polymeric structural parts that operate at temperatures of 50°C (122°F) or more as determined during the Temperature and Pressure Test, Section 26, or Temperature Test – Electric Heat, Section 27, are to be aged in a full-draft circulating air oven at the aging temperature and time determined by the intended use of the finished part in accordance with Table 49.1.

Table 49.1
Aging temperature and time

Intended use[a]	Maximum normal operating temperature, degrees C (F)[b]	Aging temperature, degrees C (F)	Aging time, hours
Enclosure	65 (149)	90 (194)	168
Enclosure	75 (167)	90 (194)	1440
Enclosure	85 (185)	95 (203)	1440
Enclosure	95 (203)	105 (221)	1440
Enclosure	100 (212)	121 (250)	1440
Structural	50 (122)	75 (167)	1440
Structural	75 (167)	100 (212)	1440
Structural	100 (212)	121 (250)	1440

[a] If a material is used as both an enclosure and a structural part, it is to be subjected to the aging condition shown for structural parts.
[b] If normal operating temperature is between two values shown in table, the higher of these two values is used in determining the aging conditions.

49.2 Following air oven aging, the material is to be subjected to the applicable burning test for the material classification. See Horizontal Burning Test – HB Materials, Section 41, Vertical Burning Test – V-0, V-1, or V-2 Solid Materials, Section 43, and Vertical Burning Test – 5V, Section 44.

49.2 revised March 31, 1998

MANUFACTURING AND PRODUCTION TESTS

50 Pressure Tests

50.1 Each dehumidifier shall be tested and proved tight at not less than the design pressure(s) marked on the appliance. See 53.6.

50.2 If the final assembly is completed with flare-type fittings or telescoped tubing joints sealed with silver solder, brazing, or the equivalent, pressure testing of the complete system may be at the low-side design pressure, provided the high-side parts are individually tested either by the dehumidifier manufacturer or by the manufacturer of the part at not less than the high-side design pressure.

50.3 Deleted April 23, 1996

50.4 Deleted April 23, 1996

51 Production Line Dielectric Voltage Withstand Tests

51.1 Each product 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, or a dc potential

a) Between the primary wiring, including connected components, and accessible dead metal parts that are likely to become energized; and

b) Between primary wiring and accessible low-voltage, 42.4 volts peak or less, metal parts, including terminals.

51.1 revised April 23, 1996

51.2 Revised and relocated as 51.9 April 23, 1996

51.3 Revised and relocated as 51.8 April 23, 1996

51.4 The production-line test shall be conducted in the time and at the potential specified in either Condition A or Condition B of Table 51.1.

51.4 added April 23, 1996

Table 51.1
Production-line test conditions

Table 51.1 added April 23, 1996

Product rating	Condition A			Condition B		
	Potential,		Time,	Potential,		Time,
	volts ac[c]	volts dc	seconds	volts ac[c]	volts dc	seconds
250 volts or less with no motor rated more than 1/2 horsepower (373 watts output)	1000	1400	60	1200	1700	1
250 volts or less with a motor rated more than 1/2 horsepower (373 watts output)	1000 + 2V[a]	1400 + 2.8V[a]	60	1200 + 2.4V[a]	1700 + 3.4V[a]	1
251 – 600 volts	1000 + 2V[b]	1400 + 2.8V[b]	60	1200 + 2.4V[b]	1700 + 3.4V[b]	1

[a] Maximum marked voltage but not less than 120 volts if the maximum marked voltage is within the range 105 – 120 volts, and not less than 240 volts if the maximum marked voltage is within the range 210 – 240 volts.

[b] Maximum marked voltage.

[c] Where there are capacitors across the insulation under test (e.g radio-frequency filter capacitors), it is recommended that d.c. test voltages are used.

51.5 For equipment employing low-voltage circuits, the test is to be conducted with the low-voltage circuit connected to the cabinet, chassis, or other dead metal part so that the potential applied between the high-voltage live parts and dead metal parts will simultaneously be applied between high-voltage live parts and low-voltage circuits.

51.5 added April 23, 1996

51.6 The test shall be conducted when the product is fully assembled. It is not intended that the product be unwired, modified, or disassembled for the test.

Exception No. 1: A part, such as a snap cover or friction-fit knob, that would interfere with the performance of the test need not be in place.

Exception No. 2: The test may be performed before final assembly if the test represents that for the complete product. Any component not included shall not affect the results with respect to determination of possible risk of electric shock resulting from miswiring, defective component, insufficient spacings, and the like.

51.6 added April 23, 1996

51.7 Solid-state and similar components that might be damaged by a secondary effect (induced voltage surge, excessive heating, and the like), of the test may be short-circuited by means of a temporary electrical jumper or the test may be conducted without the component electrically connected, providing the wiring and terminal spacings are maintained. Additionally, components providing a d.c. path in parallel with the insulation to be tested (primary to dead-metal) may be disconnected during the test. Examples of such components are discharge resistors for filter capacitors and voltage limiting devices such as transient voltage suppressors (other than capacitors).

51.7 added April 23, 1996

51.8 The test equipment shall have a means of indicating the test potential, an audible or visual indicator of electrical breakdown, and either a manually reset device to restore the equipment after electrical breakdown or an automatic reject feature of any unacceptable unit. When an ac test potential is applied, the test equipment shall include a transformer having an essentially sinusoidal output.

51.3 revised and relocated as 51.8 April 23, 1996

51.9 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.

51.2 revised and relocated as 51.9 April 23, 1996

51.10 If the output of the test-equipment transformer is 500 volt-amperes or more, the test potential may be indicated:

a) By a voltmeter in the primary circuit or in a tertiary-winding circuit,

b) By a selector switch marked to indicate the test potential, or

c) For equipment having a single test-potential output, by a marking in a readily visible location to indicate the test potential. If marking is used without an indicating voltmeter, the equipment shall include a positive means, such as an indicator lamp, to indicate that the manually reset switch has been reset following a dielectric breakdown.

51.10 added April 23, 1996

51.11 Test equipment other than that described in the preceding paragraphs may be used if found to accomplish the intended factory control.

51.11 added April 23, 1996

51.12 During the test, the primary switch is to be in the on position, both sides of the primary circuit of the product 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.

Exception: A product having circuitry – resistive, high-impedance winding, or the like – not subject to excessive secondary-voltage build-up in case of electrical breakdown during the test may be tested:

a) With a single-pole primary switch, if used, in the off position, or

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.

51.12 added April 23, 1996

52 Production Line Grounding Continuity Tests

52.1 The manufacturer shall test each dehumidifier to determine that electrical continuity exists between the appliance and the grounding blade of the attachment plug.

52.2 An indicating device, such as an ohmmeter, low-voltage battery-and-buzzer combination, or the like, may be employed in the test mentioned in 52.1.

MARKING

53 General

53.1 A required marking shall be permanent, such as molded, die-stamped, paint-stenciled, stamped, or etched metal that is permanently secured, or indelibly stamped on pressure-sensitive labels secured by adhesive. Pressure-sensitive labels shall comply with the Standard for Marking and Labeling Systems, UL 969.

53.2 Each dehumidifier shall be marked with the following:

a) The manufacturer’s or private labeler’s name or identifying symbol.

b) A distinctive type or model designation.

c) The electrical rating. See 53.5.

d) The kind and amount of refrigerant in pounds-mass and/or ounces. See 53.3 and 53.4.

e) The high- and low-side design pressures. See 53.3 and 53.6.

f) The date of manufacture, which may be in code, that will enable the product to be identified as being manufactured within a consecutive 3 month period. The information shall be on or near the nameplate.

53.3 With reference to 53.2 (d) and (e), dehumidifiers may be marked with equivalent SI units in addition to the USA customary units of measure.

53.4 The kind of refrigerant shall be designated by number. The number shall be prefixed or suffixed with the word ″Refrigerant″ or it shall be prefixed with the letter ″R″ or the trade name of the refrigerant. Combinations of these marks are acceptable, except that employing the letter ″R″ and the word ″Refrigerant″ in the same marking group is not appropriate. Examples for refrigerant marking are as follows: R12, Refrigerant 12, or 12 Refrigerant; (Trade Name) 12, (Trade Name) R 12, or (Trade Name) 12 Refrigerant as shown in the Number Designation and Safety Classification of Refrigerants, ANSI/ASHRAE 34-1992.

53.4 revised April 23, 1996

53.5 A dehumidifier shall be marked with the operating voltage, the frequency, and the rated load in amperes. If a dehumidifier incorporates an electric heater, the heating load (heating element plus fan motor) shall be marked in amperes or watts.

Exception: If the heating load exceeds the dehumidifying load or vice versa, only the larger load need be marked.

53.6 The high- and low-side design pressures marked on the dehumidifier shall not be less than the maximum values recorded during the Temperature and Pressure Test, Section 26, nor less than the values in Table 53.1.

53.6 revised April 23, 1996

Table 53.1
Minimum design pressure

Table 53.1 added April 23, 1996

Refrigerant	Minimum design pressure, psig (kPa)					
	Low-side		High-side			
			Air-cooled		Water cooled	
12	85	(586)	169	(1165)	127	(876)
22	144	(993)	278	(1917)	211	(1455)
134a	88	(606)	186	(1282)	135	(930)
401A	85	(586)	182	(1255)	133	(917)
401B	93	(641)	195	(1344)	143	(986)
402A	183	(1262)	347	(2394)	265	(1828)
402B	170	(1172)	324	(2234)	247	(1703)
404A	174	(1200)	331	(2281)	253	(1745)
502	162	(1117)	300	(2067)	232	(1599)
507	180	(1242)	344	(2374)	262	(1808)

NOTE – For other refrigerants, the minimum design pressure shall be not less than the values recorded during the Input Test (cooling mode), Section 36, nor less than the saturation pressure of the refrigerant at the following temperatures:

80°F (26.5°C) for low-sides
105°F (40.5°C) for water-cooled high-sides
125°F (51.7°C) for air cooled-high-sides

53.7 The information specified in 53.2 – 53.5 shall be on a nameplate or plates located where they will be visible and legible without requiring the use of tools for removal of panels or the like. The nameplate shall be constructed and fastened so as to form a permanent part of the assembly.

53.8 If the design of a dehumidifier contemplates disassembly for the purpose of cleaning or similar servicing, and if such disassembly involves the exposure of persons to accidental contact with any normally enclosed or protected moving part, hot part, or uninsulated live part, the dehumidifier shall be marked with the word ″CAUTION″ followed by the appropriate statement(s) or equivalent wording, indicated below:

Moving parts	Uninsulated live parts	Hot parts
Moving parts. Do not operate unit with a removed.	Risk of electric shock. Disconnect power before servicing unit.	Hot parts. Do not operate unit with a removed.

[a] Specify appropriate part

The warning marking shall be permanent, shall be in letters no less than 1/8 inch (3.2 mm) high, and shall be located so as to be visible before or immediately upon removal of a cover, panel, or the like, which normally encloses or protects the moving part, hot part, or uninsulated live part. The marking shall not be on the back of a removable cover or panel.

53.9 If a manufacturer produces dehumidifiers at more than one factory, each such assembly shall have a distinctive marking to identify it as the product of a particular factory.

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APPENDIX A

Standards for Components

Standards under which components of the products covered by this standard are evaluated include the following:

Title of Standard − UL Standard Designation

Attachment Plugs and Receptacles, Electrical – UL 498
Cord Sets and Power-Supply Cords – UL 817
Flexible Cord and Fixture Wire – UL 62
Marking and Labeling Systems – UL 969
Motor-Compressors, Hermetic Refrigerant – UL 984
Motor-Operated Appliances, Electric – UL 73
Motors, Electric – UL 1004
Plastic Materials for Parts in Devices and Appliances, Tests for Flammability of – UL 94
Polymeric Materials – Long Term Property Evaluations – UL 746B
Polymeric Materials – Short Term Property Evaluations – UL 746A
Polymeric Materials – Use in Electrical Equipment Evaluations – UL 746C
Refrigerant-Containing Components and Accessories, Nonelectrical – UL 207
Switches, Special-Use – UL 1054
Temperature-Indicating and -Regulating Equipment, Electrical – UL 873
Terminals, Electrical Quick-Connect – UL 310
Thermal Cutoffs for Use in Electrical Appliances and Components – UL 1020
Overheating Protection for Motors – UL 2111
Wires and Cables, Rubber-Insulated – UL 44
Wires and Cables, Thermoplastic-Insulated – UL 83
Wire Connectors and Soldering Lugs for Use With Copper Conductors – UL 486A

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