



# UL 430

## STANDARD FOR SAFETY

### Waste Disposers

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UL Standard for Safety for Waste Disposers, UL 430

Eighth Edition, Dated September 8, 2015

### **Summary of Topics**

***This revision of ANSI/UL 430 dated September 14, 2021 includes the replacement of the reference to UL 508C, Standard for Power Conversion Equipment, with a reference to UL 61800-5-1, Standard for Adjustable Speed Electrical Power Drive Systems – Part 5-1: Safety Requirements – Electrical, Thermal and Energy; [5.5.4.1](#) and [5.13.4.4](#)***

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated February 5, 2021 and June 18, 2021.

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## **UL 430**

### **Standard for Waste Disposers**

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**September 8, 2015**

This ANSI/UL Standard for Safety consists of the Eighth Edition including revisions through September 14, 2021.

The most recent designation of ANSI/UL 430 as an American National Standard (ANSI) occurred on September 14, 2021. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, and Title Page.

The Department of Defense (DoD) has adopted UL 430 on August 5, 1994. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at <https://csds.ul.com>.

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## INTRODUCTION

### 1 Scope

1.1 These requirements cover motor operated household and commercial disposers rated 600 V or less and intended to be used in accordance with the National Electrical Code, ANSI/NFPA 70. These disposers are intended to convert organic types of waste material to a form that can be accommodated by plumbing systems. The requirements also cover field-installed control assemblies and accessories specifically intended for use with disposers covered by this standard.

1.1.1 These requirements also cover rechargeable battery-powered appliances with rechargeable non-user-replaceable and/or user-replaceable batteries; see Supplement [SC](#).

1.2 These requirements do not cover an incinerator-type disposer or a disposer using a universal motor with a rating greater than 250 V.

### 2 Units of Measurement

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

### 3 Undated References

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.

### 4 Glossary

4.1 For the purpose of this standard the following definitions apply.

4.2 BARRIER – A part of a disposer that functions to reduce the risk of access to current-carrying parts or internal wiring through openings in the enclosure that involves a risk of electric shock or injury to persons, or reduces the risk of fire or injury to persons as a result of molten metal or burning insulation being expelled through openings in the enclosure under abnormal conditions.

4.3 COMPONENT – A device or fabricated part of the appliance covered by the scope of a safety standard dedicated to the purpose. When incorporated in an appliance, equipment otherwise typically field installed (e.g. luminaire) is considered to be a component. Unless otherwise specified, materials that compose a device or fabricated part, such as thermoplastic or copper, are not considered components.

4.4 CONTROL, AUTOMATIC ACTION – A control in which at least one aspect is non-manual.

4.5 CONTROL, AUXILIARY – A device or assembly of devices that provides a functional utility, is not relied upon as an operational or protective control, and therefore is not relied upon for safety. For example, an efficiency control not relied upon to reduce the risk of fire, electric shock, or injury to persons during normal or abnormal operation of the end product is considered an auxiliary control.

4.6 CONTROL, MANUAL – A device that requires direct human interaction to activate or rest the control.

4.7 CONTROL, OPERATING – A device or assembly of devices, the operation of which starts or regulates the end product during normal operation. For example, a thermostat, the failure of which a thermal cutout/limiter or another layer of protection would mitigate the risk of fire, electric shock, or injury to persons, is considered an operating control.

4.8 CONTROL, PROTECTIVE – A device or assembly of devices, the operation of which is intended to reduce the risk of fire, electric shock, or injury to persons during normal and reasonably anticipated abnormal operation of the appliance whereby during the evaluation of the protective control/circuit, the protective functions are verified under normal and single-fault conditions of the control. For example, a thermal cutout/limiter, or any other control/circuit relied upon for normal and abnormal conditions, is considered a protective control.

4.9 CONTROL, TYPE 1 ACTION – The actuation of an automatic control for which the manufacturing deviation and the drift (tolerance before and after certain conditions) of its operating value, operating time, or operating sequence has not been declared and tested under this end product standard.

4.10 CONTROL, TYPE 2 ACTION – The actuation of an automatic control for which the manufacturing deviation and the drift (tolerance before and after certain conditions) of its operating value, operating time, or operating sequence have been declared and tested under this end product standard.

4.11 DECORATIVE PART – A part used for no function other than appearance.

4.12 ENCLOSURE – That portion of a disposer that:

- a) Renders inaccessible any part that presents a risk of electric shock or injury to persons;
- b) Reduces the risk of flame propagation initiated by electrical disturbances occurring within; or
- c) Both.

A grill, guard, panel, barrier, or similar part forms part of an enclosure if it reduces the risk of contact with an uninsulated current-carrying part or a part that presents a risk of injury to persons.

4.13 FUNCTIONAL PART – A part that is necessary for the intended operation of the disposer, the deterioration of which may result in a risk of fire, electric shock, or injury to persons.

4.14 HOPPER – A container that funnels material into the disposer prior to the reduction process.

## CONSTRUCTION

### 5 Components

#### 5.1 General

5.1.1 A component of a product covered by this standard shall:

- a) Comply with the requirements for that component as indicated in [5.2](#) – [5.19](#);
- b) Be used in accordance with its rating(s) established for the intended conditions of use;
- c) Be used within its established use limitations or conditions of acceptability;
- d) Additionally comply with the applicable requirements of this end product standard; and
- e) Not contain mercury.

*Exception No. 1: A component of a product covered by this standard is not required to comply with a specific component requirement that:*

- a) *Involves a feature or characteristic not required in the application of the component in the product;*
- b) *Is superseded by a requirement in this standard; or*
- c) *Is separately investigated when forming part of another component, provided the component is used within its established ratings and limitations.*

*Exception No. 2: A component that complies with a UL component standard other than those specified in [5.2](#) – [5.19](#) is acceptable if:*

- a) *The component also complies with the applicable component standard specified in [5.2](#) – [5.19](#); or*
- b) *The component standard:*
  - 1) *Is compatible with the ampacity and overcurrent protection requirements in the National Electrical Code, ANSI/NFPA 70, where applicable;*
  - 2) *Considers long-term thermal properties of polymeric insulating materials in accordance with the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B; and*
  - 3) *Any use limitations of the other component standard are identified and appropriately accommodated in the end use application. For example, a component used in a household application, but intended for industrial use and complying with the relevant component standard may assume user expertise not common in household applications.*

5.1.2 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

5.1.3 A component that is also intended to perform other functions, such as over current protection, ground-fault circuit-interruption, surge suppression, any other similar functions, or any combination thereof, shall comply additionally with the requirements of the applicable UL standard(s) that cover devices that provide those functions.

*Exception: Where these other functions are not required for the application and not identified as part of markings, instructions, or packaging for the appliance, the additional component standard(s) need not be applied.*

5.1.4 A component not anticipated by the requirements of this end product standard, not specifically covered by the component standards in [5.2](#) – [5.19](#), and that involves a risk of fire, electric shock, or injury to persons, shall be additionally investigated in accordance with the applicable UL standard, and shall comply with [5.1.1](#)(b) – (e).

5.1.5 With regard to a component being additionally investigated, reference to construction and performance requirements in another UL end product standard is suitable where that standard anticipates normal and abnormal use conditions consistent with the application of this end product standard.

## **5.2 Attachment plugs, receptacles, connectors, and terminals**

5.2.1 Attachment plugs and receptacles shall comply with the Standard for Attachment Plugs and Receptacles, UL 498. See [5.2.9](#).

*Exception No. 1: Attachment plugs and appliance couplers integral to cord sets or power supply cords that are investigated in accordance with the Standard for Cord Sets and Power Supply Cords, UL 817 are not required to comply with UL 498.*

*Exception No. 2: A fabricated pin terminal assembly need not comply with UL 498 if it complies with the requirements in Accessibility of Uninsulated Live Parts and Film Coated Wire, Section [7.3](#), Polymeric Materials, Section [8](#), Current Carrying Parts, Section [12](#), Electrical Insulation, Section [14](#), and Spacings, Section [24](#), of this end product standard, as well as the applicable performance requirements when tested in this end product standard.*

5.2.2 Quick-connect terminals, both connectors and tabs, for use with one or two 22 – 10 AWG copper conductors, having nominal widths of 2.8, 3.2, 4.8, 5.2, and 6.3 mm (0.110, 0.125, 0.187, 0.205, and 0.250 in), intended for internal wiring connections in appliances, or for the field termination of conductors to the appliance, shall comply with the Standard for Electrical Quick-Connect Terminals, UL 310.

*Exception No. 1: Other sizes of quick-connect terminals shall be investigated with respect to crimp pull out, insertion-withdrawal, temperature rise, and all tests shall be conducted in accordance with UL 310.*

*Exception No. 2: A connector that complies with UL 310 may be used with an appropriately sized tab that complies with the material, configuration, and dimensional requirements for production tabs as specified in UL 310. The connector is the part of a quick-connect terminal that is pushed onto the male tab, and the tab is the part that receives the female connector.*

5.2.3 Single and multipole connectors for use in data, signal, control and power applications within and between electrical equipment, and that are intended for factory assembly to copper or copper alloy conductors, or for factory assembly to printed wiring boards, shall comply with the Standard for Component Connectors for Data, Signal, Control and Power Applications, UL 1977. See [5.2.9](#).

5.2.4 Wire connectors shall comply with the Standard for Wire Connectors, UL 486A-486B.

5.2.5 Splicing wire connectors shall comply with the Standard for Splicing Wire Connectors, UL 486C.

5.2.6 Multi-pole splicing wire connectors that are intended to facilitate the connection of hard-wired utilization equipment to the branch-circuit conductors of buildings shall comply with the Standard for Insulated Multi-Pole Splicing Wire Connectors, UL 2459. See [5.2.9](#).

5.2.7 Equipment wiring terminals for use with all alloys of copper, aluminum, or copper-clad aluminum conductors, shall comply with the Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors, UL 486E.

5.2.8 Terminal blocks shall comply with the Standard for Terminal Blocks, UL 1059, and, if applicable, be suitably rated for field wiring.

*Exception: A fabricated part performing the function of a terminal block need not comply with UL 1059 if the part complies with the requirements in Polymeric Materials, Section [8](#), Wiring Terminals and Leads, Section [11.2.4](#), Current-Carrying Parts, Section [12](#), Electrical Insulation, Section [14](#) and Spacings, Section [21](#), of this end product standard, as well as the applicable performance requirements when tested in the end-product. This exception does not apply to protective conductor terminal blocks.*

5.2.9 Female devices (such as receptacles, appliance couplers, and connectors) that are intended, or that may be used, to interrupt current in the end product, shall be suitably rated for current interruption of the specific type of load, when evaluated with its mating plug or connector. For example, an appliance coupler that can be used to interrupt the current of a motor load shall have a suitable horsepower rating when tested with its mating plug.

### 5.3 Boxes, conduits, and raceways

5.3.1 Electrical boxes and the associated bushings, conduits, fittings, and raceways of the types specified in Chapter 3, Wiring Methods and Materials, of the National Electrical Code, ANSI/NFPA 70, and that comply with the relevant UL standard (such as the Standard for Flexible Metal Conduit, UL 1, the Standard for Metallic Outlet Boxes, UL 514A, the Standard for Conduit, Tubing, and Cable Fittings, UL 514B, the Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers, UL 514C, the Standard for Cover Plates for Flush-Mounted Wiring Devices, UL 514D, and the Standard for Electrical Metallic Tubing – Steel, UL797) and [5.1](#) are considered to comply with the requirements of this end product standard.

### 5.4 Capacitors and filters

5.4.1 The component requirements for capacitors and filters are specified in Controls – End Product Test Parameters, Section [19](#).

### 5.5 Controls

#### 5.5.1 General

5.5.1.1 Auxiliary controls shall be evaluated in accordance with the applicable requirements of this end product standard and the parameters in Controls – End Product Test Parameters, Section [19](#).

5.5.1.2 Operating (regulating) controls shall be evaluated in accordance with the applicable component standard requirements specified in [5.5.2](#) – [5.5.7](#), and if applicable, the parameters in Controls – End Product Test Parameters, Section [19](#), unless otherwise specified in this end product standard.

5.5.1.3 Operating controls that rely upon software for the normal operation of the end product where deviation or drift of the control may result in an increased risk of fire, electric shock, or injury to persons shall comply with one of the following:

- a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991; and the Standard for Software in Programmable Components, UL 1998; or
- b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1.

5.5.1.4 Electronic protective (limiting) controls that do not rely upon software as a protective component shall comply with the applicable component standard requirements specified in [5.5.2](#) – [5.5.7](#), and if applicable, the parameters in Controls – End Product Test Parameters, Section [19](#), unless otherwise specified in this end product standard. See also [5.5.1.5](#), [5.13.4.4](#), and [42.5](#).

5.5.1.5 Electronic protective controls that do not rely upon software as a protective component and that comply with one of the following standards are considered to comply with [5.5.1.4](#):

- a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991; or
- b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, except the Controls Using Software requirements, Clause H 11.12.

5.5.1.6 Electronic protective controls that rely upon software as a protective component shall comply with one of the following:

- a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991, and the Standard for Software in Programmable Components, UL 1998; or



b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1.

5.5.1.7 An electronic, auxiliary or operating control (e.g. a non-protective control), the failure of which would not increase the risk of electric shock, fire, or personal injury, need only be subjected to the applicable requirements of this end product standard. See Switches and Controls, Section [18](#) and Abnormal Operation Test, Section [58](#).

5.5.1.8 An electronic circuit that complies with the requirements in Alternative Requirements for the Evaluation of Electronic Circuits, Supplement [SA](#) is considered to comply with the requirements of a control in [5.5.1](#) – [5.5.7](#).

## 5.5.2 Electromechanical and electronic controls

5.5.2.1 A control, other than as specified in [5.5.3](#) – [5.5.7](#), shall comply with the applicable requirements of this end product standard, or comply with one of the following:

- a) The Standard for Solid-State Controls for Appliances, UL 244A;
- b) The Standard for Temperature-Indicating and -Regulating Equipment, UL 873; or
- c) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1.

## 5.5.3 Liquid level controls

5.5.3.1 A liquid level control shall comply with one of the following:

- a) The Standard for Solid-State Controls for Appliances, UL 244A;
- b) The Standard for Temperature-Indicating and -Regulating Equipment, UL 873;
- c) The Standard for Industrial Control Equipment, UL 508; or
- d) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, and;
  - 1) Deleted
  - 2) Deleted
  - 3) The Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Automatic Electrical Air Flow, Water Flow and Water Level Sensing Controls, UL 60730-2-15.

5.5.3.2 A switch employed as part of a water level detection mechanism shall comply with one of the switch standards specified in Switches, Section [5.20](#).

## 5.5.4 Motor and speed controls

5.5.4.1 A control used to start, stop, regulate or control the speed of a motor shall comply with the applicable requirements of this end product standard, or comply with one of the following:

- a) The Standard for Solid-State Controls for Appliances, UL 244A;
- b) The Standard for Temperature-Indicating and -Regulating Equipment, UL 873;
- c) The Standard for Industrial Control Equipment, UL 508;



- d) The Standard for Power Conversion Equipment, UL 508C;
- e) The Standard for Adjustable Speed Electrical Power Drive Systems – Part 5-1: Safety Requirements – Electrical, Thermal and Energy, UL 61800-5-1, or
- f) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1.

#### 5.5.5 Pressure controls

5.5.5.1 A pressure control shall comply with one of the following:

- a) The Standard for Temperature-Indicating and – Regulating Equipment, UL 873;
- b) The Standard for Industrial Control Equipment, UL 508; or
- c) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1; and the Standard for Automatic Electrical Controls – Part 2-6: Particular Requirements for Automatic Electrical Pressure Sensing Controls Including Mechanical Requirements, UL 60730-2-6.

#### 5.5.6 Temperature controls

5.5.6.1 A temperature control shall comply with one of the following:

- a) The Standard for Solid-State Controls for Appliances, UL 244A;
- b) The Standard for Temperature-Indicating and –Regulating Equipment, UL 873;
- c) The Standard for Industrial Control Equipment, UL 508; or
- d) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1; and the Standard for Automatic Electrical Controls – Part 2-9: Particular Requirements for Temperature Sensing Controls, UL 60730-2-9.

5.5.6.2 A temperature sensing positive temperature coefficient (PTC) or a negative temperature coefficient (NTC) thermistor, that performs the same function as an operating or protective control shall comply with the one of the following:

- a) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1; and the Standard for Automatic Electrical Controls – Part 2-9: Particular Requirements for Temperature Sensing Controls, UL 60730-2-9, with Annex J; or
- b) The Standard for Thermistor-Type Devices, UL 1434.

5.5.6.3 A thermal cutoff shall comply with the Standard for Thermal-Links – Requirements and Application Guide, UL 60691.

#### 5.5.7 Timer controls

5.5.7.1 A timer control shall comply with one of the following:

- a) The Standard for Solid-State Controls for Appliances, UL 244A; or
- b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1; and the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Timers and Time Switches, UL 60730-2-7.

## 5.6 Cords, cables, and internal wiring

5.6.1 A cord set or power supply cord shall comply with the Standard for Cord Sets and Power Supply Cords, UL 817.

5.6.2 Flexible cords and cables shall comply with the Standard for Flexible Cords and Cables, UL 62. Flexible cord and cables are considered to comply with this requirement when pre-assembled in a cord set or power supply cord that complies with the Standard for Cord Sets and Power Supply Cords, UL 817.

5.6.3 Internal wiring composed of insulated conductors shall comply with the Standard for Appliance Wiring Material, UL 758.

*Exception No. 1: Insulated conductors need not comply with UL 758 if they comply with one of the following:*

- a) The Standard for Thermoset-Insulated Wires and Cables, UL 44;*
- b) The Standard for Thermoplastic-Insulated Wires and Cables, UL 83;*
- c) The Standard for Fixture Wire, UL 66; or*
- d) The applicable UL standard(s) for other insulated conductor types specified in Chapter 3, Wiring Methods and Materials, of the National Electrical Code, ANSI/NFPA 70.*

*Exception No. 2: Insulated conductors for specialty applications (e.g. data processing or communications) and located in a low-voltage circuit not involving the risk of fire, electric shock or injury to persons need not comply with UL 758.*

## 5.7 Film-coated wire (magnet wire)

5.7.1 The component requirements for film coated wire and Class 105 (A) insulation systems are not specified.

5.7.2 Film coated wire in intimate combination with one or more insulators, and incorporated in an insulation system rated Class 120 (E) or higher, shall comply with the magnet wire requirements in the Standard for Systems of Insulating Materials – General, UL 1446.

## 5.8 Gaskets and seals

5.8.1 Gaskets and seals that are relied upon to prevent water entrance into electrical compartments and flooding of electrically live parts shall comply with the requirements in Physical Properties of Gaskets and Seals Test, Section [40](#).

## 5.9 Ground-fault, arc-fault, and leakage current detectors/interrupters

5.9.1 Ground-fault circuit-interrupters (GFCI) for protection against electrical shock shall comply with the Standard for Ground-Fault Circuit-Interrupters, UL 943. The following statement, or equivalent, shall be included as a marking near the GFCI, or as an instruction in the manual: "Press the TEST button (then RESET button) every month to assure proper operation."

5.9.2 Appliance-leakage-current interrupters (ALCI) for protection against electrical shock shall comply with the Standard for Appliance-Leakage-Current Interrupters, UL 943B.

5.9.3 With respect to [5.9.2](#), an ALCI is not considered an acceptable substitute for a GFCI when the National Electrical Code, ANSI/NFPA 70 requires a GFCI.

5.9.4 Equipment ground-fault protective devices shall comply with the Standard for Ground-Fault Sensing and Relaying Equipment, UL 1053, and the applicable requirements in the Standard for Ground-Fault Circuit-Interrupters, UL 943.

5.9.5 Arc-fault circuit-interrupters (AFCI) shall comply with the Standard for Arc-Fault Circuit-Interrupters, UL 1699. See Arc-Fault and Leakage Current Detectors/Interrupters, Section [26](#).

5.9.6 Leakage-current detector-interrupters (LCDI) and any shielded cord between the LCDI and appliance shall comply with the Standard for Arc-Fault Circuit-Interrupters, UL 1699. See Arc-Fault and Leakage Current Detectors/Interrupters, Section [26](#).

## 5.10 Heating elements and heaters

5.10.1 Electric resistance heating elements shall comply with the construction requirements in:

- a) The Standard for Electric Heating Appliances, UL 499; or
- b) The Standard for Sheathed Heating Elements, UL 1030.

5.10.2 Thermistor-type heaters (e.g. PTC and NTC heaters) shall comply with the Standard for Thermistor-Type Devices, UL 1434.

## 5.11 Insulation systems

5.11.1 Materials used in a Class 105 (A) insulation system shall comply with the requirements in Insulation Systems, Section [17](#).

5.11.2 Materials used in an insulation system that operates above Class 105 (A) temperatures shall comply with the Standard for Systems of Insulating Materials – General, UL 1446.

5.11.3 All insulation systems employing integral ground insulation shall comply with the requirements specified in the Standard for Systems of Insulating Materials – General, UL 1446.

## 5.12 Marking and labeling systems

5.12.1 A marking and labeling system shall comply the requirements in Permanence of Marking Tests, Section [47](#).

## 5.13 Motors and motor overload protection

### 5.13.1 General

5.13.1.1 General-purpose type motors having a NEMA frame size shall comply with the requirements specified in [5.15.2](#). This includes fractional HP motors rated up to 1 HP (typically NEMA frame sizes 42, 48, or 56), and integral HP motors rated 1 HP and greater (typically NEMA frame sizes 140 – 449T).

5.13.1.2 Motors not enclosed, or partially enclosed, by the end product enclosure shall comply with the requirements specified in [5.13.2](#) or [5.13.3](#).

5.13.1.3 Component type motors completely enclosed within the end product enclosure shall comply with the requirements specified in [5.13.2](#) or [5.13.3](#).

### 5.13.2 General-purpose type motors

5.13.2.1 A general-purpose type motor shall comply with the Standard for Rotating Electrical Machines – General Requirements, UL 1004-1.

### 5.13.3 Component type motors

5.13.3.1 Component type motors shall comply with either [5.13.3.2](#) or [5.13.3.3](#).

5.13.3.2 The motor shall comply with the Standard for Rotating Electrical Machines – General Requirements, UL 1004-1 except as noted in [Table 5.1](#).

**Table 5.1**  
**Superseded requirements**

UL 1004-1 exempted requirement	Superseded by UL 430 requirements
Current and Horsepower Relation	Paragraph <a href="#">16.4</a>
Cord-Connected Motors	Section <a href="#">11.1</a>
Factory Wiring Terminals and Leads	Section <a href="#">13</a>
Electrical Insulation	Sections <a href="#">8</a> and <a href="#">14</a>
Non-Metallic Functional Parts	Sections <a href="#">8</a> , <a href="#">14</a> , and <a href="#">16</a>
Solid-State Controls, 7.2	Section <a href="#">5.5.2</a>
Non-metallic enclosure thermal aging, 9.1.4	Section <a href="#">8</a>
Motor enclosure, 9.2 – 9.4	Sections <a href="#">7</a> and <a href="#">8</a>
Grounding	Section <a href="#">25</a>
Ventilation Openings, only applicable where the openings are on surfaces considered to be the appliance enclosure.	Section <a href="#">7</a>
Accessibility of Uninsulated Live Parts, Film-Coated Wire, and Moving Parts	Section <a href="#">7.3</a>
Protection Against Corrosion	Section <a href="#">10</a>
Available fault current ratings for motor start and running capacitors, Paragraph 26.6; not applicable for cord and plug connected appliances.	Section <a href="#">22</a>
Switch, is not applicable to centrifugal starting switches	Section <a href="#">18</a>
With the exception of Resilient Elastomer Mounting and Electrolytic Capacitor Tests, the performance tests in the Standard for Rotating Electrical Machines – General Requirements, UL 1004-1 are not applicable	All applicable performance tests
Only the following marking requirements in UL 1004-1 are applicable: manufacturer's name or identification; rated voltage; rated frequency; number of phases if greater than 1; and multi-speed motors, other than a shaded-pole or a permanent-split-capacitor motor, shall be marked with the amperes and horsepower at each speed	Paragraph <a href="#">63.1</a>

5.13.3.3 The motor shall comply with the applicable component requirements for Components, Section [5](#), the following construction requirements, and the applicable performance requirements (when tested in conjunction with the end product), of this end product standard:

- a) Polymeric Materials, Section [8](#);

- b) Corrosion Protection, Section [10](#);
- c) Terminal Compartment, Section [11](#) ([11.2.1.1](#));
- d) Current-Carrying Parts, Section [12](#);
- e) Internal Wiring, Section [13](#);
- f) Electrical Insulation, Section [14](#);
- g) Motors, Section [16](#);
- h) Capacitors, Section [22](#);
- i) Spacings, Section [24](#); and
- j) Grounding, Section [25](#).

#### 5.13.4 Motor overload protection

5.13.4.1 Thermal protection devices integral with the motor shall comply with one of the following:

- a) The Standard for Overheating Protection for Motors, UL 2111;
- b) The Standard for Thermally Protected Motors, UL 1004-3; or
- c) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, and the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2 Particular Requirements for Thermal Motor Protectors, UL 60730-2-2, in conjunction with the Standard for Thermally Protected Motors, UL 1004-3 (to evaluate the motor-protector combination).

5.13.4.2 Impedance protection shall comply with the Standard for Impedance Protected Motors, UL 1004-2.

5.13.4.3 Electronic protection integral to the motor shall comply with the Standard for Electronically Protected Motors, UL 1004-7 or the requirements in Alternative Requirements for the Evaluation of Electronic Circuits, Supplement [SA](#).

5.13.4.4 Except as indicated in [5.13.4.3](#), electronically protected motor circuits shall comply with one of the following. See [5.5.4](#) for basic control requirements:

- a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991. When the protective electronic circuit is relying upon software as a protective component, it shall comply with the requirements in the Standard for Software in Programmable Components, UL 1998. If software is relied upon to perform a safety function, it shall be considered software Class 1;
- b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1. If software is relied upon to perform a safety function, it shall be considered software Class B;
- c) The Standard for Power Conversion Equipment, UL 508C, when no software is relied upon to perform a safety function. If software is relied upon to perform a safety function, the circuit shall additionally comply with applicable requirements in (a), (b), or (e) of this section;
- d) The Standard for Adjustable Speed Electrical Power Drive Systems – Part 5-1: Safety Requirements – Electrical, Thermal and Energy, UL 61800-5-1, when no software is relied upon to perform a safety function. If software is relied upon to perform a safety function, the circuit shall additionally comply with applicable requirements in (a), (b), or (e) of this section; or

e) Electronic protection complying with the tests of Standard for Thermally Protected Motors, UL 1004-3 and the circuit requirements in Alternative Requirements for the Evaluation of Electronic Circuits, Supplement [SA](#).

*Exception: Compliance with the above standards is not required for an electronically protected motor circuit if there is no risk of fire, electric shock, or injury to persons during abnormal testing with the motor electronic circuit rendered ineffective; compliance with the applicable requirements of this end product standard is then required.*

#### 5.14 Overcurrent protection

5.14.1 Fuses shall comply with the Standard for Low-Voltage Fuses – Part 1: General Requirements, UL 248-1; and the applicable UL 248 Part 2 (e.g. the Standard for Low-Voltage Fuses - Part 5: Class G Fuses, UL 248-5). Defined use fuses that comply with UL 248-1 and another applicable UL standards for fuses are considered to comply with this requirement.

5.14.2 Fuseholders shall comply with The Standard for Fuseholders – Part 1: General Requirements, UL 4248-1, and the applicable Part 2 (e.g. the Standard for Fuseholders – Part 9: Class K, UL 4248-9).

5.14.3 Circuit breakers shall comply with the Standard for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures, UL 489.

*Exception: Circuit breakers used in telecommunications circuitry that comply with the Standard for Circuit Breakers For Use in Communications Equipment, UL 489A, need not comply with UL 489.*

5.14.4 Circuit breakers having integral ground fault circuit interrupter capability for protection against electrical shock shall additionally comply with the Standard for Ground-Fault Circuit-Interrupters, UL 943.

5.14.5 Supplementary protectors shall comply with the Standard for Supplementary Protectors for Use in Electrical Equipment, UL 1077.

#### 5.15 Polymeric materials and enclosures

5.15.1 Unless otherwise specified in this end product standard, polymeric electrical insulation shall comply with the applicable requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C; see [48.3](#) of this end product standard. See Polymeric Materials, Section [8](#).

5.15.2 Metallized or painted polymeric parts or enclosures shall comply with the applicable requirements of the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C; see [48.3](#) of this end product standard. This requirement is not applicable to exterior surfaces of polymeric enclosure materials or parts provided that the metallized coating or paint does not offer a continuous path for an internal flame to propagate externally; see Polymeric Materials Test – General, Section [48](#), for applicable requirements.

#### 5.16 Power supplies

5.16.1 A Class 2 power supply shall comply with one of the following:

a) The Standard for Class 2 Power Units, UL 1310; or

b) The Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1, with an output marked "Class 2", or that complies with the limited power source (LPS) requirements and is marked "LPS".

5.16.2 A non-Class 2 power supply shall comply with one of the following:

- a) The Standard Power Units Other Than Class 2, UL 1012; or
- b) The Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1.

## 5.17 Printed wiring boards

5.17.1 Printed wiring boards, including the coatings, shall comply with the Standard for Printed Wiring Boards, UL 796.

*Exception: A printed-wiring board in a Class 2 nonsafety circuit is not required to comply with the bonding requirements in UL 796 if the board is separated from parts of other circuits such that loosening of the bond between the foil conductor and the base material will not result in the foil conductors or components coming in contact with parts of other circuits of the control or of the end-use product.*

5.17.2 A printed-wiring board containing circuitry in a line-connected circuit or a safety circuit shall comply with the direct-support requirements for insulating materials in Electrical Insulation, Section [14](#) of this end product standard.

5.17.3 Unless otherwise specified, the flammability class and temperature rating shall be that as specified for insulating materials in Polymeric Materials, Section [8](#) of this end product standard.

## 5.18 Semiconductors and small electronic components

5.18.1 A power switching semiconductor device that is relied upon to provide isolation to ground shall comply with the Standard for Safety for Electrically Isolated Semiconductor Devices, UL 1557. The Dielectric Voltage Withstand Tests required by UL 1557 shall be conducted applying the requirements of the Dielectric Voltage Withstand Test, Section [40](#), of this end product standard.

5.18.2 An optical isolator that is relied upon to provide isolation between primary and secondary circuits or between other circuits as required by this end product standard shall comply with the Standard for Safety for Optical Isolators, UL 1577. The Dielectric Voltage Withstand Tests required by UL 1577 shall be conducted applying the requirements in Dielectric Voltage Withstand Test, Section [40](#) of this end product standard. The dielectric test voltage is to be applied between the input and output terminals of the optical isolator.

5.18.3 Except as specified in [5.18.4](#), component requirements are not specified for small electronic components on printed wiring boards, including diodes, transistors, resistors, inductors, integrated circuits, and capacitors not directly connected to the supply source.

5.18.4 Where an electronic component is determined to be a critical component during the Abnormal Operation Test, Section [58](#), one of the following standards shall be applied. See [19.4](#) of this end product standard for the test requirements to be used:

- a) The Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991, including its Follow-Up Program; and as applicable, the Standard for Software in Programmable Components, UL 1998 for controls that rely upon software as a protective component; or
- b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1.

5.18.5 A critical component is a component that performs one or more safety-related functions whose failure results in a condition, such as the risk of fire, electric shock, or injury to persons, in the end product application.



5.18.6 A critical component may also be identified using a failure-mode and effect analysis (FMEA) in accordance with the Failure-Mode and Effect Analysis (FMEA) requirements in the Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991.

5.18.7 Portions of a circuit comprised of a microcontroller or other programmable device that performs a back-up, limiting, or other safety function intended to reduce the risk of fire, electric shock, or injury to persons shall comply with the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, Annex H.

## 5.19 Supplemental insulation, insulating bushings, and assembly aids

5.19.1 The requirements for supplemental insulation (e.g. tape, sleeving or tubing) are not specified unless the insulation or device is required to comply with [13.13](#) or a performance requirement of this end product standard. In such cases, the insulation shall comply with the following applicable standards:

- a) Insulating tape shall comply with the Standard for Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape, UL 510;
- b) Sleeving shall comply with the Standard for Coated Electrical Sleeving, UL 1441; or
- c) Tubing shall comply with the Standard for Extruded Insulating Tubing, UL 224.

5.19.2 Wire positioning devices shall comply with the requirements in Polymeric Material, Section [8](#), and Electrical Insulation, Section [14](#). A device that complies with the Standard for Positioning Devices, UL 1565, is considered to comply with this requirement.

5.19.3 Insulating bushings that comply with the requirements in General, Section [5.1](#), of this end product standard, and the Standard for Insulating Bushings, UL 635 are considered to comply with the requirements of this end product standard. Tests specified in this end product standard (e.g. Strain Relief Test) may still need to be performed to confirm the combination of the insulating bushing and the supporting part comply with the intent of the requirements.

## 5.20 Switches

5.20.1 Switches shall comply with one of the following:

- a) The Standard for Switches for Appliances – Part 1: General Requirements, UL 61058-1; and
- b) The Standard for General-Use Snap Switches, UL 20; or
- c) The Standard for Nonindustrial Photoelectric Switches for Lighting Control, UL 773A.

*Exception: Switching devices that comply with the applicable UL standards for specialty applications (e.g. transfer switch equipment), industrial use (e.g. contactors, relays, auxiliary devices), or are integral to another component (e.g. switched lampholder), need not comply with this requirement.*

5.20.2 A clock-operated switch, in which the switching contacts are actuated by a clock-work, by a gear-train, by electrically-wound spring motors, by electric clock-type motors, or by equivalent arrangements shall comply with one of the following:

- a) The Standard for Clock-Operated Switches, UL 917; or
- b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, and the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Timers and Time Switches, UL 60730-2-7.



5.20.3 A timer or time switch, incorporating electronic timing circuits or switching circuits, with or without separable contacts, shall comply with the requirements for an operating control with Type 1 action for 6000 cycles of operation, or as a manual control for 5000 cycles of operation, in accordance with one of the following:

- a) The Standard for Solid-State Controls for Appliances, UL 244A; or
- b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1; and the Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Timers and Time Switches, UL 60730-2-7.

5.20.4 A timer or time switch, incorporating electronic timing circuits or switching circuits, with or without separable contacts, that functions as a protective control, shall comply with the requirements for a protective control; see [5.5.1.4](#).

## 5.21 Transformers

5.21.1 General-purpose transformers shall comply with the Standard for Low Voltage Transformers – Part 1: General Requirements, UL 5085-1; and the Standard for Low Voltage Transformers – Part 2: General Purpose Transformers, UL 5085-2.

5.21.2 Class 2 and Class 3 transformers shall comply with the Standard for Low Voltage Transformers – Part 1: General Requirements, UL 5085-1; and the Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3.

*Exception: Transformers located in a Class 2 circuit, and that do not involve a risk of fire, electric shock or injury to persons need not comply with this requirement.*

## 6 Field-Installed Accessories and Assemblies

6.1 The requirements in [6.2](#) – [6.8](#) apply to accessories intended for installation on or attachment to a disposer in the field for the purpose of modifying or supplementing the functions of the disposer. The combination of the basic disposer and control assembly or other field-installed accessory shall comply with the applicable requirements in this standard.

6.2 A disposer intended for use with a field-installed control assembly or accessory that is not shipped with the disposer shall be marked in accordance with [63.10](#).

6.3 A field-installed control assembly or accessory identified for use with a disposer as specified in [63.10](#) shall comply with [18.9](#).

6.4 A disposer having provision for an accessory to be attached in the field shall be constructed so that use of the accessory does not introduce a risk of fire, electric shock, or injury to persons.

6.5 The means provided for attachment of an accessory by the operator shall be receptacles and plug-in connectors.

6.6 The use of wire connectors and existing terminals as a means of attaching an accessory by qualified personnel is acceptable.

6.7 A disposer shall not require rearrangement of components or wires, cutting or splicing wires, or soldering connections in the field.

6.8 An accessory shall be field-installed and tested to determine whether:

- a) The accessory can be installed according to the instructions;
- b) The instructions are detailed and correct; and
- c) Use of the accessory after installation according to the instructions does not result in a risk of fire, electric shock, or injury to persons.

## 7 Enclosure

### 7.1 General

7.1.1 A disposer shall be formed and assembled so that it has the strength and rigidity necessary to resist the abuses to which it may be subjected, without resulting in a risk of fire, electric shock, or injury to persons due to total or partial collapse with resulting reduction of spacings, loosening or displacement of parts, or other defects.

7.1.2 For an unreinforced flat surface, cast metal shall not be less than 1/8 in (3.2 mm) thick, malleable iron shall not be less than 3/32 in (2.4 mm) thick, and die-cast metal shall not be less than 5/64 in (2.0 mm) thick.

*Exception No. 1: The use of thinner metal complies if:*

- a) *The metal is curved, ribbed, or otherwise reinforced to provide equivalent or better mechanical strength; or*
- b) *The metal is of a size or shape that provides equivalent or better mechanical strength.*

*In any case, the metal shall not be less than 3/32 in (mm) for cast metal, 1/16 in (1.6 mm) for malleable iron, or 3/64 in (1.2 mm) for die-cast metal.*

*Exception No. 2: Thinner metal meets the intent of the requirement if found acceptable when investigated with respect to the factors specified in [7.1.6](#).*

7.1.3 In addition to being investigated with respect to the factors specified in [7.1.6](#), the effects of the following factors shall be investigated to determine compliance of a sheet-metal enclosure with [7.1.1](#):

- a) The size and shape of the disposer with respect to the intended use of the disposer;
- b) The thickness of metal with respect to the intended use of the disposer; and
- c) The application of the metal with respect to the intended use of the disposer.

7.1.4 Sheet metal used for other than relatively small areas or for surfaces that are curved or otherwise reinforced shall not be thinner than:

- a) 0.026 in (0.66 mm) if uncoated steel;
- b) 0.029 in (0.74 mm) if galvanized steel; or
- c) 0.029 in (0.74 mm) if of nonferrous sheet metal having a thickness less than 0.036 in (0.91 mm).

7.1.5 Sheet metal to which a wiring system is to be connected in the field shall not be thinner than:

- a) 0.032 in (0.81 mm) if uncoated steel;
- b) 0.034 in (0.86 mm) if galvanized steel; or

c) 0.045 in (1.14 mm) if nonferrous sheet metal.

7.1.6 The effects of the following factors shall be determined for compliance with [7.1.1](#):

- a) Mechanical strength;
- b) Resistance to impact;
- c) Moisture-absorption properties;
- d) Combustibility;
- e) Resistance to corrosion; and
- f) Resistance to distortion at temperatures to which the enclosure is subjected under conditions of intended or unintended use.

These factors shall be investigated with respect to thermal aging if a nonmetallic enclosure is being investigated.

7.1.7 The polymeric housing of a component is not considered to be an appliance enclosure unless this part is the sole insulation (excluding air) between a live part and an external surface of the appliance.

## 7.2 Barriers

7.2.1 The enclosure of a disposer shall reduce the likelihood of molten metal, burning insulation, flaming particles, or the like from falling on combustible materials, including surfaces located beneath the disposer.

7.2.2 Compliance with [7.2.1](#) requires that a switch, a relay, a solenoid, or similar component be completely enclosed (no openings), unless it is shown that malfunction of the component does not result in a risk of fire; or there are no openings in the bottom of the disposer enclosure. Compliance with [7.2.1](#) also requires the use of a barrier:

- a) Under a motor, unless:
  - 1) The structural parts of the motor or of the disposer provide the equivalent of such a barrier;
  - 2) The protection provided with the motor is such that no burning insulation or molten material falls to surfaces located beneath the disposer when the motor is energized under each of the following fault conditions:
    - i) Open main winding;
    - ii) Open auxiliary winding;
    - iii) Starting switch short-circuited; and
    - iv) Capacitor of a permanent-split-capacitor motor short-circuited – the short-circuit is to be applied before the motor is energized and the rotor is to be locked;
  - 3) The motor is provided with a thermal motor protector – a protective device that is sensitive to temperature and current – that reduces the risk of the temperature of the motor windings from becoming greater than 125°C (257°F) under the maximum load under which the motor runs without causing the protector to cycle, and from becoming greater than 150°C (302°F) with the rotor of the motor locked; or

4) The motor complies with the requirements for impedance-protected motors in the Standard for Impedance Protected Motors, UL 1004-2 and the temperature of the motor winding does not exceed 150°C (302°F) during the first 72 h of operation with the rotor of the motor locked.

b) Under wire, unless the wire complies with the vertical flame test requirements of the applicable UL Standard and is marked VW-1.

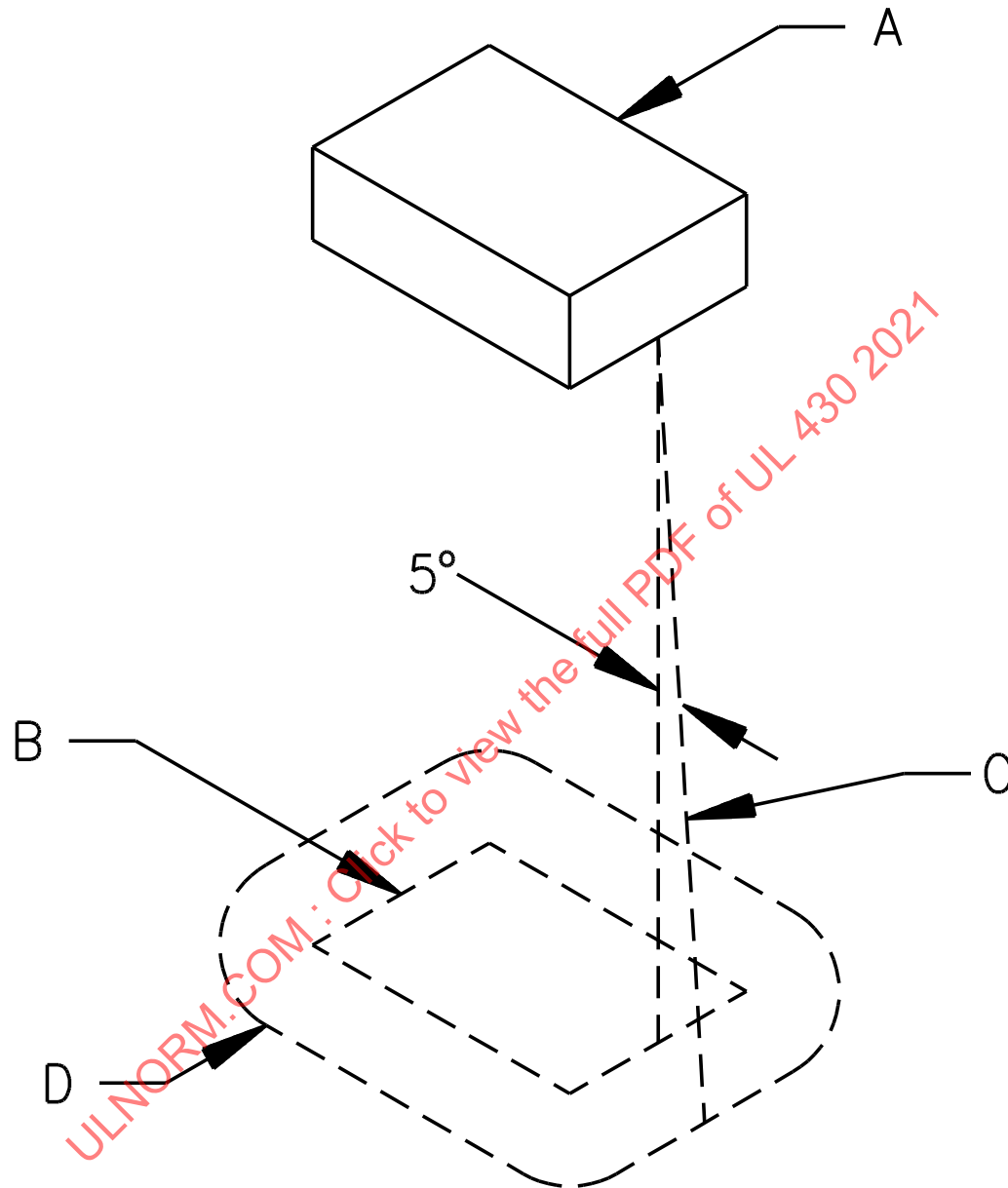
7.2.3 The barrier specified in [7.2.2](#) shall:

a) Be located as illustrated in [Figure 7.1](#); and

b) Have an area not less than that determined in accordance with [Figure 7.1](#).

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**Figure 7.1**  
**Location and extent of barrier**



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A – Region to be shielded by barrier. This will consist of the entire component if it is not otherwise shielded, and will consist of the unshielded portion of a component that is partially shielded by the component enclosure or equivalent.

B – Projection of outline of component on horizontal plane.

C – Inclined line that traces out minimum area of barrier. When moving, the line is always tangent to the component, five degrees from the vertical, and oriented so that the area traced out on a horizontal plane is maximum.

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

7.2.4 With reference to [7.2.3](#), an opening that is intended for drainage or ventilation shall be such that molten metal, burning insulation, or similar material does not fall onto combustible material.

### 7.3 Accessibility of uninsulated live parts and film-coated wire

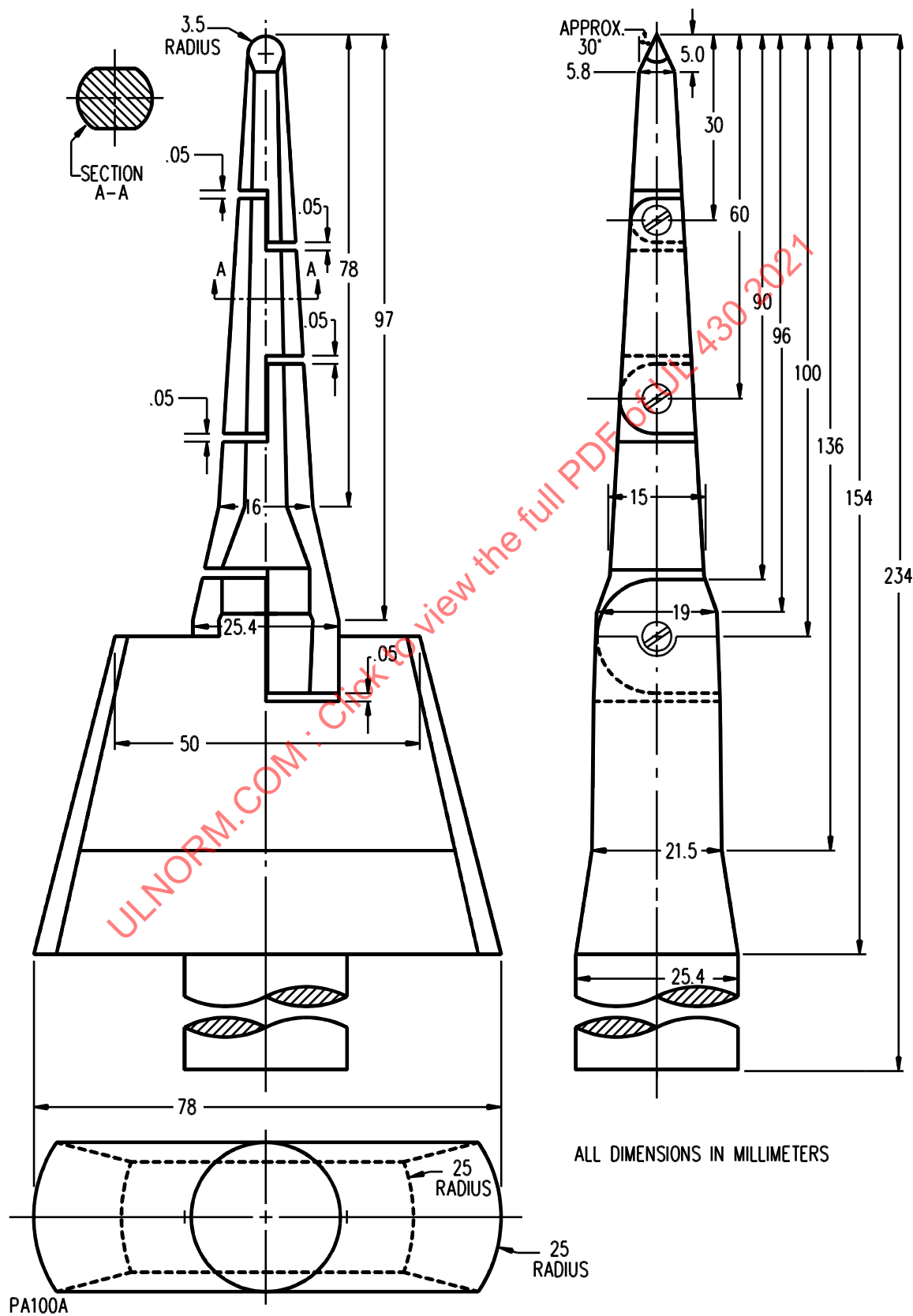
7.3.1 To reduce the risk of unintentional contact with an uninsulated live part or film-coated wire that involves a risk of electric shock, an opening in an enclosure shall comply with (a) or (b).

- a) For an opening that has a minor dimension (see [7.3.5](#)) less than 1 in (25.4 mm), such a part or wire shall not be contacted by the probe illustrated in [Figure 7.2](#).
- b) For an opening that has a minor dimension of 1 in or greater, such a part or wire shall be spaced from the opening as specified in [Table 7.1](#).

*Exception: An integral enclosure of a motor is not required to comply with these requirements if it complies with [7.3.2](#).*

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**Figure 7.2**  
**Articulate probe with web stop**



**Table 7.1**  
**Minimum acceptable distance from an opening to a part that may involve a risk of electric shock**

Minor dimension <sup>a</sup> of opening		Minimum distance from opening to part	
in <sup>b</sup>	(mm)	in <sup>b</sup>	(mm)
3/4 <sup>c</sup>	19.1	4-1/2	114.0
1 <sup>c</sup>	25.4	6-1/2	165.0
1-1/4	31.8	7-1/2	190.0
1-1/2	38.1	12-1/2	318.0
1-7/8	47.6	15-1/2	394.0
2-1/8	54.0	17-1/2	444.0
d		30	762.0

<sup>a</sup> See [7.3.5](#).  
<sup>b</sup> Between 3/4 in and 2-1/8 in, interpolation is to be used to determine a value between values specified in the table.  
<sup>c</sup> Any dimension less than 1 in applies to a motor only.  
<sup>d</sup> Greater than 2-1/8 in, but not greater than 6 in (152.0 mm).

7.3.2 With reference to the Exception to [7.3.1](#), an opening in an integral enclosure of a motor shall comply with (a) or (b).

a) For an opening that has a minor dimension (see [7.3.5](#)) less than 3/4 in (19.1 mm):

1) Film-coated wire shall not be contacted by the probe illustrated in [Figure 7.3](#); and

2) In a directly accessible motor (see [7.3.6](#)), an uninsulated live part shall not be contacted by the probe illustrated in [Figure 7.4](#).

b) For an opening that has a minor dimension of 3/4 in or greater, a part or wire shall be spaced from the opening as specified in [Table 7.1](#).



Figure 7.3

Probe for internal wiring and film-coated wire

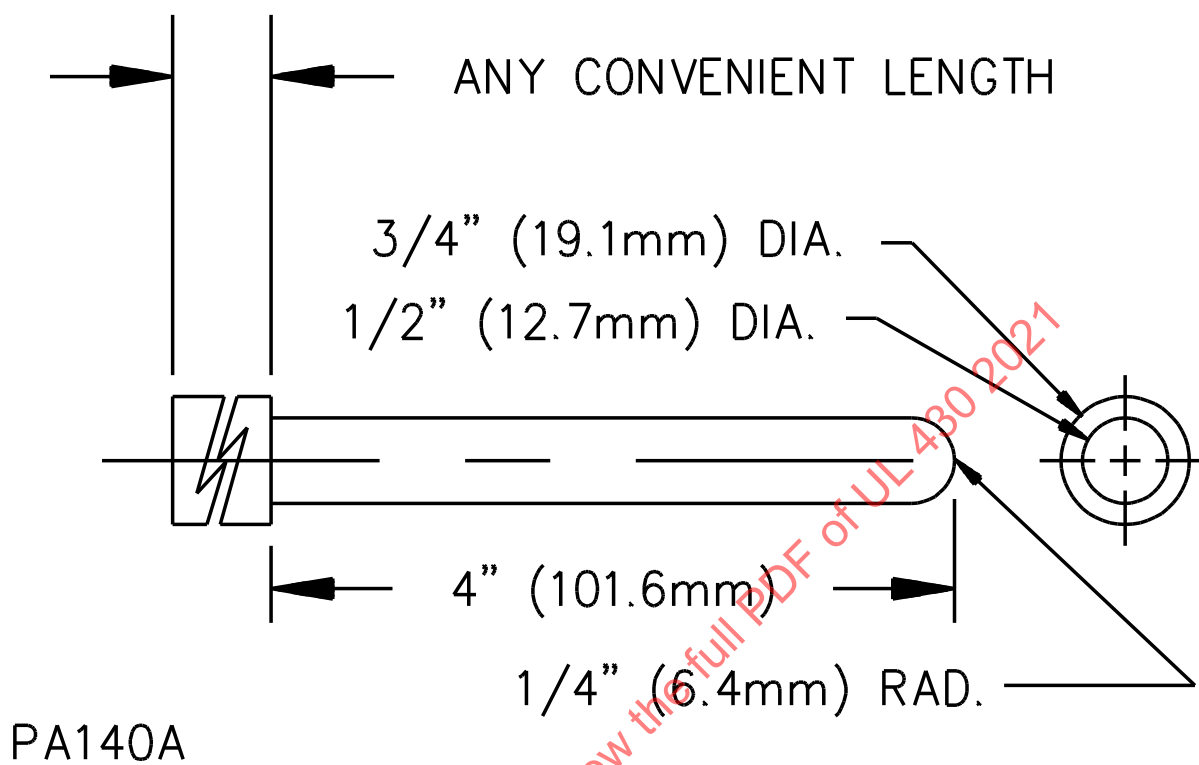
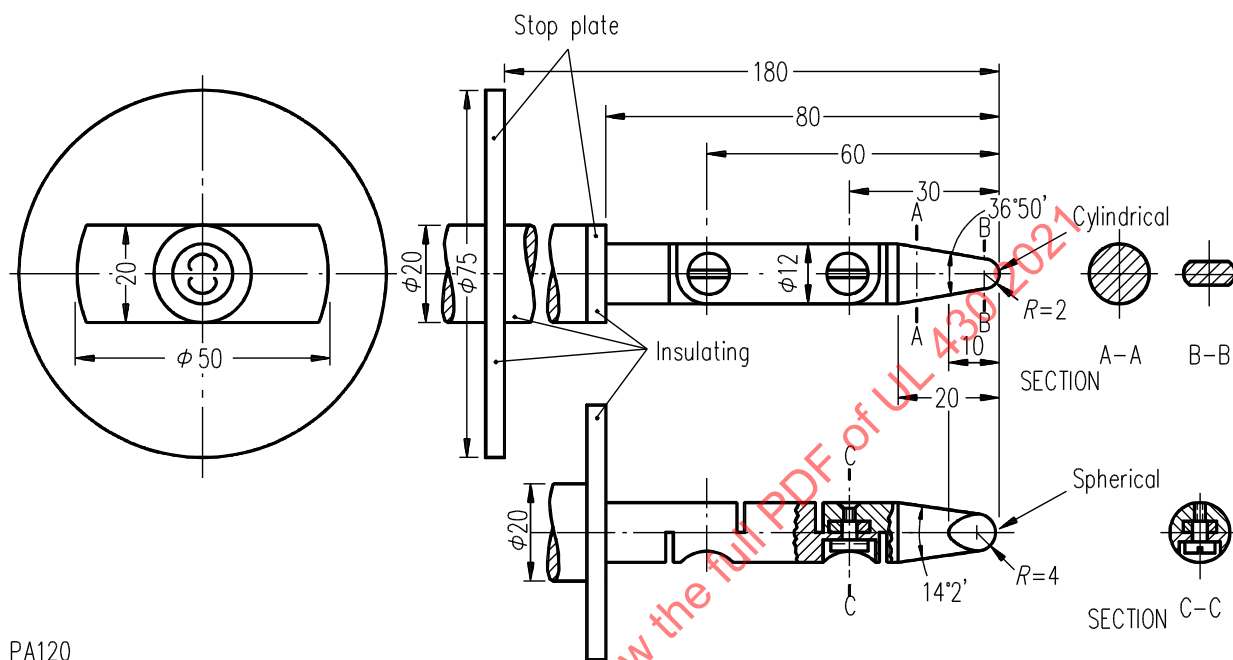


Figure 7.4

International Electrotechnical Commission (IEC) articulate accessibility probe with stop plate

Courtesy of IEC

Dimensions in millimeters



PA120

7.3.3 The probes specified in 7.3.1 and 7.3.2 and illustrated in Figure 7.2 – Figure 7.4 shall be applied to any depth that the opening permits, and shall be rotated or angled before, during, and after insertion through the opening to any position that is necessary to examine the enclosure. The probes illustrated in Figure 7.2 and Figure 7.4 shall be applied in any possible configuration, and, if necessary, the configuration shall be changed after insertion through the opening.

7.3.4 The probes specified in 7.3.3 and 7.3.5 shall be used as measuring instruments to determine the accessibility provided by an opening, and not as instruments to determine the strength of a material. The probes shall be applied with the minimum force necessary to determine compliance.

7.3.5 With reference to 7.3.1 and 7.3.2, the minor dimension of an opening is the diameter of the largest cylindrical probe having a hemispherical tip that can be inserted through the opening.

7.3.6 With reference to 7.3.2, a directly accessible motor is a motor:

- a) That can be contacted without opening or removing any part; or
- b) That is located so as to be accessible to contact.

7.3.7 During the examination of a disposer to determine compliance with 7.3.1 or 7.3.2, a part of the enclosure that can be opened or removed by the user without using a tool (to attach an accessory, to make an operating adjustment, or for other reasons) is to be opened or removed.

7.3.8 With reference to 7.3.1 and 7.3.2, insulated brush caps are not required to be additionally enclosed.

## 8 Polymeric Materials

8.1 A polymeric material used as a part of a disposer shall comply with the applicable requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C, and with the requirements for polymeric materials specified in Sections [48](#) – [58](#).

*Exception: A material need not comply with the requirements for enclosures, direct contact with current-carrying parts, or other requirements for functional parts if a complete or partial deterioration or breakage of the part does not adversely affect compliance with any other requirement in this standard. In such cases, the material shall comply with the requirements applicable to decorative parts.*

8.2 When determining compliance with [8.1](#), a disposer shall be investigated as:

- a) A fixed appliance if it is intended to be permanently connected electrically or sink-mounted; or
- b) A stationary appliance if it is cord-connected and intended to be fastened in place or located in a dedicated space.

8.3 A material used in a part that contacts water or food waste during normal operation, including water and food waste from a dishwasher, shall be investigated on the basis of operating at temperatures not less than 82°C (180°F) unless measured temperatures on a polymeric part, obtained in accordance with the method described in [8.4](#), are less.

8.4 The disposer is to be connected to a power supply as specified in [33.2](#). Thermocouples are to be placed on the outside of the polymeric parts that contact water or food waste during normal operation. The disposer is to be operated while water is run through the top of the disposer for 20 minutes. The water is to be at a temperature of 180°F (82°C) and run at a rate of 2.2 gal/min (8.3 L/min). See [39.3](#) – [39.5](#).

8.5 A material that attains temperatures greater than 50°C (122°F) during the Temperature Test, Section [39](#), including those described in [8.3](#), shall have a relative thermal index or other temperature rating for the application in accordance with the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B.

8.6 A polymeric material of a disposer shall be resistant to thermal degradation at the maximum temperature to which it is exposed during intended use and shall comply with Thermal-Aging Test, Section [56](#).

8.7 If the deterioration of a polymeric material results in a risk of fire, electric shock, or injury to persons, the material shall be resistant to solutions to which it is exposed during intended use and shall comply with Long Term Exposure Tests, Section [57](#).

## 9 Mechanical Assembly

9.1 A disposer shall be assembled so that its functioning is not impacted by the vibration produced during intended operation. Brush caps shall be tightly threaded or otherwise constructed so that the caps do not loosen.

9.2 A switch, attachment-plug receptacle, motor-attachment plug, or similar component shall be mounted securely, and shall not rotate. Friction between surfaces shall not be used as the only means to prevent rotation. Using a lock washer to prevent rotation of a stem-mounted switch or other device having a single-hole mounting means is acceptable.

*Exception: This requirement does not apply to a switch if:*

- a) *The switch is of a plunger or other type that does not tend to rotate when operated - a toggle switch does not comply with this requirement;*
- b) *The risk of the switch loosening from its mounting means due to operation is remote;*
- c) *The spacings are not reduced below the minimum required values if the switch rotate; and*
- d) *Normal operation of the switch is by mechanical means rather than direct contact by persons.*

## 10 Corrosion Protection

10.1 All surfaces of an iron or a steel part shall be enameled, galvanized, plated, or similarly treated to reduce the risk of corrosion.

*Exception No. 1: Corrosion protection is not required for a bearing, balance weight, lamination, or a minor part such as a screw or washer.*

*Exception No. 2: Corrosion protection is not required for an iron or steel part where corrosion of the part does not result in a risk of fire, electric shock, or injury to persons.*

## 11 Power-Supply Connections

### 11.1 Cord-connected disposers

#### 11.1.1 Cords and plugs

11.1.1.1 A power-supply cord – a length of flexible cord and an attachment plug – is acceptable on a household appliance, but not on a commercial appliance.

11.1.1.2 For a portable disposer:

- a) The flexible cord shall be S, SE, SEO, SEOO, SJ, SJE, SJEO, SJEOO, SJO, SJT, SJTO, SJTOO, SO, SOO, ST, STO, or STOO; and
- b) The length of the flexible cord shall not be less than 5 ft (1.52 m).

11.1.1.3 For a household disposer intended for attachment to a sink:

- a) The flexible cord shall be Type S, SE, SEO, SEOO, SJ, SJE, SJEO, SJEOO, SJO, SJT, SJTO, SJTOO, SP-3, SPE-3, SO, SOO, SPT-3, ST, STO, or STOO; and
- b) The length of the flexible cord shall not be less than 1-1/2 ft (457 mm) and not greater than 3 ft (914 mm).

11.1.1.4 The flexible cord shall be rated for a voltage not less than the rated voltage of the disposer. The ampacity of the cord shall not be less than the current rating of the disposer. The attachment plug shall be rated for use with a current not less than 125 percent of the current rating of the disposer, and at a voltage equal to the voltage rating of the disposer.

11.1.1.5 If a disposer is adaptable for use on two or more different values of voltage by field alteration of internal connections, the attachment plug shall be rated for the voltage for which the appliance is connected when shipped from the factory. See [63.11](#).

11.1.1.6 A 3-wire to 2-wire, grounding adapter shall not be provided with an appliance.

11.1.1.7 Means shall be provided to reduce the risk of the flexible cord being pushed into the disposer through the cord-entry hole when such displacement results in a risk of:

- a) Subjecting the cord to mechanical damage;
- b) Exposing the cord to a temperature higher than that for which it 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.

To determine compliance, the cord shall be tested in accordance with Push-Back Relief Test, Section [46](#).

### 11.1.2 Strain relief

11.1.2.1 Strain relief means shall be provided for a permanently attached power-supply cord so that mechanical stress on the flexible cord is not transmitted to terminals, splices, or interior wiring. The strain relief shall comply with Strain Relief Test, Section [45](#).

11.1.2.2 For a knot in a flexible cord serving as strain relief, the surfaces that the knot contacts shall be smooth and free from projections, sharp edges, burrs, or fins.

11.1.2.3 The flexible cord of a portable household disposer shall:

- a) Enter the enclosure through a watertight fitting or be otherwise sealed in place; and
- b) Be provided with strain relief that is independent of the seal, and the strain relief means shall reduce the risk of flexing or movement of the seal.

## 11.2 Permanently connected disposers

### 11.2.1 General

11.2.1.1 A disposer intended to be fastened or secured in position shall be provided with wiring terminals or leads for the connection of power-supply conductors and shall have provision for connection to a wiring system. The terminal or wiring compartment of a disposer intended for permanent connection to a wiring system shall comply with the Standard for Metallic Outlet Boxes, UL 514A or the requirements for field wiring compartments in the Standard for Rotating Electrical Machines – General Requirements, UL 1004-1.

*Exception: A disposer that is intended to be connected only by means of a power-supply cord, and that complies with [11.1.1.1](#) – [11.1.2.3](#) is not required to comply with this requirement.*

11.2.1.2 A field-wiring terminal is a terminal to which a wire might be connected in the field, unless the wire and a means of making the connection – such as a pressure wire connector, soldering lug, soldered loop, or crimped eyelet – factory-assembled to the wire, are provided as a part of a disposer.

### 11.2.2 Terminal compartments

11.2.2.1 A terminal box or compartment in which power-supply connections are to be made shall be located so that the connections can be readily inspected after a disposer has been installed as intended.

11.2.2.2 The requirement in [11.2.2.1](#) does not preclude compliance of a disposer in which the cover of the wiring terminal compartment is on the bottom surface of the disposer.

11.2.2.3 A terminal compartment intended for connection of a supply raceway shall be attached to a disposer so that the compartment does not rotate.

11.2.2.4 An outlet box, terminal box, or wiring compartment, in which connections to the supply circuit are made in the field shall be free from sharp edges, including screw threads, burrs, fins, moving parts, or the like that could damage the insulation on a conductor.

### 11.2.3 Wiring compartments

11.2.3.1 If threads used to connect conduit at the exterior of the enclosure are tapped completely through the hole in a wall of a box, conduit hub, or similar compartment, or if an equivalent construction is used, there shall not be less than 3-1/2 nor more than five threads in the metal, and the construction shall be such that a conduit bushing can be attached as intended.

11.2.3.2 If threads used to connect conduit are not tapped completely through a hole in a wall of a box, conduit hub, or similar compartment, there shall not be less than five full threads in the metal and there shall be a smooth, rounded inlet hole for the conductors. The inlet hole shall provide protection for the conductors equivalent to that provided by a conduit bushing and shall have an internal diameter as specified in [Table 11.1](#).

**Table 11.1**  
**Locknut and bushing dimensions**

Trade size of conduit	Maximum diameter of locknut		Throat diameter of opening				Nominal knockout diameter	
			Minimum		Maximum			
in	in	(mm)	in	(mm)	in	(mm)	in	(mm)
1/2	1.140	28.96	0.591	15.01	0.622	15.80	7/8	22.2
3/4	1.420	36.07	0.783	19.89	0.824	20.93	1-3/32	27.8
1	1.770	44.96	0.997	25.32	1.049	26.64	1-23/64	34.5

11.2.3.3 The diameter of a knockout shall be such that it accommodates conduit of the trade size for which the knockout is intended as specified in [Table 11.1](#).

11.2.3.4 There shall be a flat surface surrounding a knockout. The flat surface shall have an area that allows a hexagonal shaped locknut or locknuts having a maximum diameter as specified in [Table 11.1](#) to be seated. The resulting assembly shall be mechanically secure and shall provide an electrical bond between the box and the conduit.

### 11.2.4 Wiring terminals and leads

11.2.4.1 A permanently-connected disposer shall be provided with wiring terminals to connect conductors having an ampacity rated for the disposer, or the disposer shall be provided with leads for such connection not smaller than 18 AWG (0.82 mm<sup>2</sup>).

11.2.4.2 A disposer shall have a terminal or lead for connection of an equipment-grounding conductor.

11.2.4.3 A terminal intended solely for connection of an equipment-grounding conductor shall be capable of securing a conductor of the size rated for the application.

11.2.4.4 A wiring terminal shall be provided with a pressure wire connector securely fastened in place – for example, firmly bolted or held by a screw.

*Exception: The use of a wire-binding screw at a terminal intended to accommodate a 10 AWG (5.3 mm<sup>2</sup>) or smaller conductor complies with the requirement. Uprturned lugs or the equivalent shall be provided to hold the wire in position.*

11.2.4.5 A wiring terminal shall not rotate.

11.2.4.6 The free length of a lead inside a wiring compartment shall not be less than 6 in (152 mm) if the lead is intended for field connection to an external circuit.

*Exception: A free length less than 6 in is acceptable if it is evident that the use of a longer lead might result in a risk of fire or electric shock.*

11.2.4.7 A wire-binding screw at a wiring terminal shall not be smaller than No. 10 (4.8 mm diameter).

*Exception: A No. 8 (4.2 mm diameter) screw is acceptable at a terminal intended only for the connection of a 14 AWG (2.1 mm<sup>2</sup>) conductor.*

11.2.4.8 A terminal plate tapped for a wire-binding screw shall be metal not less than 0.050 in (1.27 mm) thick. There shall not be fewer than two full threads in the metal of the plate.

*Exception: Using a plate not less than 0.030 in (0.76 mm) thick complies with the requirement if the tapped threads have equivalent mechanical strength.*

11.2.4.9 A terminal plate formed from stock having the minimum required thickness specified in [11.2.4.8](#), that has the metal extruded at the tapped hole to provide two full threads for the binding screw complies with the requirement.

11.2.4.10 Uprturned lugs or a cupped washer shall be capable of retaining a supply conductor of the size specified in [11.2.4.1](#) under the head of the screw or washer.

11.2.4.11 A permanently wired disposer intended for connection to a grounded power-supply conductor and using a single-pole switch shall have one terminal or lead identified for connection to the grounded conductor of the supply circuit. The identified terminal or lead shall be that to which no single-pole switches or single-pole overcurrent-protective devices are connected.

11.2.4.12 A terminal intended for connection to a grounded power-supply conductor shall be of, or plated with, a metal substantially white in color; and shall be readily distinguishable from the other terminals, or identification of that terminal shall be clearly shown in some other manner, such as on an attached wiring diagram.

11.2.4.13 A lead intended for connection to a grounded power-supply conductor shall have a white or gray color and shall be readily distinguishable from the other leads.

11.2.4.14 The surface of a lead intended for the connection of an equipment-grounding conductor shall be green, with or without one or more yellow stripes, and no other lead shall be so identified.

11.2.4.15 The requirements in [11.2.4.13](#) and [11.2.4.14](#) relating to color coding for identification do not apply to internal wiring that is not visible in a wiring compartment in which field connections are to be made.

11.2.4.16 A wire-binding screw intended for the connection of an equipment-grounding conductor shall have a green-colored head. A pressure wire connector intended for the connection shall be marked in accordance with [63.13](#). The wire-binding screw or pressure wire connector shall be located so that it does

not require removal during routine servicing of the disposer. A sheet-metal screw shall not be used for the connection of an equipment-grounding conductor.

### 11.2.5 Power-supply-cord accessory kit

11.2.5.1 A household disposer that is intended for attachment to a sink, that has provision for both permanent wiring and cord connection as specified in [7.1.5](#), [11.1.1.2](#) – [11.2.4.16](#), [23.1](#), [45.1](#), and [45.2](#), and that is provided with a power-supply-cord accessory kit shall comply with [11.2.5.2](#) and [66.2](#).

11.2.5.2 A power-supply-cord accessory kit shall include the components necessary to comply with [11.1.1.2](#) – [11.1.2.3](#), [23.1](#), [45.1](#), and [45.2](#).

### 11.3 Battery-powered waste disposers

11.3.1 Products covered by this Standard that are powered by rechargeable batteries, in addition to or in place of a mains or other non-isolated power source, shall additionally comply with Supplement [SC](#).

## 12 Current-Carrying Parts

12.1 A current-carrying part shall be silver, silver alloy, copper, copper alloy, stainless steel, or other corrosion-resistant material. Iron or steel shall not be used as a current-carrying part.

*Exception: A plated iron or steel part used as a current-carrying part complies with the requirement:*

- a) Where the part is within a motor or associated governor; or
- b) Where the part complies with [5](#).

*These conditions do not apply to stainless steel and other corrosion-resistant alloys.*

12.2 An uninsulated current-carrying part shall be secured to the base or mounting surface so that the part does not rotate or shift where such motion results in a reduction of spacings less than the required values. Friction between surfaces shall not be used as the only means to prevent rotating or shifting. Using a lock washer to prevent rotation of the parts is acceptable.

## 13 Internal Wiring

13.1 The internal wiring and connections between parts of a disposer shall be protected or enclosed. Flexible cord used for external interconnection between parts shall be:

- a) As specified in [11.1.1.3](#)(a) for household disposers and Types S, SE, SEO, SEOO, SO, SOO, ST, STO, or STOO for commercial disposers; and
- b) Provided with strain relief in accordance with [11.1.2.1](#) and [11.1.2.2](#) and comply with Strain Relief Test, Section [41](#), unless the construction is such that the cord is not subjected to stress or motion.

13.2 With reference to [13.1](#), required protection of insulated wiring exists when the wiring is investigated as though it were film-coated wire, and the wiring complies with [7.3.1](#). Internal wiring not so protected complies where it is secured within the enclosure so that the risk of stress or mechanical damage to the wire is reduced.

13.3 A conductor shall not be smaller than 20 AWG (0.52 mm<sup>2</sup>).



*Exception No. 1: This requirement does not apply to integral leads of a small electrical component, such as a relay coil or timer motor, where the leads are:*

- a) 6 in (152 mm) or less in length; and*
- b) Not smaller than 24 AWG (0.21 mm<sup>2</sup>).*

*Exception No. 2: This requirement does not apply to solid, integral leads of a solid-state component when such leads have been investigated and found to comply.*

13.4 Internal wiring shall have insulation rated for the application. The following factors shall be used to determine the applicable wire to be used:

- a) The temperature and voltage to which the wiring may be subjected;
- b) Exposure to oil, grease, cleaning fluid, or other substances having a degrading effect on the insulation; and
- c) Other conditions of service to which the wire may be subjected during intended use.

13.5 Internal wiring shall be standard building wire or appliance wiring material and shall comply with [Table 13.1](#).

**Table 13.1**  
**Characteristics of internal wiring**

Insulation	Nominal wall thickness of insulation		Braid or jacket required	Nominal wall thickness of braid or jacket	
	in	(mm)		in	(mm)
Thermoplastic or neoprene	1/32 <sup>a</sup>	0.8 <sup>a</sup>	No <sup>a</sup>	—	—
Rubber <sup>b</sup>	1/32	0.8	Yes	1/64	0.4
Cross-linked synthetic polymer	1/64	0.4	No	—	—
<sup>a</sup> A wall thickness not less than 1/64 in (0.4 mm) complies where the wire is provided with a braid or jacket not less than 1/64 in thick.					
<sup>b</sup> For heat-resistant rubber, other than a silicone type, a wall thickness not less than 3/64 in (1.2 mm) is acceptable and no braid is required.					

13.6 Internal wiring shall be protected from sharp edges including projections, screw threads, burrs, fins, and moving parts so that the wiring insulation on conductors is not abraded.

13.7 A hole through which insulated wires pass in a sheet-metal wall within the overall enclosure of a disposer shall be provided with a smooth, rounded bushing or shall have smooth, rounded surfaces free of sharp edges including projections, screw threads, burrs, or fins upon which the wires bear so that the wiring insulation on conductors is not abraded.

13.8 Insulated wires that are bunched and passed through a single opening in a metal wall within the enclosure of a disposer is acceptable.

13.9 Splices and connections shall be mechanically secure and shall provide electrical contact.

13.10 A soldered connection shall be made mechanically secure before being soldered.

13.11 Where the loosening of a screw or nut results in a risk of fire or electric shock, the screw or nut shall be provided with a means to reduce the risk of loosening. For example, where a wire-binding screw or nut can be loosened by vibration, providing a lock washer under the head of the screw or under the nut complies with the requirement.

13.12 A splice shall be provided with insulation equivalent to that of the wires involved if means are not provided to maintain the spacing between the splice and other metal parts.

13.13 Insulation consisting of:

- a) Two layers of friction tape;
- b) Two layers of thermoplastic tape; or
- c) One layer of friction tape wrapped over one layer of rubber tape,

is acceptable on a splice if the voltage involved is less than 250 V. In determining if splice insulation consisting of coated fabric, thermoplastic, or other type of tubing is acceptable, consideration is to be given to such factors as its dielectric properties, heat resistance, and moisture resistance. Thermoplastic tape wrapped over a sharp edge is not acceptable.

13.14 The means of connecting stranded internal wiring to a wire-binding screw shall be such that loose strands of wire will be prevented from, reducing spacings, contacting other live parts not always of the same polarity as the wire, and from contacting dead metal parts. Acceptable means include pressure terminal connectors, soldering lugs, crimped eyelets, soldering all strands of the wire together, or other similar means.

13.15 Aluminum conductors, insulated or uninsulated, used as internal wiring, such as for interconnection between current-carrying parts or as motor windings, shall be terminated at each end by a method that is rated for the combination of metals involved at the connection point. A wire-binding screw or a pressure terminal connector used as a terminating device shall be rated for use with aluminum under the conditions involved, for example, temperature, heat cycling, vibration, and corrosion.

## 14 Electrical Insulation

14.1 Material used for the mounting of current-carrying parts shall be of porcelain, phenolic composition, or other material that has been investigated and found acceptable for the application.

14.2 Ordinary vulcanized fiber, impregnated fiber, or similar materials shall not be used in direct contact or for support of uninsulated current-carrying parts where shrinkage, current-leakage, moisture absorption, or warpage results in a risk of fire or electric shock. Use of vulcanized fiber as insulating material for a bushing, washer, separator, or barrier is acceptable.

14.3 A small molded part, such as a brush cap, shall have the mechanical strength and rigidity to withstand the stresses of intended use. A brush cap shall be secured or located so that it is protected from mechanical damage that might occur during intended use, especially on a disposer intended for commercial use.

## 15 Motor Overload Protective Devices

15.1 An overcurrent- or thermal-protective device shall be provided as part of a disposer and shall comply with Motor Protection Tests, Section [42](#).

15.2 If the handle of a circuit breaker is operated vertically rather than rotationally or horizontally, the up position of the handle shall be the on position.

15.3 A motor-protector reset button that projects through the enclosure of a disposer shall be recessed or otherwise guarded so that when a 3-in (76.2-mm) diameter cylinder, with its longitudinal axis parallel to the centerline of the button, is applied to the area of the enclosure surrounding the button:

- a) The flat end of the cylinder cannot be brought closer than 1/16 in (1.6 mm) to the button when the protector is closed;
- b) The cylinder does not prevent the protector from tripping; and
- c) After having tripped, the protector does not automatically reset.

*Exception: This requirement does not apply to an automatic-reset protector that complies with [30.1](#) and [30.2](#).*

## 16 Motors

16.1 A motor shall be acceptable for the application and shall be capable of handling the maximum normal load of the disposer without introducing a risk of fire, electric shock, or injury to persons. See [38.1](#), [39.7](#), and [39.8](#).

16.2 A motor winding shall resist the absorption of moisture. Film-coated wire is not required to be additionally treated to prevent absorption of moisture, but fiber slot liners, cloth coil wrap, and similar moisture-absorptive materials shall be provided with impregnation or otherwise treated to prevent moisture absorption.

16.3 A brush-holder assembly shall be constructed so that when a brush is no longer capable of performing its function, the brush, spring, and other parts of the assembly are retained to the degree that an accessible dead metal part does not become energized and a live part does not become accessible.

16.4 In the application of requirements related to a horsepower rating, the horsepower rating shall be determined in accordance with [Table 16.1](#) that specifies the relationship between horsepower and full-load current (or watts) for motors. The horsepower rating shall be based on the current input under maximum normal load determined for Current Input Test, Section [38](#), regardless of any horsepower rating that is:

- a) Marked on the disposer or motor;
- b) Referenced in any literature packaged with the disposer; or
- c) On the packaging of the disposer.

**Table 16.1**  
**Full-load alternating-current motor horsepower (wattage) ratings corresponding to various full-load running currents in amperes**

Horsepower	(kW)	110 – 120 V			220 – 240 V <sup>a,b</sup>			440 – 480 V			550 – 600 V		
		Single phase	Two phase	Three phase	Single phase	Two phase	Three phase	Single phase	Two phase	Three phase	Single phase	Two phase	Three phase
1/10	0.075	3.0	–	–	1.5	–	–	–	–	–	–	–	–
1/8	0.093	3.8	–	–	1.9	–	–	–	–	–	–	–	–
1/6	0.124	4.4	–	–	2.2	–	–	–	–	–	–	–	–
1/4	0.187	5.8	–	–	2.9	–	–	–	–	–	–	–	–
1/3	0.249	7.2	–	–	3.6	–	–	–	–	–	–	–	–
1/2	0.373	9.8	4.0	4.4	4.9	2.0	2.2	2.5	1.0	1.1	2.0	0.8	0.9
3/4	0.560	13.8	4.8	6.4	6.9	2.4	3.2	3.5	1.2	1.6	2.8	1.0	1.3
1	0.746	16.0	6.4	8.4	8.0	3.2	4.2	4.0	1.6	2.1	3.2	1.3	1.7
1-1/2	1.12	20.0	9.0	12.0	10.0	4.5	6.0	5.0	2.3	3.0	4.0	1.8	2.4
2	1.49	24.0	11.8	13.6	12.0	5.9	6.8	6.0	3.0	3.4	4.8	2.4	2.7
3	2.24	34.0	16.6	19.2	17.0	8.3	9.6	8.5	4.2	4.8	6.8	3.3	3.9
5	3.73	56.0	26.4	30.4	28.0	13.2	15.2	14.0	6.6	7.6	11.2	5.3	6.1
7-1/2	5.60	80.0	38.0	44.0	40.0	19.0	22.0	20.0	9.0	11.0	16.0	8.0	9.0
10	7.46	100.0	48.0	56.0	50.0	24.0	28.0	25.0	12.0	14.0	20.0	10.0	11.0
15	11.19	135.0	72.0	84.0	68.0	36.0	42.0	34.0	18.0	21.0	27.0	14.0	17.0

NOTE – For full-load currents that are between the values noted, the horsepower rating shall be that which corresponds to the closest current specified.

<sup>a</sup> To obtain full-load currents for 200- and 208-V motors, corresponding 220 – 240 V ratings are to be increased by 15 and 10 percent, respectively.

<sup>b</sup> To obtain full-load currents for 265- and 277-V motors, corresponding 220 – 240 V ratings are to be decreased by 13 and 17 percent, respectively.

## 17 Insulation systems

17.1 Class A insulation systems shall consist of a combination of magnet wire and major component insulation materials evaluated and found to operate as intended in its end use. The materials in combination with the end product motor are to be evaluated during the testing in Motor Protection Tests, Section [42](#).

17.2 Materials used in an insulation system that operate above Class 105 (A) temperatures shall comply with the requirements in the Standard for Systems of Insulating Materials – General, UL 1446. The materials in combination with the end product motor are to be evaluated during the testing in Motor Protection Tests, Section [42](#).

17.3 All insulation systems employing integral ground insulation shall comply with the requirements specified in the Standard for Systems of Insulating Materials – General, UL 1446. The insulation in combination with the end product motor are to be evaluated during the testing in Motor Protection Tests, Section [42](#).

## 18 Switches and Controls

18.1 A switch or other control device shall have a current and voltage rating not less than that of the load it controls.

18.2 A switch or other control device that controls a motor, shall comply with [18.1](#) and have a horsepower rating not less than that of the motor it controls.

*Exception: A switch or device that complies with [43.1](#) is not required to be horsepower rated.*

18.3 A switch shall be located or protected so that it is not exposed to mechanical damage or water during intended use.

18.4 If the handle of a switch is operated vertically rather than rotationally or horizontally, the up position of the handle shall be the on position.

18.5 A switch that controls a medium-base lampholder for other than a pilot light or indicating light shall be rated for use with tungsten-filament lamps.

18.6 A manually operable motor-control switch shall be provided in a portable disposer using a motor rated more than 1/3 hp (249 W) output.

*Exception: This requirement does not apply to a cord-connected disposer marked in accordance with [63.21](#).*

18.7 A switch provided as part of a disposer intended to be connected to a power-supply circuit having a potential to ground of more than 150 V shall be rated for the maximum potential to ground of the circuit. See [63.22](#).

18.8 A nominal 208-V, single- or 3-phase; or a 120/240 V, 3-wire, single-phase disposer is considered to involve a potential to ground of less than 150 V. A 2-wire, single-phase or a 3-wire, 3-phase disposer with a rating in the range of 220 – 240 V is considered to involve a potential to ground greater than 150 V.

18.9 A control assembly that is provided, with or recommended by the manufacturer, for use with a disposer shall comply with the applicable control requirements specified in Controls, Section [5.5](#). In addition, the combination of such a control assembly and a disposer shall comply with the performance requirements of this standard.

*Exception: It is acceptable to apply the alternate spacing requirements for clearances and creepage distances in the Standard for Solid-State Controls for Appliances, UL 244A, to spacings within a control assembly using solid-state components or circuits.*

18.10 A switch or an overcurrent-protective device of the single-pole type – other than an automatic control without a marked off position – shall be electrically connected to a terminal or lead intended for connection to an ungrounded conductor of the supply circuit.

18.11 If the wiring diagram of a disposer indicates that one side of the control circuit is or can be grounded, the control circuit shall be arranged so that an unintentional ground in a remote-control device does not start the motor, or bypass a manually operated shutdown device or automatic safety shutdown device.

18.12 A household use only foot-actuated switch shall additionally comply with the requirements in Foot Actuated Switches For Household Use Only, Section [20](#).

18.13 A waste disposer employing a wireless control to operate the disposer shall additionally comply with Supplement [SB](#), Waste Disposers with Wireless Control.

## 19 Controls – End Product Test Parameters

### 19.1 General

19.1.1 Spacings of controls shall comply with the electrical spacing, or clearances and clearance distance requirements of the applicable control standard as determined in Controls, Section [5.5](#).

19.1.2 Where reference is made to declared deviation and drift, this indicates the manufacturer's declaration of the control's tolerance before and after certain conditioning tests.

### 19.2 Auxiliary controls

19.2.1 Auxiliary controls shall not introduce a risk of fire, electric shock, or injury to persons.

19.2.2 Auxiliary controls shall comply with the requirements of this end product standard.

*Exception No. 1: An auxiliary control that complies with a component standard(s) specified in Controls, [5.5](#) is considered to comply with this requirement.*

*Exception No. 2: An auxiliary control that complies with Alternative Requirements for the Evaluation of Electronic Circuits, Supplement [SA](#), is considered to comply with this requirement.*

### 19.3 Operating controls (regulating controls)

19.3.1 The following test parameters shall be among the items considered when judging the acceptability of an operating control investigated in accordance with the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1:

- a) Control action Types 1 or 2;
- b) Unless otherwise specified in this end product standard, manual and automatic controls shall be tested for 6,000 cycles under maximum normal load conditions, and 50 cycles under overload conditions;
- c) Installation class 2 in accordance with the Standard for Electromagnetic Compatibility (EMC) – Part 4-5: Testing and Measurement Techniques – Surge Immunity Test, IEC 61000-4-5;
- d) For the applicable Overvoltage Category, see [Table 19.1](#);
- e) For the applicable Material Group, see [Table 19.2](#); and
- f) For the applicable Pollution Degree, see [Table 19.3](#).

19.3.2 The following test requirements shall be among the items considered when judging the acceptability of an operating control investigated in accordance with other than the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1:

- a) Control action Types 1 or 2;
- b) Unless otherwise specified in this end product standard, manual and automatic controls shall be tested for 6,000 cycles with under maximum normal load conditions, and 50 cycles under overload conditions;
- c) For the applicable Overvoltage Category, see [Table 19.1](#);
- d) For the applicable Material Group, see [Table 19.2](#); and

e) For the applicable Pollution Degree, see [Table 19.3](#).

**Table 19.1**  
**Overvoltage categories**

Appliance	Overvoltage category
Control located in low-voltage circuit	I
Portable and stationary cord-connected	II
Intended for fixed wiring connection	III
NOTE – Applicable to Class 2 circuits if a short circuit between the parts involved may result in operation of the controlled equipment that would increase the risk of fire or electric shock.	

**Table 19.2**  
**Material group**

CTI PLC value of insulating materials	Material group
CTI $\geq$ 600 (PLC = 0)	I
$400 \leq$ CTI < 600 (PLC = 1)	II
$175 \leq$ CTI < 400 (PLC = 2 or 3)	IIIa
$100 \leq$ CTI < 175 (PLC = 4)	IIIb
NOTE – PLC stands for Performance Level Category, and CTI stands for Comparative Tracking Index as specified in the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.	

**Table 19.3**  
**Pollution degrees**

Appliance control microenvironment	Pollution degree
No pollution or only dry, nonconductive pollution. The pollution has no influence. Typically hermetically sealed or encapsulated control without contaminating influences, or printed wiring boards with a protective coating can achieve this degree.	1
Normally, only nonconductive pollution. However, a temporary conductivity caused by condensation may be expected. Typically indoor appliances for use in household or commercial clean environments achieve this degree.	2
Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation that is expected. Typically controls located near and may be adversely affected by motors with graphite or graphite composite brushes, or outdoor use appliances achieve this degree.	3

#### 19.4 Protective controls (limiting controls)

19.4.1 An electronic control that performs a protective function shall comply with the requirements in Controls, Section [5.5](#) while tested in accordance with the parameters the in this section. Examples of protective controls are: a control used to sense abnormal temperatures of components within the appliance; an interlock function to de-energize a motor; temperature protection of the motor due to locked rotor, running overload, loss of phase; or other function intended to reduce the risk of fire, electric shock, or injury to persons.

19.4.2 The following test parameters shall be among the items considered when judging the acceptability of an electronic protective control investigated in accordance with the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1:

- a) Failure-Mode and Effect Analysis (FMEA) or equivalent risk analysis method;
- b) Power supply voltage dips, variation and interruptions within a temperature range of 10°C and the maximum ambient temperature determined by conducting the Temperature Test, Section 39;
- c) Surge immunity test – installation class 3 shall be used;
- d) Electrical fast transient/burst test, a test level 3 shall be used;
- e) Electrostatic Discharge Test;
- f) Radio-frequency electromagnetic field immunity:
  - 1) Immunity to conducted disturbances, when applicable, test level 3 shall be used; and
  - 2) Immunity to radiated electromagnetic fields, field strength of 3 V/m shall be used;
- g) Thermal Cycling Test in UL 60730-1 shall be conducted at ambient temperatures of 10.0+2°C and the maximum ambient temperature determined by conducting the Temperature Test, Section 39. The test shall be conducted for 14 days;
- h) Overload shall be conducted based on the maximum declared ambient temperature ( $T_{max}$ ) or as determined by conducting the Temperature Test, Section 39; and
- i) If software is relied upon as part of the protective electronic control, it shall be evaluated as software class B.

19.4.3 The test parameters and conditions used in the investigation of the circuit specified in 19.4.1 shall be as specified in the Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991, in accordance with the following test parameters:

- a) With regard to electrical supervision of critical components, for attended appliances, a motor operated system becoming permanently inoperative with respect to movement of an exposed portion of the appliance complies with the requirements for trouble indication. For unattended appliances, electrical supervision of critical components may not rely on trouble indication.
- b) A field strength of 3 V/m is to be used for the Radiated EMI Test.
- c) The Composite Operational and Cycling Test are to be conducted for 14 days at temperature extremes of 0°C (32°F) and 70°C (158°F).
- d) The Humidity Class is to be based on the appliance's intended end use and is to be used for the Humidity Test.
- e) A vibration level of 5 g is to be used for the Vibration Test.
- f) When a computational investigation is conducted,  $\lambda_p$  shall not be greater than 6 failures/10<sup>6</sup> hours for the entire system. The Operational Test is to be conducted for 14 days.
- g) When the Demonstrated Method Test is conducted, the multiplier for the test acceleration factor is to be 576.30 for intermittent use appliances, or 5763.00 for continuous use appliances. The test acceleration factor equation is to be based on a 25°C use ambient.
- h) The Endurance Test is to be conducted concurrently with the Operational Test. The control shall perform its intended function while being conditioned for 14 days in an ambient air temperature of 60°C (140°F), or 10°C (18°F) greater than the operating temperature of the control, whichever is higher. During the test, the control is to be operated in a manner representing normal use.
- i) For the Electrical Fast Transient Burst Test, test level 1 is to be used.



j) Conduct a failure-mode and effect analysis (FMEA).

k) If software is relied upon as part of the protective electronic control, it shall be evaluated as software class 1 in accordance with the Standard for Software in Programmable Components, UL 1998.

19.4.4 Unless otherwise specified in this end product standard, protective controls shall be evaluated for 100,000 cycles for Type 2 devices and 6,000 cycles for Type 1 devices with rated current.

## 19.5 Controls using a temperature sensing device

19.5.1 A temperature sensing positive temperature coefficient (PTC) or negative temperature coefficient (NTC) thermistor, that performs the same function as an operating or protective control, shall be tested using the following number of cycles when testing a sensing device in accordance with the Endurance Tests in the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1 or the Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991:

- a) For a device employed as a operating device – 6000 cycles;
- b) For a device employed as a protective device – 100,000 cycles; and
- c) For a device employed as a combination operating and protective device – 100,000 cycles.

## 20 Foot Actuated Switches For Household Use Only

### 20.1 General

20.1.1 A foot actuated switch of a disposer for household use shall comply with the following:

- a) Actuation of the switch shall require a minimum of two different and distinct motions, each motion triggering a different switch actuating mechanism. A foot motion toward the front of the cabinet or a downward foot motion toward the floor shall not be a foot motion that triggers any switch actuation mechanism.
- b) A minimum force of 2 pounds (.90 kg) shall be required to activate each footswitch assembly activating mechanism.
- c) Deactivation of the switch shall require only one motion that returns the switch to a non-operating condition.
- d) The switch assembly shall be activated in accordance with item (a) of this section and upon removal of active pressure on any activation mechanism the footswitch assembly shall deactivate and reset. Reactivation shall require the switch to fully comply with all the activation requirements of subsection a) of this section. Exception: When pressure is maintained upon the first activating mechanism keeping it continuously activated while simultaneously operating the second activation mechanism, deactivation of the second mechanism would not require the footswitch assembly to reset.
- e) The switch shall have provisions and associated instructions to be firmly attached (to the cabinet, wall, floor, etc.) as intended.
- f) A switch assembly that is not an integral part of the disposer, and is located where water could drip, spray or accumulate once installed, shall comply with the Water Spill Test, Section [20.2](#).
- g) The switch assembly shall comply with the requirements in Enclosure, Section [7](#). The actuating mechanism of the switch shall be subjected to the Impact Test, Section [52](#). As a result of the test,

there shall be no mechanical malfunction of the switch actuator and shall comply with the requirements in [20.1.1](#) (a) and (b).

h) The switch shall comply with the applicable requirements in Switches, Section [5.20](#), or with the Standard for Industrial Control Equipment, UL 508. The switch together with the actuator shall comply with a minimum of 6,000 cycles of operation.

i) The switch shall comply with the applicable requirements in Switches and Controls, Section [18](#).

## 20.2 Water Spill Test

20.2.1 A switch assembly as described in [20.1.1](#) (d) shall comply with [20.2.2](#) – [20.2.6](#).

20.2.2 With the switch assembly positioned as intended during installation, 2 gallons (8 liters) of the solution specified in [20.2.3](#) shall be poured over the switch assembly and associated parts that are likely to be subject to dripping, spraying or accumulating water. A cabinet or portion thereof ordinarily used to mount the switch during installation shall be made to not interfere with water gaining access to the switch assembly.

20.2.3 The solution specified in [20.2.2](#) shall consist of  $8 \pm 0.1$  grams of table salt per  $1 \pm 0.1$  liters of distilled water of ambient room temperature.

20.2.4 The solution shall be poured from a container of any convenient size and shape, such that all the solution is poured from the container within 30 – 90 seconds.

20.2.5 As soon as possible after the water is poured, and without disturbing the switch, the switch shall comply with:

- a) The Leakage Current Test, Section [35](#);
- b) The Insulation Resistance Test, Section [36.3](#); and
- c) The Dielectric Voltage-Withstand Test, Section [40](#).

20.2.6 After the tests in [20.2.5](#), the outside surface shall be dried and the inside of the switch assembly examined for any evidence of wetting of uninsulated live parts. No water shall be evident on uninsulated live parts, and no immersion of insulated parts.

## 21 Lampholders

21.1 The screwshell of an Edison-base lampholder in a permanently connected disposer or a disposer equipped with a polarized attachment plug shall be connected to the terminal or lead that is intended to be connected to the grounded conductor of the power-supply circuit.

## 22 Capacitors

22.1 A capacitor provided as a part of a capacitor-type motor and a capacitor connected across the line, such as a power-factor correction capacitor, shall be housed within an enclosure or container that complies with [22.2](#). The enclosure or container shall reduce the risk of:

- a) The capacitor plates being mechanically damaged; and
- b) The emission of flame or molten material from the enclosure or container as a result of the capacitor malfunctioning or breaking down.

*Exception: A capacitor used for noise suppression or as an electromagnetic interference filter that complies with the Standard for Fixed Capacitors for Use in Electronic Equipment – Part 14: Sectional Specification: Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains, UL 60384-14, or the Standard for Electromagnetic-Interference Filters, UL 1283, complies with this requirement.*

22.2 The enclosure or container described in [22.1](#) shall be of sheet steel having a thickness of not less than 0.02 in (0.5 mm) or shall be constructed to provide equivalent protection.

*Exception No. 1: An individual container of a capacitor constructed of sheet metal less than 0.02 in (0.51 mm) thick or of material, other than metal, rated for the application complies with the requirement where the capacitor is mounted in an enclosure that houses other parts of a disposer and the enclosure that houses other parts is rated for the enclosure of current-carrying parts.*

*Exception No. 2: When an individual enclosure of an electrolytic capacitor is provided with means for venting and is constructed so that the capacitor is not mechanically damaged, the enclosure is not required to have the specified minimum enclosure thickness.*

*Exception No. 3: The individual enclosure of an electrolytic capacitor not provided with means for venting and with an opening more than 1/16 in (1.6 mm) wide between the capacitor enclosure and the motor is not required to comply with the requirement for enclosure thickness if it complies with Component Burnout Test, Section [59](#).*

22.3 Other than as noted in [35.1](#), the total capacitance of capacitors connected from one or more ungrounded sides of the line to the frame or enclosure of a single-phase disposer shall not result in a leakage current greater than 5 mA between capacitive and other sources.

22.4 The voltage rating of a capacitor, other than a motor-starting capacitor, shall not be less than the maximum steady-state potential to which the capacitor is subjected during operation of the disposer.

22.5 Under both normal and abnormal conditions of use, a capacitor shall not result in a risk of electric shock or fire when tested in accordance with the applicable performance tests in this standard.

22.6 An oil-filled capacitor shall comply with the Standard for Capacitors, UL 810, for capacitors used with motors, and shall have a fault-current rating of not less than the maximum available fault current (AFC) to which it is subjected:

a) If connected across the disposer source of supply:

- 1) 1000 A AFC for a disposer intended for connection to a 20 A or less branch circuit; or
  - 2) 5000 A AFC for a disposer intended for connection to a greater than 20 A branch circuit;
- or

b) If connected in series with a motor or other similar impedance, the maximum fault current available to the capacitor measured:

- 1) Under capacitor short-circuit conditions with the disposer operating at normal load (see [38.2](#)); or
- 2) Under motor locked-rotor conditions.

22.7 A dry-metallized-film capacitor shall comply with the applicable requirements in the Standard for Electromagnetic-Interference Filters, UL 1283, or the Standard for Fixed Capacitors for Use in Electronic

Equipment – Part 14: Sectional Specification: Fixed Capacitors for Electromagnetic Interference Suppression and Connection to the Supply Mains, UL 60384-14.

22.8 A dry-metallized-film capacitor operating:

- a) At a voltage of less than 330 V need not have a maximum available fault current rating; or
- b) At a voltage equal to or greater than 330 V shall:
  - 1) Comply with the applicable requirements in the Standard for Capacitors, UL 810; and
  - 2) Have an available fault current rating in accordance with [22.6](#).

## 23 Receptacles

23.1 The face of a receptacle shall:

- a) Be flush with, or project beyond, a nonconductive surrounding surface; or
- b) Project not less than 0.015 in (0.38 mm) beyond a conductive surrounding surface.

## 24 Spacings

24.1 The spacings at wiring terminals shall not be less than the values specified in [Table 24.1](#). See [11.2.1.2](#).

**Table 24.1**  
**Spacings at wiring terminals**

Potential involved, V	Minimum spacings, in (mm)			
	Between wiring terminals, through air or over surface	Between terminals and other uninsulated metal parts not always of the same polarity <sup>a</sup>		
		Over surface	Through air	
250 or less	1/4 (6.4)	1/4 (6.4)	1/4 (6.4)	
More than 250	1/2 (12.7) <sup>b</sup>	1/2 (12.7) <sup>b</sup>	3/8 (9.5)	
<sup>a</sup> Applies to the sum of the spacings involved where an isolated dead metal part is interposed.				
<sup>b</sup> In a compartment or box that is integral with a motor, a spacing of not less than 3/8 in through air and over surface at wiring terminals is acceptable.				

24.2 At other than a field-wiring terminal, or as specified in [24.3](#) – [24.5](#), [24.7](#) and [24.8](#), the spacings between uninsulated current-carrying parts of opposite polarity, and between an uninsulated live part and a dead metal part, shall not be less than the values specified in [Table 24.2](#). If an uninsulated current-carrying part is not rigidly fixed in position by means other than friction between surfaces, or if a movable dead metal part is in proximity to an uninsulated current-carrying part, the construction shall be such that the minimum acceptable spacings are maintained. See [24.11](#).

**Table 24.2**  
**Spacings at other than wiring terminals, in a motor circuit, or inside a motor**

Potential involved, V	Minimum through air or over surface spacings,	
	in	(mm)
0 – 125	1/16	1.6
126 – 250	3/32	2.4
251 – 600	1/4	6.4

24.3 In a motor circuit other than inside the motor, the spacings between uninsulated current-carrying parts of opposite polarity, and between an uninsulated live part and a dead metal part shall not be less than the values specified in [Table 24.3](#). If an uninsulated live part is not rigidly fixed in position by means other than friction between surfaces, or if a movable dead metal part is in proximity to an uninsulated current-carrying part, the construction shall be such that the minimum spacings are maintained. See [24.11](#).

*Exception No. 1: Spacings as specified in [24.7](#) and [24.8](#) comply with this requirement.*

*Exception No. 2: Investigating a circuit in which the only motor load is a timer motor to [24.2](#) and [Table 24.2](#) complies with the requirement when the investigation of the circuit indicates that such spacings comply for this application.*

**Table 24.3**  
**Spacings in a motor circuit other than inside the motor**

Potential involved, V	Minimum spacings, in (mm)			
	Disposer using a motor having a diameter 7 in (178 mm) or less <sup>a</sup>		Disposer using a motor having a diameter more than 7 in (178 mm), through 11 in (279 mm) <sup>a, b</sup>	
	Over surface	Through air	Over surface	Through air
0 – 125	3/32 (2.4) <sup>c</sup>	3/32 (2.4) <sup>c</sup>	1/4 (6.4)	1/8 (3.2)
126 – 250	3/32 (2.4)	3/32 (2.4)	1/4 (6.4)	1/4 (6.4)
251 – 600	1/2 (12.7)	3/8 (9.5)	1/2 (12.7)	3/8 (9.5)

<sup>a</sup>This is the diameter, measured in the plane of the laminations of the circle circumscribing the stator frame, excluding lugs, fins, boxes, or similar parts used only for motor mounting, cooling, assembly, or connection.

<sup>b</sup>A spacing of not less than 3/32 in, over surface and through air, between film-coated wire, rigidly supported and held in place on a coil, and a dead metal part complies.

<sup>c</sup>For a disposer only using motors rated 1/3 hp (249 W output) or less, these spacings not less than 1/16 in (1.6 mm) comply with the requirement.

24.4 The spacings within a motor shall comply with the spacing requirements in the Standard for Rotating Electrical Machines – General Requirement sUL 1004-1.

24.5 Spacings for solid-state circuits that comply with the Standard for Solid-State Controls for Appliances, UL 244A, comply with the intent of the requirements. Compliance with the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, and/or the applicable Part 2 standard from the UL 60730 series fulfills these requirements.

24.6 The spacing between parts of different circuits shall not be less than the largest spacings required for the circuits involved.

24.7 The spacing requirements in [24.3](#) do not apply to the inherent spacings of a component of the disposer, such as a snap switch. Such spacings shall comply with the requirements for the particular component if they are smaller than the values specified in [Table 24.3](#).

24.8 At a closed-in point, such as the screw and washer construction of an insulated terminal mounted in metal, a spacing of not less than 3/64 in (1.2 mm) complies.

24.9 In applying [Table 24.3](#) to a motor circuit in which two or more motors of different sizes are connected, the spacings in the motor circuit shall be judged on the basis of the size of the largest motor involved.

24.10 Film-coated wire is determined to be an uninsulated current-carrying part when spacings are being investigated.

24.11 At terminal screws and studs to which wire connectors, eyelets, or similar devices as described in [11.2.1.2](#) are connected in the field, spacings shall not be less than those specified in [Table 24.2](#) when such connectors, eyelets, or similar devices are in a position that minimum spacings to opposite polarity and dead metal exist.

24.12 An insulated liner or barrier of vulcanized fiber or similar material used as an alternative to spacings shall be 1/32 in (0.8 mm) thick or greater and shall be located or constructed of material that is not adversely affected by arcing.

*Exception: Using fiber not less than 1/64 in (0.4 mm) thick in conjunction with an air spacing of not less than 50 percent of the spacing required for air alone complies with the requirement.*

## 25 Grounding

25.1 Exposed dead metal parts that can become energized, and dead metal parts inside the enclosure of a disposer that are exposed to contact during any servicing operation, including maintenance and repair, and that can become energized shall be reliably connected to:

- a) A knockout or equivalent opening in the metal enclosure of a disposer intended to be permanently connected by a metal-enclosed wiring system.
- b) An equipment grounding terminal or lead in a disposer intended to be permanently connected by a nonmetal-enclosed wiring system, for example, nonmetallic-sheathed cable.
- c) The equipment-grounding conductor of the power-supply cord of a cord-connected disposer.

*Exception: A portable cord-connected disposer intended to be used on a circuit operating at 150 V to ground or less and that is provided with a system of double insulation as an alternative to a grounding means, complies with the requirement.*

25.2 Using double insulation for a 2-wire disposer marked 120/240 V or otherwise marked to indicate that the disposer is to be connected to a circuit operating at 150 V or less to ground complies.

25.3 A disposer provided with a system of double insulation shall not be provided with a means for grounding.

25.4 A grounding conductor of a flexible cord shall:

- a) Be provided with an outer surface that is green with or without one or more yellow stripes;
- b) Be connected to the grounding blade of an attachment plug of the grounding type; and

- c) Be connected to the enclosure of the disposer.

This connection shall be made by means of a screw. The screw shall not require removal during servicing not involving the power-supply cord. Solder alone shall not be used for making this connection. A sheet-metal screw shall not be used to secure a grounding conductor to the enclosure.

25.5 If a disposer is intended to be grounded and is provided with means for separate connection to more than one power supply, each such connection shall be provided with a means for grounding.

## 26 Arc-Fault, and Leakage Current Detectors/Interrupters

26.1 When required by this end-product standard, or when provided as part of an end-product, an AFCI or LCDI shall comply with [5.9](#) and [26.2](#) – [26.3](#).

26.2 An arc-fault circuit-interrupter (AFCI) or leakage-current detector-interrupter (LCDI) shall be installed as an integral part of the attachment plug or located in the supply cord within 102 mm (4 inches) of the attachment plug.

26.3 Arc fault detection testing shall include the applicable tests in the Standard for Arc-Fault Circuit-Interrupters, UL 1699 required for cord-type arc-fault circuit-interrupters.

*Exception: The carbonized path arc clearing time test is not applicable for LCDIs that are provided with shielded power-supply cords.*

## 27 Plumbing Requirements

27.1 A household disposer shall comply with the Performance Requirements for Plumbing Aspects of Residential Food Waste Disposer Units, ASSE 1008.

## PROTECTION AGAINST RISK OF INJURY TO PERSONS

### 28 General

28.1 If the operation of a disposer involves a risk of injury to persons, protection shall be provided to reduce such risk.

### 29 Sharp Edges

29.1 A part of a disposer such as an enclosure, opening, frame, guard, knob, or handle, shall not be so sharp as to result in a risk of injury to persons during routine maintenance or intended use.

*Exception: This requirement does not apply to parts that require a sharp edge to be exposed so that the disposer performs as intended.*

### 30 Automatic Restarting

30.1 If an automatic-reset protective device is used in a disposer, restarting the motor shall not result in a risk of injury to persons.

30.2 Compliance with [30.1](#) requires the use of an interlock in the disposer if moving or similar parts result in a risk of injury to persons upon restarting the motor.



### 31 Moving Parts

31.1 A moving part of a disposer such as a pulley, belt, gear, or rotor of a motor shall be enclosed or guarded to reduce the risk of injury to persons. See [28.1](#).

31.2 The degree of protection required to be provided by the enclosure depends upon the general design and intended use of the disposer. The effects of the following factors shall be assessed to determine compliance of an exposed moving part with [31.1](#):

- a) The degree of exposure;
- b) The sharpness of the moving parts;
- c) The risk of unintentional contact with the moving parts;
- d) The speed of movement of those parts; and
- e) The risk of fingers, arms, or clothing being drawn into the moving parts, such as at points where gears mesh, where belts travel onto a pulley, or where moving parts close in a pinning or shearing action.

### 32 Guards and Interlocks

32.1 The details of a guard, release, interlock, and the like are not specified, but the necessity for such accessories and their acceptability, if provided, are to be determined from a study of the complete appliance, its operating characteristics, and the likelihood of injury to persons resulting from other than gross negligence.

32.2 An interlock shall not be defeated by materials, such as food, that accumulate during intended use. An interlock shall comply with Interlock Switch Tests, Section [34](#).

32.3 A disposer shall comply with one or more of the following:

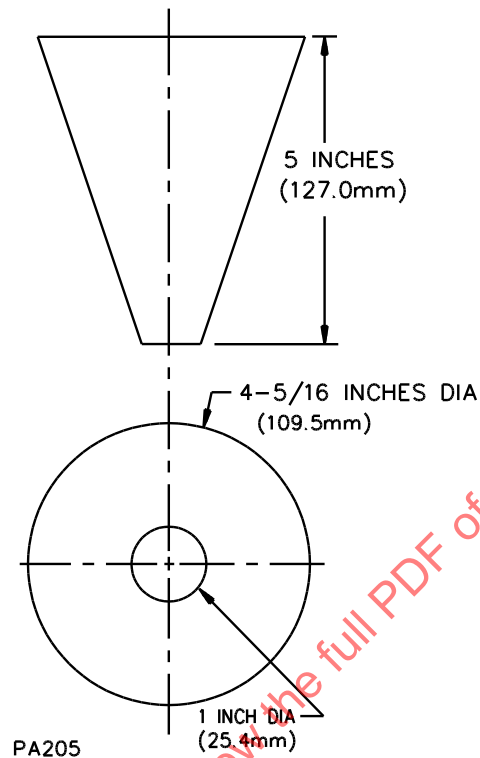
- a) The opening in the sink flange shall not allow entry of a 2-1/2 in (63.5 mm) diameter cylinder.
- b) The sink flange shall be offset so that a 2-1/2 in diameter cylinder, inserted to a depth of 5 in (127.0 mm) or less, does not touch cutting or moving parts.
- c) The opening in the sink flange shall have a diameter of 3-5/8 in (92.1 mm) or less, and a truncated cone as illustrated in [Figure 32.1](#), when inserted small end first to a depth of 4 in (102 mm) or less, does not touch cutting or moving parts.
- d) If the diameter of the top opening of the sink flange is larger than 3-5/8 in, the distance from the plane of the opening to the nearest cutting or moving parts shall not be less than 1.5 times the largest diameter of the opening of the sink flange.

*Exception No. 1: This requirement does not apply to a commercial disposer provided with a hopper that complies with [32.4](#).*

*Exception No. 2: This requirement does not apply to a disposer equipped with a cover for the sink flange and with an interlock switch arranged so that removal of the cover de-energizes the motor.*



**Figure 32.1**  
**Truncated cone – accessibility**



32.4 With reference to [32.3](#), Exception No. 1, an inverted truncated cone or pyramid with a depth as specified in items (a) and (b) is a hopper that complies with the requirement:

- a) Not less than the maximum internal dimension of throat opening – the diameter if the opening is a circle, the major axis if the opening is an ellipse, and the longest diagonal if the opening is a polygon; and
- b) Not less than 5 in (127.0 mm) in any case.

32.5 The hopper or cone of a commercial disposer that is provided in order to comply with [32.3](#) or [32.4](#) is not required to be shipped with the remainder of the unit:

- a) If the disposer is provided with a means (such as an electrical or mechanical interlock) that reduces the risk of the disposer being energized or used when the hopper is not properly installed, see also [32.4](#); or
- b) If the disposer and a hopper or a cone are marked in accordance with [63.23](#), and the instruction manual includes the instructions specified in Instruction Manual – Commercial Disposers – General, Section [70](#).

32.6 An interlock provided in accordance with [32.5\(a\)](#) shall comply with the accessibility requirements specified in Interlock Switch Tests, Section [34](#).

32.7 If the disposer is adjustable for sink bottoms of different thickness, the depth measurements mentioned in [32.3\(b\)](#), (c), and (d) are to be made with it adjusted for minimum thickness. The depth

measurements mentioned in (b) and (c) are to be made vertically from the plane of the opening in the top of the sink flange.

32.8 A household disposer shall be provided with a cover or baffle that reduces the risk of objects being expelled from the disposer.

## PERFORMANCE

### 33 General

33.1 In tests on a disposer, maximum normal load is the load that approximates the most severe conditions of intended operation. The load shall not be a deliberate overload. However, a deliberate overload shall be used when the conditions of actual operation are determined to be more severe than the maximum-load conditions that are specified by the manufacturer of the disposer. Test loads that have been found to be close approximations of the most severe conditions of normal use are specified in [33.5](#) – [33.6](#) for some common forms of disposers.

33.2 All tests are to be performed with the product connected to a power-supply circuit of rated frequency. The voltage of the supply circuit is to be:

- a) For a product rated from 110 V up to and including 120 V, 120 V;
- b) For a product rated from 200 V up to and including 208 V, 208 V;
- c) For a product rated from 220 V up to and including 240 V, 240 V;
- d) For a product rated from 440 V up to and including 480 V, 480 V; or
- e) For a product rated other than as mentioned in (a) – (d), the maximum rated voltage of the product.

33.3 If the rating of a product is given in terms of a range of voltage, the maximum rated voltage is the highest value of the range.

33.4 If a disposer has a single frequency rating, the test is to be performed at that frequency. A disposer rated for both alternating and direct current is to be tested on both alternating current and direct current supply circuits. A disposer having a frequency rating of 25 – 60 Hz or 50 – 60 Hz is to be tested on 60-Hz alternating current.

33.5 For tests involving water, the water temperature is to be 18 – 24°C (65 – 75°F) unless otherwise noted.

33.6 The flow of water through a:

- a) Household disposer is to be adjusted to a rate of 1 gal/min (3.78 L/min).
- b) Commercial disposer is to be adjusted to the minimum rate required to flush ground waste material out of the disposer.

### 34 Interlock Switch Tests

34.1 A disposer equipped with a cover for the sink flange and with an interlock switch constructed so that removal of the cover de-energizes the motor shall be subjected to the test described in [34.2](#). During the test, the interlock switch shall not become actuated.

34.2 A 2-1/2 in (63.5 mm) diameter, nonmagnetic cylinder with a hemispherical tip is to be inserted at any angle into the throat of the disposer. The cylinder is to be pressed against the inner surface of the throat using the maximum force that can be exerted without damaging the disposer such that it does not operate as intended.

34.3 Unless known to be acceptable for 100,000 cycles of operation, an interlock switch used to reduce the risk of injury to persons from moving parts, and actuated during the use of the disposer or during disassembly for cleaning or maintenance shall not malfunction, electrically or mechanically, when subjected to 100,000 cycles of operation, and shall function as intended. Devices such as rods, shafts, levers, or springs, used to transmit force to the switch actuator shall also be subjected to 100,000 cycles of operation.

### 35 Leakage Current Test

35.1 When tested in accordance with [35.2](#) – [35.8](#), the leakage current of a cord-connected disposer rated 250 V or less shall not be greater than:

- a) 0.5 mA for a portable disposer; and
- b) 0.75 mA for a stationary or fixed disposer.

35.2 Leakage current refers to all currents, including capacitively coupled currents, that may be conveyed between exposed conductive surfaces of a disposer and ground or other exposed surfaces of the disposer.

35.3 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 if simultaneously accessible and from one surface to another if simultaneously accessible. Parts are to be considered to be exposed surfaces unless guarded by an enclosure considered acceptable to reduce the risk of electric shock as required by [7.3.1](#) and [7.3.7](#). Surfaces are considered to be simultaneously accessible if they can be readily contacted by one or both hands of a person at the same time. These measurements do not apply to terminals operating at voltages that are not considered to present a risk of electric shock.

35.4 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 100 by 200 mm in contact with the surface. If the surface is less than 100 by 200 mm, 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 disposer.

35.5 The measurement circuit for leakage current is to be as illustrated in [Figure 35.1](#). The measurement instrument is defined in (a) – (c). The meter used to measure the current during the test is required to indicate the same numerical value for a particular measurement as the defined instrument. The test meter used is not required to have all the attributes of the specified instrument.

- a) The meter is to have an input impedance of 1500  $\Omega$  resistive shunted by a capacitance of 0.15 mF.
- b) The meter is to indicate 1.11 times the average of the full-wave rectified composite waveform of the voltage across the resistor or current through the resistor.
- c) Over a frequency 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- $\Omega$  resistor shunted by a 0.15-mF capacitor to 1500  $\Omega$ . At an indication of 0.5 or 0.75 mA, the measurement is to have an error of not greater than 5 percent.

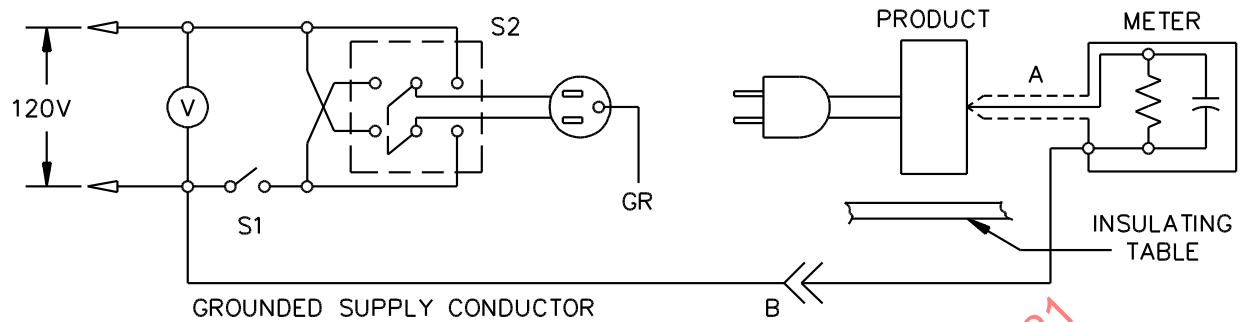
35.6 Unless the meter described in [35.5](#) is used to measure leakage from one part of a disposer to another, the meter is to be connected between accessible parts and the grounded supply conductor.

35.7 The leakage current is to be measured on a sample of the disposer that has not been previously energized other than as occurs as part of the production-line testing. The sample, including the water, is to be isolated from ground. The supply voltage is to be adjusted to the voltage specified in [33.2](#). The test sequence with reference to the measuring circuit in [Figure 35.1](#) is to be as follows:

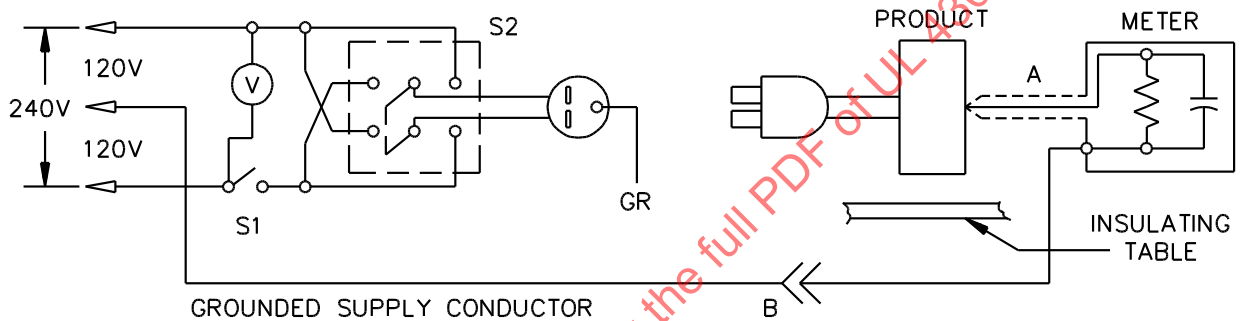
- a) With switch S1 open, the disposer is to be connected to the measuring circuit. Leakage current is to be measured using both positions of switch S2, and with the disposer switching devices in all their normal operating positions.
- b) Switch S1 is then to be closed energizing the disposer, and within 5 s the leakage current is to be measured using both positions of switch S2 and with the disposer switching devices in all their normal operating positions.
- c) The leakage current is to be monitored until thermal stabilization. Both positions of switch S2 are to be used in determining this measurement. Thermal stabilization is to be obtained by operating the disposer as described in Temperature Test, Section [39](#).

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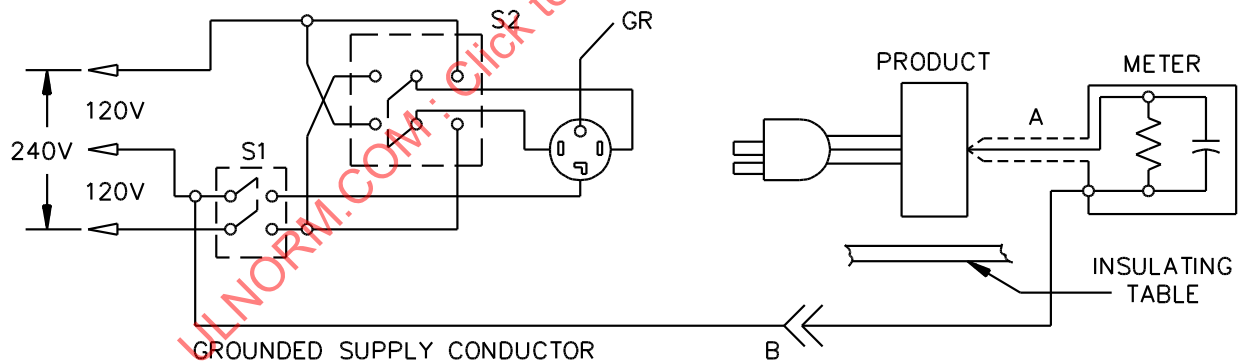
**Figure 35.1**  
**Leakage current measurement circuits**



Product intended for connection to a 120-volt power supply, as illustrated above.



Product intended for connection to a 3-wire, grounded-neutral power supply, as illustrated above.



Product intended for connection to a 3-wire, grounded neutral power supply, as illustrated above.

LC300J

A – Probe with shielded lead.

B – Conductor separated and used as clip when measuring currents from one part of appliance to another.

35.8 Normally a sample is subjected to the complete leakage-current-test program specified in [35.7](#), without interruption for other tests. When required, the Leakage Current Test may be interrupted for the purpose of performing other nondestructive tests.

### 36 Humidity Conditioning Test

36.1 A complete disposer, including all electrical accessories provided with or specifically recommended for use with the disposer by the manufacturer, shall be conditioned for 48 h in air having a relative humidity of  $88 \pm 2$  percent at a temperature of  $32 \pm 2^{\circ}\text{C}$  ( $90 \pm 4^{\circ}\text{F}$ ). Immediately after removing the disposer from the conditioning chamber:

- a) A cord-connected disposer rated for a nominal 240-V or less supply shall comply with Leakage Current Test, Section [35](#).
- b) A disposer other than as specified in (a) shall have an insulation resistance of 50,000  $\Omega$  or more between current-carrying parts and interconnected dead metal parts.

36.2 To determine whether a product complies with the requirement in [36.1](#), a sample of the product is to be heated to a temperature just above  $34^{\circ}\text{C}$  ( $93^{\circ}\text{F}$ ) to reduce the likelihood of condensation of moisture during conditioning. The heated sample is to be placed in the humidity chamber and conditioned as specified in [36.1](#). Following conditioning:

- a) A cord-connected product rated for a nominal 240-V supply or less is to be tested as described in [35.7](#). The test is to be discontinued when the leakage current stabilizes or decreases.
- b) The insulation resistance of a product other than as described in (a) is to be measured as described in [36.3](#).

36.3 Ordinarily, insulation resistance is to be determined by using:

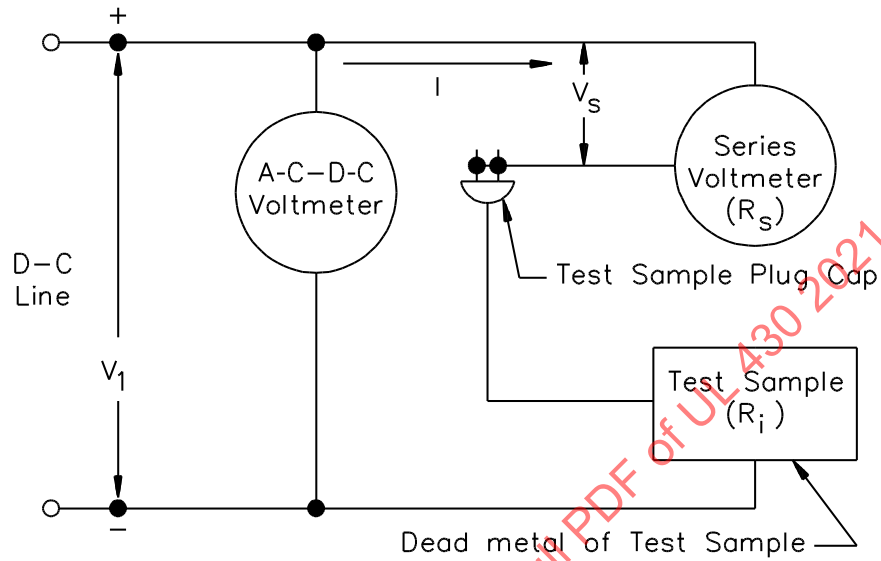
- a) A high-resistance voltmeter and a 250-V, direct-current circuit; or
- b) Two voltmeters and a 250-V, direct-current circuit.

36.4 To determine the insulation resistance by using the means specified in [36.3\(b\)](#), a circuit and test parameters as specified in [Figure 36.1](#) are to be used.

Figure 36.1

**Two-voltmeter method of measuring insulation resistance**

1. Test circuit:



(Note that two meters are used. No assumptions should be made as to the value of the D-C line voltage as measured on the A-C - D-C voltmeter.)

2. Test parameters:

$V_1$  = D-C Line Voltage (Reading Given on A-C - D-C Voltmeter)

$I$  = Current Flowing Through Test Sample Insulation

$V_s$  = Voltage Across Series Voltmeter (Reading Given on Series Voltmeter)

$R_s$  = Resistance of Series Voltmeter

$R_i$  = Insulation Resistance of Test Sample

3. Circuit equation:

$$R_i = \frac{V_1 - V_s}{V_s} R_s$$

### 37 Starting Current Test

37.1 A disposer other than that described in [37.2](#) shall start and operate as intended on a circuit protected by:

- a) An ordinary – nontime-delay – fuse having a current rating corresponding to that of the minimum branch-circuit fuse to which the disposer can be connected;
- b) A time-delay fuse with a current rating corresponding to the minimum branch circuit time-delay fuse to which the disposer can be connected; or
- c) A nontime-delay, or time-delay fuse having a current rating not more than the maximum specified in the National Electrical Code, ANSI/NFPA 70.

37.2 A disposer that is tested in accordance with [37.1](#)(b) or (c) shall be marked in accordance with [63.8](#).

37.3 With reference to [37.1](#), the minimum current rating of the branch circuit fuse to which the disposer can be connected is considered to be equal to the marked current rating of the disposer. If the marked current rating of the disposer does not correspond to one of the standard current ratings for branch circuit fuses, the minimum rating is considered to be the next highest standard branch-circuit fuse current rating. If the disposer is rated in watts rather than amperes, the minimum rating is considered to be the marked wattage rating divided by the marked voltage rating.

37.4 An appliance that would normally be used on a 15- or 20-A branch circuit shall start and operate normally on a circuit protected by a time-delay fuse having an ampere rating corresponding to that of the branch circuit on which the appliance would normally be used.

37.5 With reference to [37.1](#), the disposer is to be started three times with the disposer at room temperature at the beginning of the test. The start of each motor is to be made under conditions representing the normal operating cycle with the disposer loaded in accordance with [38.2](#). Each motor is to be allowed to come to full speed and then to come to rest between successive starts. The performance is unacceptable if the fuse opens. Tripping of an overload protector that is part of the disposer is also unacceptable.

### 38 Current Input Test

38.1 As a result of the test described in [38.2](#) – [38.3](#), the current input to any supply conductor shall not be more than 110 percent of the rated value when the disposer is operated under the conditions described in [33.2](#) – [33.6](#) and [38.2](#) and [38.3](#). If the disposer is rated in watts in accordance with the Exception to [66.2](#), the input in watts shall not be greater than 110 percent of the rated value of the disposer.

38.2 The disposer is to be loaded and the average value input current is to be obtained as specified in (a) or (b):

- a) For a household or commercial disposer, a mixture of 50 percent by weight of bones, 25 percent leafy waste, and 25 percent potatoes, with the first layer consisting of potatoes and leafy waste. The materials used for the tests are to be raw potatoes – each having a maximum dimension of approximately 2 in (50.8 mm), leafy waste, and uncooked steer rib bones – from 1 to 2 in long (25.4 to 50.8 mm). The average value of input current (or wattage) is to be determined by recording a graph of the curve of input current (or wattage) plotted against time. The average value input current (or wattage) is to be obtained by dividing the area under the curve by the length of the base or by a similar method yielding equivalent results. The length of the base is to be determined at the point that the input current (or wattage) has decreased to 110 percent of the water-load input current (or wattage) determined as specified in [38.1](#) under the conditions specified in [33.6](#). Instantaneous motor inrush currents (or wattage) shall not be included in the average input



calculation. If the disposer stalls while running, the obstruction is to be removed and the entire test restarted after the disposer has cooled to room temperature; or

b) For a household disposer only, – 30 1/2 in x 1/2 in x 1/2 in cubes of soft pine wood. If the hopper cannot contain all of the cubes at once, they are to be added as quickly as possible during operation of the disposer. Water temperatures are to be between 18°C and 24°C flowing at a rate of 2.2 gallons per minute. The average value input current (or wattage) is to be obtained as specified in (a) between the fifth second and fifteenth second of operation. If the disposer stalls while running, the obstruction is to be removed and the entire test restarted after the disposer has cooled to room temperature.

38.3 If, during the test specified in [38.2](#), the input current (or wattage) does not become greater than 110 percent of the water-load input, the average input shall be considered to be equal to 110 percent of the water-load input.

### 39 Temperature Test

39.1 A disposer shall be tested as described in [39.3](#) – [39.9](#). As a result of the test:

- a) A disposer shall not attain a temperature at any point that:
  - 1) Results in a risk of fire;
  - 2) Damages any material used; or
  - 3) Exceeds the temperature rises specified in [Table 39.1](#).
- b) A disposer shall not stall more than twice while operating with a food load.
- c) A thermal- or overcurrent-protective device shall not operate during the test.

**Table 39.1**  
**Maximum temperature rises**

Materials and components		°C	°F
1.	Varnished-cloth insulation	60	108
2.	Fuses	65	117
3.	Fiber employed as electrical insulation	65	117
4.	Wood and other combustible material	65	117
5.	Any point on or within a terminal box on a fixed disposer – see <a href="#">63.14</a>	65	117
6.	A surface upon which a fixed or stationary disposer is mounted in service and surfaces that is adjacent to the disposer when so mounted	65	117
7.	Class 105 (A) insulation systems on coil windings of an a-c motor having a frame diameter of more than 7 in (178 mm), of a d-c motor, and of a universal motor <sup>a</sup>		
a.	In an open motor		
	Thermocouple method	65	117
	Resistance method	75	135
b.	In a totally enclosed motor		
	Thermocouple method	70	126
	Resistance method	80	144

Table 39.1 Continued on Next Page

Table 39.1 Continued

Materials and components		°C	°F
8.	Class 105 (A) insulation on coil windings of an a-c motor having a frame diameter of 7 in or less – not including a universal motor – and on a vibrator coil <sup>a</sup>		
a.	In an open motor and on a vibrator coil		
	Thermocouple or resistance method	75	135
b.	In a totally enclosed motor		
	Thermocouple or resistance method	80	144
9.	Class 130 (B) insulation on a relay and a solenoid		
	Thermocouple method	85	153
	Resistance method	105	189
10.	Phenolic composition employed as electrical insulation or as a part the deterioration of which results in a risk of fire or electric shock <sup>b</sup>	125	225
11.	Rubber- or thermoplastic-insulated wire and cord <sup>b,c</sup>	35	63
12.	Capacitor		
	Electrolytic <sup>d</sup>	40	72
	Other types <sup>e</sup>	65	117
13.	Sealing compound– maximum temperature, not temperature rise	40°C (72°F) less than melting point	
14.	Class 105 (A) insulation on windings of a relay, a solenoid, or similar component		
	Thermocouple method	65	117
	Resistance method	85	153
15.	Class 130 (B) insulation on coil windings of an a-c motor having a frame diameter of more than 7 in and of a d-c motor, and of a universal motor <sup>a</sup>		
a.	In an open motor		
	Thermocouple method	85	153
	Resistance method	95	171
b.	In a totally enclosed motor		
	Thermocouple method	90	162
	Resistance method	100	180
16.	Class 130 (B) insulation systems on coil windings of an a-c motor having a frame diameter of 7 in or less – not including a universal motor– and on a vibrator coil <sup>a</sup>		
a.	In an open motor and on a vibrator coil		
	Thermocouple or resistance method	95	171
b.	In a totally enclosed motor		
	Thermocouple or resistance method	100	180
17.	Copper conductors		
a.	Tined or bare strands having		
	A diameter less than 0.015 in (0.38 mm)	125	225
	A diameter of 0.015 in or more	175	315
b.	Plated with nickel, gold, silver, or a combination of these	225	405
18.	Class 155 (F) insulation systems on coil windings on an a-c motor having a frame diameter of 7 in (178 mm) or less, not including a universal motor, and on a vibrator coil <sup>a</sup>		
a.	In an open motor		
	Thermocouple or resistance method	120	216

Table 39.1 Continued on Next Page

Table 39.1 Continued

Materials and components		°C	°F
19.	b. In a totally enclosed motor Thermocouple or resistance method	125	225
	Class 155 (F) insulation on coil windings of a-c motors having a frame diameter of more than 7 in (178 mm), and of a d-c motor, and a universal motor <sup>a</sup>		
	a. In open motors Thermocouple method	110	198
	Resistance method	120	216
	b. In totally enclosed motors Thermocouple method	115	207
	Resistance method	125	225
20.	Class 180 (H) insulation on coil windings of a-c motors having a frame diameter of 7 in (178 mm) or less – not including a universal motor – and on a vibrator coil <sup>a</sup>		
	a. In open motors Thermocouple or resistance method	135	243
	b. In totally enclosed motors Thermocouple or resistance method	140	252
	Class 180 (H) insulation on coil windings of a-c motors having a frame diameter of more than 7 in (178 mm), of a d-c motor, and a universal motor <sup>a</sup>		
21.	a. In open motors Thermocouple method	125	225
	Resistance method	135	243
	b. In totally enclosed motors Thermocouple method	130	234
	Resistance method	140	252
<sup>a</sup> See 39.2 and note (a) to Table 24.3. <sup>b</sup> The limitations on phenolic composition and on rubber and thermoplastic insulation do not apply to compounds that have been investigated and found to be rated for a higher temperature. <sup>c</sup> Rubber-insulated conductors within a Class 105 (A) insulated motor, rubber-insulated motor leads, and a rubber-insulated flexible cord entering a motor is acceptable where subjected to a temperature rise of more than 35°C (63°F), when a braid is used on the conductor of other than a flexible cord. However, this does not apply to thermoplastic-insulated wire or cord. See 39.6. <sup>d</sup> For an electrolytic capacitor that is physically integral with or attached to a motor, the temperature rise on insulating material integral with the capacitor enclosure is not to be more than 65°C (117°F). <sup>e</sup> For a capacitor operating at a temperature rise of more than 65°C (117°F), compliance investigated on the basis of its marked temperature limit.			

39.2 A thermocouple is to be used for determining the temperature of a coil or winding if it can be mounted, without removal of encapsulating compound or the like, on the integrally applied insulation of a coil without a wrap or the outer surface of a wrap that is not more than 1/32 in (0.8 mm) thick and consists of cotton, paper, rayon, or the like – but not of thermal insulation. The change-of-resistance method is to be used if the thermocouple measurement cannot be performed in accordance with the foregoing considerations. For a thermocouple-measured temperature of a motor coil as mentioned in items 7 and 15 in Table 39.1, the thermocouple is to be mounted on the integrally applied insulation on the conductor.

39.3 A thermocouple is to consist of wires not larger than 24 AWG. However, it should be noted that when thermocouples are used in the determination of temperatures in connection with the heating of electrical devices, it is common practice to employ thermocouples consisting of 30 AWG iron and constantan wires and a potentiometer-type indicating instrument; and such equipment is to be used whenever referee temperature measurements by thermocouples are necessary.

39.4 The values for temperature rises in [Table 39.1](#) are based on an assumed ambient temperature of 25°C (77°F). Tests performed at any ambient temperature within the range of 20° – 40°C (68° – 104°F) comply with the requirement.

39.5 With reference to [39.7](#) and [39.8](#), a temperature is constant when three successive readings, taken at intervals of 10 percent of the previously elapsed duration of the test indicate no change. In any case, the interval duration between readings shall not be less than 5 min.

39.6 A short length of rubber- or thermoplastic-insulated flexible cord exposed to a temperature greater than 60°C (140°F), such as at terminals, complies if supplementary heat-resistant insulation having the dielectric strength to reduce the risk of deterioration of the conductor insulation is used on the individual conductors of the cord.

39.7 A household or commercial disposer is to be loaded as described in [38.2](#), and then started. After 3 min or when the current or watts input decreases to 110 percent of the water-load input current or watts, whichever results in the longer cycle, the disposer is to be stopped, the water turned off, and the hopper refilled. After 1 min at rest, the unit is to be restarted. The procedure previously described is to be repeated until a total of 3 lb (1.361 kg) of food waste has been inserted into the disposer. If the unit stalls at the beginning of any cycle, the obstruction is to be removed and the test continued. If the unit stalls while running, the obstruction is to be removed and the entire test restarted after the unit has cooled to room temperature. The unit does not comply if it stalls more than twice while operating. See [39.8](#).

39.8 An alternative test method for commercial disposers (continuous duty motors), is to load a commercial disposer as described in [34.2\(a\)](#) or by means of a dynamometer. If the disposer is tested by means of a dynamometer, the load is to be adjusted until the unit draws a current or wattage equal to the average value measured as specified in [38.2\(a\)](#). The load is to be adjusted as required during the test to maintain the average current or wattage value. The unit does not comply if it stalls more than twice while operating. If the disposer is loaded as described in [38.2\(a\)](#), the load is to be continuously inserted into the hopper so that the input current or wattage at the level measured during Current Input Test, Section [38.2\(a\)](#), is maintained and until constant temperatures are attained. See [39.5](#).

39.9 An alternative test method for household disposers only (intermittent duty), is to load the household disposer as specified in [38.2\(b\)](#) or by means of a dynamometer. If the disposer is tested by means of a dynamometer, the load is to be adjusted until the unit draws a current or wattage equal to the average value measured as specified in [38.2\(b\)](#). The load is to be adjusted as required during the test to maintain the average current or wattage value. After 3 minutes, the disposer is to be stopped, and the water turned off. After 1 minute at rest, the unit is to be restarted. The procedure previously described is to be repeated until a total of three (3 minute) operating cycles have been completed allowing 1 minute of rest in between each cycle. If the disposer is loaded as described in [38.2\(b\)](#), the load is to be inserted into the hopper for each 3 minute operation cycle so that the input current or wattage at the level measured as specified in [38.2\(b\)](#), is maintained for each cycle. The unit does not comply if it stalls more than twice while operating.

#### 40 Dielectric Voltage-Withstand Test

40.1 A disposer shall be subjected to the test described in [40.2](#) and [40.3](#). As a result of the test, the disposer shall withstand the test potential without electrical breakdown.

40.2 A 60-Hz sinusoidal potential as specified in items (a) – (c) is to be applied between current-carrying parts and dead metal parts, or between current-carrying parts of opposite polarity for a capacitor as described in item (c). The test potential is to be applied as specified in [40.3](#). The disposer is to be tested at the maximum temperature reached during intended operation. The potential for the test shall be:

- a) 1000 V for a disposer using a motor rated 1/2 hp (373 W) or less and 250 V or less.

- b) 1000 V plus twice rated voltage for a disposer using a motor rated more than 1/2 hp or more than 250 V.
- c) 1000 V, or 1000 V plus twice rated voltage, depending upon the value of the test potential applied to the disposer as a whole, for a radio interference-elimination or arc-suppression capacitor.

*Exception No. 1: Testing the motor or motors specified in (a) separately from the remainder of the disposer is acceptable.*

*Exception No. 2: If a disposer uses both a motor with input current that is greater than the full load current of a 1/2 hp motor and a motor with input current less than or equal to the full load current of a 1/2 hp motor, the disposer is to be tested as specified in (b).*

40.3 The test shall be performed using a 500 VA or larger transformer, the output voltage of which is sinusoidal and variable. The applied potential is to be increased from zero to the required test value and held at that value for 1 min. The increase in the applied potential is to be at a substantially uniform rate and as rapidly as is consistent with its value being correctly indicated by a voltmeter.

#### 41 Moisture Resistance Test

41.1 A portable disposer having insulating material adversely affected by moisture while operating as intended shall be conditioned as specified in [41.2](#). As a result of the conditioning:

- a) No water shall enter the interior of the disposer in such manner that a risk of contacting uninsulated live parts or film-coated wire is introduced;
- b) The disposer shall comply with Leakage Current Test, Section [35](#);
- c) The disposer shall comply with Dielectric Voltage-Withstand Test, Section; and
- d) No other factors of risk of electric shock shall be introduced.

41.2 With reference to [41.1](#)(a) and (c), encapsulation of a coil is considered to prevent water from contacting the winding of the coil if the encapsulating material is not less than 1/8 in (3.2 mm) thick at every point. A one-piece molded coil form with a wall thickness of not less than 1/32 in (0.8 mm) is considered to prevent water reaching the coil winding if the coil form passes between the coil winding and the laminations on which the coil is mounted.

41.3 A portable disposer having insulating material that is able to be adversely affected by moisture while operating as intended, is to be conditioned as follows:

- a) Three samples of a portable disposer are to be immersed for 48 h at room temperature in a salt-water solution composed of 1/2 g of sodium chloride per L of distilled water. While still immersed, each sample is to be connected to a power-supply circuit at rated voltage and frequency and operated for 4 cycles. Each cycle is to consist of 5 min on and 15 min off. For the first cycle, each sample is to rest in an upright position. For the second cycle, each sample is to rest upside down. For the third and fourth cycles, each sample is to rest on a different side. The samples are then to be disconnected and removed from the water.
- b) Three additional samples of a portable disposer are to be arranged so that they are able to be operated at intended no-load speed from external sources. The samples are to be operated under these conditions for 475 h. Each sample disposer is then to be connected to a power-supply circuit of rated voltage and frequency and operated for 25 h with water flowing over it as during intended operation. Each sample is then to be immersed for 1 h in a salt water solution composed of 1/2 g of sodium chloride per L of distilled water, and then removed.

## 42 Motor Protection Tests

42.1 A motor-overcurrent or thermal-protective device that is provided in a disposer in accordance with Motor Overload Protective Devices, Section 15, shall comply with the applicable requirements in the Standard for Overheating Protection for Motors, UL 2111 or the Standard for Impedance Protected Motors, UL 1004-2, or the Standard for Thermally Protected Motors, UL 1004-3. See 42.2 – 42.4, 42.7, and 42.9.

42.2 A motor connected directly to the waste grinding mechanism shall be subjected to the running overload test specified in the Standard for Overheating Protection for Motors, UL 2111. During the test, the disposer is to be loaded as specified in UL 2111 or the Standard for Thermally Protected Motors, UL 1004-3, or is to be operated dry and without load. See Table 16.1.

42.3 For a manually reset device, the locked-rotor temperature test specified in the Standard for Overheating Protection for Motors, UL 2111 or the Standard for Thermally Protected Motors, UL 1004-3, is to be continued until the device has tripped four times. The device is to be reset after the first, second, and third trip, with the device being reset immediately after it has opened. For an automatic-reset device, the locked-rotor temperature test is to be continued for 72 h unless the disposer includes other controls, such as a timer, that restricts the duration of the operation to a shorter interval. See 42.5.

42.4 For an automatic-reset device, the locked-rotor endurance test in the Standard for Overheating Protection for Motors, UL 2111 or the Standard for Thermally Protected Motors, UL 1004-3, is to be continued for 15 d, unless the disposer includes other controls, such as a timer, that restricts the duration of the test. See 42.5.

42.5 With reference to 42.3 and 42.4, a mechanical or electro-mechanical control that restricts the duration of the operating interval and test shall comply with the endurance requirements of the standard covering the control. A solid-state control or circuit that restricts the duration of the operating interval and test shall comply with the Standard for Tests for Safety-Related Controls Employing Solid-State Devices, UL 991.

42.6 A motor may employ impedance protection when:

- a) The motor input current (or watts) corresponds to a rating of 1 hp or less (see Table 16.1) during the Current Input Test, Section 38; and
- b) The motor complies with the requirements for impedance-protected motors in the Standard for Impedance Protected Motors, UL 1004-2.

42.7 Overcurrent protective devices used for motor-overload protection shall be located in each ungrounded conductor. For a 3-phase, 3-wire, alternating-current motor, the protective devices shall be located in each of the three phases.

42.8 Fuses shall not be used as motor overload protective devices unless the motor is protected by a time-delay fuse of the highest ampere rating accommodated by the fuseholder.

42.9 The functioning of a motor protective device shall not result in a risk of fire, electric shock, or injury to persons.

42.10 An overcurrent-protective device shall be rated or set as indicated in Column A of Table 42.1. If the rating of the motor overcurrent protection determined in accordance with Column A of Table 42.1 does not correspond to a standard size or rating of fuses, nonadjustable circuit breakers, thermal cutouts, thermal relays, or heating elements of thermal-trip motor switches, the next higher size, rating, or setting may be used. The device rating shall not be greater than that specified in Column B of Table 42.1. For a multi-speed motor, the rating of each winding connection is to be determined separately.

**Table 42.1**  
**Maximum rating or setting of overcurrent protective device**

Type of motor	Current rating of device as a percentage of motor full-load current rating	
	A	B
Motor with marked service factor of 1.5 or more	125	140
Motor with marked temperature rise of 40°C or less	125	140
Any other motor	115	130

### 43 Overload Tests on Switches

43.1 A switch or other device that controls a motor shall be subjected to the test described in [43.2](#). As a result of the test:

- a) The switch or device shall not break down electrically or mechanically;
- b) The contacts shall not be pitted or burned such that the device no longer performs its function; and
- c) The fuse connected to ground shall not open.

*Exception: If the switch or other device is rated for the application or is interlocked so that the device does not break the locked-rotor motor current, the switch or device is not required to be subjected to the test.*

43.2 The disposer is to be connected to a grounded power-supply circuit at rated frequency and maximum rated voltage as described in [33.2](#). The rotor of the motor is to be locked in position. During the test, exposed dead-metal parts of the disposer are to be connected to ground through a 3-A plug fuse. The power-supply connection is to be such that any single-pole, current-interrupting device is in an ungrounded conductor of the supply circuit. If the disposer is intended for use on direct current, or on direct current as well as alternating current, the exposed dead-metal parts of the disposer are to be connected so as to be positive with respect to a single-pole, current-interrupting, control device. The device is to be operated for 50 cycles of operation at a rate of not more than 10 cycles/min. Each cycle is to consist of making and breaking the locked-rotor current of the disposer.

*Exception: Operating the device at a faster rate is acceptable, if agreeable to the concerned parties.*

### 44 Physical Properties of Gaskets and Seals Test

44.1 A gasket or seal shall be tested as specified in [Table 44.1](#) and [Table 44.2](#) in accordance with the test procedure and performance criteria specified in the Standard for Gaskets and Seals, UL 157. As a result of the tests, the gasket or seal shall comply with the requirements specified in [Table 44.2](#).



**Table 44.1**  
**Accelerated-aging conditions**

Maximum Use Temperature °C (°F)	Test program <sup>a,b</sup>	
	Nonelastomers	Elastomers
	Exposure time °C (°F)	Exposure time °C (°F)
60 or less (140 or less)	168 h at 87 (189)	70 h at 100 (212)
61 – 75 (142 – 167)	168 h at 100 (212)	168 h at 100 (212)
76 – 80 (169 – 176)	168 h at 113 (235)	168 h at 113 (235)
81 – 90 (178 – 194)	168 h at 121 (250)	168 h at 121 (250)
91 – 105 (196 – 221)	168 h at 136 (277)	168 h at 136 (277)
106 – 115 ( 222– 239)	1440 h at 123 (253) or 360 h at 143 (289)	1440 h at 123 (253)
116 – 125 (240– 257)	1440 h at 133 (271) or 360 h at 153 (307)	1440 h at 133 (271)
126 – 135 ( 258– 275)	1440 h at 143 (289) or 360 h at 163 (325)	1440 h at 143 (289)
136 – 145 (276– 239)	1440 h at 153 (307) or 360 h at 173 (343)	1440 h at 153 (307)
Any	Immersion for 168 h in boiling solution of Cascade detergent or the equivalent – 25 g per L of water	
Any	Immersion, 70 h in corn oil at 25°C (77°F)	
Any	Immersion, 70 h in IRM 903 oil (Calumet Oil No. 3) at 25°C (77°F)	

<sup>a</sup> Temperatures specified have a tolerance of ±1.0°C (1.8°F). Separate samples are to be used for each of the aging conditions. Using the same samples for more than one conditioning complies if the results of one conditioning does not affect the results of the other test.

<sup>b</sup> In an air-circulating oven at the specified temperature in accordance with the Standard for Gaskets and Seals, UL 157.

**Table 44.2**  
**Physical properties of gaskets and seals**

Physical properties <sup>a</sup>	Elastomers		Nonelastomers	
	Before conditioning	After conditioning	Before conditioning	After conditioning
Minimum elongation	250 percent	–	200 percent	–
Minimum tensile strength	1500 psi (10.3 MPa)	–	1500 psi (10.3 MPa)	–
Minimum elongation – air oven	–	60 percent of original	–	60 percent of original
Minimum tensile strength – air oven	–	60 percent of original	–	60 percent of original
Minimum tensile strength and elongation – Cascade detergent	–	50 percent of original	–	50 percent of original
Minimum tensile strength and elongation – Corn oil	–	50 percent of original	–	50 percent of original
Minimum tensile strength and elongation – IRM 903 oil	–	50 percent of original	–	50 percent of original
Maximum tensile set	25 percent	–	Not specified	–
Maximum compression set	15 percent	–	Not specified	–
<sup>a</sup> For description of performance criteria see the Standard for Gaskets and Seals, UL 157.				

44.2 The test procedure for determining whether a component complies with 44.1 depends upon the material of which it is composed, its size and shape, the mode of application in the disposer, and other factors. The test procedure is to include:



- a) Visual inspection for the presence of cracks, deformation, and similar characteristics after artificial aging;
- b) A comparison of tensile strength, and elongation before and after artificial aging; and
- c) Determination of recovery on unaged specimens.

#### 45 Strain Relief Test

45.1 The strain-relief means provided on the flexible cord of a disposer shall be tested as described in [45.2](#). During the test, the strain-relief means shall withstand for 1 min, without displacement, a direct pull of 35 lbf (156 N) applied to the cord. At the point of disconnection of the conductors, there shall not be movement of the conductors.

45.2 The connections within the disposer shall be disconnected. A 35-lb (15.9 kg) weight is to be suspended on the cord and supported by the disposer so that the strain-relief means is stressed from any angle that the construction of the appliance permits.

#### 46 Push-Back Relief Test

46.1 To determine compliance with [11.1.1.7](#), a disposer shall be tested in accordance with [46.2](#) without occurrence of any of the conditions specified in [11.1.1.7\(a\) – \(d\)](#).

46.2 The attached flexible cord is to be held 1 in (25.4 mm) from the point where the cord emerges from the enclosure of the disposer and is then to be pushed back into the disposer. The cord is to be pushed back into the dishwasher in 1 in (25.4 mm) increments until the cord buckles or the force to push the cord into the disposer is greater than 6 lb (26.7 N). The cord within the disposer is to be manipulated to determine compliance.

*Exception: If an integral cord guard is provided, the push-back force is to be applied 1 in from the end of the cord guard.*

#### 47 Permanence of Marking Tests

47.1 An ink-stamped marking, a pressure-sensitive label, or a cement or adhesive secured label containing a marking required by this standard shall comply with the applicable requirements for indoor-use labels in the Standard for Marking and Labeling Systems, UL 969. A marking system rated for indoor dry locations is acceptable for use only in locations where the marking is not subjected to cleaning or occasional splashing of water.

47.2 In addition to complying with [47.1](#), a label that is exposed to unusual conditions in service – such as deodorants or detergents – shall show permanence and legibility as specified in the Standard for Marking and Labeling Systems, UL 969, after being conditioned as follows. Three samples of the label applied to test surfaces as in the intended application are to be conditioned for 24 h in a controlled atmosphere maintained at  $23.0 \pm 2.0^{\circ}\text{C}$  ( $73.4 \pm 3.6^{\circ}\text{F}$ ) with a  $50 \pm 5$  percent relative humidity. The samples are then to be immersed for 48 h in a solution representative of service use maintained at the temperature the solution would attain in service, but not less than  $23.0 \pm 2.0^{\circ}\text{C}$ .

## POLYMERIC MATERIALS TESTS

### 48 General

48.1 The requirements in Sections [48](#) – [58](#) apply to polymeric materials, including thermoset materials, used in a disposer as an enclosure or a functional part. These requirements do not apply to materials used as electrical insulation.

48.2 Waiving or modifying a test complies with the intent of these requirements if sample testing, as part of a previous test program, indicates that the polymeric material is acceptable for use with the property being investigated.

48.3 If the loss of bond strength between the polymeric substrate and the metal coating of a plated polymeric part results in a reduction of electrical spacings, mechanical strength, or resistance to flammability, the plated polymeric part shall be investigated in accordance with the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

48.4 A test that specifies the use of a specific detergent is to be performed with the specified detergent or with any other detergent having the same properties.

48.5 Polymeric materials are to be tested as specified in [Table 48.1](#). Each test method and the conditions under which each test is to be performed are specified in Sections [49](#) – [58](#).

**Table 48.1**  
**Test summary**

Section	Test	Polymeric part		
		Decorative	Enclosure	Functional
<a href="#">45</a>	Horizontal burning-rate	X	–	X
<a href="#">46</a>	Flammability	–	X	–
<a href="#">47</a>	Flame	X	X	X
<a href="#">48</a>	Impact	–	X	–
<a href="#">49</a>	Thermal-cycling	–	X	X
<a href="#">50</a>	Mold-stress relief	–	X	X
<a href="#">51</a>	Immersion	–	X	X
<a href="#">52</a>	Thermal-aging	–	X	X
<a href="#">53</a>	Long term exposures	–	X	X
<a href="#">54</a>	Abnormal operation	–	X	X
NOTES				
1 The X appearing in a column designates the applicable requirement.				
2 Parts that function as an enclosure and a functional part shall be subjected to the tests specified for an enclosure and functional part. The Horizontal Burning-Rate Test is not required to be performed.				

### 49 Horizontal Burning-Rate Test

49.1 The burning rate of a polymeric part not functioning as an enclosure shall not be greater than the rate for an HB material when tested as specified in the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94. The sample tested is to be cut from the end-use part or flat stock with a thickness equal to that of the end-use part.

## 50 Flammability Test

50.1 Three disposers that use a polymeric enclosure or have an enclosure that is partially constructed of polymeric material shall comply with the enclosure flammability – 3/4-in flame test requirements in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

*Exception: A disposer using an enclosure constructed entirely of, or partially of, a polymeric material having a V-0, V-1, V-2, 5VA, or 5VB rating as determined in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, is not required to be additionally tested.*

## 51 Flame Spread Test

51.1 A sample of an external part of polymeric material having a single linear dimension greater than 6 ft (1.8 m), or a projected surface area greater than 10 square ft (0.9 m<sup>2</sup>) shall be tested as described in the Standard for Tests for Surface Burning Characteristics of Building Materials, UL 723, or Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source, ASTM E162. The flame-spread index of the part shall not be greater than 200.

## 52 Impact Test

52.1 A polymeric enclosure or the polymeric portion of an enclosure shall be tested as described in [52.2](#). As a result of the test:

- a) Spacings shall not be reduced to less than those specified in [Table 24.1](#) – [Table 24.3](#);
- b) Current-carrying parts or internal wiring shall not be exposed as determined in accordance with Enclosure, Section [7](#); and
- c) The enclosure shall not be damaged such that a risk of fire, electric shock, or injury to persons results.

52.2 Three complete, as-received samples of a polymeric enclosure or the polymeric portion of an enclosure are to be subjected to the resistance to impact test described in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. An enclosure for a fixed or stationary appliance is to be subjected to 5 ft-lb (6.8 J) impacts as follows:

- a) Each sample is to be subjected to three impacts per surface at different points on each surface.
- b) The points chosen on the second and third samples are to be different from those chosen on the first sample.
- c) If the size of the surface is such that the results of a second or third impact would be affected by previous impacts, only one impact is to be performed.

*Exception: Performing each impact on one sample complies with the requirement if requested by the manufacturer.*

## 53 Thermal-Cycling Test

53.1 Three samples of a polymeric enclosure or functional part shall be tested as described in [53.2](#). As a result of the test, the part shall not crack or deteriorate such that a risk of fire, electric shock, or injury to persons results. If the part is intended to contain or carry a liquid, the part shall not leak if such leakage results in a risk of fire, electric shock, or injury to persons.

53.2 Each sample is to be subjected to 50 cycles of thermal cycling. Each thermal cycle is to consist of 1 h in an air-circulating oven at a temperature 10°C (50°F) above that temperature to which the part is subjected during intended use, but not less than 70°C (158°F). The sample is then to be cooled for 1 h in a room ambient temperature of 25°C ±3°C (77°F ±5°F).

#### 54 Mold Stress-Relief Distortion Test

54.1 A polymeric part of a disposer shall be subjected to a mold stress-relief distortion test as described in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. As a result of the test:

- a) Spacings shall not be reduced to less than those specified in [Table 24.1](#) – [Table 24.3](#);
- b) Current-carrying parts or internal wiring shall not be exposed as determined in accordance with Enclosure, Section [7](#);
- c) A polymeric part shall not be damaged such that a risk of fire, electric shock, or injury to persons results; and
- d) A polymeric part exposed to liquid shall not crack or leak if such leakage results in a risk of fire, electric shock, or injury to persons.

*Exception: This test is not required for a polymeric part that complies with Thermal-Aging Test, Section [56](#).*

54.2 After being subjected to the test specified in [54.1](#), the polymeric part shall comply with Impact Test, Section [52](#).

#### 55 Immersion Test

55.1 A polymeric part exposed to a detergent or oil shall be tested in accordance with [Table 55.1](#). As a result of the tests, the polymeric part shall not crack or deteriorate such that a risk of fire, electric shock, or injury to persons results. If the part is intended to contain or convey a liquid, the part shall not leak if such leakage results in the liquid contacting current-carrying parts or otherwise increasing the risk of fire, electric shock, or injury to persons.

**Table 55.1**  
Immersion tests

Part usage	Applicable test paragraphs
A part that functions as a waste-water carrier, hose fitting, sump pump, or similar function	<a href="#">55.2</a> , <a href="#">55.3</a>
A part subjected to casual splashing of water or vapor, or a part subjected to waste-water or vapor during intended operation	<a href="#">55.4</a> , <a href="#">55.5</a>

55.2 Three samples of the complete polymeric part are to be immersed in a solution of 25 g of Cascade detergent per L of distilled water or the equivalent for 1000 h. See [48.4](#). The solution is to be maintained at a temperature 10°C (18°F) above that temperature to which the part is subjected during intended use, but not less than 70°C (158°F).

55.3 Three samples of the part or parts assembly are to be immersed in a corn oil for 1000 h at 25 ±3°C (77 ±5°F).

55.4 Three samples of the complete polymeric part are to be immersed in a solution of 25 g of Cascade detergent or the equivalent per L of distilled water for 168 h. See [48.4](#). The solution is to be maintained at

a temperature 10°C (18°F) above that temperature to which the part is subjected during intended use, but not less than 70°C (158°F).

55.5 Three samples of the part or parts assembly are to be immersed in a corn oil for 168 h at 25 ±3°C (77 ±5°F).

## 56 Thermal-Aging Test

56.1 The thermal-aging characteristics of a polymeric material shall be investigated using one of the following procedures:

- a) The polymeric material is to have a temperature index, based on historical data or a long term thermal-aging program, that indicates its acceptability for use at the temperature involved;
- b) The polymeric material is determined to comply with the thermal-aging requirement when it is determined that the maximum temperature to which the material is exposed during intended operation of the disposer is not greater than 50°C (122°F); or
- c) The polymeric part complies with [56.2](#) when subjected to the test specified in [56.3](#), and the maximum temperature to which it is exposed during intended use of the disposer is not greater than 95°C (203°F).

56.2 A polymeric part shall be tested as described in [56.3](#). As a result of the test:

- a) Spacings shall not be reduced to less than those specified in [Table 24.1](#) – [Table 24.3](#);
- b) Current-carrying parts or internal wiring shall not be exposed as determined in accordance with Enclosure, Section [7](#);
- c) A condition shall not be produced that increases the risk of fire, electric shock, or injury to persons; and
- d) A part exposed to liquids shall not crack or leak if such leakage results in a risk of fire, electric shock, or injury to persons.

56.3 Three complete samples of a polymeric part are to be conditioned in an air-circulating oven for 1000 h at the temperature specified in [Table 56.1](#). The samples are to be removed from the oven, cooled to room temperature, and examined to determine compliance with [56.2](#).

**Table 56.1**  
**Temperatures for oven conditioning**

Maximum operating temperature of a polymeric part, °C (°F)		Oven temperature	
More than	Not more than	°C	(°F)
50 (122)	75 (167)	85	(185)
75 (167)	85 (185)	95	(203)
85 (185)	95 (203)	105	(221)

56.4 At the completion of the Thermal Aging Test specified in [56.1](#) – [56.3](#), the thermally aged samples of a polymeric part are to be subjected to the Impact Test, Section [52](#).

## 57 Long Term Exposure Tests

### 57.1 General

57.1.1 The long-term exposure characteristics of a polymeric material shall be investigated using one of the following procedures:

- a) Three complete disposers shall be subjected to an endurance test and impact test as described in Endurance Test on Complete Disposers, Section [57.2](#);
- b) Forty samples of polymeric material of a disposer shall be subjected to the tensile strength test described in [57.3.3](#) and forty samples of polymeric material of a disposer shall be subjected to the tensile impact energy test described in [57.3.1](#) – [57.3.4](#); or
- c) The polymeric material shall have a mechanical impact relative thermal index, based on historical data or a long-term thermal-aging program that indicates the acceptability of the material for use at the maximum temperature to which the material is exposed, as measured during the Temperature Test, Section [39](#).

### 57.2 Endurance test on complete disposers

57.2.1 Following the endurance test described in [57.2.2](#), a disposer is to be subjected to an impact test as described in [52.2](#) with an impact of 2-1/2 ft-lb (3.4 J). There shall be no cracking, leaking, or similar conditions that could result in a risk of fire, electric shock, or injury to persons.

57.2.2 Three complete disposers are each to be subjected to 6000 cycles of operation. The disposer is to be connected to a supply circuit having a voltage in accordance with [33.2](#), and to a water supply of 71°C (160°F). Each cycle is to consist of the disposer operating for the maximum length of time permitted by the timer, followed by an off time (rest period) of one hour. During each cycle, 25 g of detergent per L of water are to be added to the waste water. The heated solution is to flow through the disposer during the operating cycle, and the solution is not to flow during the off time.

*Exception No. 1: For a disposer without a timer, the length of the cycle is to be 5 min.*

*Exception No. 2: The cycle off time (rest period) may be less than one hour if it is determined that the shorter test time maintains the same level of safety as that anticipated by the stated test criteria.*

### 57.3 Specimen tests

57.3.1 After the conditioning described in [57.3.2](#), the average tensile strength and the average tensile impact energy of the specimens shall be at least 50 percent of that for the as-received specimens for each condition; and the specimens shall indicate no significant change with respect to time.

57.3.2 Each specimen is to be approximately 8 in (203 mm) by 3 in (76 mm) by the minimum thickness of the polymeric material as used in the disposer. The average tensile strength of ten as-received specimens is to be determined as described in [57.3.3](#), and the average tensile impact energy of ten as-received specimens is to be determined as described in [57.3.4](#). The specimens are to be subjected to conditioning by immersion of three sets of ten specimens each for 30, 60, and 138 d, respectively, in 2.5 percent, by weight, aqueous Cascade solution for a part subjected to waste water. The solution temperature is to be 10°C higher than the maximum temperature recorded on the thermoplastic parts when measured in accordance with [8.3](#) and [8.4](#). See [48.4](#).

57.3.3 Immediately after the conditioning described in [57.3.2](#), the tensile strength of each sample is to be determined in accordance with the Standard Test Method for Tensile Properties of Plastics, ASTM D638, (Type I specimens).

57.3.4 Immediately after the conditioning described in [57.3.2](#), the tensile impact energy of each sample is to be determined in accordance with the Standard Test Method for Tensile-Impact Energy to Break Plastics and Electrical Insulating Materials, ASTM D1822, (Type S specimens).

## 58 Abnormal Operation Test

58.1 A polymeric part of a disposer that is located below a motor, solenoid, relay, transformer, solid-state component, or within 4 in (101.6 mm) of any of these components shall be tested as described in [58.2](#) – [58.5](#). As a result of the test:

- a) Parts shall not ignite;
- b) Current-carrying parts or internal wiring shall not be exposed;
- c) Spacings shall not be reduced to less than the required spacings specified in Spacings, Section [24](#);
- d) Parts shall not be deformed or damaged such that the risk of fire, electric shock, or injury to persons is increased;
- e) The 3-A fuse connected to ground shall not open; and
- f) The disposer shall comply with Dielectric Voltage-Withstand Test, Section [40](#).

58.2 A polymeric part as described in [58.1](#) is to be tested with the motor armature locked, relay or solenoid plunger blocked open, transformer secondary winding or windings shorted, or solid-state component opened or shorted. If other electrical components are located within 4 in of the polymeric part, or above the part, these electrical components are to be operated under abnormal conditions as required to determine compliance with [58.1](#). The abnormal conditions are to be representative of abnormal conditions likely to occur. The remainder of the disposer is to be operated as described in the Temperature Test, Section [39](#), but component temperatures are not required to be measured. Immediately following the test procedure described in Section [39](#), the disposer is to be operated under the abnormal condition with water flowing through the disposer as described in the temperature test without the additional food load.

58.3 Only one abnormal condition is to be imposed as an initial condition. If as a result of the initial condition other abnormal conditions occur during the test, operation is to be continued.

58.4 During the test, the test sink or supporting structure, water supply, and drain piping are to be electrically isolated from earth ground and all exposed dead metal parts of the disposer are to be connected to ground through a 3-A, nontime-delay fuse. Immediately following the test, the disposer shall be subjected to Dielectric Voltage-Withstand Test, Section [40](#).

58.5 Unless ultimate results are obtained in less time, the tests are to be continued for not less than 1 h. If during, or at the end of, the 1 h time period there is an indication of a risk of fire or electric shock (for example, the generation of smoke, deterioration of insulation, or similar condition), the test is to be continued until ultimate results are obtained, but not longer than 7 h. Ultimate results include the opening of a fuse, thermal cutoff, or other one-time protective device, functioning of a manual reset thermostat, or similar occurrence.



## 59 Component Burnout Test

59.1 An electrolytic capacitor shall be subjected to the test described in [59.2](#). As a result of the test, the cotton placed around openings in the enclosure of the capacitor shall not ignite.

59.2 Three samples of the capacitor, mounted in the usual manner and with cotton placed around openings in the enclosure, are to be subjected to such overvoltage as to result in breakdown.

## MANUFACTURING AND PRODUCTION TESTS

## 60 Grounding Continuity Test

60.1 A disposer that has a power-supply cord having a grounding conductor shall be tested, as a routine production-line test, to determine that grounding continuity exists between the grounding blade of the attachment plug and the accessible dead metal parts of the disposer that are at risk of becoming energized.

60.2 Only a single test is required to be performed if the accessible metal selected is conductively connected to all other accessible metal.

60.3 An indicating device, such as an ohmmeter or a battery-and-buzzer combination, shall be used to determine compliance with [60.1](#).

## 61 Dielectric Voltage-Withstand Test

61.1 Each disposer shall withstand without electrical breakdown, as a routine production-line test, the application of a 40 – 70 Hz potential as specified in [Table 61.1](#) for either Condition A or Condition B. The potential is to be applied:

- a) Between the primary winding, including connected components, and accessible dead metal parts that are at risk of becoming energized; and
- b) Between primary wiring and accessible low-voltage (42.4 V peak or less) metal parts, including terminals.

**Table 61.1**  
**Production-line test conditions**

Disposer rating	Condition A		Condition B	
	Potential, V	Time, s	Potential, V	Time, s
250 V or less with a motor rated 1/2 hp (373 W output) or less	1000	60	1200	1
250 V or less with a motor rated more than 1/2 hp	$1000 + 2V^a$	60	$1200 + 2.4V^a$	1
251 – 600 V	$1000 + 2V^b$	60	$1200 + 2.4V^b$	1
<sup>a</sup> Maximum marked voltage but not less than 120 V if the maximum marked voltage is within the range 105 – 120 V, and not less than 240 V if the maximum marked voltage is within the range 210 – 240 V. <sup>b</sup> Maximum marked voltage.				

61.2 The disposer is to be in a heated or unheated condition for the test.

61.3 For the test, the disposer is to be fully assembled and is not to be unwired, modified, or disassembled.



*Exception No. 1: A part, such as a snap cover or a friction-fit knob, is not required to be in place for the test when the part interferes with performing the test.*

*Exception No. 2: Full assembly of the disposer is not required where performing the test on a partially assembled unit is representative of performing the test on a fully assembled unit.*

61.4 A disposer using a solid-state component that is not relied upon to reduce the risk of electric shock and that is able to be damaged by the dielectric potential may be tested before the component is electrically connected provided a random sampling of production each day is tested at the potential specified in [Table 61.1](#). The circuitry is to be rearranged for the purpose of reducing the risk of solid-state-component damage while retaining representative dielectric stress of the circuit.

61.5 The test equipment shall include a transformer having an essentially sinusoidal output, 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 feature that identifies a unit that does not comply.

61.6 If the output of the test equipment transformer is less than 500 VA, the equipment is to include a voltmeter in the output circuit to indicate the test potential directly.

61.7 If the output of the test equipment transformer is 500 VA or more, the test potential is to 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.

When 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.

61.8 Using test equipment other than that described in [61.5](#) – [61.7](#), is acceptable if the equipment is found to accomplish the intended factory control.

61.9 During the test, the primary switch is to be in the on position, both sides of the primary circuit of the disposer 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 No. 1: A disposer with resistive, high-impedance winding, or similar electrical characteristics having circuitry not subject to excessive secondary-voltage build-up under electrical breakdown conditions that is tested as follows complies with the intent of the requirement:*

- a) With a single-pole primary switch 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.

*Exception No. 2: The primary switch is not required to be in the on position if the testing means applies full test potential between primary wiring and dead metal parts with the switch not in the on position.*

## RATING

### 62 Details

62.1 A disposer shall be rated in volts. The number of phases shall be included in the rating if the disposer is intended for connection to a polyphase circuit and the rating shall include the frequency.

62.2 A disposer shall have a single current rating in amperes.

*Exception: A rating in watts or kilowatts is acceptable if the overall full-load power factor is 0.80 or greater.*

## MARKING

### 63 Details

63.1 A disposer shall be legibly and permanently marked with the following:

- a) The manufacturer's name, trade name, trademark, or other descriptive marking by which the organization responsible for the disposer is identified.
- b) A distinctive catalog number or the equivalent.
- c) The voltage, input in amperes, and frequency expressed in Hertz, Hz, cycles-per-second, cps, cycles/second, or c/s.

*Exception: A rating in watts or kilowatts is acceptable if the overall full-load power factor is 0.80 or greater.*

- d) The number of phases if the disposer is intended for use on a polyphase circuit.
- e) The date or other dating period of manufacture not exceeding any three consecutive months.

*Exception No. 1: The manufacturer's identification provided in a traceable code is acceptable if the disposer is identified by the brand or trademark owned by a private labeler.*

*Exception No. 2: A date of manufacture complies that is abbreviated or provided in a nationally accepted conventional code or in a code affirmed by the manufacturer is acceptable if the code:*

- 1) Does not repeat in less than 12 years; and
- 2) Does not require reference to the production records of the manufacturer to determine the date the product was manufactured.

63.2 The shipping container of a power-supply cord accessory kit shall be legibly and permanently marked with the manufacturer's name, trade name, or trademark and a distinctive catalog number or the equivalent.

63.3 The marking on a permanently installed disposer shall be located so that it is readily visible after the disposer has been installed as intended.

63.4 If a single motor is the only electric-energy-consuming component of a disposer, the electrical rating provided on the motor nameplate is not required to be marked elsewhere on the disposer if the nameplate is readily visible after the motor has been installed in the disposer.

63.5 A permanently connected disposer having one motor and other loads or more than one motor with or without other loads shall be permanently marked with:

- a) The minimum supply-circuit conductor ampacity in accordance with [63.6](#).
- b) The maximum rating and type – for example, nontime-delay fuse, dual-element time-delay fuse, and similar control devices – of supply-circuit overcurrent-protective device in accordance with [63.7](#).

The marking shall be in a location that is visible after the disposer has been installed as intended.

63.6 With reference to [63.5\(a\)](#), the minimum supply-circuit conductor ampacity shall be based on the maximum current recorded during Current Input Test, Section [38](#).

63.7 With reference to [63.5\(b\)](#), the rating of the supply-circuit overcurrent-protective device shall not be greater than the rating of the fuse used in the short-circuit test of the motor-overload protective device used in the disposer.

63.8 A disposer that is tested in accordance with [37.1\(b\)](#) or (c) shall be plainly and permanently marked with the words: "If connected to a circuit protected by fuses, use time-delay fuses (or nontime-delay, as applicable) with this disposer," or with equivalent wording. If the current rating of the fuse used for Starting Current Test, Section [37](#), is greater than the minimum current rating of the branch circuit protection device to which the disposer is connected as specified in the National Electrical Code, ANSI/NFPA 70, the marking shall specify the current rating of the fuse used. This marking shall be readily visible during installation and examination of field wiring connections.

63.9 The requirements in [63.1](#) and [63.5](#) regarding the location of the marking do not preclude compliance of the marking on the bottom or on the side of a disposer.

63.10 If a disposer is intended to be used with a field-installed control assembly that is not shipped with the disposer, the disposer shall be provided with a permanent marking that includes the following or equivalent statement: "Use only with (manufacturer's name) (model or catalog number) control assembly."

*Exception: If the installation instructions include the manufacturer's name and model or catalog number of control assemblies for field installation in a disposer, then the disposer may be provided with a permanent marking that includes the following or equivalent statement: "Use only with control assemblies specified in the installation instructions."*

63.11 If a disposer can be readily adapted upon installation for connection to a supply circuit of either of two different voltages, complete instructions for making the connections for the different voltages, including identification of terminals, shall be included in the permanent marking of the disposer. If the disposer uses an attachment plug, instructions shall be provided to indicate the type of plug to be used if the disposer is reconnected for the alternate voltage.

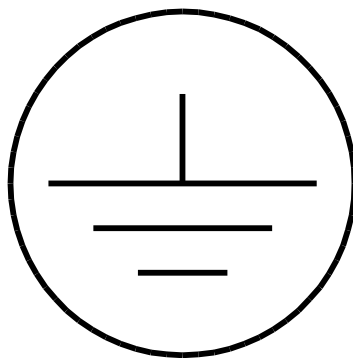
63.12 A disposer having field-wiring terminals shall be marked:

- a) "Use copper conductors only" if the terminal is to be connected to copper wire only.
- b) "Use aluminum conductors only" if the terminal is to be connected to aluminum wire only.
- c) "Use copper or aluminum conductors" or "Use copper, copper-clad aluminum, or aluminum conductors" if the terminal is to be connected to either copper wire or aluminum wire only.
- d) "Use copper-clad aluminum or copper conductors" if the terminal is to be connected to either copper wire or copper-clad aluminum wire only.

63.13 A pressure wire connector intended for connection of an equipment-grounding conductor shall be marked "G," "GR," "Ground," "Grounding," the grounding symbol illustrated in [Figure 63.1](#), a marking

adjacent to the pressure wire connector, a similar marking; or a marking on a wiring diagram provided on the disposer.

**Figure 63.1**  
**Grounding symbol**



IEC417, Symbol 5019

63.14 If during the tests for Temperature Test, Section 39, a terminal box or compartment intended for power-supply connections attains a temperature higher than 60°C (140°F), the disposer shall be plainly and permanently marked with the following statement or the equivalent: "For supply connections, use wires rated for not less than \_\_\_C (\_\_\_F)." The temperature value to be used in the preceding statement shall be in accordance with Table 63.1. The marking shall be located at or near the point where the supply connections are to be made, so that it is readily visible during and after installation.

**Table 63.1**  
**Outlet-box marking**

Temperature attained in terminal box or compartment,		Temperature marking,	
°C	°F	°C	°F
61 – 75	142 – 167	75	167
76 – 90	168 – 194	90	194

63.15 A disposer that uses a thermal-overload relay incorporating a replaceable heater shall be marked to indicate the heater required to protect the disposer.

63.16 A disposer that is acceptable only for installation with a nonmetal-enclosed wiring system shall be marked to indicate that it shall be installed with such a wiring system. The marking shall be located so that it is visible while power-supply connections to the disposer are being made.

63.17 If a manufacturer produces or assembles a disposer at more than one factory, each finished disposer shall have a distinctive marking by which it is identified as the product of a particular factory.

63.18 A disposer provided with double insulation shall be permanently marked with the words " Double Insulation – When servicing, use only identical replacement parts." The words "Double-Insulated" may be used instead of "Double-Insulation."