



UL 982

STANDARD FOR SAFETY

Motor-Operated Household Food
Preparing Machines

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UL Standard for Safety for Motor-Operated Household Food Preparing Machines, UL 982

Eighth Edition, Dated September 27, 2019

Summary of Topics

This revision of ANSI/UL 982 dated April 23, 2024 includes the following changes in requirements:

- Blender Cover Opening for Individual Serving Size Open-Top Blenders; [30.4.3.1](#)***
- Motor Capacitor Temperature Limit Correction; [Table 36.1](#)***
- Addition of UL 969A into UL 982; [SA14.1](#)***
- Use of Detergent Type D for Conditioning of Centrifugal Juicer Baskets; [54.4](#), [55.2](#)***
- Battery Chargers; [6.3.5](#)***
- Products Incorporating Button Batteries or Coin Cell Batteries, UL 4200A; [Section 29](#)***

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

The new and revised requirements are substantially in accordance with Proposal(s) on this subject dated March 1, 2024.

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1

UL 982

Standard for Motor-Operated Household Food Preparing Machines

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

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CONTENTS

INTRODUCTION

1	Scope	9
2	Units of Measurement	9
3	Undated References	9
4	Glossary	9

CONSTRUCTION

5	General	14
6	Components	15
	6.1 General	15
	6.2 Attachment plugs, receptacles, connectors, and terminals	16
	6.3 Batteries and battery chargers	17
	6.4 Capacitors and filters	18
	6.5 Controls	18
	6.6 Cords, cables, and internal wiring	21
	6.7 Cord reels	21
	6.8 Lampholders and indicating lamps	22
	6.9 Motors	22
	6.10 Motor overload protection	23
	6.11 Overcurrent protection	25
	6.12 Polymeric materials and enclosures	25
	6.13 Power supplies	25
	6.14 Printed wiring boards	26
	6.15 Pumps	26
	6.16 Semiconductors, relays and small electrical and electronic components	26
	6.17 Solenoids and electrically operated valves	26
	6.18 Supplemental insulation, insulating bushings and assembly aids	27
	6.19 Switches, timers and interlocks	27
	6.20 Transformers	31
7	Frame and Enclosure	31
8	Mechanical Assembly	37
9	Protection Against Corrosion	38
10	Power Supply Connections – Cord-Connected Appliances	40
	10.1 Cords and plugs	40
	10.2 Pin terminals	43
	10.3 Strain relief	44
	10.4 Cord bushings	44
	10.5 Mechanical protection	45
11	Power Supply Connections – Permanently-Connected Appliances	45
	11.1 General	45
	11.2 Wiring terminals	46
	11.3 Grounded terminals and leads	46
12	Direct Plug-In Rechargeable Appliances	48
13	Internal Wiring	50
14	Live Parts	52
15	Electrical Insulation	52
16	Thermal and Acoustic Insulation	53
17	Spacings	53
18	Alternate Spacings – Clearances and Creepage Distances	54
19	Grounding	56
	19.1 Required grounding	56

19.2	Continuity.....	56
19.3	Grounding identification	56
20	Flooding of Live Parts	57

PROTECTION AGAINST PERSONAL INJURY

21	General	57
22	Attachments.....	58
23	Moving Members.....	58
24	Stability	59
25	Stability – Floor Supported Carts and Stands.....	59
26	Enclosure and Guards	60
27	Switches, Controls, and Interlocks	63
28	Surface Temperatures	65
29	Button Batteries or Coin Cell Batteries	65
30	Appliances.....	66
30.1	All knives	66
30.2	Cord-connected knives	66
30.3	Battery-operated knives	66
30.4	Blenders	67
30.5	Food processors including food choppers.....	72
30.6	Coffee or grain grinders.....	72
30.7	Vegetable shredders/slicers and centrifugal juicers	72
30.8	Ice-cube crushers	73
30.9	Wand-type mixers.....	74
30.10	Coffee or grain mills	74
30.11	Pasta mixer-extruders	74

PERFORMANCE

31	General	75
32	Leakage Current Test	75
33	Operational Tests	77
34	Starting Current Test.....	77
34.1	Protection by fuses	77
34.2	Other overcurrent protection	77
35	Input Test.....	78
36	Normal Temperature Test.....	79
36.1	General.....	79
36.2	Food mixers	82
36.3	Blending mixers.....	83
36.4	Liquid mixers	84
36.5	Reamer juicers	85
36.6	Centrifugal juicers and masticating juicers	85
36.7	Meat grinders	85
36.8	Baby food grinders.....	85
36.9	Baby food choppers	86
36.10	Meat slicers	86
36.11	Churns	86
36.12	Knife sharpeners	87
36.13	Can openers.....	87
36.14	Ice crushers and ice shavers.....	87
36.15	Vegetable shredder/slicers	87
36.16	Ice cream mixer freezers (bucket type)	88
36.17	Mills and grinders, other than meat grinders.....	88
36.18	Knives.....	89

36.19	Food processors including food choppers	89
36.20	Battery-operated appliances	91
36.21	Under-cabinet or wall-mounted appliances	91
36.22	Wand-type mixers	91
36.23	Wand-type mixers with a milk shake attachment.....	92
36.24	Pasta mixer-extruders	92
36.25	Pasta extruding attachments.....	92
36.26	Handheld pizza cutters	93
37	Dielectric Voltage-Withstand Test	93
38	Leakage Current Following Humidity Tests	95
39	Leakage Current and Dielectric Voltage-Withstand Test (Repeated)	95
40	Flooding of Live Parts Tests	95
40.1	Overflow test	95
40.2	Ingress test	96
41	Test for Deterioration of Parts Subject to Flexing	96
42	Test for Reliability of Parts Not Subject to Flexing.....	97
43	Insulation Resistance Test	98
44	Blender Cover Opening Splash Test	98
45	Blender Vented Lid Test	99
46	Blender Blade Endurance Test	99
46.6	General.....	99
46.7	500 Cycle endurance test.....	99
46.8	Salt spray and 5 cycle endurance test	100
47	Resistance to Moisture Test	100
48	Continuous Operation Test.....	103
49	Abnormal Operation Test	103
49.1	Metal enclosure abnormal locked rotor test.....	103
49.2	Self-holding protector abnormal locked rotor test.....	105
49.3	Oversoltage of appliances Intended to be supplied by Universal Serial Bus (USB).....	105
50	Capacitor Failure Test.....	105
51	Power Supplies and Battery Chargers Test.....	106
52	Direct Plug-In Appliance Testing	106
52.1	Weights and moments test	106
52.2	Blade security pull test	107
52.3	Blade security push test	108
52.4	Blade flexing test	108
53	Electronic Control Circuits Test.....	109
54	Cut Strainer/Enclosure Stress Withstand Test.....	109
55	Operational Test Following Environmental Conditionings.....	110
56	Switch Overload Test	111
57	Switch Endurance Test	111
58	Interlock System Testing	112
58.1	Cutter stopping time determination test.....	112
58.2	Interlock system endurance test.....	112
58.3	Cover/Guard misalignment test.....	113
59	Strain Relief Test	113
60	Push Back Relief Test.....	114
61	Wiring Flexing Test	114
62	Appliance Coupler Retention.....	114
63	Metal Enclosure Impact Tests.....	115
64	Enclosures of Polymeric Material for Portable Appliances.....	115
64.1	Scope	115
64.2	General.....	115
64.3	Flammability of enclosure	117
64.4	Resistance to hot-wire ignition	118
64.5	Impact	118

64.6	Stress-relief distortion	123
64.7	Input (repeated).....	124
64.8	Strain relief (repeated)	124
64.9	Accessibility	124
64.10	Spacings to enclosure	127
64.11	Abnormal operation.....	128
64.12	Severe-use conditions.....	129
64.13	Thermal aging	129
64.14	Load test.....	130
64.15	Non-metallic enclosure fasteners test.....	130
65	Enclosures of Polymeric Material for Stationary or Fixed Appliances	132
66	Thermoplastic Coil Forms and Thermoplastic Insulating Material	133
66.1	General.....	133
66.2	Normal conditioning	133
66.3	Abnormal conditioning.....	133
66.4	Running-burnout conditioning.....	134

MANUFACTURING AND PRODUCTION TESTS

67	Dielectric Voltage-Withstand Test	135
68	Grounding Continuity Test.....	137
69	Polarization Test.....	137
70	Electrical Indicating Device	137

MARKINGS

71	General	137
72	Cautionary	139
72.1	General.....	139
72.2	Food mixer	140
72.3	Blending mixer	141
72.4	Cord-connected knife	142
72.5	Battery-operated knife	142
72.6	Combination cleaver-meat tenderizer	142
72.7	Vegetable shredder/slicer (cone type)	142
72.8	Vegetable shredder/slicer (disc type)	142
72.9	Food processor, food chopper, and baby-food chopper	142
72.10	Baby-food grinder	143
72.11	Juice extractor (centrifugal type)	143
72.12	Slicer	143
72.13	Ice crushing appliance and ice-crushing attachment	143
72.14	Appliance with a lamp	143
72.15	Appliance (outdoor-use type).....	143
72.16	Multi-speed appliance	143
72.17	Appliance cart or stand.....	144
72.18	Wand-type mixer.....	144
72.19	Product with detachable battery/battery pack	144
72.20	Blender with capacitive touch screen and appliance with stand-by mode.....	144
72.21	Appliances with a jar grasping function	144
72.22	Appliances with interlocks.....	145
73	Carton Marking	145

INSTRUCTION MANUAL

74	General	145
----	---------------	-----

75	All Appliances	146
76	Specific Appliances	147
	76.1 Food mixers	147
	76.2 Blending mixers	147
	76.3 Liquid mixers	149
	76.4 Cord-connected knives	149
	76.5 Battery-operated knives	150
	76.6 Can openers	150
	76.7 Knife sharpeners	150
	76.8 Combination cleaver-meat tenderizers	150
	76.9 Vegetable shredders (cone type).....	150
	76.10 Vegetable shredder/slicers (disc type)	151
	76.11 Meat grinders.....	151
	76.12 Baby-food chopper	151
	76.13 Baby-food grinders.....	151
	76.14 Ice cream freezers	151
	76.15 Ice crushers.....	152
	76.16 Juicers (reamer type)	152
	76.17 Juicers or juice extractors (centrifugal type)	152
	76.18 Slicers.....	152
	76.19 Food processors.....	153
	76.20 Food choppers	153
	76.21 Coffee or grain mills	153
	76.22 Outdoor-use appliances	153
	76.23 Appliances intended for use with a cart or stand	154
	76.24 Appliance carts or stands	154
	76.25 Multi-speed appliances.....	154
	76.26 Battery operated appliances (with separate chargers).....	154
	76.27 Battery operated appliances	154
	76.28 Under-cabinet and wall-mounted products, and appliances provided with a hanging means	154
	76.29 Pasta mixers-extruders	155
	76.30 Pasta extruding attachments and masticating juicers	155
	76.31 Wand-type mixers	155
	76.32 Blender with capacitive touch screen and appliances with stand-by mode	155
	76.33 Appliance intended to be supplied by a Universal Serial Bus (USB)	155
77	User Maintenance	156
78	Mounting Instructions	156
79	Appliance- Outdoor Use	156
80	Polarization.....	157

SUPPLEMENT SA – HOUSEHOLD AND HOSPITALITY-USE SINGLE-SERVING COLD BEVERAGE DISPENSERS

SA1	Scope	159
SA2	Glossary	159
SA3	Components.....	159
SA4	Mechanical Assembly – Hospitality-Use Appliances	159
SA5	Power Supply Connections – Hospitality-Use Appliances.....	160
SA6	Flooding of Live Parts	160
SA7	Thermal and Acoustic Insulation	161
SA8	Parts Subject to Pressure	161
	SA8.1 Vapor pressure	161
	SA8.2 Liquid pressure	162
	SA8.3 Pressure relief devices	163
SA9	Appliances with Means for Thermoelectric Cooling.....	163

SA10	Input Test	164
SA11	Normal Temperature.....	164
SA12	Abnormal Operation.....	164
	SA12.1 General	164
	SA12.2 Continuous operation – hospitality use appliances	165
	SA12.3 Thermoelectric cooling systems	165
	SA12.4 Blocked solenoid.....	166
SA13	Moisture Resistance Tests.....	166
	SA13.1 Overfill.....	166
	SA13.2 Water valve failure.....	166
SA14	Test for Permanence of Cord Tag	166
SA15	Markings – Hospitality Use	167
SA16	Important Safeguards – Hospitality Use Cord Tag.....	167
SA17	User Maintenance Instructions – Hospitality Use	168

SUPPLEMENT SB – SAFETY OF SMART ENABLED HOUSEHOLD FOOD PREPARING MACHINES

INTRODUCTION

SB1	Scope	169
-----	-------------	-----

CONSTRUCTION

SB2	General.....	169
	SB2.1 Controls	169
	SB2.2 Separation of circuits	170
	SB2.3 Communication and display devices	170
	SB2.4 Communication conductors and cables.....	170
	SB2.5 Communication connectors.....	171
	SB2.6 Smart enabled or remote operation.....	171
SB3	Functional Safety.....	171
SB4	Resistance to Electro-Magnetic Phenomena (Immunity)	172

MARKINGS AND INSTRUCTIONS

SB5	Markings and Instructions.....	173
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INTRODUCTION

1 Scope

1.1 These requirements cover household motor-operated food preparing machines and kitchen accessories such as knife sharpeners and can openers, that are intended to be operated for short-periods of time resulting in cumulative use-time per year of less than 100 hours and that are for use in accordance with the National Electrical Code, ANSI/NFPA 70.

1.2 In the following text, a requirement that applies to one type of equipment coming within its scope, such as a blender, or mixer will be so identified by a specific reference in that requirement to the type of equipment involved. In the absence of such specific reference or if the term appliance is employed, it is to be understood that the requirement applies to all of the types of equipment covered by the standard.

1.3 These requirements cover cord-connected and permanently wired motor-operated appliances rated at a nominal 120 V including appliances supplied by low-voltage power supplies, and battery-operated appliances provided with battery chargers.

1.4 These requirements cover appliances for household use. The requirements in the Standard for Motor-Operated Commercial Food Preparing Machines, UL 763 are employed for the evaluation of appliances also intended for commercial application.

1.5 This standard does not cover sanitation, contamination, or noise aspects of these products. Reference to these items can be found in the Standard for Food, Drug and Beverage Equipment, ANSI/ASME F2.1.

1.6 An appliance employing a heating element is judged on the basis of its compliance with the requirements of this Standard, insofar as they apply and further appropriate requirements applicable to household cooking appliances.

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 ACCESSIBLE PART OR SURFACE – A part or surface subject to contact by persons under any condition of normal operation or user function. See [7.9](#), [7.11](#), [7.12](#), [26.5](#), [37.4](#) and [49.1.5](#) for details.

4.3 APPLIANCE COUPLER – A single-outlet, female contact device for attachment to a flexible cord as part of a detachable power-supply cord to be connected to an appliance inlet (motor attachment plug).

4.4 APPLIANCE INLET (MOTOR ATTACHMENT PLUG) – A male contact device mounted on an end product appliance to provide an integral blade configuration for the connection of an appliance coupler or cord connector.

4.5 APPLIANCE (FLATIRON) PLUG – An appliance coupler type of device having a cord guard and a slot configuration specified for use with heating or cooking appliances.

4.6 ATTENDED APPLIANCE – An appliance intended for use where operator presence is required for the equipment to function but is not necessarily required for the equipment to operate. Operator absence is effectively limited to short durations due to one or more characteristics of the equipment such as production of excessive noise or vibration. Examples include food processors, can openers, blenders, and food mixers.

4.7 ATTENDED PORTABLE INTERMITTENT-DUTY APPLIANCE – A portable attended appliance intended for infrequent and short-time use. Food mixers and can openers are examples of this type of equipment.

4.8 Deleted

4.9 AUTOMATICALLY CONTROLLED APPLIANCE – An appliance is considered to be automatically controlled under any one or more of the following conditions:

- a) If the repeated starting of the appliance, beyond one complete predetermined cycle of operation, to the point where some form of limit switch opens the circuit, is independent of any manual control.
- b) If, during any single predetermined cycle of operation, the motor is caused to stop and restart one or more times.
- c) If, upon energizing the appliance, the initial starting of the motor may be intentionally delayed beyond normal, conventional starting.
- d) If, during any single predetermined cycle of operation, automatic changing of the mechanical load may reduce the motor speed to the point of reestablishing the starting-winding connections to the supply circuit.

4.10 BABY FOOD CHOPPER – A food chopper intended to chop cooked meat or vegetables in small quantities for immediate consumption as indicated in the operating instructions. A chopper also intended for processing other food loads, such as cheese, nuts or raw meat or vegetables, is considered a food chopper.

4.11 BABY FOOD GRINDER - A meat grinder intended to grind cooked meat or vegetables in small quantities for immediate consumption as indicated in the operating instructions. A grinder also intended for processing raw meat is considered a meat grinder.

4.12 BLENDER TAMPER – A food pusher provided with a blender to be applied through the cover opening to facilitate blending of some food loads.

4.13 BLENDER WITH A HEATING FUNCTION – A blender with instructions or control settings for heating the contents of the container either by friction during blending or by a heating element. A heating function may also be called a soup making function.

4.14 BLENDING MIXER – An appliance intended to pulverize solids, such as ice, vegetables or fruit, and to combine them into a blend, or to merge liquids and solids into a blend. A blending mixer may also be referred to as a blender.

4.15 CART – A stand – see [4.51](#) – provided with casters, wheels, rollers, or the like to make it mobile.

4.16 CASTER – A roller or swiveled wheel attached to a cart or stand that makes the cart or stand mobile.

4.17 CENTRIFUGAL JUICER – An appliance intended to juice various fruits and vegetables by use of a grating disc mounted within a straining basket that spins at high speed so that the juice is filtered through the strainer and the pulp is discharged via a discharge opening at the top of the straining basket.

4.18 CLOSED-TOP BLENDER CONTAINER – Food blending container with one opening that is used for securing the blade assembly.

4.19 COFFEE, SPICE, OR GRAIN GRINDER – A motor operated appliance that crushes coffee beans, spices, or grain into a powder by passing them through a system of closely fitting wheels or cones having serrated surfaces. This appliance will have an intake hopper and a discharge container.

4.20 COFFEE, SPICE OR GRAIN MILL – A motor operated appliance that chops coffee beans, spices, or grain into a powder by means of a system of blades rotating at high speed.

4.21 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.

4.22 CONTROL, AUXILIARY – A device or assembly of devices that provides a functional utility, is not relied upon as an operating or protective control, and therefore is not relied upon for safety.

4.23 CONTROL, OPERATING – A device or assembly of devices, the operation of which starts or regulates the end product during normal operation to comply with this end-product Standard. Operating controls are also referred to as “regulating controls”.

4.24 CONTROL, PROTECTIVE – A device or assembly of devices, the operation of which is intended to reduce the risk of electric shock, fire or injury to persons during normal and reasonably anticipated abnormal operation of the appliance. Protective controls are also referred to as “limiting controls” and “safety controls”.

4.25 CORD/CORDLESS APPLIANCE – An appliance that can be operated while cord connected or via the battery (cordless).

4.26 COUNTER-SUPPORTED APPLIANCE – An appliance that is physically supported by a counter, table or bench during the performance of its intended electrically-operated functions, such as for a blender – blending, is to be considered a counter supported appliance. Reference is to be made to the specific product's Use and Care Literature in establishing the intended electrically-operated functions of the appliance.

4.27 DAMP LOCATION – Partially protected place or area where the appliance is either used or stored under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, barns, and cold-storage warehouses.

4.28 DRY LOCATION – A place or area where the appliance is either used or stored not normally subject to dampness or wetness. A location temporarily subject to dampness or wetness, as in the case of a building under construction, is included in this category.

4.29 ENCLOSURE – That part of the appliance that:

- a) Renders inaccessible all or any parts of the equipment that may otherwise present a risk of electric shock; or

b) Reduces the likelihood of propagation of flame initiated by electrical disturbances occurring within.

4.30 FIXED APPLIANCE – An appliance that is fastened or otherwise secured at a specific location.

4.31 FOOD CHOPPER – A food processor without a slicing or shredding blade and without feed or discharge openings.

4.32 FOOD MIXER – An appliance intended for mixing food ingredients in a bowl with beater(s), dough hook(s), or a whisk. It may be hand-held or stand supported.

4.33 FOOD PROCESSOR – An appliance provided with various chopping, mixing, slicing and shredding blades that processes food by means of rotating blades within a container. A food processor may have additional blades intended for mixing dough. A food processor has a feed chute and may have a discharge opening.

4.34 HAND-SUPPORTED APPLIANCE – An appliance that is physically supported by any part of the body of the user during the performance of its intended electrically-operated functions, such as for an electric knife – carving meat, is to be considered a hand-supported appliance. Reference is to be made to the specific product's Use and Care Literature in establishing the intended electrically-operated functions of the appliance.

4.35 INDIVIDUAL SERVING SIZE OPEN-TOP BLENDER CONTAINER – Blender container, with a maximum capacity not exceeding 20 oz., where the blender blades are attached to the bottom of the container and the drinking lid is attached to the top of the container during blending. The drinking lid is provided with an integral cover which seals the drink opening during blending. When blending is completed, the container is inverted, so that the blender blades may be removed and the container bottom secured. The product is then consumed directly from the container via the sealable drink opening in the lid.

4.36 INTERLOCK – A device or arrangement by means of which the functioning of one part is controlled by the functioning of another, for safety purposes.

4.37 LINE-VOLTAGE CIRCUIT – A circuit classified as line voltage for the purpose of this Standard is one involving a maximum potential of not more than 125 V and having circuit characteristics in excess of those of a low-voltage circuit.

4.38 LIQUID MIXER – An appliance with an exposed rotating shaft intended to mix liquid ingredients within a provided cup. This is also known as a drink mixer or spindle type mixer.

4.39 LOW-VOLTAGE CIRCUIT – A circuit classified as low voltage is one involving a peak open-circuit potential of not more than 42.4 V supplied by a primary battery, by a standard Class 2 transformer, or by a combination of a transformer and a fixed impedance which, as a unit, complies with all performance requirements for Class 2 transformers.

4.40 MASTICATING JUICER – An appliance intended to juice various fruits and vegetables by use of an auger to crush the food load and a strainer to separate the juice from the pulp. A masticating juicer may also be referred to as an auger juicer or a slow juicer.

4.41 MAXIMUM CAPACITY – The maximum capacity of a container when completely filled regardless of any marked capacity or fill lines. When so indicated, the maximum capacity is determined while the unit is operating.

4.42 MEAT GRINDER – An appliance consisting of an auger and a feed tube intended for grinding pieces of raw meat into ground meat.

4.43 OPEN-TOP BLENDER CONTAINER – Food blending container with opening on the top provided with a separable cover.

4.44 PORTABLE APPLIANCE – An appliance that is actually moved or can easily be moved from one place to another in normal use. Some portable appliances, however, are not likely to be moved from one place to another in normal use.

4.45 RATED CAPACITY – The capacity of a container when filled to the maximum marked capacity or maximum fill line, whichever is greater.

4.46 REAMER JUICER – An appliance intended to juice citrus fruits by pushing the fruit halves against a rotating reamer cone.

4.47 REMOTELY CONTROLLED APPLIANCE – Control of an appliance by a command that can be initiated out of sight of the appliance using means such as telecommunications, sound controls or bus systems

4.48 SELF-HOLDING PROTECTOR – A device that is calibrated to open the motor circuit upon reaching a certain temperature but requires both cool down below the calibration point and removal of power for resetting of the protector. This is considered a manual reset device.

4.49 SLICER – An appliance with an exposed rotating slicing blade and a food carriage intended for slicing meats and cheeses.

4.50 SOUP MAKING BLENDER – A blender with instructions or control settings for heating the contents of the container either by friction during blending or by a heating element.

4.51 STAND – A structure intended to support an appliance.

4.52 STAND-BY MODE – When movable parts are not in motion, but the appliance control is energized. A separate means to de-energize the appliance, other than unplugging the appliance, is provided.

4.53 STATIONARY APPLIANCE – An appliance that is not easily moved from one place to another in normal use.

4.54 SUPPLEMENTARY OVERCURRENT PROTECTOR – A device designed to open the circuit automatically on a predetermined value of time versus current or voltage within the appliance. It is intended for use as overcurrent, or over- or under-voltage protection within the appliance where branch-circuit overcurrent protection is already provided.

4.55 UNATTENDED APPLIANCE – An appliance that is not an attended appliance. Examples include ice cream freezers and butter churns.

4.56 VACUUM BLENDER – A blender that incorporates, or is provided with, a pump to create a vacuum in the blender container during blending.

4.57 VEGETABLE SHREDDER/SLICER – An appliance with various slicing and shredding attachments in the form of discs or cones intended for slicing and shredding vegetables and cheeses. A cheese grating attachment may also be provided. A vegetable shredder/slicer has a feed chute and may have a discharge opening.

4.58 WAND-TYPE MIXER – A hand-held appliance with a momentary contact switch and a guarded rotating cutting blade on the bottom. This is also known as a wand mixer, hand blender, or immersion blender.

4.59 WET LOCATION – A place or area where the appliance is either used or stored exposed to weather and unprotected.

CONSTRUCTION

5 General

5.1 An appliance shall employ materials that are intended for the particular use and shall be made and finished with the degree of uniformity and grade of workmanship practicable in a well-equipped factory.

5.2 A blender with a heating function shall be evaluated as a blender in accordance with this standard, including the blender with a heating function requirements in Sections [10](#), [28](#), [30.4.7](#), [36.3](#), [64.1](#), [72.3](#) and [76.2](#), and also to the applicable requirements for a soup warmer in accordance with the following Sections of the Standard for Household Electric Coffee Makers and Brewing Type Appliances, UL 1082:

- a) Handles;
- b) Protection Against Injury to Persons;
- c) Normal Temperature Test, with respect to operation in a test corner and the handle temperatures except as specified in [28.2](#);
- d) Dynamic Stability Test;
- e) Overfill; and
- f) Gaskets and Seals, except gaskets and seals that are removable for cleaning shall comply with Section [41](#).

5.3 In addition to the requirements specified in [5.2](#), a blender with a heating function in which liquid is heated to greater than 115°F (46°C) shall also be evaluated to the following Sections of UL 1082:

- a) Handle Securement Tests;
- b) Stability Test; and
- c) Tip Over Test.

5.4 In addition to the requirements specified in [5.2](#) and [5.3](#), a blender with a heating function provided with a heating element shall also be evaluated to the Standard for Household Electric Skillets and Frying-Type Appliances, UL 1083, if it is intended to cook with oil to a depth greater than 0.5 in. (13 mm) during normal operation, and the following Sections of the Standard for Household Electric Coffee Makers and Brewing Type Appliances, UL 1082:

- a) Heating Elements,
- b) Thermal Cutoffs,
- c) Controls and Control Circuits,
- d) Overheating Protection,
- e) Power Input,

- f) Normal Temperature Test,
- g) Broken Element Test,
- h) Thermal Degradation,
- i) Dry Operation,
- j) Boil Dry Operation,
- k) Fusible Devices Test,
- l) Automatic Controls Test, and
- m) For appliances likely to be immersed in water for cleaning: Leakage Current as a Result of Moisture Tests.

5.5 An appliance intended to be supplied by a Universal Serial Bus (USB) power source, whether the USB power supply is provided with the appliance or not, shall be considered as powered by a Class 2 power supply and shall be:

- a) Provided with cable assemblies or wiring external to the unit, coiled or uncoiled, rated:
 - 1) VW-1 or FT 1 or better in accordance with the Standard for Appliance Wire Material, UL 758, if not exceeding 3.05 m (10 ft) in length; or
 - 2) CL2 or better in accordance with the Standard for Power-Limited Circuit Cables, UL 13, if longer than 3.05 m (10 ft) in length;
- b) Incapable of being supplied by other sources when powered from the USB source;
- c) Tested in accordance with [31.6](#) and [49.3](#);
- d) Rated and marked in accordance with [71.12](#) – [71.14](#); and
- e) Provided with user instructions in accordance with [76.33](#).

5.6 Appliances intended to be powered by an automotive adapter shall be:

- a) Provided with a plug and cord complying with the Standard for Vehicle Battery Adapters, UL 2089;
- b) Incapable of being supplied by other sources when powered from the automotive adapter; and
- c) Tested in accordance with [31.7](#).

6 Components

6.1 General

6.1.1 Except as indicated in [6.1.2](#), a component of a product covered by this standard shall comply with the requirements for that component, as indicated in [6.2](#) – [6.20](#) and the additional component requirements of this standard.

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

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

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.

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

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

6.1.5 A component not anticipated by the requirements of this standard, not specifically covered by the component standards specified in this standard and that involves a potential risk of electric shock, fire, or personal injury, shall be additionally investigated.

6.1.6 With respect to [6.1.5](#), reference to construction and performance requirements in another UL end product standard is appropriate where that standard anticipates normal and abnormal use conditions consistent with the application of motor-operated household food preparing machines.

6.1.7 Unless otherwise specified, components that do not present a risk of electric shock, fire or injury to persons, such as connectors in a low voltage circuit, are not required to meet the specified component standards.

6.2 Attachment plugs, receptacles, connectors, and terminals

6.2.1 Attachment plugs, appliance couplers, and appliance inlets (motor attachment plugs) shall comply with the Standard for Attachment Plugs and Receptacles, UL 498 or the Standard for Appliance Couplers for Household and Similar General Purposes – Part 1: General Requirements, UL 60320-1.

Exception No. 1: Attachment plugs and appliance couplers integral to power supply cords are covered under the requirements in the Standard for Cord Sets and Power-Supply Cords, UL 817, and need not comply with UL 498 or UL 60320-1.

Exception No. 2: A pin terminal assembly need not comply with UL 498 or UL 60320-1 if it complies with the following construction requirements and all applicable performance requirements as outlined in this standard:

a) *Mechanical Assembly, Section [8](#);*

b) *Power Supply Connections – Permanently-Connected Appliances, Section [11](#);*

c) *Live Parts, Section [14](#);*

d) *Electrical Insulation Section [15](#); and*

e) *Spacings, Section [17](#).*

6.2.2 Female devices (such as 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.

6.2.3 Quick-connect terminals, both connectors and tabs, shall comply with the Standard for Electrical Quick-Connect Terminals, UL 310, and shall be suitable for the wire size, type (solid or stranded), conductor material (copper or aluminum) and the number of conductors terminated. If insulated, the rated voltage and temperature shall be suitable for the intended use. Quick-connect terminals shall be applied per the installation instructions of the quick-connect terminal manufacturer.

6.2.4 Single and multipole connectors for use in data, signal, control and power applications within the appliance 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 Use in Data, Signal, Control and Power Applications, UL 1977.

6.2.5 Wire connectors shall comply with the Standard for Wiring Connectors, UL 486A-486B, the Standard for Splicing Wire Connectors, UL 486C, or the Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors, UL 486E, and shall be suitable for the wire size, type (solid or stranded), conductor material (copper or aluminum) and the number of conductors terminated. If insulated, the rated voltage and temperature shall be suitable for the intended use. Wire connectors shall be applied per the installation instructions of the wire connector manufacturer.

6.2.6 Terminal blocks shall comply with the Standard for Terminal Blocks, UL 1059, and, if applicable, be suitably rated for field wiring. A terminal block shall be suitable for the number of conductors per termination, wire size, type (solid or stranded), conductor material (copper or aluminum), voltage and current of the intended use.

6.3 Batteries and battery chargers

6.3.1 Lithium ion (Li-Ion) single cell batteries shall comply with the requirements for secondary lithium cells outlined in the Standard for Lithium Batteries, UL 1642. Lithium ion multiple cell batteries or lithium ion battery packs shall comply with the Standard for Household and Commercial Batteries, UL 2054.

6.3.2 Rechargeable nickel cadmium (Ni-Cad) cells and battery packs shall comply with the applicable construction and performance requirements of this end product standard.

6.3.3 Rechargeable nickel metal-hydride (Ni-MH) battery cells and packs shall comply with the applicable construction and performance requirements of this end-product standard or the applicable requirements for secondary cells or battery packs in the Standard for Household and Commercial Batteries, UL 2054.

6.3.4 Primary batteries (non-rechargeable) that comply with the relevant UL standard, as applicable, and [6.1](#) are considered to fulfill the requirements of this standard.

6.3.5 Class 2 battery charger shall comply with the Standard for Class 2 Power Units, UL 1310 or the Standard for Household and Similar Electrical Appliances – Safety – Part 2-29: Particular Requirements for Battery Chargers, UL 60335-2-29. Limited Power Source (LPS) battery chargers shall comply with the Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1 or the Standard for Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements, UL 62368-1.

6.3.6 A battery charger integral to the appliance or an induction charger shall comply with the applicable construction and performance requirements of this end-product standard. See also Section [12](#) for direct plug-in rechargeable appliances.

6.4 Capacitors and filters

6.4.1 Capacitors that are connected between the ungrounded and grounded conductors (across the line) or from one of these conductors to accessible dead metal of the appliance shall comply with:

- a) The Standard for Electromagnetic Interference Filters, UL 1283; or
- b) The Standard for Safety Requirements 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

6.4.2 A capacitor of a capacitor motor and a capacitor connected across the line (such as a capacitor for radio-interference elimination) shall be housed within an enclosure or container that protects the plates against physical damage and prevents the emission of flame or molten material resulting from failure of the capacitor. Except as noted in [6.4.3](#) and [6.4.5](#) the container shall be sheet steel having an average thickness of 0.020 inch (0.51 mm) or shall be so constructed as to afford equivalent protection.

Exception: A capacitor complying with the Standard for Capacitors, UL 810, or an electromagnetic interference filter with an integral enclosure complying with the Standard for Electromagnetic Interference Filters, UL 1283, is considered to be adequately protected.

6.4.3 The container of a capacitor may be of sheet metal less in thickness than that mentioned in [6.4.2](#) or of other appropriate material if the capacitor is mounted in an enclosure that houses other parts of the appliance that is acceptable for the enclosure of live parts.

6.4.4 Under both normal and abnormal conditions of use, a capacitor employing a dielectric medium more combustible than askarel shall not cause or increase a risk of electric shock or fire and shall be protected against expulsion of the dielectric medium.

Exception: A protected capacitor complying with the Standard for Capacitors, UL 810, or an electromagnetic interference filter complying with the Standard for Electromagnetic Interference Filters, UL 1283, is considered to have adequate protection against expulsion of the dielectric medium.

6.4.5 The individual enclosure of an electrolytic capacitor with means for venting is required to be such as to provide protection against physical injury only and the requirement for minimum enclosure thickness does not apply. The individual enclosure of an electrolytic capacitor not provided with means for venting and with an opening more than 1/16 inch (1.6 mm) wide between the capacitor enclosure and the motor need not comply with the requirement for enclosure thickness given in [6.4.2](#), if the capacitor does not present a risk of fire when subjected to the Capacitor Failure Test, Section [50](#).

Exception: An electrolytic capacitor complying with the Standard for Capacitors, UL 810 is considered to have adequate ventilation.

6.4.6 The voltage rating of a capacitor, other than a motor capacitor, shall be no less than the maximum steady-state potential to which the capacitor is subjected during operation of the appliance.

6.5 Controls

6.5.1 General

6.5.1.1 Components, wiring, printed wiring assemblies, insulation materials, and the like, and associated circuitry employed in controls shall be investigated and found acceptable for the application in accordance with the specific control standards with respect to the risk of electric shock, fire and injury to persons.

6.5.1.2 Auxiliary controls shall be evaluated in accordance with the applicable construction and performance requirements of this end-product standard. Auxiliary controls evaluated to the requirements specified for operating controls in [6.5.2](#) are considered to comply with this end-product standard.

6.5.1.3 A control regulating the motor speed and any other control not relied upon for compliance with this standard shall be evaluated as an auxiliary control.

6.5.2 Operating controls

6.5.2.1 Operating controls shall comply with:

- a) The Standard for Solid-State Controls for Appliances, UL 244A;
- b) The Standard for Temperature-Indicating and -Regulating Devices, UL 873; or
- c) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, and, where applicable, the relevant Part 2 standard from the UL 60730 series.

Exception: Except as specified in Exception No. 2 of [6.5.2.2](#), an electronic operating control may alternatively be evaluated as an auxiliary control in accordance with [6.5.1.2](#).

6.5.2.2 A control limiting the operating time during normal operation, starting or stopping the motor, and any control required for compliance with this standard during normal operation of the appliance shall be evaluated as an operating control.

Exception No. 1: An electronic control acting as an interlock required for compliance with this standard, shall be evaluated as a protective control.

Exception No. 2: An electronic control starting or stopping the motor shall be evaluated as an auxiliary control if:

- a) *The appliance has no accessible moving parts during normal operation likely to cause injury;*
- b) *The electronic control is placing the appliance in stand-by mode, where a single malfunction of a component can cause unexpected operation, in accordance with the Exception to [27.14](#); or*
- c) *During the Electronic Control Circuits Test of Section [53](#), malfunction or breakdown of a component does not result in loss of OFF control or unexpected operation of the motor.*

6.5.2.3 A capacitive touch screen control on a blender with a two-step ON function as specified in [30.4.6.3](#) shall additionally be subjected to the following without loss of the two-step ON function:

- a) Electronic Control Circuits Test of Section [53](#),
- b) Electrostatic Discharge of in accordance with Electromagnetic compatibility (EMC) – Part 4-2: Testing and Measurement Techniques – Electrostatic Discharge Immunity Test, IEC 61000-4-2, test level 4 being applicable. Ten discharges having a positive polarity and ten discharges having a negative polarity are applied at each preselected point, and
- c) Radiated Fields in accordance with Electromagnetic compatibility (EMC) – Part 4-3: Testing and Measurement Techniques – Radiated, Radio-Frequency, Electromagnetic Field Immunity Test, IEC 61000-4-3, test level 3 being applicable.

6.5.2.4 When evaluating an operating control to the UL 60730 series, the minimum test parameters specified in [Table 6.1](#) shall be applied.

Table 6.1
Operating Control Parameters

Operating control parameter	Minimum specification
FMEA	Conduct a failure-mode and effect analysis (FMEA) to identify component failures which may result in a risk of electric shock or fire.
Operating Ambient	Determined via the Normal Temperature Test on the appliance (Section 36)
Endurance Testing	6000 cycles of operation required for controls starting or stopping the motor
Overvoltage Category	Overvoltage Category II
Pollution Degree	Pollution Degree 2
Enclosure Flammability	As specified in Section 64 for portable appliances or Section 65 for other appliances

6.5.3 Protective controls

6.5.3.1 Protective controls shall comply with:

- a) The Standard for Solid-State Controls for Appliances, UL 244A;
- b) The Standard for Temperature-Indicating and -Regulating Devices, UL 873;
- c) The Standard for Thermal-Links – Requirements and Application Guide, UL 60691; or
- d) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, and, where applicable, the relevant Part 2 standard from the UL 60730 series.

6.5.3.2 In addition to the standards referenced in [6.5.3.1](#), electronic protective controls shall also be evaluated for reliability in accordance with:

- 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 Clause H 11.12 (Controls using software).

6.5.3.3 In addition to the standards referenced in [6.5.3.1](#) and [6.5.3.2](#), electronic protective controls relying upon software as a protective component shall also comply with:

- a) The Standard for Software in Programmable Components, UL 1998; or
- b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1.

6.5.3.4 A control serving as motor overload protection required in accordance with [6.10](#), limiting the operating time under abnormal operating conditions or acting as an interlock required for compliance with this standard, and any other control relied upon for compliance with this standard shall be evaluated as a protective control.

Exception: If the appliance complies with this standard with the control defeated, the control shall be evaluated as an auxiliary control.

6.5.3.5 When evaluating a protective control to the UL 60730 series, the minimum test parameters specified in [Table 6.2](#) shall be applied.

Table 6.2
Protective Control Parameters

Protective control parameter	Minimum specification
FMEA	Conduct a failure-mode and effect analysis (FMEA) to identify component failures which may result in a risk of electric shock, fire or injury and confirming protective function continues to operate as intended. ¹
Operating Ambient	Determined via the Normal Temperature Test on the appliance (Section 36)
Endurance Testing	Except for interlocks, as indicated in 6.19.3.2, 6000 cycles of operation required for controls starting or stopping the motor
Overvoltage Category	Overvoltage Category II
Pollution Degree	Pollution Degree 2
Enclosure Flammability	As specified in Section 64 for portable appliances or Section 65 for other appliances
Conducted Disturbances	Test Level 3
Radiated Electromagnetic Fields	Test Level 3
Fast Transient Bursts	Test Level 3 applied for 2 minutes in each polarity
Surge Immunity	Installation Class 2
Electrostatic Discharge	Test Level 3
Thermal Cycling	Temperature range: 10.0 ±2°C to the Operating Ambient
Software Class	Software Class B (See 6.5.3.3)
Notes:	
¹ For a magnetic interlock reed switch, the short-circuit failure mode of the contacts is excluded due to the Interlock System Endurance Test, Section 58.2	

6.6 Cords, cables, and internal wiring

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

6.6.2 Flexible cords and cables shall comply with the Standard for Flexible Cords and Cables, UL 62. Flexible cord and cables are considered to fulfill this requirement when preassembled in a power supply cord complying with the Standard for Cord Sets and Power Supply Cords, UL 817.

6.6.3 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:

- a) *The Standard for Thermoset-Insulated Wires and Cables, UL 44;*
- b) *The Standard for Thermoplastic-Insulated Wires and Cables, UL 83; or*
- c) *The Standard for Fixture Wire, UL 66.*

Exception No. 2: Insulated conductors located in a low-voltage circuit not involving the risk of personal injury need not comply with UL 758.

6.7 Cord reels

6.7.1 A cord reel shall comply with the special-use cord reel requirements of the Standard for Cord Reels, UL 355.

6.8 Lampholders and indicating lamps

6.8.1 Lampholders and indicating lamps shall comply with the Standard for Lampholders, UL 496.

6.8.2 Light emitting diode (LED) light sources shall comply with the Standard for Light Emitting Diode (LED) Equipment For Use In Lighting Products, UL 8750, unless the LED light source forms a part of a luminaire complying with the appropriate UL Standards. Individual light emitting diodes connected to the printed wiring board of a control and intended for indicating or decorative accent purposes shall be evaluated with the control.

6.9 Motors

6.9.1 A motor shall be acceptable for the particular application, and shall be capable of handling the maximum normal load of the appliance as described in [36.1.12](#) – [36.26](#) without introducing a risk of fire, electric shock, or injury to persons.

6.9.2 A motor shall comply with:

- a) The Standard for Rotating Electrical Machines – General Requirements, UL 1004-1, or
- b) The construction and performance requirements of this standard, when tested in conjunction with the appliance.

Exception No. 1: A motor located in a Low Voltage Circuit may be evaluated only for the Risk of Fire and Personal Injury in accordance with the applicable requirements of this standard.

Exception No. 2: An oil-filled motor shall be evaluated as an oil immersed machine in accordance with UL 1004-1.

6.9.3 With respect to evaluation of a motor to the Standard for Rotating Electrical Machines – General Requirements, UL 1004-1 per [6.9.2\(a\)](#), the following exceptions shall be applied:

- a) Motor controls shall be evaluated in accordance with [6.5](#).
- b) Parts of phenolic material in contact with live parts, other than magnet wire, such as brush holders or commutator insulation, shall be considered suitable without further evaluation of the material's electrical insulating properties if the material has:

- 1) A flammability rating of at least HB, and
- 2) A suitable relative thermal index (RTI) for the temperatures obtained during the Normal Temperature Test.

Exception: Phenolic material with an RTI of min 150°C (Electrical) is considered to meet this requirement for commutator insulation.

- c) Parts of other materials in contact with live parts, other than magnet wire, shall be evaluated in accordance with Spacings to enclosure, [64.10](#).
- d) For motors used in attended, portable, intermittent-duty appliances utilizing alternative spacings specified in the Standard for Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment, UL 840, conditions and requirements for Pollution Degree 2 shall be applied

6.9.4 With respect to evaluation of a motor to this standard per [6.9.2\(b\)](#), the following additional requirements shall be applied:

- a) A motor winding shall be resistant to the absorption of moisture and shall be formed and assembled in a uniform manner, such as free of loose turns, irregular crossovers, and poor ties. Magnet wire is not required to be additionally treated to resist absorption of moisture, but fiber slot liners, cloth coil wrap and similar moisture-absorptive materials should be provided with impregnation or otherwise treated to resist moisture absorption.
- b) A brush holder assembly shall be constructed so that if a carbon brush becomes worn away to the maximum possible extent, the spring or other parts of the assembly shall not defeat the required spacings between live parts and dead metal parts, or result in a live part becoming accessible.
- c) Motors that are provided with thermoplastic coil forms or thermoplastic insulating material shall comply with the requirements for Thermoplastic Coil Forms and Thermoplastic Insulating Material, Section [66](#).
- d) Resilient elastomer (e.g. rubber), thermoplastic, or non-metallic mounting of a motor relied upon for bonding of the motor in an appliance provided with grounding shall comply with the respective requirements of Standard for Rotating Electrical Machines – General Requirements, UL 1004-1, if the dead metal parts of the motor are accessible during normal use or servicing of the appliance.
- e) A starting or running capacitor of a motor in a permanently-connected appliance shall comply with UL 1004-1 with respect to the maximum available fault current.
- f) A motor shall be marked with the motor manufacturer name or identification, catalog or model number, rated voltage and rated frequency.
- g) All insulation systems employing integral ground insulation shall comply with the requirements specified in the Standard for Systems of Insulating Materials – General, UL 1446.
- h) A motor requiring a motor insulation system greater than Class 105 (A) due to motor winding temperatures obtained during appliance testing shall comply with UL 1446 for the Class insulation required.
- i) All motor materials shall be evaluated with respect to corrosion protection and galvanic compatibility. (See [9.3](#).) Winding terminal materials shall be suitable for the connection of motor leads. Wire connectors used to join live parts of dissimilar materials shall comply with the Standard for Wire Connectors, UL 486A-486B.

6.10 Motor overload protection

6.10.1 An appliance shall incorporate thermal or overcurrent protection in accordance with [6.10.6](#) if the appliance is unattended or remotely or automatically controlled. See [4.9](#) and [4.47](#).

6.10.2 An automatically controlled blender is considered to comply with [6.10.1](#) if it is provided with locked-rotor protection in accordance with [6.10.6](#).

6.10.3 The motor of an ice cream freezer (bucket type), butter churn or pasta mixer-extruder shall comply with the locked rotor protection in [6.10.6](#).

Exception: An ice cream freezer, butter churn or pasta mixer-extruder motor is considered to comply with the requirement in [6.10.6](#), if when the ice cream freezer, butter churn or pasta mixer-extruder container and the driven member are frozen together, the motor is energized and the temperature limits specified in [6.10.6](#) are not exceeded.

6.10.4 A motor intended to move air only by means of an air-moving fan that is integrally attached, keyed, or otherwise fixed to the motor shaft is not required to have running-overload protection.

6.10.5 A shaded-pole motor with a 2:1 or smaller ratio between locked-rotor and no-load currents and a 1 A or smaller difference between no-load and locked-rotor currents is considered to have acceptable overload protection if it is protected against locked-rotor conditions only.

6.10.6 Motor-overload protection required for an appliance shall consist of one of the following:

- a) Thermal motor protection complying with the Standard for Thermally Protected Motors, UL 1004-3.
- b) Impedance motor protection complying with (when the motor is tested as used in the appliance under locked-rotor conditions) the Standard for Impedance Protected Motors, UL 1004-2.
- c) Electronic motor protection complying with the Standard for Electronically Protected Motors, UL 1004-7.
- d) Other protection that is shown by test to be equivalent to the protection as specified in (a).

6.10.7 With respect to [6.10.6](#), for an appliance that includes a control that positively and reliably limits the length of the time the appliance can operate under normal operation, the duration of the temperature test and the endurance test, both under locked-rotor conditions, may be less than that specified but shall not be less than the time the appliance can operate. If an electronic control operates only under abnormal conditions to end the test or limit the motor temperatures, the control shall be evaluated as electronic motor protection per [6.10.6\(c\)](#) or the test shall be repeated with the electronic control defeated.

6.10.8 With respect to [6.10.6\(a\)](#), a thermal link provided for motor overload protection need not be evaluated in accordance with the Standard for Thermally Protected Motors, UL 1004-3 if it complies with the Standard for Thermal Links – Requirements and Application Guide, UL 60691, and the appliance complies with this standard.

6.10.9 With respect to the evaluation of electronic motor protection in accordance with [6.10.6\(c\)](#), the control shall be evaluated in accordance with [6.5](#) as a protective control.

6.10.10 The functioning of a motor-protective device provided as part of an appliance (whether such device is required or not) shall not result in a risk of fire or injury to persons. Compliance shall be determined by the following as applicable:

- a) For automatically-controlled appliances, compliance with [6.10.1](#);
- b) For appliances actuated by a momentary contact switch, compliance with the Continuous Operation Test, Section [48](#);
- c) For appliances with metal or partly-metallic enclosures, compliance with the Metal Enclosure Abnormal Locked Rotor Test, Section [49.1](#);
- d) For appliances with polymeric enclosures, compliance with the Enclosures of Polymeric Material for Portable Appliances, Section [64](#).
- e) For appliances provided with an automatic reset overload-protective device, automatic restarting shall not result in injury to persons. See [27.2](#); and
- f) For appliances provided with a self-holding protector, where automatic restarting would result in a risk of injury to persons, compliance with the Self-Holding Protector Abnormal Locked Rotor Test, Section [49.2](#).

6.11 Overcurrent protection

6.11.1 Fuses shall comply with the Standard for Low-Voltage Fuses – Part 1: General Requirements, UL 248-1; and the applicable Part of the UL 248 series for the specific fuse type.

6.11.2 Fuseholders shall comply with the Standard for Fuseholders – Part 1: General Requirements, UL 4248-1, and the applicable Part of the UL 4248 series for the specific fuseholder type.

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

6.11.4 A protective device shall be wholly inaccessible from outside the appliance except that the operating handle of a circuit breaker, the operating button of a manually operable motor protector, and similar parts may project outside the appliance enclosure.

6.11.5 If an appliance is provided with a single-pole overcurrent protective device and is required to employ a polarized plug, the overcurrent protective device shall be connected to the ungrounded conductor of the power-supply cord of an appliance. [Table 10.3](#) specifies the polarity identification of the power-supply cord conductors.

Exception: For portable, non-automatically starting appliances employing a motor rated 1-hp or less intended to be operated on a nominal 120 volts branch circuit and employing a plug rated at 15-amperes, an overcurrent protective device within the appliance is not prohibited from being located in either conductor of the power-supply cord, when the overcurrent protective device acts only as a supplementary overcurrent protector.

6.12 Polymeric materials and enclosures

6.12.1 Polymeric materials shall have:

- a) A suitable flammability rating in accordance with the Standard for Test for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, as specified in Section [64](#) for portable appliances or Section [65](#) for stationary and fixed appliances, and
- b) A suitable Functional-Use Temperature Index, Generic Thermal Index, or Relative Thermal Index (RTI) in accordance with Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

See also Section [15](#) for polymeric electrical insulation, Section [64](#) for portable appliances, Section [65](#) for stationary or fixed appliances, and Section [66](#) for thermoplastic motor insulation.

Exception: If the deterioration of a part formed of polymeric material does not result in noncompliance with this standard, the thermal index need not be determined.

6.12.2 Metallized polymeric parts or enclosures shall comply with the applicable requirements of the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C. This requirement is not applicable to metallized coating applied only to the exterior surfaces of the appliance such that flaking of the coating is not likely to enter the electrical enclosure of the appliance.

6.13 Power supplies

6.13.1 A Class 2 power supply shall comply with the Standard for Class 2 Power Units, UL 1310.

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

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

6.13.3 Limited Power Source (LPS) power supplies shall comply with the Standard for Information Technology Equipment – Safety – Part 1: General Requirements, UL 60950-1 or the Standard for Audio/Video, Information and Communication Technology Equipment – Part 1: Safety Requirements, UL 62368-1.

6.14 Printed wiring boards

- 6.14.1 Printed wiring boards shall comply with the Standard for Printed Wiring Boards, UL 796.
- 6.14.2 Printed wiring boards shall have a flammability class of at least HB.
- 6.14.3 Printed wiring boards containing line voltage circuits shall be rated for direct support.

6.15 Pumps

6.15.1 A pump provided with a vacuum blender shall comply with the construction and performance requirements of this Standard, unless it complies with the Standard for Motor-Operated Air Compressors, Vacuum Pumps, and Painting Equipment, UL 1450.

6.16 Semiconductors, relays and small electrical and electronic components

6.16.1 A power switching semiconductor device that is relied upon to provide isolation to ground shall comply with the Standard for Electrically Isolated Semiconductor Devices, UL 1557. The dielectric voltage withstand tests required by UL 1557 shall be conducted applying the criteria of Section [37](#), Dielectric Voltage-Withstand Test, of this end product standard.

6.16.2 An optical isolator that is relied upon to provide isolation between primary and secondary circuits or between other circuits as required by this standard shall comply with the Standard for Optical Isolators, UL 1577. The dielectric voltage withstand tests required by UL 1577 shall be conducted applying the criteria of Section [37](#), Dielectric Voltage-Withstand Test, of this end product standard.

6.16.3 Except as otherwise specified in this standard, component requirements are not specified for small electrical parts on printed wiring boards, including diodes, transistors, resistors, inductors, integrated circuits, and capacitors not directly connected to the supply source.

6.16.4 Relays shall comply with the Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, and, where applicable, the relevant Part 2 standard from the UL 60730 series; or the Standard for Industrial Control Equipment, UL 508.

6.17 Solenoids and electrically operated valves

6.17.1 Solenoids shall comply with the Outline of Investigation for Solenoids, UL 906.

6.17.2 Electrically operated valves shall comply with:

- a) The Standard for Electrically Operated Valves, UL 429; or
- b) The Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, and, where applicable, the relevant Part 2 standard from the UL 60730 series.

6.18 Supplemental insulation, insulating bushings and assembly aids

6.18.1 The requirements for supplemental insulation (e.g. tape, sleeving or tubing) are not specified unless the insulation or device is required for compliance with this standard. In such cases:

- 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;
- c) Tubing shall comply with the Standard for Extruded Insulating Tubing, UL 224.

6.18.2 Wire positioning devices required for compliance with this standard shall comply with the Standard for Positioning Devices, UL 1565.

6.18.3 Insulating bushings required for compliance with this standard shall comply the Standard for Insulating Bushings, UL 635. Tests specified in this Standard (e.g. Strain Relief Test) may still need to be performed to confirm the combination of the insulating bushing and the supporting part are suitable.

6.19 Switches, timers and interlocks

6.19.1 Switches

6.19.1.1 Switches shall comply with:

- a) The Standard for Switches for Appliances – Part 1: General Requirements, UL 61058-1;
- b) The Standard for General-Use Snap Switches, UL 20; or
- c) The construction and performance requirements of this standard, when tested in conjunction with the appliance.

6.19.1.2 With respect to evaluation of a switch to this standard per [6.19.1.1\(c\)](#), a switch shall comply with the Switch Overload Test of [56.1](#) and the Switch Endurance Test of [57.1](#).

6.19.1.3 A switch evaluated in accordance with [6.19.1.1](#) (a) or (b) shall be appropriate for the particular application, and shall have a current and voltage rating not less than that of the load which it controls when the appliance is operated normally.

6.19.1.4 In applying the requirement in [6.19.1.3](#) to a switch controlling a motor, the switch shall have a horsepower rating not less than that of the controlled motor.

Exception No. 1: A switch with suitable general purpose voltage and current ratings, but without a suitable horsepower rating, may be used if it complies with the Switch Overload Test of [56.1](#) or if:

- a) The power factor in the locked rotor condition is at least 80 percent; and*
- b) The locked rotor current is not more than 150 percent of the switch rating, for switches rated 10 A or less; or*
- c) The locked rotor current is not more than 125 percent of the switch rating, for switches rated greater than 10 A.*

Exception No. 2: A switch with a suitable voltage rating and a resistive current rating not less than twice the full-load current corresponding to the motor horsepower rating, per Article 430 of the National

Electrical Code, ANSI/NFPA 70, may be used if it complies with the Switch Overload Test of [56.1](#). Where the horsepower rating of the motor is not specified, the resistive current rating shall not be less than twice the rating of the appliance.

6.19.1.5 With reference to the requirement in [6.19.1.3](#), the resistive current rating of a switch that controls an inductive load other than a motor, such as a transformer or relay, shall not be less than twice the rated full-load current of the inductive load.

6.19.1.6 If, when energized, an appliance has moving parts that are likely to cause injury to persons, a motor control switch shall be provided on the appliance and shall have a plainly identified OFF position, or ON and OFF positions, in accordance with [6.19.1.7](#) and [6.19.1.8](#) as applicable. See also Exception No. 2 of [6.5.2.2](#) for electronic controls employed in place of a motor control OFF switch.

Exception No. 1: If a momentary contact switch with no means for locking in the on condition is used as the motor control switch, the ON and OFF markings may be omitted.

Exception No. 2: The OFF marking specified in [6.19.1.7](#) may be omitted for a product with a reliable standby condition if the construction complies with all of the following:

- a) *The same push button switch actuator is used for placing the unit in the OFF, ON and Standby conditions,*
- b) *The OFF and standby condition comply with the single fault reliability as specified in [27.14](#),*
- c) *The switch is marked with the Standby symbol (IEC 60417-5009) shown in [Figure 6.3](#), and*
- d) *The function of the switch and meaning of the symbol is described in the instruction manual per [74.6](#).*

Exception No. 3: The OFF and ON markings specified in [6.19.1.7](#) and [6.19.1.8](#) respectively may be replaced by the ON/OFF (push-push) symbol (IEC 60417-5010) shown in [Figure 6.4](#) if a single switch push button actuator is used for ON and OFF with separate and stable ON and OFF positions.

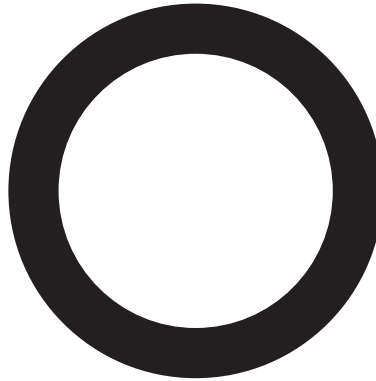
6.19.1.7 With reference to the requirement in [6.19.1.6](#), the OFF position of the switch shall be marked with either one or both of the following:

- a) The word "OFF", or
- b) The symbol shown in [Figure 6.1](#). See also [74.6](#).

6.19.1.8 With reference to the requirement in [6.19.1.6](#), the ON position of the switch, when identified, shall be marked with one or both of the following, as determined by the marking of the OFF position of the switch:

- a) The word "ON" when the OFF position of the switch is marked with the word "OFF", or
- b) The symbol shown in [Figure 6.2](#), when the OFF position of the switch is marked with the symbol shown in [Figure 6.1](#). See also [74.6](#).

Figure 6.1
Symbol for OFF Position



IEC 60417 Symbol 5008

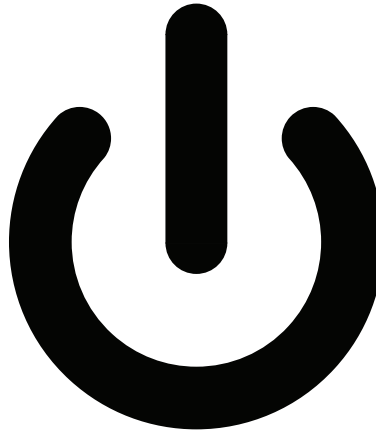
Figure 6.2
Symbol for ON Position



IEC 60417 Symbol 5007

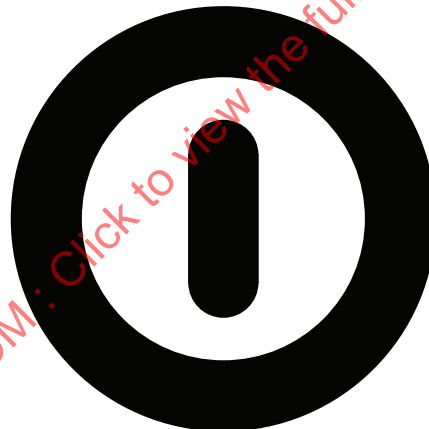
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Figure 6.3
Symbol for Standby Condition



su2581

Figure 6.4
Symbol for ON/OFF Position



su2582

6.19.1.9 If a portable appliance employs a motor rated at more than 1/3 horsepower, a motor-control switch for the motor shall be provided in the appliance. See [17.8](#).

6.19.1.10 An appliance shall not employ a through-cord switch.

6.19.1.11 A manually operated, line-connected, single pole switch, a triac controlling a motor, or other control device, intended for appliance ON-OFF operation shall be connected to the ungrounded conductor of the power-supply cord. [Table 10.3](#) specifies the polarity identification of the power-supply cord conductors.

6.19.2 Timing switches and controls

6.19.2.1 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 electro-mechanical arrangements shall comply with:

- a) The Standard for Clock-Operated Switches, UL 917; or
- b) Standard for Automatic Electrical Controls – Part 1: General Requirements, UL 60730-1, and, where applicable, the relevant Part 2 standard from the UL 60730 series.

6.19.2.2 A timer or time switch, incorporating electronic timing circuits or switching circuits, with or without separable contacts, shall be evaluated in accordance with [6.5](#).

6.19.3 Interlock systems

6.19.3.1 An interlock system required for compliance with this standard shall be capable of completing the Interlock Endurance Test of [58.2](#) without malfunction.

6.19.3.2 With respect to [6.19.3.1](#), except as indicated for centrifugal juicers per [30.7.6](#), coffee mills per [30.10.2](#) and pasta mixer-extruders per [30.11.1](#), the Interlock Endurance Test shall consist of 10,000 cycles of operation in the intended manner.

6.19.3.3 An interlock system required for compliance with this standard shall be such that both of the following conditions are met:

- a) When the cover or guard is removed, the moving parts shall stop within 4 seconds when subjected to the Cutter Stopping Time Determination Test of [58.1](#).

Exception: A centrifugal juicer shall not be subjected to the Cutter Stopping Time Determination Test.

- b) If the cover or guard can be assembled for use to actuate the interlock switch without being properly locked in place, any access opening to moving parts that can be created by the misalignment shall have a maximum vertical dimension of not more than 1 inch (25.4 mm) between the bowl and cover when subjected to the Cover/Guard Misalignment Test of [58.3](#).

6.20 Transformers

6.20.1 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.

6.20.2 Class 2 and Class 3 transformers shall comply with the Standard for Low Voltage Transformers – Part 3: Class 2 and Class 3 Transformers, UL 5085-3.

7 Frame and Enclosure

7.1 The frame and enclosure of an appliance shall be strong and rigid enough to resist the abuses likely to be encountered during normal service. The construction of the appliance shall preclude total or partial collapse with the attendant reduction of required minimum acceptable spacings, loosening or displacement of parts, and other serious defects which alone or in combination constitute an increase in the risk of fire, electric shock, or injury to persons.

7.2 An appliance shall be provided with enclosures of material acceptable for the particular application that shall house all electrical parts that may present a risk of fire or injury to persons under normal use and under reasonably foreseeable misuse.

7.3 Among the factors taken into consideration when an enclosure is being judged for acceptability are its: