

UL 82

ISBN 1-55989-573-X

Electric Gardening Appliances

Document Was Downloaded By Rice, Shi SHIMISHENG
For Use By KUANTECH CO LTD
12039 : 8/1/2007 - 2:08 AM

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL



Documents

Document Sharing Hub

Document Was Downloaded By Rice, Shi SHIMISHENG
For Use By KUANTECH CO LTD
12039 : 8/1/2007 - 2:08 AM

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM



Documents

Document Sharing Hub

Underwriters Laboratories Inc. (UL)
333 Pfingsten Road
Northbrook, IL 60062-2096

UL Standard for Safety for Electric Gardening Appliances, UL 82

Sixth Edition, Dated June 23, 1994

Revisions: This Standard contains revisions through and including February 20, 2007.

Summary of Topics

This revision to ANSI/UL 82 includes the deletion of obsolete asbestos and cotton insulated wire type and a clarification that sheet metal screws are not an acceptable means for securing grounding or bonding conductors to an enclosure.

UL Standards for Safety are developed and maintained in the Standard Generalized Markup Language (SGML). SGML -- an international standard (ISO 8879-1986) -- is a descriptive markup language that describes a document's structure and purpose, rather than its physical appearance on a page. Due to formatting differences resulting from the use of UL's new electronic publishing system, please note that additional pages (on which no requirements have been changed) may be included in revision pages due to relocation of existing text and reformatting of the Standard.

Text that has been changed in any manner is marked with a vertical line in the margin. Changes in requirements are marked with a vertical line in the margin and are followed by an effective date note indicating the date of publication or the date on which the changed requirement becomes effective.

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

Future Effective Dates	References
November 15, 2008	Paragraph 22.2

The revised requirements are substantially in accordance with UL's Proposal(s) on this subject dated December 8, 2006.

The revisions dated February 20, 2007 include a reprinted title page (page1) for this Standard.

The revisions dated April 19, 2006 editorially replace all references to UL 1020 with the reference to UL 60691.

The revisions dated December 22, 1998 were issued to change references to UL 547, Standard for Thermal Protectors for Motors, to UL 2111, Standard for Overheating Protection for Motors. UL 547 has been withdrawn and replaced by UL 2111. These revisions were also issued to remove the "94" prefix from the flammability classifications. This type of flame classification has become familiar globally, therefore there is no need to retain the "94" designation.

The revisions dated June 25, 1996 were issued to include Type W cords as an alternative to Type W-A cords, and eliminate the oxygen bomb test.

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

The UL Foreword is no longer located within the UL Standard. For information concerning the use and application of the requirements contained in this Standard, the current version of the UL Foreword is located on ULStandardsInfoNet at: <http://ulstandardsinfo.net.ul.com/ulforeword.html>

The master for this Standard at UL's Northbrook Office is the official document insofar as it relates to a UL service and the compliance of a product with respect to the requirements for that product and service, or if there are questions regarding the accuracy of this Standard.

UL's Standards for Safety are copyrighted by UL. Neither a printed copy of a Standard, nor the distribution diskette for a Standard-on-Diskette and the file for the Standard on the distribution diskette should be altered in any way. All of UL's Standards and all copyrights, ownerships, and rights regarding those Standards shall remain the sole and exclusive property of UL.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form by any means, electronic, mechanical photocopying, recording, or otherwise without prior permission of UL.

Revisions of UL Standards for Safety are issued from time to time. A UL Standard for Safety is current only if it incorporates the most recently adopted revisions.

UL provides this Standard "as is" without warranty of any kind, either expressed or implied, including but not limited to, the implied warranties of merchantability or fitness for any purpose.

In no event will UL be liable for any special, incidental, consequential, indirect or similar damages, including loss of profits, lost savings, loss of data, or any other damages arising out of the use of or the inability to use this Standard, even if UL or an authorized UL representative has been advised of the possibility of such damage. In no event shall UL's liability for any damage ever exceed the price paid for this Standard, regardless of the form of the claim.

UL will attempt to answer support requests concerning electronic versions of its Standards. However, this support service is offered on a reasonable efforts basis only, and UL may not be able to resolve every support request. UL supports the electronic versions of its Standards only if they are used under the conditions and operating systems for which it is intended. UL's support policies may change from time-to-time without notification.

UL reserves the right to change the format, presentation, file types and formats, delivery methods and formats, and the like of both its printed and electronic Standards without prior notice.

Purchasers of the electronic versions of UL's Standards for Safety agree to defend, indemnify, and hold UL harmless from and against any loss, expense, liability, damage, claim, or judgement (including reasonable attorney's fees) resulting from any error or deviation introduced while purchaser is storing an electronic Standard on the purchaser's computer system.

If a single-user version electronic Standard was purchased, one copy of this Standard may be stored on the hard disk of a single personal computer, or on a single LAN file-server, or the permanent storage device of a multiple-user computer in such a manner that this Standard may only be accessed by one user at a time and for which there is no possibility of multiple concurrent access.

If a multiple-user version electronic Standard was purchased, one copy of the Standard may be stored on a single LAN file-server, or on the permanent storage device of a multiple-user computer, or on an Intranet server. The number of concurrent users shall not exceed the number of users authorized.

Electronic Standards are intended for on-line use, such as for viewing the requirements of a Standard, conducting a word search, and the like. Only one copy of the Standard may be printed from each single-user version of an electronic Standard. Only one copy of the Standard may be printed for each authorized user of a multiple-user version of an electronic Standard. Because of differences in the computer/software/printer setup used by UL and those of electronic Standards purchasers, the printed copy obtained by a purchaser may not look exactly like the on-line screen view or the printed Standard.

An employee of an organization purchasing a UL Standard can make a copy of the page or pages being viewed for their own fair and/or practical internal use.

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

New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

Copyright © 2007 Underwriters Laboratories Inc.

Document Was Downloaded By Rice, Shi SHIMISHENG
For Use By KUANTECH CO LTD
12039 : 8/1/2007 - 2:08 AM
UL COPYRIGHTED MATERIAL –

NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL



Documents

Document Sharing Hub

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

Page	Date
1	February 20, 2007
2-3	April 19, 2006
4-4B	January 7, 2000
5	March 14, 2002
6	April 19, 2006
7	March 14, 2002
8	June 23, 1994
9-10	March 14, 2002
10A-10B	December 22, 1998
11-12	January 7, 2000
13	June 23, 1994
14	June 25, 1996
15-19	June 23, 1994
20-21	June 25, 1996
22	February 20, 2007
23	June 23, 1994
24	December 22, 1998
25	June 23, 1994
26-27	December 22, 1998
28-28B	February 20, 2007
29	June 23, 1994
30	June 25, 1996
31-32B	December 22, 1998
33-36	June 25, 1996
37-38B	January 7, 2000
39	June 23, 1994
40	June 25, 1996
41-42	June 23, 1994
43-44A	December 22, 1998
44B-44D	June 25, 1996
45	June 23, 1994
46-46B	December 22, 1998
47	June 9, 1997
48	June 23, 1994
49	December 22, 1998
50	June 25, 1996
51-52	June 23, 1994
53	December 22, 1998
54-58	June 23, 1994
59	June 25, 1996
60	June 23, 1994
61-62B	June 25, 1996
63	June 23, 1994
64-64B	December 22, 1998
65	June 23, 1994
66	June 25, 1996
67-68	December 22, 1998
68A-70	January 7, 2000
71	June 25, 1996

UL COPYRIGHTED MATERIAL –

NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM



Documents

Document Sharing Hub

72	June 23, 1994
73	June 25, 1996
74-80	June 23, 1994
81	June 25, 1996
82-84	June 23, 1994
85-88	June 25, 1996
SA1-SA2	June 23, 1994
SA3	June 25, 1996
SA4	June 23, 1994
SA5-SA6	January 7, 2000
SA7-SA9	June 25, 1996
SA10-SA10B	January 7, 2000
SA11-SA12	June 25, 1996
SA13	June 23, 1994
SA14	June 25, 1996
SA15-SA16	June 23, 1994
A1-A2	February 20, 2007
SR1-SR2	February 20, 2007

Document Was Downloaded By Rice, Shi SHIMISHENG
For Use By KUANTECH CO LTD
12039 : 8/1/2007 - 2:08 AM
UL COPYRIGHTED MATERIAL –

NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM



Documents

Document Sharing Hub

No Text on This Page

Document Was Downloaded By Rice, Shi SHIMISHENG
For Use By KUANTECH CO LTD
12039 : 8/1/2007 - 2:08 AM

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL



Documents

Document Sharing Hub

JUNE 23, 1994

(Title Page Reprinted: February 20, 2007)



ANSI/UL 82-2007

1

UL 82

Standard for Electric Gardening Appliances

First Edition – March, 1973

Second Edition – February, 1974

Third Edition – May, 1977

Fourth Edition – January, 1986

Fifth Edition – December, 1991

Sixth Edition

June 23, 1994

The most recent designation of ANSI/UL 82 as an American National Standard (ANSI) occurred on February 5, 2007.

This ANSI/UL Standard for Safety, which consists of the Sixth edition with revisions through February 20, 2007, is under continuous maintenance, whereby each revision is ANSI approved upon publication.

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

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

ISBN 1-55989-573-X

COPYRIGHT © 2007 UNDERWRITERS LABORATORIES INC.

Document Was Downloaded By Rice, Shi SHIMISHENG
For Use By KUANTECH CO LTD
12039 : 8/1/2007 - 2:08 AM

**UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL**



Documents

Document Sharing Hub

No Text on This Page

Document Was Downloaded By Rice, Shi SHIMISHENG
For Use By KUANTECH CO LTD
12039 : 8/1/2007 - 2:08 AM

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL



Documents

Document Sharing Hub

CONTENTS

PART 1 – ALL GARDENING APPLIANCES

INTRODUCTION

1 Scope	7
2 Glossary	7
3 Components	9
4 Units of Measurements	10

CONSTRUCTION

5 Frames and Enclosures	10
5.1 General	10
5.2 Metallic enclosures	10A
6 Polymeric Enclosures	11
7 Handles	12
8 Accessibility of Moving Parts	13
9 Accessibility of Live Parts	14
9.1 General	14
9.2 Assembly screws	17
10 Mechanical Assembly	17
10.1 General	17
10.2 Appliances shipped partially disassembled	19
11 Protection Against Corrosion	19
12 Supply Connections	20
12.1 Power supply cord	20
12.2 Attachment plug	20
12.3 Strain relief	20
12.4 Bushings	21
13 Live Parts	21
14 Internal Wiring - Electrical Connections	21
14.1 General	21
14.2 Splices and connections	23
15 Electrical Insulation	23
16 Motors	24
16.1 General	24
16.2 Overtemperature protection	24
17 Switches and Controls	24
18 Lampholders	25
19 Capacitors	25
20 Printed Wiring Boards	26
21 Spacings	26
22 Grounding	28
23 Rotating Parts	29

UL COPYRIGHTED MATERIAL –

NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL



Documents

Document Sharing Hub

PERFORMANCE

24	General	29
25	Leakage Current Test	30
26	Starting Current Test	32
27	Continuity of Ground Connection Test	32
28	Input Test	32A
29	Dielectric Voltage Withstand Test	33
30	Temperature Test	33
31	Humidity Conditioning Test	38A
32	Water Spray Test	39
33	Abnormal Operation Tests	42
33.1	Component short- and open-circuit test	42
33.2	Capacitor overvoltage test	42
34	Handle Tests	42
35	Brush Cap Test	43
36	Rotating Members Test	44
36A	Structural Integrity Test	44A
36B	Thrown Object Test	44A
36C	Throwback Test	44B
36D	Balance Test	44B
37	Attachment Plug Test	44C
38	Strain Relief Tests	45
39	Cord Flexing Test	45
40	Pressure Pad Test	46A
41	Switch and Control Tests	47
41.1	General	47
41.2	Reversing switch	48
41.3	Speed changing switch	48
42	Accelerated Aging Test	48
43	Materials Not Classed HB	49
43.1	Mold stress evaluation	49
43.2	Resistance to impact test	50
43.3	Abnormal operation test	52
43.4	Flame resistance test	52
44	Polymeric Materials Classed HB	53
44.1	Mold-stress evaluation and input test	53
44.2	Resistance to impact test	53
44.3	Overload test	53
44.4	Physical properties of enclosure material tests	54
45	High Current Arc Ignition Test	54
46	Permanence of Marking Tests	55
46.1	General	55
46.2	Oven aging test	55
46.3	Immersion test	56
46.4	Standard atmosphere test	56

MANUFACTURING AND PRODUCTION TESTS

47	General	56
48	Production Line Dielectric Voltage Withstand Test	56
49	Production Line Grounding Continuity Test	57

UL COPYRIGHTED MATERIAL -

NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL



Documents

Document Sharing Hub

RATING

50 General	58
------------------	----

MARKING

51 General	58
52 Cautionary	59
53 Instruction Manual	60
53.1 General	60
53.2 Important safety instructions	61

PART 2 – SPECIFIC APPLIANCES**GRASS SHEARS**

54 Construction	65
55 Performance	66

LAWN TRIMMERS, EDGERS, AND EDGER-TRIMMERS

56 Construction	66
56.1 General	66
56.2 Guarding	66
56.3 Knife blade	68
56.4 Cutting blade position	68
56.5 Switches	68
56.6 Gauges	68A
56.7 Support	68A
57 Performance	68A

CULTIVATORS

58 Construction	68A
59 Performance	68A

SHREDDERS, SHREDDER-BAGGERS, OR CHIPPERS

59A Construction	68B
60 Performance	69

PART 3 – DOUBLE-INSULATED APPLIANCES**GENERAL**

61 Scope	70
----------------	----

CONSTRUCTION

62 Accessibility of Live Parts	70
63 Insulation	70
64 Supply Connections	71
64.1 Power supply cord	71
64.2 Strain relief	72
64.3 Bushing	72
65 Grounding	72
66 Internal Wiring	72
67 Capacitors	74
68 Brush Holders	74
69 Commutators and Armature End-Turns	75
70 Switches	75
71 Spacings	76

PERFORMANCE

72 Leakage Current Test	77
73 Insulation Resistance Test	78
74 Dielectric Voltage Withstand Test	79
75 Resistance to Impact Tests	80
75.1 General	80
75.2 Overall appliance	80
75.3 Switches, handles, and knobs	80
76 Resistance to Heat Test	81
77 Overload Test	81
77.1 General	81
77.2 Test terminated – appliance does not operate	84
77.3 Test terminated – appliance still operates	85
78 Armature Investigation	86

MARKING

79 Details	86
------------------	----

SUPPLEMENT SA - BATTERY-OPERATED GARDENING APPLIANCES**GENERAL**

SA1 Scope	SA1
SA2 Glossary	SA1

CONSTRUCTION

SA3 Battery Enclosure	SA2
SA3.1 General	SA2
SA3.2 Enclosures for vented batteries	SA2
SA4 Batteries, Battery Leads, And Connections	SA3
SA5 Spacings	SA5

UL COPYRIGHTED MATERIAL -
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL



Documents

Document Sharing Hub

SA6 Battery Charger	SA7
SA7 Battery Cables	SA7
SA8 Switching Devices	SA7
SA9 Overcurrent Protection	SA8
SA10 Enclosure Ventilation	SA8

PERFORMANCE

SA11 Charging Input Test	SA8
SA12 Temperature Test	SA9
SA13 Dielectric Voltage Withstand Test	SA10
SA14 Battery Enclosure Test	SA10
SA15 Slosh Test	SA10
SA16 Battery Overfill/Spillage Test	SA11
SA17 Abnormal Operation Tests	SA11
SA18 Switch Test	SA12
SA19 Battery Compartment Ventilation Test	SA12

MARKING

SA20 Details	SA13
SA21 Instruction Manual	SA14

APPENDIX A

Standards for Components.....	A1
-------------------------------	----

Document Was Downloaded By Rice, Shi SHIMISHENG
For Use By KUANTECH CO LTD
12039 : 8/1/2007 - 2:08 AM
UL COPYRIGHTED MATERIAL -

NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM



Documents

Document Sharing Hub

This page intentionally left blank.

Document Was Downloaded By Rice, Shi SHIMISHENG
For Use By KUANTECH CO LTD
12039 : 8/1/2007 - 2:08 AM

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM



Documents

Document Sharing Hub

PART 1 – ALL GARDENING APPLIANCES

INTRODUCTION

1 Scope

1.1 These requirements cover cord-connected, electrically-operated gardening appliances, such as cultivators, edger-trimmers, and the like, rated 250 volts or less for use in accordance with the National Electrical Code, NFPA 70.

1.2 These requirements also cover battery-operated gardening appliances.

1.3 These requirements do not cover sprayers, foggers, or equipment for use in hazardous locations as defined in the National Electrical Code, NFPA 70.

1.4 These requirements do not cover electrically operated lawn mowers or garden tractors or their attachments.

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

1.5 revised January 7, 2000

2 Glossary

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

2.2 ACCESSIBLE PART – A part so located that it can be contacted by a person, either directly or by means of a probe or tool, or that is not recessed the required distance behind an opening. See Accessibility of Moving Parts, Section 8.

2.3 BASIC INSULATION – The insulation applied to live parts to provide basic protection against electric shock.

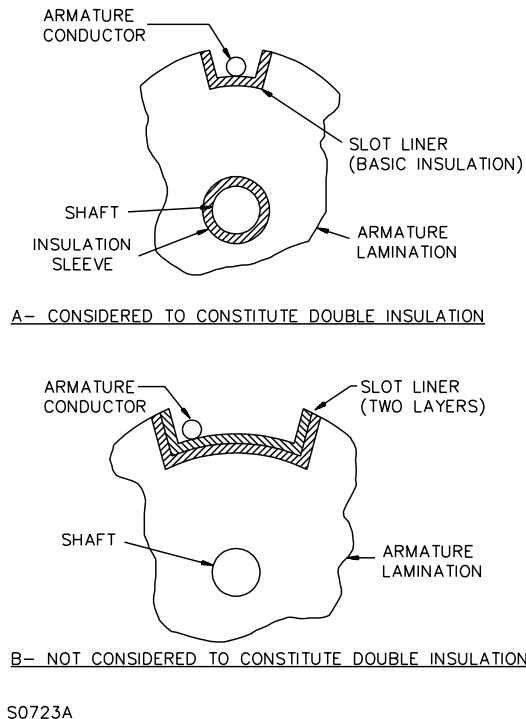
2.3 revised June 25, 1996

2.4 CUTTER AREA – The area through which the cutting means moves and in which a foreign object may be struck by the cutting means.

2.5 DEAD-MAN CONTROL – A control intended to automatically interrupt power when the actuating force supplied by the operator is removed.

2.6 DOUBLE INSULATION – An insulation system comprised of basic insulation and supplementary insulation, with the two insulations physically separated and so arranged that they are not simultaneously subjected to the same deteriorating influences, such as temperature, contaminants, and the like, to the same degree. See Figure 2.1.

Figure 2.1
Example of double insulation



2.7 ENCLOSURE – That portion of an appliance that:

- a) Renders all or any part that may otherwise present a risk of electric shock or injury to persons inaccessible; or
- b) Prevents propagation of flame initiated by electrical disturbances occurring within the appliance.

2.8 FOOT PROBE – A simulated human foot. See Figure 2.2 for dimensional details.

2.9 GROUND-SUPPORTED APPLIANCE – An appliance that, during normal operation, is supported entirely or in part by the ground.

2.10 GUARD – A part of an assembly provided for shielding parts that may present a risk of fire, electric shock, or injury to persons.

2.11 HAND-SUPPORTED APPLIANCE – An appliance that, during normal operation, must be completely supported by the user.

2.12 LEAKAGE CURRENT – All current or currents, including capacitively-coupled currents, that may be conveyed between exposed conductive surfaces of an appliance and ground or other exposed conductive surfaces of the appliance.

2.13 LIVE PART – A part energized with respect to earth or energized with respect to some other part.

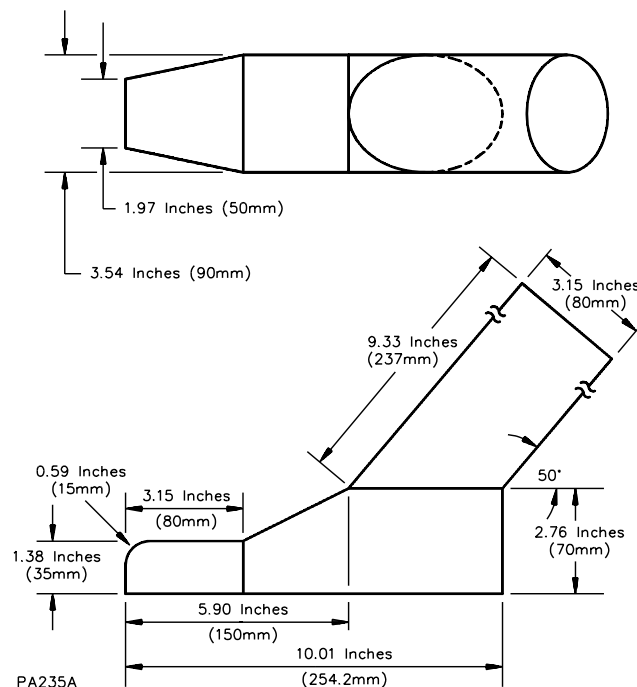
2.14 OPERATOR CONTROL – Any device necessary for operating an appliance including a drive-engaging control, a movable-guide control, a drive-speed changing control, and a deflector control.

2.15 REINFORCED INSULATION – An improved basic insulation with such mechanical and electrical qualities that it, in itself, provides the same degree of protection against electric shock as double insulation. It may consist of one or more layers of insulating material.

2.16 SUPPLEMENTARY INSULATION – An independent insulation provided in addition to the basic insulation to protect against electric shock in case of mechanical rupture or electrical breakdown of the basic insulation. An enclosure of insulating material may form a part or the whole of the supplementary insulation.

Figure 2.2
Foot probe

Figure 2.2 revised December 22, 1998



3 Components

3.1 Except as indicated in 3.2, a component of a product covered by this standard shall comply with the requirements for that component. See Appendix A for a list of standards covering components generally used in the products covered by this standard.

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

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

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

3.4 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.

4 Units of Measurements

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

CONSTRUCTION

5 Frames and Enclosures

5.1 General

5.1.1 The frame and enclosure of an appliance shall have the strength and rigidity necessary to resist the abuses to which it is likely to be subjected during normal service without total or partial collapse resulting in a risk of fire, electric shock, or injury to persons due to reduction of spacings, loosening or displacement of parts, and other serious defects.

5.1.2 Among the factors taken into consideration when judging the acceptability of a frame or enclosure are its:

- a) Mechanical strength;
- b) Resistance to impact;
- c) Moisture-absorptive properties;
- d) Combustibility and resistance to ignition from electrical sources;
- e) Resistance to corrosion;
- f) Resistance to distortion at temperatures to which the enclosure may be subjected under conditions of normal or abnormal use; and
- g) Dielectric properties, insulation resistance, and resistance to arc tracking. A material that will be exposed to oil, acids, solvents, reagents, cleaning agents, or ozone as part of the use or application of the appliance shall not be adversely affected by these environments, as determined by tests.

5.2 Metallic enclosures

5.2.1 The thickness of cast- and sheet-metal portions of an enclosure shall not be less than the applicable value specified in Table 5.1.

Exception: The specifications in Table 5.1 do not apply to an enclosure found to be acceptable when judged under the considerations mentioned in 5.1.2.

Document Was Downloaded By Rice, Shi SHIMISHENG
For Use By KUANTECH CO LTD
12039 : 8/1/2007 - 2:08 AM

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL



Documents

Document Sharing Hub

No Text on This Page

Document Was Downloaded By Rice, Shi SHIMISHENG
For Use By KUANTECH CO LTD
12039 : 8/1/2007 - 2:08 AM

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM



Documents

Document Sharing Hub

Table 5.1
Thickness of metal enclosure

Metal	Minimum thickness, inch (mm)			
	At small, flat, unreinforced surfaces and at surfaces that are reinforced by curving, ribbing, or the like		At relatively large unreinforced, flat surfaces	
Die-cast metal	3/64	(1.2)	5/64	(2.0)
Cast malleable iron	1/16	(1.6)	3/32	(2.4)
Other cast metal	3/32	(2.4)	1/8	(3.2)
Uncoated sheet steel	0.026	(0.66)	0.026	(0.66)
Galvanized sheet steel	0.029	(0.74)	0.029	(0.74)
Nonferrous sheet metal	0.036	(0.91)	0.036	(0.91)

5.2.2 The material used as the enclosure shall be acceptable for use at the maximum temperature to which it is exposed in normal use. Material exposed to temperatures in excess of 80°C (176°F) shall be investigated with respect to aging to determine whether it is acceptable for the purpose. See 6.1.

6 Polymeric Enclosures

6.1 An enclosure formed of polymeric material shall either:

- a) Comply with the requirements for Materials not Classed HB, Section 43; or
- b) Be classed HB in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, and comply with the requirements for Polymeric Materials Classed HB, Section 44 and, if applicable, with the requirements for High Current Arc Ignition Test, Section 45.

Exception No. 1: An enclosure formed of polymeric material classed HB or less flammable is acceptable without further test provided the appliance complies with all of the following:

- a) All live parts within the enclosure are acceptably insulated or have acceptable internal enclosures independent of the outer polymeric enclosure;*
- b) All leads connecting components inside the enclosure are mechanically secured so that displacement of any component resulting from degradation of the polymeric material will not cause a stress on the junction between a lead and a terminal of the component. A component having integral leads is to be subjected to strain relief tests if such tests are not otherwise a part of the required test procedure for the component; and*
- c) The power supply cord strain relief does not depend upon the enclosure.*

Exception No. 2: An enclosure formed of polymeric material classed HB that complies with all of the requirements for Materials not Classed HB, Section 43, except those for the flame resistance test described in 43.4.1 – 43.4.6 is acceptable provided all live parts within the enclosure are acceptably insulated or have acceptable internal enclosures independent of the outer polymeric enclosure.

Exception No. 3: An enclosure formed of material classed V-2 or less flammable need not be subjected to the flame resistance test described in 43.4.1 – 43.4.6 provided the thickness of the enclosure is not less than the minimum thickness for which the material was classed.

6.1 revised January 7, 2000

UL COPYRIGHTED MATERIAL –

NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM



Documents

Document Sharing Hub

7 Handles

7.1 An appliance shall have a handle or handles that permit grasping the appliance with both hands.

Exception: An appliance that is manipulated with one hand, such as grass shears, may have only one handle.

7.2 Other than as noted in 7.4, the handles or surfaces most likely to be grasped by the user during the normal operation of an appliance shall be made of or covered with an insulating material that complies with the requirements in 7.5, the Handle Tests, Section 34, and the dielectric voltage withstand test in accordance with 74.1 and entry 2 of Table 74.1.

7.2 revised June 25, 1996

7.3 With reference to 7.2, examples of surfaces that are likely to be grasped by the user during normal operation include a lever, handle, or button for a switch or other operator control. Surfaces of a guard for a switch or other operator control are also included if located where likely to be grasped.

7.4 The outer surfaces of a handle or other area likely to be grasped during normal operation shall not be of electrically conductive material, unless:

a) Insulation complying with the requirements in 74.1 and entry 2 of Table 74.1 is interposed between the surfaces likely to be grasped and:

- 1) The cutting member; and
- 2) Any metallic guard for the cutting member; and

b) Surfaces likely to be grasped:

- 1) Are double-insulated from live parts; or
- 2) Do not enclose electrical components and are separated from all dead metal parts that enclose electrical components by insulation complying with the requirements in 74.1 and entry 2 of Table 74.1.

7.4 revised June 25, 1996

7.5 The insulating material mentioned in 7.2 shall be of a type and thickness that make it acceptable as the sole insulation between a live part and a dead metal part. If it overlies and is in intimate contact with dead metal, the insulating material shall not be less than 5/64 inch (2.0 mm) thick.

Exception: The thickness of the insulating material may be less than 5/64 inch if the material is found to be acceptable when evaluated in accordance with 5.1.2.

Document Was Downloaded By RICH SHI SEMISHENG
For Use By KUANTECH CO LTD
12039 : 8/1/2007 - 2:08 AM
UL COPYRIGHTED MATERIAL -

NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM



Documents

Document Sharing Hub

8 Accessibility of Moving Parts

8.1 Specific tests, markings, guards, and the like, are detailed for some appliances, but such detailed requirements apply to more or less common constructions and specific features. Other appliances not contemplated herein are to be given appropriate consideration regarding compliance with these detailed requirements.

8.2 There are risks of injury to persons inherent in some appliances that, if completely eliminated, would defeat the utility of the appliance. The requirements in this section are intended to reduce the risks, while retaining the normal function of such an appliance.

8.3 If various functional attachments are available for use with a basic appliance, each attachment is to be considered individually.

8.4 An enclosure, a frame, a guard, a handle, or the like, shall not be sufficiently sharp to constitute a risk of injury to persons in normal maintenance and use.

8.5 A moving part shall be guarded or enclosed to reduce the likelihood of injury to persons.

8.6 Among the factors to be considered when judging the acceptability of an exposed moving part are:

- a) Degree of exposure necessary to perform its intended function;
- b) Sharpness of the part;
- c) The likelihood of unintentional contact with the part;
- d) The speed of the part; and
- e) The likelihood that a part of the body could be endangered, or that clothing could be entangled, resulting in a risk of injury to persons.

8.7 Some guards provided over moving parts are required to be self-restoring. Other features of guards that are to be considered include:

- a) Removability without the use of a tool;
- b) Removability for servicing and likelihood of replacement;
- c) Strength and rigidity;
- d) Completeness; and
- e) Creation of a risk of injury to persons, such as a pinch point, and the necessity for additional handling because of the increased need for servicing, such as cleaning, unjamming, and the like.

8.8 An opening in a guard or enclosure around a moving part capable of causing injury, such as a cutting tool, a fan, a pulley, a gear, a chain, or the like, shall have a minor dimension less than 1 inch (25.4 mm).

Exception: This requirement does not apply to an opening for cutting edges or a discharge chute of an appliance.

8.9 The unobstructed distance from the opening to the moving part mentioned in 8.8 shall not be less than $8D$ minus 1.5 inches (38 mm), in which D is the minor dimension of the opening in inches (mm).

Exception: A fan is considered to be acceptably guarded if the blade cannot be contacted with the probe illustrated in Figure 9.2.

8.10 An enclosure or guard over a rotating part and a discharge guide or deflector shall be sufficiently complete and shall have such strength as to:

- a) Contain and deflect a part that, because of breakage or other reasons, may become loose or separated from the rotating part; and
- b) Retain a foreign object that may be struck and propelled by the rotating part.

8.11 If the breakage or deformation of an enclosure, a frame, a guard, and the like, could result in a risk of injury to persons, the material of the part shall have the properties necessary to withstand the expected loading conditions.

8.12 A device that automatically starts an appliance, such as a timer, an automatically reset overload-protective device, or the like, shall not be employed unless it can be demonstrated that automatic starting will not result in a risk of injury to persons.

9 Accessibility of Live Parts

9.1 General

9.1.1 Electrical parts of an appliance shall be located or enclosed to reduce the likelihood of unintentional contact with uninsulated live parts. Insulated brush caps do not require additional enclosure.

9.1.2 An opening anywhere in the enclosure of a hand-supported appliance, or in the handle portion, the area likely to be handled in guiding during normal operation, of an appliance that normally rests on the ground and is guided by the handle is acceptable if the probe of Figure 9.1, when inserted as far as possible into the opening:

- a) Does not enter the opening for a distance of more than 1/8 inch (3.2 mm); and
- b) Does not touch any uninsulated live part or film-coated wire.

9.1.3 With reference to the requirement in 9.1.1 and except as indicated in 9.1.2, an opening is capable of being used when:

- a) A probe as illustrated in Figure 9.2 cannot be made to touch any uninsulated live part or any film-coated wire when inserted through the opening in any possible direction using no appreciable force; and
- b) A probe as illustrated in Figure 9.3 cannot be made to touch any uninsulated live part when inserted through the opening in any possible direction using no appreciable force.

9.1.3 effective August 1, 1996

Figure 9.1
Probe for hand-supported enclosure

Figure 9.1 effective August 1, 1996

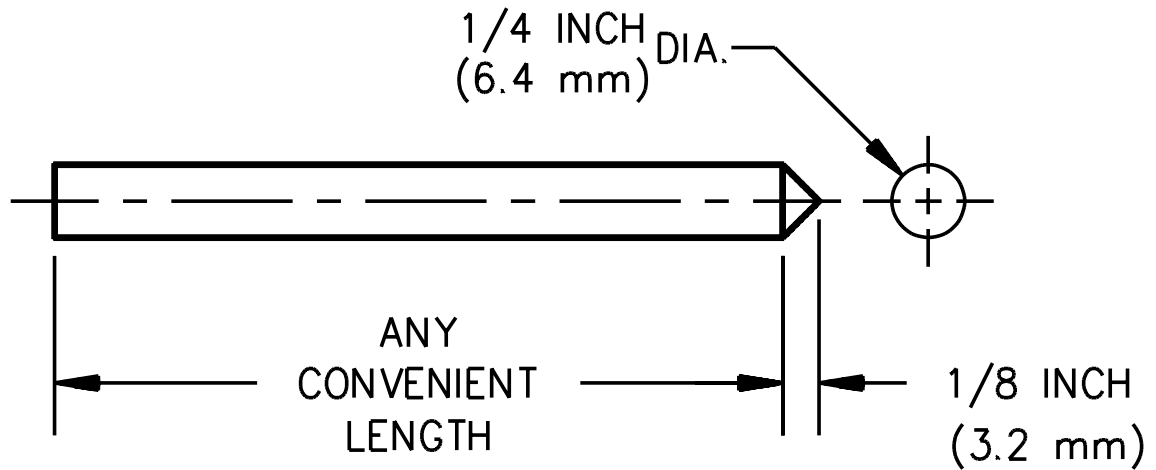
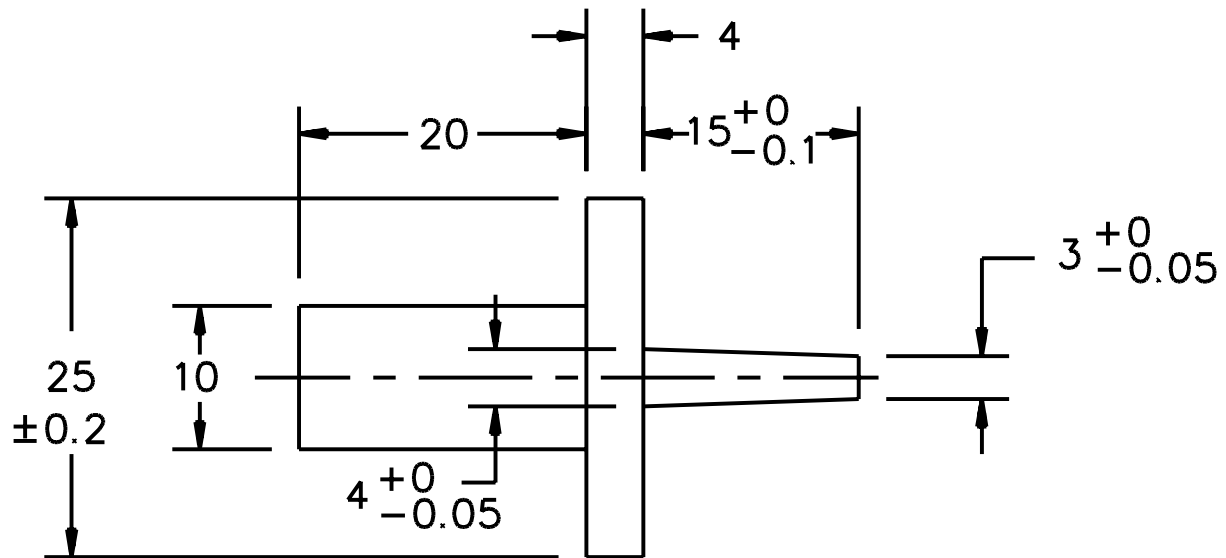


Figure 9.3
IEC test pin

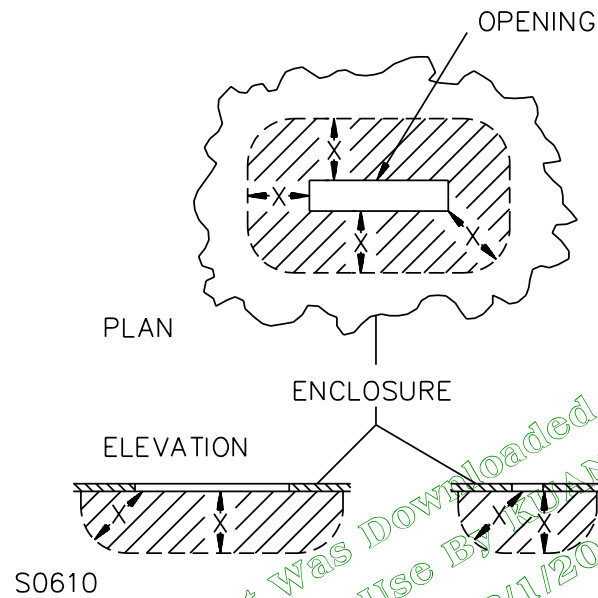
Figure 9.3 effective August 1, 1996



S2962

Dimensions in millimeters

Figure 9.4
Opening in enclosure



S0610

Proportions exaggerated for clarity

UL COPYRIGHTED MATERIAL -
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM



Documents
Document Sharing Hub

9.1.4 The opening illustrated in Figure 9.4 is acceptable if, within the enclosure, there is no uninsulated live part or film-coated wire:

- a) Less than X distance from the perimeter of the opening; and
- b) Within the volume generated by projecting the perimeter distance X normal to its plane.

X equals five times the diameter of the largest round rod that can be inserted through the opening, but not less than 4 inches (102 mm). In evaluating an opening, any barrier located within the volume is to be ignored unless it intersects the boundaries of the volume in a continuous, closed line.

9.1.5 During the examination of an appliance to determine compliance with the requirements in 9.1.1, a part of the outer enclosure that may be removed without the use of a tool by the user of the appliance, to permit the attachment of accessories, to allow access to means for making operating adjustments, or for another reason, is to be disregarded – that is, it will not be assumed that the part in question reduces the risk of electric shock unless marked in accordance with 52.5.

9.1.6 A latch or fastener that is intended to be opened by use of a coin or the like is considered to be capable of being opened without the use of a tool.

9.2 Assembly screws

9.2.1 An assembly screw in the area likely to be grasped that secures a covering of insulating material to a metal enclosure and threads into a metal enclosure containing electrical components or into a metal enclosure that contacts another metal enclosure containing live parts shall:

- a) Not be accessible to the probes illustrated in Figure 9.2 and Figure 9.3 when inserted; or
- b) Be recessed at least 1/8 inch (3.2 mm) behind the outer surface of the insulating material if the opening will not admit a 3/8 inch (9.5 mm) diameter rod.

9.2.1 effective August 1, 1996

10 Mechanical Assembly

10.1 General

10.1.1 An appliance shall be assembled so that it will not introduce a risk of fire, electric shock, or injury to persons due to vibration during normal operation.

10.1.2 Except as noted in 10.1.3 and 10.1.4, a switch, a lampholder, an attachment-plug receptacle, a plug connector, or other component that is handled by the user shall be mounted securely and shall be prevented from turning by means other than friction between surfaces.

10.1.3 A switch need not be prevented from turning if all four of the following conditions are met:

- a) The switch is of a plunger, slide, or other type that does not tend to rotate when operated. A toggle switch is considered to be subject to forces that tend to turn the switch during normal operation of the switch.
- b) The means of mounting the switch makes it unlikely that operation of the switch will loosen the switch.

- c) Spacings are not reduced below the minimum acceptable values if the switch rotates.
- d) Normal operation of the switch is by mechanical means rather than by direct contact by persons.

10.1.4 A lampholder of the type in which the lamp cannot be replaced, such as a neon pilot or an indicator light in which the lamp is sealed in a nonremovable jewel, need not be prevented from turning if rotation cannot reduce spacings below the minimum acceptable values.

10.1.5 With reference to the requirement in 10.1.2, a properly applied lock washer is acceptable as the means of preventing a small stem-mounted switch or other device having a single-hole mounting means from turning.

10.1.6 An adhesive that is used to secure a part which if dislodged would result in a risk of electric shock, fire, or injury to persons shall comply with the requirements for adhesives in the Standard for Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C.

10.1.7 The requirement in 10.1.6 also applies to an adhesive used to secure a conductive part that may, if loosened or dislodged:

- a) Energize an accessible dead metal part;
- b) Make a live part accessible;
- c) Reduce spacings below the minimum acceptable values; or
- d) Short-circuit live parts.

10.1.8 A gardening appliance shall be so constructed that user-maintenance can be accomplished without the likelihood of:

- a) Pinching leads;
- b) Reducing spacings to values less than those indicated in Table 21.1;
- c) Mislocating or damaging the means for accomplishing strain relief; and
- d) Mislocating or damaging a guard or other similar device.

10.1.9 User-maintenance is considered to consist of inspection of or replacement of motor brushes or fuses and other service that is recommended in the instruction manual to be performed by the user. It does not include maintenance that the instruction manual recommends be done by authorized service personnel.

10.1.10 Compliance with the requirements in 10.1.8 may be accomplished by routing of wires, provision of wire channels, provision of locating wells for components, use of barriers, use of restraints, securing of components, and other means.

10.1.11 Routing as mentioned in 10.1.8 is acceptable if the construction is such that, after the wire has been put into the intended position prior to reassembling the gardening appliance, the reassembly procedure will not result in the wire contacting a moving part or being pinched. This does not mean that the wire must be of such length or so clamped that it cannot reach the pinch point or the moving part.

10.1.12 A gardening appliance employing a soft rubber, neoprene, or polyvinyl chloride pressure pad to hold down or maintain permanent position of an electrical part, such as a motor, to provide for intended functioning of the appliance is to be tested in accordance with 40.2. If the pressure pad is exposed to grease, it is also to be tested in accordance with 40.3.

Exception: The test is not required if a risk of fire or electric shock does not result from deterioration of the pad as determined by the test in 40.1.

10.2 Appliances shipped partially disassembled

10.2.1 Except as noted in 10.2.2, an appliance shall be completely assembled before being shipped from the factory.

10.2.2 An appliance may be shipped from the factory partially disassembled to facilitate packaging if:

- a) All parts for assembly that are necessary for the operation of the appliance are provided in one carton;
- b) Proper assembly can be readily accomplished without introducing a risk of fire, electric shock, or injury to persons;
- c) Clear and detailed assembly instructions are provided;
- d) Internal electrical connections that must be made in the field are made by plug and receptacle connections only and do not require rearrangement of components or wiring; and
- e) The appliance is marked in accordance with 52.7, if a required guard is shipped from the factory detached.

11 Protection Against Corrosion

11.1 Iron and steel parts shall be protected against corrosion by enameling, galvanizing, plating, or other equivalent means if the corrosion of such unprotected parts would be likely to result in a risk of fire, electric shock, or injury to persons.

Exception No. 1: Surfaces of sheet steel and cast-iron parts within an enclosure need not be protected against corrosion if the oxidation of iron or steel due to the exposure of the metal to air and moisture is not likely to be appreciable. The thickness of the metal and the temperature are also factors.

Exception No. 2: Bearings, laminations, or minor parts of iron or steel, such as washers, screws, and the like, need not be protected against corrosion.

11.2 If the leakage of a liquid from inside of a container provided as a part of an appliance may result in a risk of fire, electric shock, or injury to persons, the container shall be of a material that is resistant to corrosion by the liquid it is intended to hold.

UL COPYRIGHTED MATERIAL -

NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM



Documents

Document Sharing Hub

12 Supply Connections

12.1 Power supply cord

12.1.1 An appliance shall be provided with a power supply cord that cannot be damaged or impaired by any cutting edges, blades, belts, or rotating parts of the appliance.

Exception: An appliance may employ a motor attachment plug for connecting an extension cord.

12.1.2 A power supply cord shall not be less than 8 inches (203 mm) nor more than 18 inches (457 mm) long.

12.1.3 An appliance intended for use with an extension cord shall not be provided with terminal pins that will accommodate a standard flatiron or appliance plug.

12.1.4 A flexible power supply cord provided with an appliance shall be:

- a) Type SW-A, SOW-A, STW-A, STOW-A, SJW-A, SJOW-A, SJTW-A, or SJTOW-A; or
- b) Type SW, SOW, STW, STOW, SJW, SJOW, SJTW, or SJTOW.

12.1.4(b) acceptable alternative to 12.1.4(a) until 12.1.4(b) supersedes 12.1.4(a) effective July 2, 1998

12.1.5 The flexible cord used in a cord set provided with, or made available for use with, an appliance shall be one of the types specified in 12.1.4.

12.1.6 A flexible cord shall be acceptable for use at a voltage not less than the rated voltage of the appliance, and shall have an ampacity not less than the current rating of the appliance.

12.2 Attachment plug

12.2.1 An attachment plug shall be rated for use at a current not less than the rated current, and at the rated voltage of the appliance. If the appliance is acceptable for being adapted for use on two or more different values of voltage by field-alteration of internal connections, the attachment plug provided with the appliance shall be rated for the voltage for which the appliance is connected when shipped from the factory. See 51.6.

12.2.2 The attachment plug shall be of the polarized- or 3-prong grounding-type.

Effective date for 12.2.2 changed from May 2, 1994 to August 1, 1996

12.2.3 A three- to two-wire grounding adapter shall not be provided with an appliance.

12.2.4 An attachment plug may be of the locking type.

12.2.5 A ground-supported appliance shall be constructed so that the cord connector of the extension cord will not touch the ground when the handle is in a normal operating position.

12.2.6 An attachment plug on the supply cord of an appliance shall be constructed so that, when inserted in the connector of an extension cord, the blades will not be energized until they are inaccessible to contact by persons. See Attachment Plug Test, Section 37.

12.3 Strain relief

12.3.1 Strain relief shall be provided so that a stress on a flexible cord will not be transmitted to terminals, splices, or internal wiring in the appliance or in a fitting, such as an attachment plug, an appliance plug, or the like.

12.3.2 A metal strain-relief clamp or band without auxiliary protection is acceptable with a power supply cord unless it is judged that the clamp may damage the cord insulation.

12.3.3 Means shall be provided so that the flexible cord cannot be pushed into the appliance through the cord-entry hole if such displacement is likely to subject the cord to mechanical damage or to exposure to a temperature higher than that for which the cord is rated, or is likely to reduce spacings, such as from a live part to a metal strain-relief clamp, below the minimum acceptable values.

12.4 Bushings

12.4.1 The edges of the entry hole for the power supply cord, including the cord-entry hole in a bushing, shall be smooth and free from burrs, fins, and sharp edges. Unless an insulating bushing of a material that has been found acceptable for the application is provided, the hole in the metal in which the bushing is mounted shall be smooth and free from burrs, fins, and sharp edges.

13 Live Parts

13.1 A current-carrying part shall be made of aluminum, silver, copper, a copper alloy, or other material acceptable for the purpose.

13.2 Stainless steel or plated iron or steel is capable of being used for a current-carrying part that is:

- a) Within a motor or associated governor; or
- b) Permitted in accordance with 3.1.

13.2 revised June 25, 1996

13.3 An uninsulated live part and its support shall be secured to the base or mounting surface so that it will be prevented from turning or shifting in position if such motion may result in a reduction of spacings below the minimum acceptable values.

13.4 Friction between surfaces is not acceptable as the sole means to prevent the turning of a live part. A properly applied lock washer or a factory-assembled press-fit is acceptable for this purpose.

14 Internal Wiring - Electrical Connections

14.1 General

14.1.1 The wiring and connections between parts of an appliance shall be acceptably protected or enclosed.

Exception: A length of flexible cord may be employed for external connections if flexibility is necessary in the application. See 14.1.2 and 14.1.4.

14.1.2 A flexible cord used for external interconnection as mentioned in the exception to 14.1.1 shall be one of the types of cord specified in 12.1.4 or the equivalent, and shall be provided with bushings and strain relief in accordance with 12.3.1 – 12.4.1 and Strain Relief Tests, Section 38, unless the construction is such that the cord will be protected from stress and motion.

14.1.3 Insulated wires may be bunched and passed through a single opening in a metal wall within the enclosure of the appliance.

14.1.4 With reference to exposure of internal wiring through openings in the enclosure of an appliance, the protection of the wiring required in 14.1.1 is considered to exist if, when judged as if it were film-coated wire, the wiring would be acceptable in accordance with 9.1.2 and 9.1.3. No wiring is to be located where it is likely to be contacted by the user.

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL



Documents

Document Sharing Hub

14.1.5 Internal wiring shall not be located near a hole in the appliance where it can be damaged by a screw, nail, or other device intended to support the appliance.

14.1.6 Wiring inside an appliance that might otherwise be subjected to mechanical damage shall be in armored cable, conduit, or electrical metallic tubing, or shall otherwise be protected.

14.1.7 Wiring shall be protected from sharp edges including screw threads, burrs, fins, moving parts, and the like that may cause abrasion of the insulation on conductors.

14.1.8 A screw (including the blunt-end type) used in the assembly of a 2-piece tube handle shall not terminate in the wireway. A through screw used to assemble a 2-piece tube handle shall not have threads exposed in the wireway.

Exception: A screw or screw threads may be exposed in the wireway if the wires in the wireway are enclosed in sleeving that has been investigated and found to be acceptable for the application.

14.1.9 Insulated internal wiring shall be acceptable for the application when considered with respect to:

- a) The temperature and voltage to which the wiring is likely to be subjected;
- b) Exposure to oil, grease, or other substances likely to have a deleterious effect on the insulation;
- c) Exposure to moisture; and
- d) Other conditions of service to which it is likely to be subjected.

14.1.10 Thermoplastic-insulated wire and neoprene-insulated wire employed for internal wiring shall be standard building wire or acceptable appliance wiring material (see 14.1.9) and shall comply with Table 14.1.

Table 14.1
Characteristics of internal wiring

Insulation	Nominal thickness of insulation,		Braid or jacket required	Nominal thickness of braid or jacket,	
	inch	(mm)		inch	(mm)
Thermoplastic	1/32	(0.8)	No	—	—
Neoprene	1/64	(0.4)	Yes	1/64	(0.4)
Rubber	1/32 ^a	(0.8)	Yes ^a	1/64 ^a	(0.4)

^a For heat-resistant rubber, other than a silicone type, the insulation thickness shall not be less than 3/64 inch (1.2 mm) and no braid is required.

14.1.11 Deleted February 20, 2007

14.1.12 Insulating tubing employed in place of wire insulation shall be acceptable for the application and shall have a nominal wall thickness of at least 1/32 inch (0.8 mm).

14.2 Splices and connections

14.2.1 Each splice and connection shall be mechanically secure and shall provide electrical continuity. A soldered connection shall be made mechanically secure before being soldered if breaking or loosening of the connection may result in a risk of fire or electric shock. Consideration shall be given to vibration and the like when judging the acceptability of electrical connections.

14.2.2 An open-end spade lug is not acceptable unless additional means, such as upturned lugs or the like, are provided to hold the lug in place should the wire-binding screw or nut become slightly loosened. In any case, an ordinary open-end lug with a lock washer is not acceptable.

14.2.3 A splice shall be acceptably insulated if permanence of spacings between the splice and other metal parts may not be maintained.

14.2.4 The insulation on a splice shall be at least 1/32 inch (0.8 mm) thick. In determining if splice insulation consisting of coated-fabric, thermoplastic, or other tubing is acceptable, consideration is given to such factors as its dielectric properties, heat- and moisture-resistant characteristics, and the like. Thermoplastic tape wrapped over a sharp edge is not acceptable.

14.2.5 The means of connecting stranded internal wiring shall be such that loose strands of wire cannot contact live parts of opposite polarity and dead metal parts.

14.2.6 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 acceptable for the combination of metals involved at the connection point.

14.2.7 With reference to 14.2.6, a wire-binding screw, a pressure wire connector, and the like, used as a terminating device shall be acceptable for use with aluminum under the conditions involved – for example, temperature, heat cycling, and vibration.

15 Electrical Insulation

15.1 Insulating washers, bushings, and the like, and bases or supports for the mounting of live parts shall be made of a moisture-resistant material, such as glazed porcelain, phenolic, cold-molded composition, or other material acceptable for the application, that will not be adversely affected by the temperatures to which they will be subjected under conditions of actual use.

15.2 Ordinary vulcanized fiber may be used for insulating bushings, washers, separators, and barriers, but not as the sole support for uninsulated live parts if shrinkage, current leakage, or warpage may introduce a risk of fire or electric shock. Thermoplastic materials may be employed if investigated and found to have the necessary physical strength and rigidity, resistance to heat, resistance to flame propagation, dielectric strength, and other properties acceptable for the application. All these properties are to be considered with respect to the effects of thermal aging.

15.3 A molded part shall have the necessary mechanical strength and rigidity to withstand stresses of normal service. A brush cap shall be protected, by recessing or other means, from mechanical damage that may occur during normal use unless the part has the strength necessary to withstand the abuses to which it is likely to be subjected. See Brush Cap Test, Section 35.

16 Motors

16.1 General

16.1.1 A motor shall be acceptable for the application, and shall be constructed to handle the maximum normal load of the appliance as described in 28.4 and 28.5 without introducing a risk of fire, electric shock, or injury to persons.

16.1.2 A motor winding shall resist the absorption of moisture.

16.1.3 With reference to the requirement in 16.1.2, fiber slot liners, cloth coil wrap, and similar moisture-absorptive materials shall be impregnated or otherwise treated to resist moisture absorption. Film-coated wire is not required to be additionally treated to prevent absorption of moisture.

16.1.4 An overcurrent-protective device shall not open the circuit during normal operation of the appliance.

16.1.5 A brush-holder assembly shall be constructed so that when a brush is worn out – no longer capable of performing its function – the brush, spring, and other parts of the assembly are retained to the degree necessary not to cause:

- a) Accessible dead metal parts to become energized; and
- b) Live parts to become accessible.

16.2 Overtemperature protection

16.2.1 The motor of a shredder or shredder-bagger shall be provided with a manually reset locked-rotor overtemperature-protective device or equivalent protection.

16.2.2 A motor employing a protective device that complies with the requirements for locked-rotor protection specified in the Standard for Overheating Protection for Motors, UL 2111, is considered to comply with 16.2.1.

16.2.2 revised December 22, 1998

17 Switches and Controls

17.1 A switch or other control device shall be provided in an appliance to control the motor. The switch or control device shall be acceptable for the application, and shall have a voltage and current rating not less than the corresponding values of the load that it controls.

17.2 A switch shall be located or protected so that it is not likely to be operated unintentionally during intended use of the appliance.

17.3 A switch shall be located or guarded so that an appliance cannot be energized by:

- a) Placing the appliance in any at-rest position against a flat or contoured surface that may be encountered in actual use; or
- b) Actuating the switch by irregular surfaces across which the appliance may be moved.

17.4 All switches shall operate readily by finger pressure with the appliance held in the intended manner.

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

17.6 A single-pole switch in an appliance employing a polarized attachment plug shall be connected in the conductor not intended to be grounded.

17.7 All operator controls shall be readily operable from the location intended to be assumed by the operator.

17.8 A self-propelled appliance and an appliance that, because of its function, tends to be self-propelled (for example, a cultivator) shall be provided with a momentary-contact switch or a dead-man control for disengaging the propelling drive to prevent movement of the appliance when it is unattended. No means for locking the switch in the on position shall be provided.

17.9 A reversing switch shall not be provided on an appliance that, because of its function, tends to be self-propelled.

Exception: On a cultivator, a momentary contact reversing switch that cannot be locked on may be provided for an auxiliary function not intended to be continuous provided that the function, the location, and the operation of the switch make it unlikely that the product will be operated in the reverse direction for a time longer than is necessary to perform the intended auxiliary function.

18 Lampholders

18.1 A lampholder shall be constructed or installed so that uninsulated live parts other than the lamp contacts will not be exposed to contact by persons removing or replacing lamps in normal service.

18.2 The screw shell of each lampholder shall be connected to:

- a) The conductor of the flexible cord intended to be grounded; or
- b) The same conductor of the flexible cord in the absence of a conductor intended to be grounded.

19 Capacitors

19.1 A capacitor provided as a part 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 such that, should breakdown of the capacitor occur, the plates will not be subject to mechanical damage and there will be no emission of flame or molten material. The construction shall comply with one of the following:

- a) The capacitor container shall be of sheet steel not less than 0.020 inch (0.51 mm) thick or shall be constructed to afford equivalent protection;
- b) A capacitor having a sheet-steel container less than 0.020 inch thick or of other acceptable material shall be mounted in an enclosure that houses other parts of the appliance and that is acceptable for the enclosure of live parts;
- c) The individual enclosure of an electrolytic capacitor with means for venting shall reduce the likelihood of mechanical damage only, and no minimum enclosure thickness is specified; or
- d) 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 shall comply with the requirements in 33.2.1, and no minimum enclosure thickness is specified.

UL COPYRIGHTED MATERIAL –

NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM



Documents

Document Sharing Hub

19.2 The voltage rating of a capacitor other than a motor-starting capacitor shall be at least the maximum steady-state potential to which the capacitor is subjected during operation of the appliance.

20 Printed Wiring Boards

20.1 A printed wiring board included as part of the circuitry of a gardening appliance shall comply with requirements in UL 796, the Standard for Printed Wiring Boards. The printed wiring board shall have a flammability rating of V-1 or better as determined by an evaluation to UL 94, the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

Exception: A printed wiring board positioned inside an enclosure or compartment having a 5V rating in accordance with UL 94 may have a flame rating of HB.

20.1 revised December 22, 1998

21 Spacings

21.1 The spacing between uninsulated live parts of opposite polarity and between uninsulated live parts and a dead metal part that is exposed to contact by persons or that is grounded shall not be less than the applicable value specified in Table 21.1 for alternating-current circuits. 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 live part, the construction shall be such that the minimum acceptable spacing will be maintained in all possible positions of the movable part.

Exception No. 1: This requirement does not apply to the inherent spacings of a component of the appliance, such as a snap switch. Such spacings are judged on the basis of the requirements for such components.

Exception No. 2: This requirement does not apply to the commutator, the brush assembly, or the jumpers that short-circuit the brushes of a repulsion, repulsion-induction, or repulsion-start induction motor. Any uninsulated conductor of the rotor circuit is regarded as a dead metal part with respect to the stator circuit, and the appropriate spacing is required between uninsulated stator and rotor conductors.

21.1 revised June 25, 1996

21.2 In applying Table 21.1 to an appliance incorporating two or more motors of different sizes, the spacings inside each motor are judged on the basis of the size of that motor, and the spacings elsewhere in the appliance are judged on the basis of the size of the largest motor in the appliance.

21.3 If an isolated dead metal part is interposed between or in close proximity to:

- a) Live parts of opposite polarity;
- b) A live part and an exposed dead metal part; or
- c) A live part and a dead metal part that may be grounded;

the spacing may be no less than 3/64 inch (1.2 mm) between the isolated dead metal part and any one of the other parts previously mentioned, provided the sum of the spacing between the isolated dead metal part and each of the other two parts is not less than the applicable value specified in Table 21.1. See Figure 21.1.

21.4 Primary-circuit spacings apply to all secondary circuits supplied by a transformer winding having a maximum available volt-amperes of 200 or more at a potential greater than 100 volts. The spacings in all other secondary circuits are to be judged on the basis of the dielectric voltage withstand test described in 29.1.

Table 21.1
Minimum acceptable spacings

Potential involved, volts	Part involved	Minimum spacings, inch (mm)			
		Motor diameter 7 inches (178 mm) or less ^a		Motor diameter more than 7 inches (178 mm) ^{a,b}	
		Over surface	Through air	Over surface	Through air
0 – 125	Between commutator bars or collector rings of a motor and the motor shaft and laminations	3/32 (2.4)	3/32	3/16 (4.8)	1/8 (3.2)
	Elsewhere in the appliance	3/32	3/32	1/4 ^c (6.4)	1/8 ^c
126 – 250	Between commutator or collector rings of a motor	3/32	3/32	3/16	3/16
	Elsewhere in the appliance	3/32	3/32	1/4 ^c	1/4 ^c

^a This is the diameter, measured in the plane of the laminations, of the circle circumscribing the stator frame, excluding lugs, fins, boxes, and the like, used solely for motor mounting, cooling, assembly, or connection.

^b Spacings not less than 3/32 inch are acceptable throughout a universal motor.

^c Film-coated wire is considered to be an uninsulated live part. However, a spacing not less than 3/32 inch (over surface and through air) between film-coated wire, rigidly supported and held in place on a coil and a dead metal part is acceptable in an appliance.

21.5 Deleted June 25, 1996

21.6 An insulating liner or barrier of vulcanized fiber or similar material employed where a spacing would otherwise be less than the minimum acceptable value shall be no less than 1/32 inch (0.8 mm) thick, and shall be located or be of such material that it will not be adversely affected by arcing.

Exception: Vulcanized fiber not less than 1/64 inch (0.4 mm) thick may be used in conjunction with an air spacing of not less than 50 percent of the minimum acceptable through-air spacing.

21.7 An insulating liner or barrier of a material other than that mentioned in 21.6 may be used if, upon investigation, the material is found to be acceptable for the application.

21.8 The spacings between an enclosure of polymeric material classed HB in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94, and:

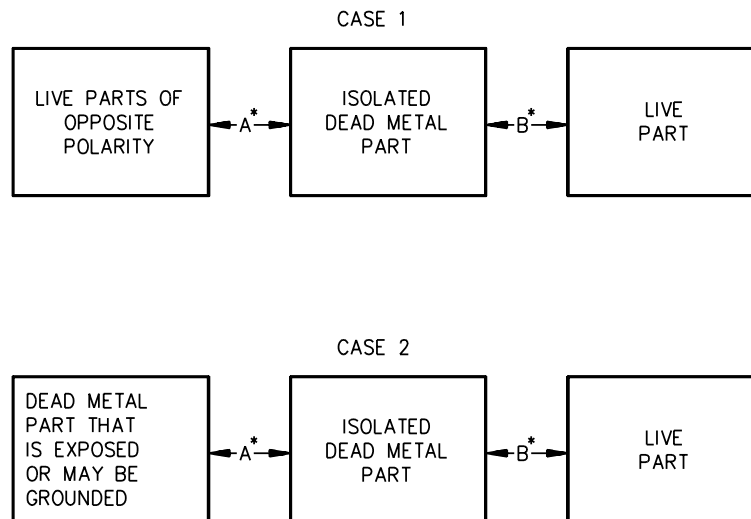
a) A nonarcing bare live part, such as a bus bar, a connecting strap, a terminal, or the like, shall be no less than 1/32 inch (0.8 mm).

b) An arcing part, such as a commutator, unenclosed switch contacts, and the like, shall be no less than 1/2 inch (12.7 mm).

Exception: The spacing may be smaller than 1/2 inch but no less than 1/32 inch provided the material complies with the requirement in 45.1.

21.8 revised December 22, 1998

Figure 21.1
Spacings for isolated dead metal parts



SB0836

Spacing A and spacing B shall be at least 3/64 inch (1.2 mm); and spacing A plus spacing B shall be no less than the applicable value specified in Table 21.1.

21.9 The spacing mentioned in 21.8 (b) is to be measured from the source of the arc.

22 Grounding

22.1 The flexible cord of an appliance shall include an equipment-grounding conductor.

22.2 An equipment-grounding conductor of a flexible cord shall be:

- a) Green with or without one or more yellow stripes;
- b) Connected to the grounding member of an acceptable attachment plug of the grounding type; and
- c) Conductively connected to:
 - 1) All exposed dead metal parts of the appliance; and
 - 2) All dead metal parts within the enclosure that are exposed to contact during any user servicing and that are likely to become energized. The grounding conductor shall be connected by means of a screw or other reliable means not likely to be removed during any servicing operation not involving the power supply cord; solder alone shall not be used for securing this conductor. A sheet metal screw shall not be used for the connection of grounding conductors or connection devices to an enclosure.

Revised 22.2 effective November 15, 2008

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM



Documents

Document Sharing Hub

22.3 The screw mentioned in 22.2 (c) shall be of corrosion-resistant metal or shall be protected against corrosion. A lock washer or other acceptable means shall be used to prevent the screw from being loosened by vibration. This screw shall have a slotted, hexagonal, green-colored head.

Document Was Downloaded By Rice, Shi SHIMISHENG
For Use By KUANTECH CO LTD
12039 : 8/1/2007 - 2:08 AM

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM UL



Documents
Document Sharing Hub

No Text on This Page

Document Was Downloaded By Rice, Shi SHIMISHENG
For Use By KUANTECH CO LTD
12039 : 8/1/2007 - 2:08 AM

UL COPYRIGHTED MATERIAL –
NOT AUTHORIZED FOR FURTHER REPRODUCTION OR
DISTRIBUTION WITHOUT PERMISSION FROM



Documents

Document Sharing Hub