UL 20

0–7629–0596–4

General-Use Snap Switches

Documents
Document Sharing Hub

Full document details: UL 20 2000

Documents
Document Sharing Hub

Full document details: UL 20 2000

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

UL Standard for Safety for General-Use Snap Switches, UL 20

Twelfth Edition, Dated September 22, 2000

The new and/or revised requirements are substantially in accordance with UL's Bulletin(s) on this subject dated May 16, 2000. The bulletin(s) is now obsolete and may be discarded.

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

Future Effective Dates	References
June 1, 2005	Entire Standard

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

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.

Documents
Document Sharing Hub

Full document details: UL 20 2000

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 Listed, Recognized, Classified, and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

Copyright © 2000 Underwriters Laboratories Inc.

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

Page Date

1-70 . . . . . September 22, 2000
A1-A2 . . . . . September 22, 2000
B1-B6 . . . . . September 22, 2000

Documents
Document Sharing Hub

Full document details: UL 20 2000

Canadian Standards Association
CSA-C22.2 No. 111
Third Edition

Underwriters Laboratories Inc.
UL 20
Twelfth Edition

General-Use Snap Switches

September 22, 2000

Documents
Document Sharing Hub

Full document details: UL 20 2000

Commitment for Amendments

This Standard is issued jointly by Canadian Standards Association and Underwriters Laboratories Incorporated. Amendments to this Standard will be made only after processing according to the Standards writing procedures by both Canadian Standards Association and Underwriters Laboratories Incorporated.

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.

The Department of Defense (DoD) has adopted UL 20 on December 4, 1981. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

ISBN 1-55324-251-3

Copyright © 2000
CSA International
All rights reserved. No part of this publication may be reproduced in any form whatsoever without the prior permission of the publisher.

ISBN 0-7629-0596-4

Copyright © 2000
Underwriters Laboratories Inc.

Documents
Document Sharing Hub

Full document details: UL 20 2000

CONTENTS

Preface 5

Foreword (CSA) 6

Foreword (UL) 8

1 Scope 9
2 Definitions 10
3 General 11
3.1 New Product Evaluation 11
3.2 Components 11
3.3 Units of Measurement 12
3.4 Reference Publications 12
4 Construction 14
4.1 Enclosure 14
4.2 Lining 16
4.3 Bushings and Strain Relief 16
4.4 Bases and Bodies 17
4.5 Current-Carrying Parts 18
4.6 Insulating Material 23
4.7 Actuating Members 24
4.8 Creepage Distances, Clearances, and Distances Through Sealing Compounds 24
4.9 Assembly 26
4.10 Provision for Grounding 27
5 Testing 29
5.1 General 29
5.2 Test Sequence 29
5.3 Tungsten-Filament-Lamp Load Characteristics 35
5.4 Assembly Test 37
5.5 Test Conditions 38
5.6 Overload Test 38
5.7 Endurance Test 41
5.8 Temperature Test 42
5.9 Dielectric Voltage-Withstand Test 44
5.10 Security of Switch Leads Test 45
5.11 Push-In Terminal Tests 45
5.12 Effect of Heat on Actuating Members Test 46
5.13 Switching Mechanism Test 46
5.14 Strain-Relief Test 48
5.15 Fault Current Test 48
5.16 Crushing Test 49
5.17 Resistance to Heat Test 49
6 Ratings 49
7 Markings 50
7.1 General 50
7.2 Supplementary Markings 52
7.3 Location 54
7.4 Tungsten 54
7.5 AC-Only Identification 55
7.6 Switch Termination Restrictions 55

Documents
Document Sharing Hub
Full document details: UL 20 2000

8 Self-Contained Switches for Use Without a Separate Outlet Box 57
8.1 General 57
8.2 Construction 57
8.3 Performance Testing 59
8.4 Markings and Instructions 66
Figures 67

Appendix A

Standards for Components

A1 Component Standards A1

Appendix B

Canadian Requirements for CO/ALR Switches

B1 General B1
B2 Heat Cycling with Wire Disturbance B3
B3 Heat Cycling with Vibration B4
B4 Environmental B5
B5 Stripping Torque B6

Documents
Document Sharing Hub
Full document details: UL 20 2000

Preface

This is the common UL and CSA Standard for General-Use Snap Switches. It is the Third edition of CSA-C22.2 No. 111 and the Twelfth edition of UL 20.

This common Standard has been prepared by CSA International and Underwriters Laboratories Inc., and the manufacturing industry. The efforts and support of NEMA (National Electrical Manufacturers Association) and EFC (Electro-Federation of Canada) are gratefully acknowledged.

This Standard was reviewed by the CSA Subcommittee on Standard C22.2 No. 111 and approved by the Technical Committee on Wiring Products under the jurisdiction of the CSA Strategic Resource Group.

This Standard will be submitted to the American National Standards Institute (ANSI) for publication as as American National Standard.

Note: *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.*

UL Effective Date

As of June 1, 2005, all products Listed, Recognized, or Classified by UL must comply with the requirements in this Standard.

Between September 22, 2000 and June 1, 2005, new product submittals to UL may be evaluated under all the requirements in this Standard or, if requested in writing evaluated under presently effective requirements only. The presently effective requirements are contained in the Eleventh edition of UL 20.

CSA Effective Date

The effective date for CSA will be announced through CSA Informs or CSA Notification Notice.

Level of Harmonization

This standard is published as an equivalent standard. An equivalent standard is a standard that is substantially the same in technical content, except as follows. Technical deviations are allowed for Codes and Governmental Regulations and those recognized as being in accordance with NAFTA Article 905, for example because of fundamental, climatic, geographical, technological, or infrastructural factors, scientific justification or the level of protection that the country considers appropriate. Presentation is word for word except for editorial changes.

Interpretations

The interpretation by the SDO of an equivalent or standard shall be based on the literal text to determine compliance with the standard in accordance with the procedural rules of the SDO. If more than one interpretation of the literal text has been identified, a revision shall be proposed as soon as possible to each of the SDOs to more accurately reflect the intent. (Note: CSA may use an ORD – Other Recognized Document – for this purpose).

Documents
Document Sharing Hub

Full document details: UL 20 2000

Foreword (CSA)

The Canadian Standards Association, which operates under the name CSA International (CSA), provides certification services for manufacturers who, under license from CSA, wish to use the appropriate registered CSA Marks on certain products of their manufacture to indicate conformity with CSA Standards.

CSA Certification for a number of products is provided in the interest of maintaining agreed-upon standards of quality, performance, interchangeability and/or safety, as appropriate. Where applicable, certification may form the basis for acceptance by inspection authorities responsible for enforcement of regulations. Where feasible, programs will be developed for additional products for which certification is desired by producers, consumers or other interests.

In performing its functions in accordance with its objectives, CSA does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of the Association represent its professional judgement given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed.

Products in substantial accord with this Standard but which exhibit a minor difference or a new feature may be deemed to meet the Standard providing the feature or difference is found acceptable utilizing appropriate CSA Certification and Testing Division Operating Procedures. Products which comply with this Standard shall not be certified if they are found to have additional features which are inconsistent with the intent of this Standard. Products shall not be certifiable if they are discovered to contravene applicable laws or regulations.

Testing techniques, test procedures and instrumentation frequently must be prescribed by the CSA Certification and Testing Division in addition to the technical requirements contained in Standards of CSA. In addition to markings specified in the Standard, the CSA Certification and Testing Division may require special cautions, markings and instructions that are not specified by the Standard.

Some tests required by CSA Standards may be inherently hazardous. The Association neither assumes nor accepts any responsibility for any injury or damage that may occur during or as the result of tests, wherever performed, whether performed in whole or in part by the manufacturer or the Association, and whether or not any equipment, facility or personnel for or in connection with the test is furnished by the manufacturer or the Association.

Manufacturers should note that, in the event of the failure of the CSA Certification and Testing Division to resolve an issue arising from the interpretation of requirements, there is an appeal procedure: the complainant should submit the matter, in writing, to the Secretary of the Canadian Standards Association.

If this Standard is to be used in obtaining CSA Certification please remember, when making application for certification, to request all current Amendments, Bulletins, Notices and Technical Information Letters that may be applicable and for which there may be a nominal charge. For such information or for further information concerning CSA Certification please address your inquiry to Applications and Customer Service, CSA International, 178 Rexdale Boulevard, Toronto, Ontario M9W 1R3.

Documents
Document Sharing Hub

Full document details: UL 20 2000

No Text on This Page

Documents
Document Sharing Hub

Full document details: UL 20 2000

Foreword (UL)

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

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

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

D. A product employing materials or having forms of construction which conflict with specific requirements of the Standard cannot be judged to comply with the Standard. A product employing materials or having forms of construction not addressed by this Standard may be examined and tested according to the intent of the requirements and, if found to meet the intent of this Standard, may be judged to comply with the Standard.

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

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

Documents
Document Sharing Hub

Full document details: UL 20 2000

1 Scope

1.1 The requirements of this Standard apply to manually operated, general-use snap switches for connection to copper (Cu) or copper-clad conductors used in accordance with the National Electrical Code(NEC), ANSI/NFPA 70, or the Canadian Electrical Code (CEC), Part 1, and intended for connection to wiring systems recognized by the NEC or the CEC, Part 1. In Canada, requirements for switches for connection to aluminum (Al) conductors used in accordance with the CEC, Part 1, and intended for connection to wiring systems recognized by the CEC, Part 1, are covered in Appendix B.

1.2 This Standard applies to ac/dc rated switches for which the load ratings do not exceed 60 A at 250 V or less, 30 A at 251 V – 600 V, and 2 hp at 125 V – 600 V or less. This Standard also covers ac-only rated switches for which the load ratings do not exceed 30 A at 347 Vac or less.

1.3 This Standard applies to switches constructed to be installed readily in a flush device box or on an outlet-box cover and intended for connection to branch-circuit wiring.

1.4 This Standard applies to pendant and through-cord switches intended for field installation on flexible cord and provided with one “on” and one “off” position.

1.5 This Standard applies to switches intended for surface mounting and provided with a separable base and cover for connection to exposed wiring consisting of nonmetallic sheathed cable or open wiring on insulators (knob and tube).

1.6 This Standard applies to self-contained switches intended for flush mounting without a separate outlet box and for connection to branch-circuit wiring consisting of one or more non-metallic sheathed cables containing copper conductors.

1.7 This Standard applies to ac/dc fixture switches intended to be installed in fixtures to control incandescent lighting or fans for connection to branch-circuit wiring.

1.8 This Standard also applies to single-pole, momentary-contact door switches constructed to be installed readily in a special-purpose device box or on an outlet-box cover for connection to branch-circuit wiring.

1.9 This Standard does not apply to:

a) Clock operated switches specified in the Standard for Clock-Operated Switches, UL 917, and CSA Standard C22.2 No. 177;

b) Dimmer switches specified in the Standard for Solid-State Dimming Controls, UL 1472, and CSA Standard C22.2 No. 184.1;

c) Industrial control equipment specified in the Standard for Industrial Control Equipment, UL 508, and CSA Standard C22.2 No. 14;

d) Solid-state, single-phase motor speed controls specified in the Standard for Solid-State Fan Speed Controls, UL 1917, and CSA Standard C22.2 No. 156;

e) Special-use and ac-only fixture switches specified in the Standard for Special-Use Switches, UL 1054, and CSA Standard C22.2 No. 55; and

f) Switches for use in hazardous locations specified in the Standard for Switches for Use in Hazardous (Classified) Locations, UL 894, and CSA Standard C22.2 No. 159.

Documents
Document Sharing Hub
Full document details: UL 20 2000

1.10 For switches intended for connection to branch-circuit wiring containing aluminum conductors, refer to the Standard for Receptacles and Switches Intended for Use with Aluminum Wire, UL 1567, or to Appendix B.

2 Definitions

2.1 The following definitions apply in this Standard:

Clearances – through-air spacing.

Creepage distances (creepage) – over-surface spacings.

Door Switch – a single-pole, momentary contact switch with a push-button actuator, provided with an outlet-box and cover. It is intended for installation in door jambs to control lighting fixtures, typically in a closet.

Fixture switch – a switch installed in the enclosure of a fixture such as a luminaire, a fan or the like.

Flush switch – a switch provided with a mounting yoke or integral flush device cover plate and intended for installation in or on an outlet box intended to control a branch circuit.

Pendant switch – a switch intended to be installed at the end of a flexible cord for use in branch-circuit pendant applications.

Self-contained switch – a switch intended for flush mounting without a separate outlet box for connection to one or more nonmetallic sheathed cables containing copper conductors.

Surface switch – a switch provided with a separable base and cover primarily intended for branch-circuit installation on exposed wiring consisting of open wiring on insulators or nonmetallic sheathed cable.

Terminal, insulation displacement – a terminal having a contacting member that forces the conductor insulation aside and presses against the side of the conductor to make contact.

Terminal, pin-type – a terminal having a contact pin that punctures the conductor insulation to contact the current-carrying conductor.

Terminal, pressure-wire – a terminal where the conductor is clamped under a pressure plate or saddle by one or more screws or nuts.

Terminal, push-in a terminal where the stripped end of a conductor is pushed into the terminal and the clamping pressure is maintained by a spring mechanism, without the use of screws.

Terminal, set-screw – a terminal where the clamping pressure is applied by the end of the screw bearing directly on the conductor.

Terminal, wire-binding screw – a terminal in which the conductor is bent around the screw and is clamped directly under the head of the screw when it is tightened.

Through-cord switch a switch intended to be installed along the length of flexible cord such as for use in power-supply cords or cord sets.

Documents
Document Sharing Hub
Full document details: UL 20 2000

3 General

3.1 New Product Evaluation

3.1.1 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, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the acceptable 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 cannot be judged to comply with this Standard. Where considered appropriate, revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this Standard.

3.2 Components

3.2.1 Except as indicated in 3.2.2, 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. A component shall comply with the Canadian Standards Association or the Underwriters Laboratories Inc., standards as appropriate for the country where the product is to be used.

3.2.2 A component need not comply with a specific requirement that:

a) involves a feature or characteristic not needed in the application of the component in the product covered by this Standard; or

b) is superseded by a requirement in this Standard.

3.2.3 A component shall be used in accordance with its ratings for the intended conditions of use.

3.2.4 Specific components are accepted as being incomplete in construction features, or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as temperatures not exceeding specified limits, and shall be used only under those specified conditions for which they have been investigated.

Documents
Document Sharing Hub
Full document details: UL 20 2000

3.3 Units of Measurement

3.3.1 If a value for measurement is followed by a value in other units in parenthesis, the second value may be only approximate. The first stated value is the requirement.

3.4 Reference Publications

3.4.1 Where reference is made to other publications, such reference shall be considered to refer to the latest edition and all amendments published to that edition up to the time when this Standard was approved.

UL Standards

UL 50,
Enclosures for Electrical Equipment;

UL 94,
Tests for Flammability of Plastic Materials for Parts in Devices and Appliances;

UL 486E,
Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors;

UL 508,
Industrial Control Equipment;

UL 514A,
Metallic Outlet Boxes;

UL 514C,
Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers;

UL 746A,
Polymeric Materials–Short Term Property Evaluations;

UL 746B,
Polymeric Materials–Long Term Property Evaluations;

UL 746C,
Polymeric Materials – Use in Electrical Equipment Evaluations;

UL 894,
Switches for Use in Hazardous (Classified) Locations;

UL 917,
Clock-Operated Switches;

UL 1054,
Special-Use Switches;

UL 1472,
Solid-State Dimming Controls (Bi-National CSA C22.2 No. 184.1-96);

Documents
Document Sharing Hub
Full document details: UL 20 2000

UL 1567,
Receptacles and Switches Intended for Use with Aluminum Wire;

UL 1917,
Solid-State Fan Speed Controls.

CSA Standards

C22.1-1998,
Canadia Electrical Code, Part 1;

CAN/CSA C22.2 No. 0-M91 (R1997),
General Requirements – Canadian Electrical Code, Part II;

CAN/CSA C22.2 No. 0.17-92 (R1997),
Evaluation of Properties of Polymeric Materials;

C22.2 No. 14-95,
Industrial Control Equipment;

C22.2 No. 18-97,
Outlet Boxes, Conduit Boxes, and Fittings;

C22.2 No. 42-M1984 (R1996),
General Use Receptacles, Attachment Plugs, and Similar Wiring Devices;

C22.2 No. 55-M1986 (R1992),
Special Use Switches;

CAN/CSA C22.2 No. 94-M91 (R1997),
Special Purpose Enclosures;

C22.2 No. 111-M1986 (R1992),
General-Use Switches;

C22.2 No. 156-M1987 (R1993),
Solid-State Speed Controls;

C22.2 No. 159-M1987 (R1993),
Attachment Plugs, Receptacles, and Similar Wiring Devices for Use in Hazardous Locations: Class I, Groups A, B, C, and D; Class II, Group G, in Coal or Coke Dust, and in Gaseous Mines;

CAN/CSA C22.2 No. 177-92 (R1997),
Clock-Operated Switches;

C22.2 No. 184.1-96,
Solid State Dimming Controls.

Documents
Document Sharing Hub
Full document details: UL 20 2000

3.4.2 Where reference is made to the following publications not under the jurisdiction of UL or of the CSA Steering Committee on the Canadian Electrical Code, Part II, such reference shall be considered to refer to the edition listed below:

CGSB Standard (Canadian General Standard Board)

7-GP-7M-1978,
Cotton, Absorbent, Sterile, and Nonsterile.

ASTM Standard (American Society for Testing and Materials)

E28-99,
Test Methods for Softening Point of Resins Derived from Naval Stores by Ring-and-Ball Apparatus.

National Fire Protection Association (NFPA)

NFPA 70,
National Electrical Code.

4 Construction

4.1 Enclosure

4.1.1 Switches shall be provided with complete enclosures that house all live parts, except that switches designed to be installed in device boxes or cut-out boxes or intended specifically for use in devices where they will be so enclosed as to prevent the exposure of live parts to accidental contact, need not be provided with such enclosures.

4.1.2 A key-operated switch shall be constructed so that a 0.8 mm (1/32 inch) diameter steel wire can not be inserted into the key slot so as to contact live parts.

4.1.3 A metal enclosure of a switch (such as the cover of a surface-type switch or the shell of a fixture or pendant-type switch) shall be not less than 0.33 mm (0.013 inch) thick. Heavier metal shall be employed to provide strength and rigidity if the switch is rated more than 5 A, 250 V; 10 A, 125 V; or if the size or shape of the enclosure warrants such increased metal thickness.

4.1.4 A nipple (male or female) through which wires may pass shall have not less than five full, clean-cut threads of standard pitch as indicated in Table 1. The wireway provided by the nipple shall be free from burrs, fins, sharp edges, and the like that can damage wiring.

Documents
Document Sharing Hub
Full document details: UL 20 2000

Table 1
Threading for nipples
(see Clause 4.1.4)

Pipe trade size, inch	Threading per inch
1/8	27 threads
1/4	18
3/8	18
1/2	14
3/4	14

4.1.5 A nipple that is not integral with the body of a switch shall be secured to prevent turning relative to the enclosure, and to provide mechanical strength equivalent to that of a unit piece.

4.1.6 A female nipple in a fixture-type switch shall be provided with a No. 8 - 40 setscrew.

Exception: The setscrew may be omitted in the nipple of a fixture-type switch if the nipple is of the 1/2 inch or larger pipe size, has a tapered thread, and is intended to be tightened with a wrench.

4.1.7 A threaded nipple for attachment to rigid metal conduit of the 1/2 inch or larger trade size shall be provided with a positive end stop for the conduit and a bushing, or an equivalent smooth, well-rounded surface, to prevent damage to wiring that enters the switch enclosure from the conduit.

Exception: Providing a positive end stop and bushing shall not be required for a hole tapped for rigid metal conduit in the wall of an outlet box or equivalent enclosure that is provided with a switch.

4.1.8 A switch intended to be exposed to a specific environment shall comply with the requirements of the Standard for Enclosures for Electrical Equipment, UL 50 or CSA C22.2. No. 94, Special Purpose Enclosures.

4.1.9 A through-cord switch shall be provided with two distinct holes to accept and pass through the intended flexible cord. If a through-cord type switch is provided with one hole and provisions such as a knock out, the device is considered to be a pendant switch

4.1.10 A door switch shall be provided with an outlet box and cover plate. The outlet box and cover plate shall comply with the performance requirements of either the Standard for Metallic Outlet Boxes, UL 514A, or the Standard for Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers, UL 514C, as appropriate, or Outlet Boxes, Conduit Boxes, and Fittings, C22.2 No. 18.

Documents
Document Sharing Hub
Full document details: UL 20 2000

4.2 Lining

4.2.1 If a part of the enclosure of a switch is removable for wiring and is wholly or partly of conductive material, the inside surface of all such conductive material shall be lined completely with insulation not less than 0.71 mm (0.028 inch) thick.

Exception: The lining of a fixture switch may be less than 0.71 mm (0.028 inch) thick but not less than 0.33 mm (0.013 inch) thick.

4.2.2 An insulating lining shall be secured so that it will remain in place under conditions of intended service, and shall prevent the enclosure from becoming a live part even if a wire inside the switch should become loose or detached from its termination. The lining of the cover of a surface-type switch shall extend beyond the edge of the cover.

4.2.3 In switches having molded covers protected by a metal armor, the armor may be flush with the cover if the construction of the switch is such that the armor is not likely to make contact with any live parts when the cover is being put in place on the switch.

4.3 Bushings and Strain Relief

4.3.1 The cord-inlet hole in a pendant or through-cord switch that has a metal enclosure shall be provided with an insulating bushing or the equivalent. The material of the bushing shall be of porcelain, phenolic, or cold-molded composition, or other insulating material determined to be acceptable for the purpose.

4.3.2 Hard fiber may be provided as the insulating material if the bushing is not less than 1.19 mm (0.047 inch) thick and if it is formed and secured in place so that it will not be affected by conditions of ordinary moisture.

4.3.3 A threaded insulating bushing shall not be used in a threaded nipple to form a pendant switch if the pipe size of the nipple is smaller than 3/8 inch.

4.3.4 A pendant or through-cord switch shall have provision for strain relief so that a pull exerted on the flexible cord cannot be transmitted directly to wiring terminals. If space is provided within the switch enclosure for a strain-relief knot, all parts of the enclosure on which the cord can touch shall be smooth and well-insulated.

4.3.5 A metal cord grip may be provided on a pendant switch intended particularly for use with jacketed flexible cord, such as Type S or SJ, if the diameter of the cord-inlet hole is not less than 7.9 mm (0.31 inch).

Documents
Document Sharing Hub
Full document details: UL 20 2000

4.4 Bases and Bodies

4.4.1 General

4.4.1.1 A base or body in or on which live parts are mounted shall be of insulating material determined to be acceptable for the particular application. See Clauses 4.6.2 and 4.6.3.

4.4.1.2 A hole for the entrance of wire in a base intended for surface mounting shall be as indicated in Table 2.

Table 2
Holes for entrance of wire
(see Clause 4.4.1.2)

Switch rating A	Diameter of smallest hole that may be provided mm (inch)
0 – 15	5.6 (0.219)
16 – 25	6.4 (0.250)
26 – 35	7.1 (0.281)

4.4.1.3 A sub-base for a surface-type switch for use with open wiring shall be constructed so that it will separate the wires leading to the switch not less than 13 mm (1/2 inch) from the surface wired over. A sub-base shall be of insulating material determined to be acceptable for the purpose.

4.4.2 Means for Mounting

4.4.2.1 A base intended for surface mounting shall have two or more holes for mounting screws, and a base with an area of more than 0.016 m^2 (25 $inch^2$) shall have three or more holes for mounting screws. A mounting-screw hole shall be countersunk not less than 3 mm (1/8 inch) in the material of the base; and there shall be a spacing over the surface of insulating material, between the head of the screw or washer, and the nearest uninsulated live part, in accordance with 4.8.1.

4.4.2.2 A flush switch shall be provided with means for mounting in a standard flush-device box or on a standard outlet-box cover in accordance with Clause 4.10, Provisions for Grounding. Flush-type switches rated 347 V shall be provided with means for mounting in a specific-use box having tapped holes, spaced on 89.69 mm (3-17/32 inch) centers, that are intended for the mounting of the switch. The mounting screws for a switch that is intended for mounting in a standard flush-device box shall be #6 - 32 and shall be spaced 83.34 mm (3-9/32 inch) apart.

4.4.2.3 A metal yoke, strap, or mounting ears shall not be less than 1.02 mm (0.040 inch) or more than 2.3 mm (0.09 inch) thick. If a nonferrous metal is used, it shall be of sufficient thickness to provide mechanical strength and rigidity not less than that of 1.02 mm (0.040 inch) thick steel. The yoke,strap,or mounting ears may be provided with extension plaster ears, which may be scored so that they can be broken off if not needed.

4.4.2.4 If a yoke, mounting ears, or strap as described in Clause 4.4.2.3 is made of steel, the corrosion protection for a switch for use in a flush-device box or on an outlet-box cover shall be a zinc or equivalent coating not less than 0.0038 mm (0.00015 inch) thick in accordance with the method for determining protection against corrosion in the Standard for Metallic Outlet Boxes, UL 514A, or CAN/CSA C22.2 No. 0, General Requirements - Canadian Electrical Code, Part II, or other coatings determined to be acceptable for the particular application.

Documents
Document Sharing Hub
Full document details: UL 20 2000

4.4.2.5 A nonmetallic yoke, strap, or mounting ears shall be of a material and construction determined to be acceptable for the intended use.

4.4.2.6 A screw provided for use in mounting the switch to an outlet box or other enclosure shall project not more than 22 mm (7/8 inch) beyond the strap or cover and shall have a flat or blunt end. The end of the screw shall have no burrs, fins, or sharp edges that can damage wiring. This does not preclude thread-cleaning slots or grooves in the end of a screw.

4.4.3 Sealing

4.4.3.1 Live screw heads or nuts on the underside of a base intended for surface mounting shall be covered with a waterproof, insulating sealing compound with a softening point of 65°C (149°F) or higher. If such parts are spaced not less than 6 mm (1/4 inch) through-air from the mounting surface and are staked, upset, or otherwise reliably prevented from loosening, sealing compound need not be provided.

4.4.3.2 Sulphur shall not be used as a sealing material.

4.4.3.3 Determination of the softening point of a sealing compound shall be made in accordance with the test method specified in ASTM, E 28-99, Standard Test Methods for Softening Point of Resins Derived from Naval Stores by Ring-and-Ball Apparatus.

4.5 Current-Carrying Parts

4.5.1 General

4.5.1.1 Current-carrying parts and wire-binding nuts and screws shall be of metal and shall have the strength, rigidity, and ampacity to comply with the requirements outlined in Clauses 4.2 – 4.5.

Exception No. 1: A switching contact in a general-use ac switch shall not be of copper, copper alloy, steel, or other material that is likely to corrode in service so as to adversely affect the switch performance, particularly the heating.

Exception No. 2: A corrosion-resistant (stainless) steel alloy may be used for hermetically sealed switching contacts and for other current-carrying parts not subject to arcing.

4.5.1.2 Current-carrying parts shall not be permitted to be iron or steel, plain or plated.

Exception No. 1: Current-carrying parts may be made of sheet steel clad on both surfaces with copper in the thickness ratio of 10 percent copper, 80 percent steel, and 10 percent copper, and with all cut edges coated with zinc, or an equivalent coating if the applicable overload and endurance tests show that the parts are not subject to arcing.

Exception No. 2: Steel that is corrosion-resistant (stainless) or steel that is protected against corrosion by zinc plating, or an equivalent coating, may be used for grounding terminals, wire-binding nuts, clamps, and screws.

Documents
Document Sharing Hub
Full document details: UL 20 2000

4.5.2 Live Parts

4.5.2.1 Uninsulated live parts shall be secured in place so that turning will not adversely affect performance and so that there is no likelihood of a reduction in spacings to values less than the minimum required spacings specified in Table 6. Contact jaws shall be prevented from turning or shifting in position by means other than friction between surfaces.

4.5.2.2 Except for a wiring terminal, an uninsulated live part mounted on insulating material that wiring can touch shall be recessed into the insulating material so that the wiring cannot touch the live part.

4.5.3 Terminals and Leads

4.5.3.1 Switches shall be provided with wire leads or wiring terminals for the connection of conductors that have an ampacity not less than the maximum current rating of the switch. Wire-binding screws shall be as specified in Clause 4.5.3.8.

4.5.3.2 The means for connection of conductors shall be one of the following:

a) Positive binding-screw pressure on a bared conductor plus upturned lugs or the equivalent to retain the wire under the screw head;

b) Soldering, welding, riveting, or crimping; or

c) Other means may be used if shown to be acceptable for the purpose by tests to determine the adequacy of the current-carrying ability and mechanical features of the connecting means. See Clause 4.5.3.3.

4.5.3.3 A push-in (screwless) terminal shall comply with the performance requirements in Push-In Terminal Tests, Clause 5.10, and shall be:

a) For use only with a solid copper conductor,

b) For a current-carrying connection only, not for grounding; and

c) Marked as indicated in Clause 7.2.2.

4.5.3.4 Push-in terminals intended for use on branch circuit wiring shall be designed so that they will permit the use of a solid No. 14 AWG conductor but will reject a No 12 AWG or larger solid conductor. The opening provided for the conductor shall reject a No. 48 drill rod, 1.981 ±0.0076 mm (0.076 ±0.0003 inch) in diameter. The rod shall be applied with 22 N (5 lbf). Openings, other than those intended for wire termination, such as wire release openings, shall not permit electrical contact to be made with a No. 14 AWG conductor.

4.5.3.5 A switch employing ″push-in″ terminations may be provided with a means to release the conductors. Where an opening in the insulating body is provided for such purpose, behind the plane of the mounting means, it shall not permit entry of a No. 14 AWG solid conductor. The wire release means, if provided, shall be subject to the Push-In Terminal Tests, Clause 5.10.

Documents
Document Sharing Hub
Full document details: UL 20 2000

4.5.3.6 A release mechanism shall be located or guarded so that it cannot be unintentionally actuated during installation. The release mechanism may be guarded by recessing, ribs, barriers, or the like.

4.5.3.7 Switches having terminals of a set screw type shall meet the performance requirements for copper conductors AWG sizes 14, 12, and 10 as specified in UL 486E or CSA C22.2 No. 65.

4.5.3.8 The minimum sizes of wire-binding screws used in making electrical connections shall conform to Table 3.

Table 3
Minimum sizes of wire binding screws
(see Clause 4.5.3.8, 4.10.6)

Rating of switch A	Minimum size of screw	Minimum head diameter	Maximum number of threads per inch
20 or less	#6	0.275 inch	36
20 or less	M3.5	7.0 mm	–
30	#8	0.315 inch	32
30	M4	8.0 mm	–

4.5.3.9 A terminal plate for a soldering lug or pressure wire connector shall not be less than 0.76 mm (0.030 inch) thick, and the tapped hole shall not have less than two full threads in the metal for a terminal screw.

4.5.3.10 A terminal plate for a wire-binding screw shall be of metal not less than 0.76 mm (0.030 inch) thick, and the tapped hole shall not have less than two full threads in the metal.

4.5.3.11 In a terminal plate formed from stock which has the minimum required thickness, as given in Clauses 4.5.3.9 and 4.5.3.10, the metal may be extruded at the tapped hole for the binding screw to provide two full threads, provided that the thickness of the original metal is not less than the pitch of the thread.

4.5.3.12 With reference to the requirements in Clauses 4.5.3.9 and 4.5.3.10, metal not less than 1.52 mm (0.060 inch) thick may be used for a tapped hole for a screw having 32 threads per inch.

4.5.3.13 A wire-binding screw shall thread into metal.

4.5.3.14 Switches intended for mounting in outlet boxes shall have their terminals located or protected so that they will not be pressed, in normal assembly, against the wiring in the box when the switches are installed.

4.5.3.15 Exposed-back wiring terminals shall not be used on a general-use switch intended for installation in a flush-device box, but may be used on a switch intended specifically for mounting in a box that is to be supported by rigid metal conduit, or on a surface-type switch mounted in or on (integral with) an outlet-box cover.

Documents
Document Sharing Hub
Full document details: UL 20 2000

4.5.3.16 Copper or copper alloy terminal parts that come into contact with branch-circuit conductors, other than the grounding conductor, shall not have a coating of zinc or cadmium.

4.5.3.17 Wire leads provided on a switch shall be insulated conductors of a type suitable for the purpose and not less than 100 mm (4 inch) in length. The ampacity of the leads shall be not less than the maximum current rating of the switch.

Exception No. 1: If provided, a grounding conductor may be a bare solid copper wire, or if insulated, the insulation shall be green with or without one or more yellow stripes. The length of a grounding lead shall not be less than 150 mm (6 inches).

Exception No. 2: The length of the leads is not specified for a fixture switch intended to be incorporated in a wiring harness provided the harness and fixture switch are assembled at the same factory.

4.5.3.18 The wire leads of a general-use switch shall be made of copper and not be smaller in size than indicated in Table 4.

Exception: Leads provided for external connection of a pilot light or other signal or sensing circuits in a switch may be No. 18 AWG or larger, regardless of the switch rating.

Table 4
Minimum sizes of switch leads
(see Clause 4.5.3.18, 4.10.7)

Current rating of switch A	Copper supply leads AWG	Copper grounding leads AWG
0 – 6	18	18
6.1 – 10	16	16
10.1 – 15	14	14
15.1 – 20	12	12
20.1 – 30	10	10
30.1 – 40	8	10
40.1 – 50	6	10
50.1 – 60	4	10

4.5.3.19 Pressure cable connectors included in the package of an individually packaged general-use snap switch employing wire leads shall be rated for the intended wire connections of the switch as identified by the switch manufacturer and rated for the size(s) and the number of wires expected to be joined. Switches shall comply with Clause 7.6.8.

4.5.3.20 In a general-use switch rated less than 30A and having provision for the connection of two or more conductors of the circuit (including an identified (grounded) conductor), one set of wiring terminals or leads shall be identified for the identified (grounded) conductor, unless the electrical connection between a pair of terminals intended to be connected to the identified (grounded) conductor is clearly evident, or unless (as in the case of a straight 2-pole switch) it does not make any difference to which set of terminals the identified (grounded) conductor is connected.

Documents
Document Sharing Hub
Full document details: UL 20 2000