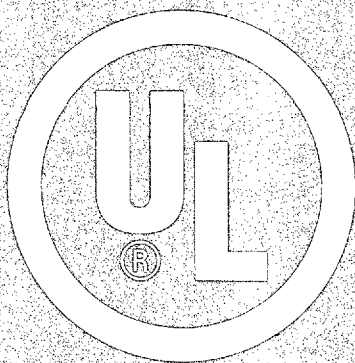


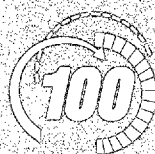
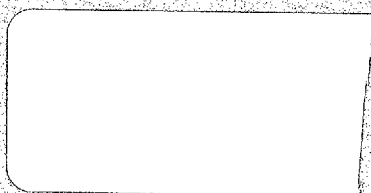


UL 512

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Underwriters Laboratories Inc. Standard for Safety

Fuseholders



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Underwriters Laboratories Inc. (UL)
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UL Standard for Safety
for
Fuseholders, UL 512

Tenth Edition, Dated February 24, 1993

Revisions: This Standard contains revisions through and including March 18, 1999. UL is in the process of converting its Standards for Safety to 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 the page. Significant benefits that will result from UL's use of SGML are increased productivity, reduced turnaround times, and data and information consistency, reusability, shareability, and portability. The changes noted in these revised pages are needed to modify the format and layout of this Standard to allow it to be converted to SGML. These editorial changes are now in effect.

A change is indicated by a note following the affected item. The note is preceded and followed by an asterisk.

The revised requirements are substantially in accordance with UL's Bulletin on this subject dated August 7, 1998. The bulletin is now obsolete and may be discarded.

The revisions dated March 18, 1999 include a reprinted title page (page 1) for this Standard.

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

As indicated on the title page (page 1), this UL Standard for Safety has been adopted by the Department of Defense.

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

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

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Page	Date
tr1 – tr4	March 18, 1999
1	February 24, 1993 (Reprinted: March 18, 1999)
2	July 18, 1997
3, 4	March 18, 1999
5	December 5, 1995
6 – 11	February 24, 1993



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12	July 2, 1993
13	February 24, 1993
14, 15	March 18, 1999
16 – 20	February 24, 1993
21, 22, 22A, 22B	March 18, 1999
23 – 25	February 24, 1993
26, 26A, 26B	March 18, 1999
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1

UL 512**Standard for****Fuseholders**

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Tenth Edition**February 24, 1993**

Approval as an American National Standard (ANSI) covers the numbered paragraphs on pages dated December 5, 1995. These pages should not be discarded when revised or additional pages are issued if it is desired to retain the ANSI approved text.

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The Department of Defense (DoD) has adopted UL 512 on November 9, 1994. The publication of revised pages or a new edition of this standard will not invalidate the DoD adoption.

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

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FOREWORD

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

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

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

D. A product 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.

INTRODUCTION

1 Scope

1.1 These requirements cover:

- a) Fuseholders for Edison-base and Type S plug fuses,
- b) Fuseholders for Class CC, G, H, J, K, R, and T cartridge fuses, and
- c) Devices to adapt Type S plug fuses for use in Edison-base fuseholders.

These fuseholders and devices are intended to accommodate fuses to be employed in lighting and power circuits in accordance with the National Electrical Code.

1.2 These requirements do not cover fused attachment plugs, car-lighting cutouts, protective devices designed for signaling systems or instruments, or fuseholders for link fuses.

1.3 A CTL (circuit-limiting) fuseholder is one having such physical size or configuration that, in conjunction with the physical means provided in a Class CTL panelboard or other device, installation of more overcurrent-protective devices than the number for which the assembly is designed and rated will be prevented.

1.4 Except as noted in 1.5, a device that has provision for connection to the conductors of more than four circuits, other than the supply circuit or a continuation thereof, is considered to be and judged as a panelboard rather than as a fuseholder.

1.5 A device that has:

- a) Provision for connection to more than four but not more than 12 branch circuits,
- b) Receptacles for plug fuses only, and
- c) Been designed specifically for use in an enclosed branch-circuit cutout is considered to be and is judged as a fuseholder.

1.6 A fuseholder that has been designed specifically for use in an enclosed branch-circuit cutout or in a panelboard assembly is judged with respect to the intended application as well as being judged under the requirements in this standard.

1.7 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.

1.7 revised December 5, 1995

2 General

2.1 Components

2.1.1 Except as indicated in paragraph 2.1.2, a component of a product covered by this standard shall comply with the requirements for that component.

2.1.2 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.

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

2.1.4 Specific components are recognized as being 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 for which they have been recognized.

2.2 Units of measurement

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

2.3 Undated references

2.3.1 Any undated reference to a code or standard appearing in the requirements of this standard shall be interpreted as referring to the latest edition of that code or standard.

CONSTRUCTION

3 Bases and Supports – Insulating Material

3.1 A base for mounting uninsulated live parts shall be an insulating material that is:

- a) Strong,
- b) Moisture-resistant, and
- c) As resistant to combustion as the materials mentioned in 3.2.

The material shall also withstand the most severe conditions likely to be met in service.

3.2 Porcelain, slate, marble, phenolic composition, and cold-molded composition are acceptable for supporting an uninsulated live part.

3.3 A material other than those mentioned in 3.2 may be used for supporting an uninsulated live part if it has been investigated and found to be acceptable for the application.

3.4 Fiber, rubber, and so-called hot-molded shellac and tar composition are not acceptable for supporting an uninsulated live part.

3.5 A base of slate, marble, or porcelain shall not be less than 1/2 inch (12.7 mm) thick.

3.6 Vulcanized fiber of good quality and not less than 1/32 inch (0.8 mm) thick, or mica, may be used for washers under center contacts of plug fuseholders.

3.7 A base shall not have fewer than two holes for mounting screws, and a base with an area of more than 25 square inches (161 cm²) shall have three or more holes for mounting screws.

Exception: A fuseholder designed particularly for use in a complete device, such as a unit-type base for panelboard assembly, and having an acceptable means for mounting, equivalent to mounting screws may be acceptable with a fewer number of holes.

3.8 A mounting-screw hole shall be located or countersunk so that there will be a spacing of not less than 1/2 inch (12.7 mm) over the surface of the insulating material between the head of the screw or washer and the nearest uninsulated live part.

3.9 A mounting-screw hole located between uninsulated live parts of opposite polarity shall be countersunk unless barriers or the equivalent are provided to prevent the screwhead from being in the path of a possible arc between such live parts.

4 Sealing

4.1 A live screwhead, rivet, or nut on the underside of a base designed for surface mounting shall be countersunk not less than 1/8 inch (3.2 mm) in the clear, and covered to a depth of not less than 1/8 inch with a water proof, insulating sealing compound.

Exception: A part that has a spacing through air from the mounting surface of not less than 1/2 inch (12.7 mm) and that is prevented from loosening.

4.2 A screw or nut mentioned in 4.1 that is prevented from loosening by being staked or upset, by a lock washer, or by other means may be insulated from the mounting surface by a material other than a sealing compound.

4.3 The sealing compound shall not soften at a temperature 15°C (27°F) higher than its normal operating temperature in the device, but not less than 65°C (149°F).

4.4 A determination of the softening point of a sealing compound is to be made in accordance with the test for Softening Point by Ring and Ball Apparatus, ASTM E28-67(1982).

5 Current-Carrying Parts

5.1 General

5.1.1 A current-carrying part shall have the necessary mechanical strength and ampacity for the service, and shall be of metal or other material that is acceptable for the application.

5.1.2 A metal part for mounting or holding contact clips shall be securely and rigidly fastened to the supporting base or mounting surface. All current-carrying parts shall be prevented from turning or shifting in position by means other than friction between surfaces. Turning or shifting may be prevented by the use of two screws or rivets, by noncircular shoulders or mortises, by a dowel pin, lug, or offset, by a connecting strap or clip fitted into an adjacent part, or by an equivalent method.

5.1.3 Where parts are held together by screws, a threaded part shall not have fewer than two full, clean-cut threads. Threads shall not be finer than the American National Standard threads indicated in Table 6.1, if the screw extends all the way through the threaded part. If the screw does not extend all the way through the threaded part, it shall engage full, clean-cut threads for a distance of not less than the diameter of the screw.

Table 5.1
Threads

American national standard screw size	Maximum number of threads per inch
12	24
10	32
8	32
6	36

5.1.4 With reference to the requirement in 5.1.3, metal not less than 0.060 inch (1.52 mm) thick is acceptable for a tapped hole for a screw having 32 threads per inch.

5.1.5 Except for plated No. 10 and larger wire-binding screws and nuts and stud terminals, iron or steel, plain or plated, shall not be used for parts that are depended upon to carry current. Plated iron or steel screws, nuts, and stud terminals, if not depended upon to carry current, may be used with soldering lugs and pressure wire connectors. A plated iron or steel washer may be used under the center contact of an Edison-base plug fuseholders.

5.1.6 Copper and brass are not acceptable for the plating of an iron or steel wire-binding screw, nut, or stud terminal, or for the plating of an iron or steel washer under the center contact of an Edison-base plug fuseholder; but a plating of cadmium or zinc is acceptable.

5.1.7 In a plug-fuseholder assembly intended for the connection of 15-ampere branch circuits, the ampacity of bus bars shall be as specified in Table 5.2. See 5.1.1.

5.1.8 A branch bar or strap leading to a branch fuseholder shall have an ampacity not less than that of the largest capacity fuse that the branch fuseholder will accommodate. See 5.1.1.

Table 5.2
Minimum ampacity of bus bars

Total number of fuses per ungrounded bus bar ^a	Minimum ampacity		
	2-wire mains	125 – 250 volt, 3-wire mains	3-phase, 4-wire mains
2	30	30	30
3	35	33	31
4	48	42	40
5	66	50	–
6	66	60	–
7 or 8	84	–	–
9 or 10	100	–	–
11 or 12	120	–	–

^a For an assembly that has an unequal number of fuses per ungrounded bus bar, calculations are to be based on the larger number of fuses per ungrounded bus bar.

5.2 Wiring terminals

5.2.1 A fuseholder shall be provided with wiring terminals that are acceptable for the connection of branch- or feeder- and supply-circuit conductors, the ampacities of which correspond respectively to the maximum current rating of the fuse accommodated and to the ampacity of the main bus bars. A wiring terminal shall be provided with a soldering lug firmly bolted or held by a screw, or with a pressure wire connector.

Exception: A wire-binding screw may be employed at a wiring terminal intended for the connection of a No. 10 AWG (5.3 mm²) or smaller conductor, if upturned lugs or the equivalent are provided to hold the wire in position.

5.2.2 With reference to 5.2.1, sizes of field-installed conductors for currents as indicated in Table 5.3 shall be determined as follows:

- a) Wire rated at 75°C (167°F) in the No. 1/0 AWG (53.5 mm²) and larger sizes.
- b) Wire rated at 60°C (140°F) in the No. 1 AWG (42.4 mm²) size, except 75°C (167°F) wire if the fuseholder is marked for 75°C wire in accordance with 14.6.
- c) Wire rated at 60°C (140°F) in the No. 2 AWG (33.6 mm²) and smaller sizes, except 75°C (167°F) wire if the fuseholder is marked for 75°C wire in accordance with 14.7 and has been found acceptable in a temperature test.

5.2.3 A wire-binding screw employed at a wiring terminal shall not be smaller than No. 10 and shall not have more than 32 threads per inch.

Exception: A machine screw not smaller than No. 8 and having not more than 32 threads per inch may be used at a terminal of a 15-ampere Type S fuseholder.

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

5.2.5 A terminal plate formed from stock having the minimum thickness specified in 5.2.4 may have the metal extruded at the tapped hole to provide two full threads for the wire-binding screw.

Table 5.3
Ampacity of insulated conductors

Wire size		60°C (140°F)		75°C (167°F)	
AWG	mm ²	Copper	Aluminum	Copper	Aluminum
14	2.1	15	—	15	—
12	3.3	20	15	20	15
10	5.3	30	25	30	25
8	8.4	40	30	45	40
6	13.3	55	40	65	50
4	21.2	70	55	85	65
3	26.7	85	65	100	75
2	33.6	95	75	115	90
1	42.4	110	85 ^a	130	100
1/0	53.5			150	120
2/0	67.4			175	135
3/0	85.0			200	155
4/0	107			230	180
KCMIL					
250	127			255	205
300	152			285	230
350	177			310	250
400	203			335	270
500	253			380	310
600	304			420	340
700	355			460	375
750	380			475	385
800	405			490	395
900	456			520	425
1000	506			545	445
1250	633			590	485
1500	760			625	520
1750	887			650	545
2000	1010			665	560

NOTE – For a multiple-conductor connector at a terminal, the value is to be multiplied by the number of 1/0 AWG (53.5 mm²) or larger conductors that the terminal will accommodate.

^a If the fuseholder is marked to indicate that 75°C (167°F) wire is to be used at the terminal, the acceptable current is 100 amperes for an aluminum conductor. See 14.6.

5.2.6 A wire-binding screw shall not thread into material other than metal.

5.2.7 A wiring terminal shall not extend beyond nor overhang the base on which it is mounted.

Exception: A soldering lug or a pressure wire connector.

5.2.8 A pressure wire connector provided with or specified for use with a fuseholder shall comply with the requirements in the Standard for Wire Connectors and Soldering Lugs for Use With Copper Conductors, UL 486A, or the Standard for Wire Connectors for Use With Aluminum Conductors, UL 486B.

5.2.9 The tightening torque for a field-wiring terminal shall be as specified by the fuseholder manufacturer and shall be marked as required by 14.10. The specified tightening torque shall not be less than 90 percent of the value employed in the static heating test as specified in the Standard for Wire Connectors and Soldering Lugs for Use With Copper Conductors, UL 486A, or the Standard for Wire Connectors for Use With Aluminum Conductors, UL 486B, for that wire size corresponding to the ampere rating of the fuseholder. See 12.1.

Exception: Torque value may be less than 90 percent if the connector is investigated in accordance with the lesser assigned torque value in UL 486A or UL 486B.

5.2.10 The relative arrangement of terminals for the connection of conductors shall be such that the terminals for any one circuit will be readily evident or the fuseholder shall be marked in accordance with 14.8.

5.2.11 In a fuseholder that employs an unfused neutral bar, each terminal for the connection of a grounded conductor shall be identified by a metallic plating substantially white in color – or the terminals may be of metal substantially white in color – and shall be readily distinguishable from the terminals for the connection of ungrounded conductors.

5.2.12 A terminal of a nonpolarized device shall not be identified by the means described in 5.2.11.

Exception: A nonpolarized device in which all terminals are white need not comply.

5.3 Contact clips of cartridge fuseholders

5.3.1 The fuse contact clips of a cartridge fuseholder shall be constructed so that electrical contact with a fuse of the corresponding rating will be maintained. Ferrule-contact clips shall be made of bronze or the equivalent, and knife-blade-contact clips shall be made of copper. End stops shall be provided to ensure the proper location of a ferrule-type cartridge fuse in the contact clips.

5.3.2 The construction of a fuseholder shall be such that it will reject a fuse having either:

- a) A current rating greater than or
- b) A voltage rating less than that of the fuse size for which it is intended.

The values in the tables that specify fuseholder dimensions are such that these conditions will be met.

5.3.3 A fuseholder intended for a Class CC or R fuse shall be provided with a rejection member to prevent installation of fuses of other classes.

5.3.4 The rejection member in a fuseholder intended for a Class R fuse may consist of a pin, a bolt, or lancing of the clips. Other methods may be used if shown to be acceptable for the purpose. See 5.3.5.

5.3.5 A fuseholder for a Class CC or R fuse shall be constructed so that removal of the rejection member by using ordinary tools and methods as described in 5.3.6 causes obvious damage to the fuseholder.

5.3.6 The methods and tools referred to in 5.3.5 are:

- a) Methods:
 - 1) Bending, twisting, reshaping, or breaking apart, and

- 2) Addition, removal, or substitution of a standard available part, common hardware, screws, or the like.

Exception: A part that is retained by standard head screws, nuts, or bolts that are accessible for release only from the rear of the fuseholder or that are retained by rivets or one-way screws need not comply.

- b) Tools: a hand screwdriver, pliers, diagonal cutter, wrench – excluding a pipe wrench – and a tool specifically designed to alter the rejection member that is readily available in the field.

5.3.7 A rejection member in a fuseholder designed for a Class R fuse shall remain effective after being subjected for 1 minute to the forces specified in Table 5.4. The force shall be applied using a Class K or H fuse or a dummy fuse.

Table 5.4
Withstand force for Class R fuseholders

Fuseholder rating		Force	
Amperes	Volts	Pounds	Newtons
30	250	50	222
30	600	80	356
60	250/600	80	356
100	250/600	100	445
200	250/600	150	667
400	250/600	200	890
600	250/600	200	890

5.3.8 A rejection member in a fuseholder designed for a Class CC fuse shall remain effective after being subjected for 1 minute to an insertion force of 50 pounds (222 N). The force shall be applied using a Class G fuse or a Class G dummy fuse.

5.3.8 revised July 2, 1993

5.3.9 Parts of contact clips for knife-blade-type fuses that are held in slots milled in the mounting piece shall fit together closely, shall be sweated with solder, and shall also be secured with one or more rivets or screws.

Exception: For a 100-ampere fuseholder, the soldering and pinning may be omitted if the contact clips are forced through holes in the mounting piece to make a tight joint and are upset or riveted on the underside of the mounting piece.

5.3.10 The dimensions of a cartridge fuseholder, other than Class R, shall be as specified in Table 5.5, 5.6, 5.7, or 5.8 and Figure 5.1, 5.2, 5.3, or 5.4, whichever is applicable.

Exception: A fuseholder with other constructions may be acceptable if it has been shown by appropriate investigation to be suitable for the purpose. See 5.3.13.

5.3.11 The dimensions of a cartridge fuseholder designed for a Class R fuse shall be the same as specified in Table 5.5 for Class H fuses except for the dimensions given in column G.

5.3.12 A rejection member shall have the configuration illustrated in Figure 5.5 or 5.6, whichever is applicable, and the dimensions specified in Table 5.9.

5.3.13 The investigation mentioned in the exception to 5.3.10 is to include consideration of the ability of the fuseholder to accommodate a cartridge fuse of standard dimensions and to provide means for mounting the fuse securely in place without overheating or other evidence of unacceptable performance.

5.3.14 Minimum distances are specified between end stops for the knife-blade type of fuseholder because a fuseholder forming a part of an enclosed switch or service equipment is often designed so that the fuse sets into a well in porcelain or other insulating material. In order that a fuse of the maximum overall length may be inserted in the clips, it is necessary that the end walls that automatically form end stops have a certain minimum distance between them. No maximum end-stop spacings are necessary for the knife-blade type of fuseholder, because the centering of the fuse is automatically taken care of by the spacing between the contact clips, for other than Class T fuses – see note b to Table 5.8 for use of maximum spacing between end stops.

5.3.15 If the end stops of a ferrule-type clip are formed from the metal of the clip itself, the construction shall be such that the effective width of the clip that will engage the ferrule of a fuse will not be less than the dimension specified in column C in Table 5.5.

5.3.16 The length of the bolted contact of a fuse clip of the bent-up type that is screwed or bolted to a connecting strap or link, shall not be less than the full width of the fuse clip – column C in Table 5.5.

5.3.17 The contact clips for a 60-ampere, 250-volt Class H fuseholder may be used:

- a) For a 30-ampere, 600-volt Class H fuseholder if the distance between the clips – dimension B in Figure 5.1 – is 3-3/4 inches (95.3 mm) and
- b) For a 30-ampere Class J fuseholder if that distance is 1 inch (25.4 mm).

5.3.18 In addition to the requirements in 5.3.1 – 5.3.17, the design, dimensions, and spacings of a cartridge fuseholder shall be such that it will properly receive a cartridge fuse of a corresponding rating that complies with the configurations illustrated in Figures 5.7 – 5.17 and the dimensions specified in Tables 5.10 – 5.18, whichever are applicable.