

**Canadian Standards Association**  
**CAN/CSA-C22.2 No. 745-2-1**  
*First Edition*



**Underwriters Laboratories Inc.**  
**UL 745-2-1**  
*First Edition*



## **Particular Requirements for Drills**

March 23, 1995

(Title Page Reprinted: February 18, 1997)

Approved  
by  
Standards Council  
of Canada



 *American National Standard*  
**ANSI/UL 745-2-1-1996**

**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.

Approval as an American National Standard (ANSI) covers the numbered paragraphs on pages dated March 23, 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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## Preface

This is the common CSA and UL Standard for portable electric drills. It is the first edition of CSA Standard C22.2 No. 745-2-1 *Safety of portable electric tools Part 2: Particular requirements for drills* and UL 745-2-1 *Safety of portable electric tools Part 2: Particular requirements for drills*. It is written in SI (metric) units.

This Standard was prepared by Canadian Standards Association and Underwriters Laboratories Inc. This common CSA and UL Standard is based on IEC Publication 745-2-1 (1989) *Part 2: Particular requirements for drills*. Where Canadian and US deviations have necessitated the deletion of IEC Publication 745-2-1 text, the IEC text has been retained but has been over-stricken to indicate it as nonmandatory. Text added to IEC Publication 745-2-1 as mandatory has been redlined (shaded) including, where feasible, Tables and Figures.

Where a particular clause of the general requirements Standard is not mentioned in this Standard, the clause applies as far as is reasonable. Where this edition states *addition*, *modification*, or *replacement*, the relevant requirement, test specification, or explanatory matter in the general requirements Standard should be adapted accordingly.

If the functions of a tool are covered by different particular Standards, the relevant particular requirements Standard is applied to each function separately, so far as is reasonable. If applicable, the influence of one function on the other is taken into account.

This Standard was reviewed by the CSA Subcommittee on Portable Electric Tools of the Technical Committee on Consumer and Commercial Products under the jurisdiction of the Standards Steering Committee on the Canadian Electrical Code, Part II, and was formally approved by these Committees.

This Standard was processed and reviewed in accordance with the method of development, revision and implementation of UL Standards for safety.

This Standard has been approved by the Standards Council of Canada as a National Standard of Canada and has been approved by the American National Standards Institute (ANSI) as an American National Standard.

March 23, 1995

### **UL Effective Date**

As of June 1, 2007, all products Listed or Recognized by UL must comply with the requirements in this Standard.

Between June 1, 2002 and June 1, 2007, new product submittals to UL must be evaluated under all requirements in this standard.

Between March 23, 1995 and June 1, 2002, new product submittals to UL may be evaluated under all requirements in this Standard or, if requested in writing, evaluated under presently effective requirements only. The presently effective requirements are contained in the seventh edition of UL 45.

**CSA Effective Date**

The effective date for CSA will be announced through a *CSA Certification Notice*.

**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.*

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# Particular Requirements for Drills



Northbrook, Illinois • (708) 272-8800  
Melville, New York • (516) 271-6200  
Santa Clara, California • (408) 985-2400  
Research Triangle Park,  
North Carolina • (919) 549-1400



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UL Standards for Safety are developed under a procedure which provides for participation and comment from the affected public as well as industry. The procedure takes into consideration a survey of known existing standards and the needs and opinions of a wide variety of interests concerned with the subject matter of the standard. Thus manufacturers, consumers, individuals associated with consumer-oriented organizations, academicians, government officials, industrial and commercial users, inspection authorities, insurance interests and others provide input to UL in the formulating of UL Standards for Safety, to keep them consonant with social and technological advances.

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**March 23, 1995**

**Standard for**

**Particular Requirements for Drills**

**UL 745-2-1, First Edition**

Accompanying this transmittal notice is a copy of the First edition of UL 745-2-1.

**THIS EDITION OF THE STANDARD BECOMES EFFECTIVE JUNE 1, 2002 FOR NEW PRODUCT SUBMITTALS AND JUNE 1, 2007 FOR ALL PRODUCTS LISTED OR RECOGNIZED BY UL.**

New product submittals made prior to a specified future effective date will be judged under all of the requirements in this standard unless the applicant specifically requests that the product be judged under the current requirements. However, should the applicant elect 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.

The requirements in this standard are substantially in accordance with UL's bulletin on this subject dated July 25, 1994. This bulletin is now obsolete and may be discarded.

Revised and/or additional pages may be issued from time to time.

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## Foreword (CSA)

Certification organizations, as accredited by the Standards Council of Canada, have their own criteria procedures for certification services. The following paragraphs define CSA Certification policies.

The Canadian Standards Association 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 necessity 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 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 Federal laws or regulations.

Testing techniques, test procedures and instrumentation frequently must be prescribed by the CSA Certification 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 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 details about CSA Certification please address your inquiry to the Applications and Records Section, Canadian Standards Association, 178 Rexdale Boulevard, Rexdale (Toronto), Ontario M9W 1R3.

## 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 differing from those detailed in the requirements of this Standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, 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.

## 1. Scope

This clause of Part 1 is applicable, except as follows:

### 1.1 *Replacement:*

This standard applies to drills and impact drills.

## 2. Definitions

This clause of Part 1 is applicable, except as follows:

### 2.2.23 *Replacement:*

**Normal load** denotes the load obtained when the drill, placed in a horizontal position, is operated continuously, the torque applied to the spindle being such that the output in watts is equal to:

- 10D for drills having D up to 6.5 mm;
- 13D for drills having D from 6.5 up to 10 mm;
- 15D for drills having D above 10 mm.

where D is equivalent to:

- either the maximum diameter, in millimeters, of the largest borer marked on the chuck, for drills supplied with a chuck, or
- the maximum diameter, in millimeters, of the borer for drilling steel marked on the drill; whichever is the greater.

The normal load is based on the rated voltage or on the upper limit of the rated voltage range.

### *Additional definitions:*

2.2.101 **Drill** denotes a tool specifically designed to make holes in various materials such as metal, plastics, wood, etc.

It is designed to rotate, normally in a clockwise direction, at one or more speeds.

2.2.102 **Impact drill** denotes a drill specially designed to make holes in concrete, stone and other similar materials. It is similar, in appearance and construction, to a drill, but has a built-in percussion system which gives an axial percussion movement to the rotating output spindle.

It may have a device for rendering the percussion system inoperative, so that it may be used as a conventional drill.

The impact energy is influenced by the force applied by the operator.

An impact drill is normally designed to rotate, in a clockwise direction, at one or more speeds.

2.2.103 The term "borer" is defined as a high-speed twist drill bit.

**3. General requirement**

This clause of Part 1 is applicable.

**4. General notes on tests**

This clause of Part 1 is applicable, except as follows:

4.9 *Replacement:*

*For drills which have both a mechanical means of setting different ranges of speed and an electronic means of setting the speed within a given range, the mechanical device is adjusted to the lowest range possible, and the electronic device is adjusted to the highest setting within the given range.*

**5. Rating**

This clause of Part 1 is applicable.

**6. Classification**

This clause of Part 1 is applicable.

**7. Marking**

This clause of Part 1 is applicable, except as follows:

7.1 *Addition:*

In addition, drills shall be marked with:

- ~~rated no-load speed, if exceeding 10,000 rev/min, preceded by the symbol  $n_0$ ;~~
- maximum diameter, in millimeters, of the borer for drilling steel having a tensile strength of 390 N/mm<sup>2</sup>, unless otherwise specified.

7.5 *Addition:*

If the drill is marked with a speed at normal load, the speed value shall be preceded by the letter  $n$ .

The marking for rated no-load speed ( $n_0$ ) and for speed at normal load ( $n$ ) may accordingly be as follows:

$n_0$ 12,000 rev/min	or	$n_0$ 12,000 <del>rev</del> /min $n$ 9,000 <del>rev</del> /min	or	$n_0$ 12,000 <del>rev</del> /min $n$ 2,000/4,500/9,000 <del>rev</del> /min
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**8. Protection against electric shock**

This clause of Part 1 is applicable.

**9. Starting**

This clause of Part 1 is applicable.

**10. Input and current**

This clause of Part 1 is applicable.

**11. Heating**

This clause of Part 1 is applicable, except as follows:

**11.2 ~~Replacement Addition:~~**

*Drills are operated continuously with the impact mechanism, if any, disengaged, while the torque applied to the spindle shall be either:*

- a) *that which attains 4/5 of the input at normal load, if the input at normal load exceeds rated input, or*
- b) *that which attains 4/5 of rated input if rated input equals or exceeds the input under normal load.*

**11.5 ~~Modification:~~**

*The temperature limits do not apply to mechanical housing of hammer drills and the like provided, two grasping surfaces are provided for normal operation.*

**12. Leakage current**

This clause of Part 1 is applicable.

**13. Radio and television interference suppression**

This clause of Part 1 is applicable.

**14. Moisture resistance**

This clause of Part 1 is applicable.

**15. Insulation Resistance and electric strength.**

This clause of Part 1 is applicable.

**16. Endurance**

This clause of Part 1 is applicable except as follows:

## 16.2

*Addition: Impact drills are additionally tested as follows:*

*Impact drills are operated with no load and, if the impact mechanism can be engaged and disengaged, at will, the impact mechanism shall remain disengaged for 12 h at a voltage equal to 1.1 times the rated voltage, and then for 12 h at a voltage equal to .9 times rated voltage. The speed is adjusted to the highest value of the highest range.*

*The impact drills are then mounted vertically in a apparatus as shown in Figure 101 and are operated at rated voltage or at the mean value of the rated voltage range, for four periods of six hours each, the interval between these periods at least 30 min, and if the impact mechanism can be engaged and disengaged at will, the impact mechanism should remain engaged.*

*During these tests, the impact drills are operated intermittently, each cycle comprising a period of operation of 30 s and a rest period of 90 s during which the tool remains switched off.*

*During the tests in the apparatus, an axial force, just enough to ensure the steady operation of the impact mechanism, is applied to the impact drill through a resilient medium.*

**17. Abnormal operation**

This clause of Part 1 is applicable.

**18. Mechanical hazards**

This clause of Part 1 is applicable, *except as follows:*

**18.1 Addition:**

Chuck keys shall be so designed that they drop easily out of position when released; they shall not be fixed to the tool by means of a chain, string, or similar means.

*Compliance is checked by inspection and by a manual test.*

*The key is inserted into the chuck, and without tightening, the drill is turned so that the key is facing down. The key must fall out.*

This requirement does not exclude the provision of clips for holding the key in place when not in use; metal clips fixed to the flexible cable or cord are, however, not acceptable.

**19. Mechanical strength**

This clause of Part 1 is applicable.

## 20. Construction

This clause of Part 1 is applicable, except as follows:

*Additional sub-clause:*

20.101 Drills which are marked for use with drill-borers having a diameter exceeding 16 mm for drilling steel or which are fitted with a chuck marked for use with such drill-borers, shall have side handles or shall have provision for fixing a side handle, in addition to the normal handle.

*Compliance is checked by inspection*

~~A more detailed requirement is under consideration.~~

~~20.18.101 A switch lock-on device on drills or impact drills shall be located outside the grasping area or so designed that it is not likely to be unintentionally locked on by the user's hand during intended left or right-handed operation.~~

~~Compliance is checked by inspection or by a manual test.~~

~~A switch with a lock-on button located in a recess within the grasping area shall not be actuated by a straight-edge utensil when the utensil is made to pass back and forth across the device in any direction.~~

~~Note: The straight-edge utensil is to be of any convenient length sufficient to bridge the surface of the lock-on device and any surface adjacent to the lock-on device.~~

## 21. Internal wiring

This clause of Part 1 is applicable.

## 22. Components

This clause of Part 1 is applicable

## 23. Supply connection and external flexible cables and cords

This clause of Part 1 is applicable.

## 24. Terminals for external conductors

This clause of Part 1 is applicable.

## 25. Provision for earthing

This clause of Part 1 is applicable.

## 26. Screws and connections

This clause of Part 1 is applicable.

**27. Creepage distances, clearances and distances through insulation**

This clause of Part 1 is applicable.

**28. Resistance to heat, fire and tracking**

This clause of Part 1 is applicable.

**29. Resistance to rusting**

This clause of Part 1 is applicable.

**30. Tests by Manufacturers**

This clause of Part 1 is applicable.

**31. Instructions**

This clause of Part 1 is applicable, except as follows:

***Additional Specific Safety Rule:***

**31.3.101 Hold tool by insulated gripping surfaces when performing an operation where the cutting tools may contact hidden wiring or its own cord. Contact with a "live" wire will make exposed metal parts of the tool "live" and shock the operator.**

**Appendix A – Thermal cut-outs and overload releases**

This appendix of Part 1 is applicable.

**Appendix B – Electronic Circuits**

This appendix of Part 1 is applicable.

**Appendix C – Construction of safety isolating transformers**

This appendix of Part 1 is applicable.

**Appendix D – Measurement of creepage distances and clearances**

This appendix of Part 1 is applicable.

**Appendix E – Reference standards**

This appendix of Part 1 is applicable.

**Appendix F – Attachments and accessories**

This appendix of Part 1 is applicable.

**Appendix G – Sequence of tests**

This appendix of Part 1 is applicable.

## Appendix H - Translations

This appendix of Part 1 is applicable, except as follows:

*Advisory Note:* In Canada there are two official languages; therefore it is necessary to have CAUTION, WARNING, and DANGER markings in both English and French on those products to be sold or used in Canada. Following is a list of acceptable French translations of the markings specified in this Standard.

This appendix of Part 1 is applicable except as follows:

### H1 Translations

Following is a list of acceptable French translations of the instructions specified in this Standard.

#### H1.2 Instructions

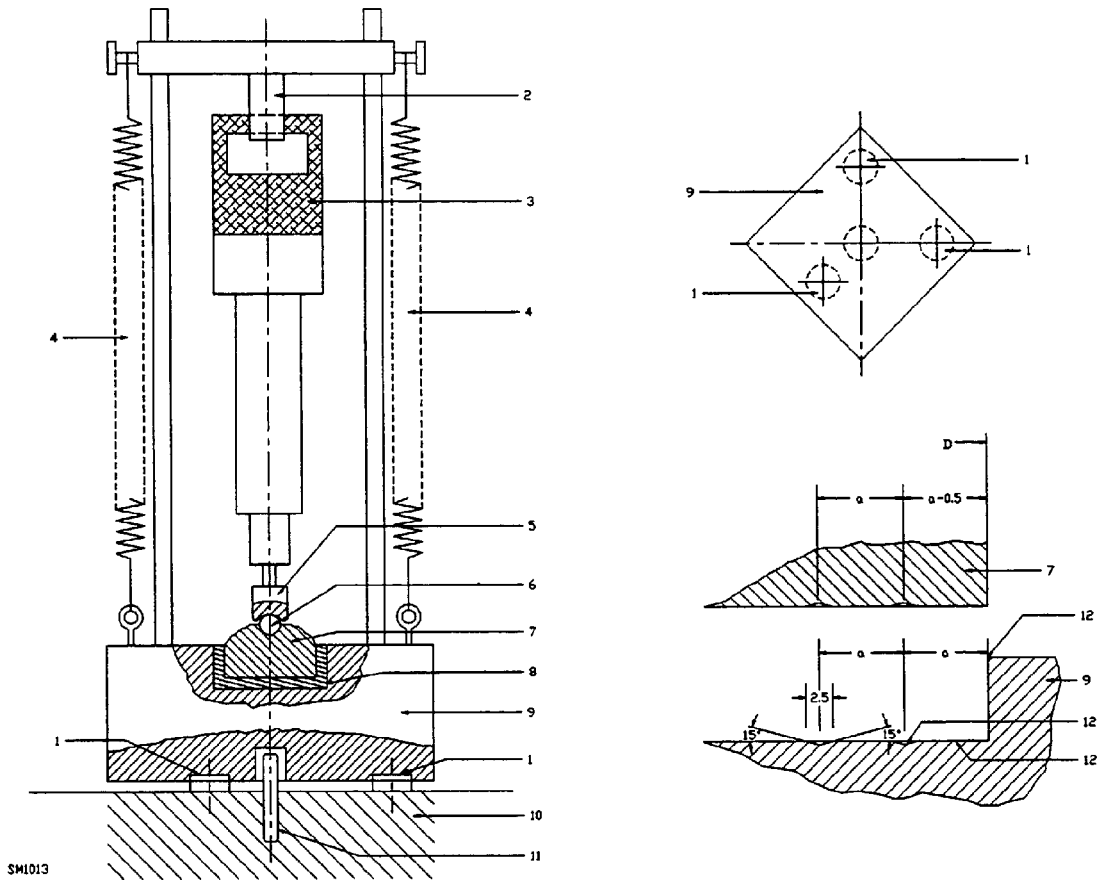
##### 31. Instructions

L'article correspondant du chapitre 1 s'applique, sauf pour ce qui suit :

*Règle de sécurité particulière supplémentaire :*

**31.3.101** Tenez l'outil par ses surfaces de prise isolées pendant toute opération où l'outil de coupe pourrait venir en contact avec un câblage dissimulé ou avec son propre cordon. En cas de contact avec un conducteur sous tension, les pièces métalliques à découvert de l'outil transmettraient un choc électrique à l'utilisateur.

Figures



Dimensions in millimeters

1. Synthetic rubber disk or material having similar properties, shore hardness 70 deg. to 80 deg. thickness 10 mm, diameter 75 mm.
2. Polyamide-lined yoke, adapted to suit the grip of the tool.
3. Sample.
4. Mechanical or pneumatical springs applying a force to the sample.
5. Punch.
6. Hardened steel ball with diameter 38 mm.
7. Hardened steel transfer plate of mass  $M_2$  and diameter  $D$ , grooved on underside as shown in detail.
8. Synthetic rubber disk or material having similar properties, shore hardness 70 deg. to 80 deg thickness 6 mm to 7 mm fitting closely in cavity.
9. Steel base at mass  $M_1$ , with circular cavity having a diameter 1 mm greater than that of the transfer plate. Bottom of cavity grooved, as shown in detail.
10. Concrete block supported by compacted ballast of earth.
11. Steel peg to prevent any horizontal movement.
12. Burnished surface and edge.

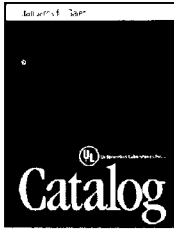
Figure 101 Testing Apparatus

When submitting a tool, the applicant may supply, if necessary, a suitable punch and shank, the total mass of which is less than that specified in the table, for the steady operation of the impact mechanism.

Rated input of tool (W)	D Diameter of transfer plate (mm)	a Distance between centers of grooves (mm)	M <sub>1</sub> Mass of steel base (kg)	M <sub>2</sub> Mass of transfer plate (kg)	M <sub>3</sub> Total mass of punch and shank (kg)
Up to and including 700	100	6.5	90	1.0	0.7
Over 700 up to and including 1200	140	5.75	180	2.25	1.4
Over 1200 up to and including 1800	180	5.0	270	3.8	2.3
Over 1800 up to and including 2500	220	4.5	360	6.0	3.4

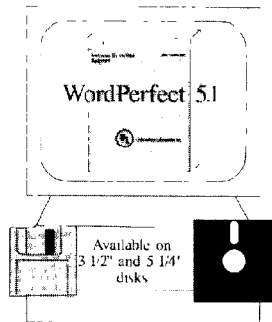


## UL's Product Safety Publications and Standards Binders



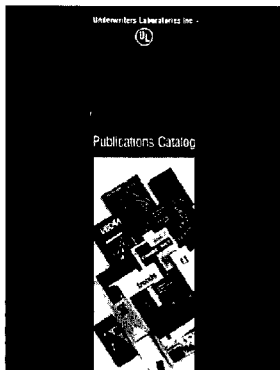
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### Publications Catalog

The variety of publications and product services described in this catalog may surprise some people who only think of UL as a symbol on the back of a television or electric coffee maker. Gas appliances, roofing materials, industrial trucks, boats, burglar alarms, computers, lightning protection components, fire extinguishers — these are just a handful of the thousands of products that fall within the scope of UL's testing for public safety. Brochures for international services, consumer information and films, product directories, and inspection guides are among the 70-plus publications described in the catalog.

Standards for Safety



### Standards Update

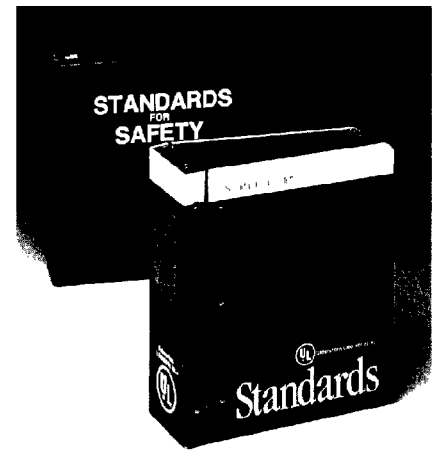
Published quarterly, the UL Standards Update contains the latest information on UL's Standards for Safety, proposed standards, outlines of investigation, and Standards-on-Diskette. The Update also includes information on revisions, bulletins, UL test equipment, upcoming effective dates, and UL/CSA and International harmonization activities. The cost of the Update is \$75 which includes shipping by regular First Class mail.

### Regular Binder

Heat-sealed blue vinyl with 2 1/4 inch rings will hold approximately 25 standards. The cost of Standards for Safety regular binders is \$7 and includes shipping by regular First Class mail.

### Deluxe Binder

Stiff-finished, heavily-sized blue fabric cover with 2 full-length metal piano-type hinges is made to last. Swing-hinge construction takes less shelf space than conventional ring binder yet holds 33% more standards. Standards for Safety Deluxe Binders are sold for \$30 and includes shipping by regular First Class mail.



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