

DOCUMENT NUMBER: UL 745-1



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Subjects 745-2-3 (745-1, 745-3, 745-4-3)

12 Laboratory Drive
 Research Triangle Park, NC 27709
 April 25, 1996

TO: Casualty Council of Underwriters Laboratories Inc.,
 Electrical Council of Underwriters Laboratories Inc.,
 Subscribers to UL's Standards Service for Portable Electric Tools
 Particular Requirements for Grinders, Polishers, and Disk-Type Sanders
 Portable Battery Operated Tools, and
 Particular Requirements for Battery-Operated Grinders, Polishers, and Disk-Type
 Sanders

SUBJECT: Grinder Guard Evaluation

In the course of conducting an evaluation to UL 745-1, the Standard for Portable Electric Tools, and to UL 745-2-3, the Standard for Particular Requirements for Grinders, Polishers, and Disk-Type Sanders, UL has realized that the grinder guard evaluation can not be conducted as written. Appendix E of UL 745-1 requires that a grinder guard meet the requirements in ANSI B7.1, the Standard for the Use, Care, and Protection of Abrasive Wheels. However, the test parameters in the ANSI B7.1 standard are not yet fully defined; therefore, the testing is not capable of being conducted at this time. UL has discussed this issue with the Grinding Wheel Institute, sponsors of ANSI B7.1, and they have indicated that they are considering revising the Standard.

Therefore, until B7.1 is revised, UL announces that the test program currently in effect for UL 45, the Standard for Portable Electric Tools, will be used to evaluate grinder guards investigated to UL 745-1 and UL 745-2-3. This announcement also applies to UL 745-3, the Standard for Battery-Operated Tools, and to UL 745-4-3, the Standard for Battery-Operated Grinders, Polishers, and Disk-Type Sanders. The current requirements now in effect are shown in Appendix A.

UL has discussed this situation with the Binational Working Group, and with CSA.

This bulletin should be kept with your copy of the standard.

Questions regarding interpretation of requirements should be directed to the responsible UL Staff. Please see Appendix B of this bulletin regarding designated responsibility for the subject product categories.

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APPENDIX A

REQUIREMENTS FOR GRINDER GUARDS BEING EVALUATED TO THE FIRST EDITIONS OF

THE STANDARD FOR PORTABLE ELECTRIC TOOLS, UL 745-1, AND THE
STANDARD FOR PARTICULAR REQUIREMENTS FOR GRINDERS,
POLISHERS, AND DISK-TYPE SANDERS, UL 745-2-3 OR

THE STANDARD FOR PORTABLE BATTERY OPERATED TOOLS, UL 745-3
AND THE STANDARD FOR PARTICULAR REQUIREMENTS FOR
BATTERY-OPERATED GRINDERS, POLISHERS, AND
DISK-TYPE SANDERS, UL 745-4-3

G1. A guard that does not comply with the requirements in G2, G3, G4, or G5, shall not be employed unless there is no breakage or penetration of the guard when tested as follows: A wheel of the maximum diameter and thickness recommended by the manufacturer is to be assembled to the spindle. The grinder is then to be operated at maximum no-load speed, and the grinding wheel is to be broken by a sharp impact or other means while running.

G2. A guard for a grinding wheel where grinding is done on the periphery of the wheel shall be so constructed that removal of the peripheral protection is not necessary for replacement of a grinding wheel. The wheel shall be provided with a hood type guard that does not expose the periphery or side of the wheel for more than 180 degrees. The top half of the wheel shall be enclosed at all times.

G3. A grinder guard shall be of a material and shall comply with the dimensions given in Table G1 or G2. See Figures G1 or G2 whichever is applicable.

G4. A drawn-steel guard for a Type 27 and 28 thin abrasive wheel for surface grinding shall comply with Table G3. See Figure G3.

G5. A grinder provided with a cup wheel shall be provided with a fixed guard complying with Table G4. See Figure G4.

Table G1
Thickness of peripheral and side members for guards

Material of guard	Maximum peripheral speed, ft/min (m/sec)		Maximum thickness of grinding wheel Inches (mm)		Grinding-wheel diameter, inches (mm)							
					3 (76.2) Through 6 (152)		More than 6 (152) but not more than 12 (305)		More than 12 (305) but not more than 16 (406)		More than 16 (406) but not more than 20 (508)	
					A ^a	B ^a	A ^a	B ^a	A ^a	B ^a	A ^a	B ^a
Malleable iron (A47-68 minimum tensile strength 50,000 psi)	9,000	(45)	2	(50.8)	1/4 (6.4)	1/4 (6.4)	3/8 (9.5)	5/16 (7.9)	1/2 (12.7)	3/8 (9.5)	5/8 (15.9)	1/2 (12.7)
Steel castings (A27-71 minimum tensile strength 60,000 psi)	16,000	(80)	2	(50.8)	1/4 (6.4)	1/4 (6.4)	5/16 (7.9)	5/16 (7.9)	3/8 (9.5)	3/8 (9.5)	1/2 (12.7)	7/16 (11.1)
Structural steel (A238-70 ^a and A306-64 excluding specifications for rivet steel, minimum tensile strength 60,000 psi)	16,000	(80)	2	(50.8)	1/8 (3.2)	1/16 (1.6)	5/16 (7.9)	1/4 (6.4)	5/16 (7.9)	1/4 (6.4)	5/16 (7.9)	1/4 (6.4)

^a A is minimum thickness of the peripheral protecting member; B is the minimum thickness of the side member of the guard. See Figure G1. Note: Minimum Tensile Strengths per ASTM.

Table G2
Drawn-steel guard

Material of guard minimum tensile strength sheet steel 60,000 psi, maximum peripheral speed,		Minimum thickness of wheel, Inches (mm)		Grinding-wheel diameter, inches (mm)							
				2 (50.8) through 5 (127)		More than 5 (127) but not more than 8 (203)		More than 8 (203) but not more than 10 (254)			
				A ^a	B ^a	A ^a	B ^a	A ^a	B ^a		
Ft/min	(m/sec)	Inches	(mm)								
5,000	(25)	2	(50.8)	1/16 (1.6)	1/16 (1.6)	3/32 (2.4)	1/16 (1.6)	3/32 (2.4)	1/16 (1.6)		
9,500	(47.5)	2	(50.8)	1/16 (1.6)	1/16 (1.6)	3/32 (2.4)	1/16 (1.6)	—	—		
12,500	(62.5)	2	(50.8)	3/32 (2.4)	1/16 (1.6)	3/32 (2.4)	3/32 (2.4)	—	—		
17,000	(85)	1	(25.4)	3/32 (2.4)	1/16 (1.6)	1/8 (3.2)	3/32 (2.4)	—	—		

^a A is the minimum thickness of the peripheral protecting number; B is the minimum thickness of the side member of the guard. See Figure G2.

Table G3
Drawn-steel guard for types 27 and 28 thin abrasive wheel

Maximum peripheral speed, Ft/min (m/sec)	Material of guard	Thickness of wheel, Inches (mm)	Wheel diameter, Inches (mm)	Minimum wall thickness, Inches (mm)	Minimum leg length, Inches (mm)
14,200 (71)	Sheet steel minimum tensile strength 60,000 psi	3/8 (9.5) or less	3 (76.2) through 9 (229)	A ^a	B ^a
11,000 (55)		More than 3/8 (9.5) but not more than 1 (25.4)	Not more than 7 (176)	1/16 (1.6)	1/2 (12.7)
				3/32 (2.4)	1-1/8 (28.6)

^a See Figure G3.

Table G4
Material thickness for drawn steel cup type wheel guards

Wheel diameter, Inches (mm)	B Washer back plate thickness, Inches (mm)	C Hood, Inches (mm)	D Skirt Inches (mm)
4 (100)	3/32 (2.4)	1/16 (1.6)	1/8 (3.2)
5 (125)	3/32 (2.4)	3/32 (2.4)	1/8 (3.20)
6 (150)	3/32 (2.4)	3/32 (2.4)	1/8 (3.20)

NOTE - Thickness based 50,000 psi minimum tensile strength and operating speed not exceeding 9,500 SFPM. See Figure G4.

Figure G1
Typical guard for wheel not more than 20 inches in diameter

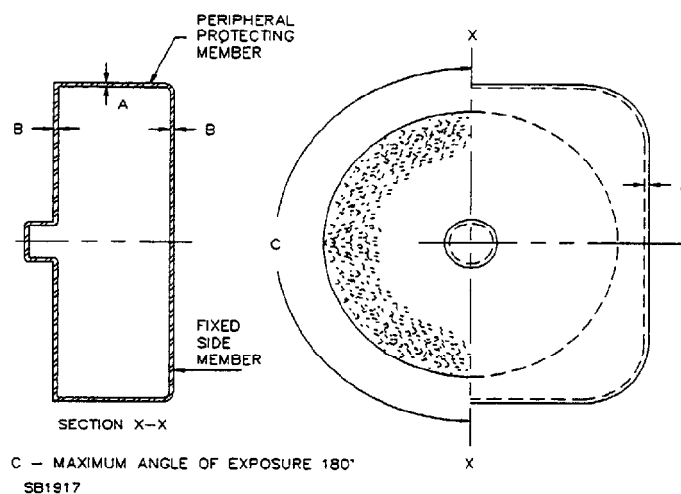


Figure G2
Typical drawn-steel guard for type 1 straight wheels not more than 10 inches in diameter

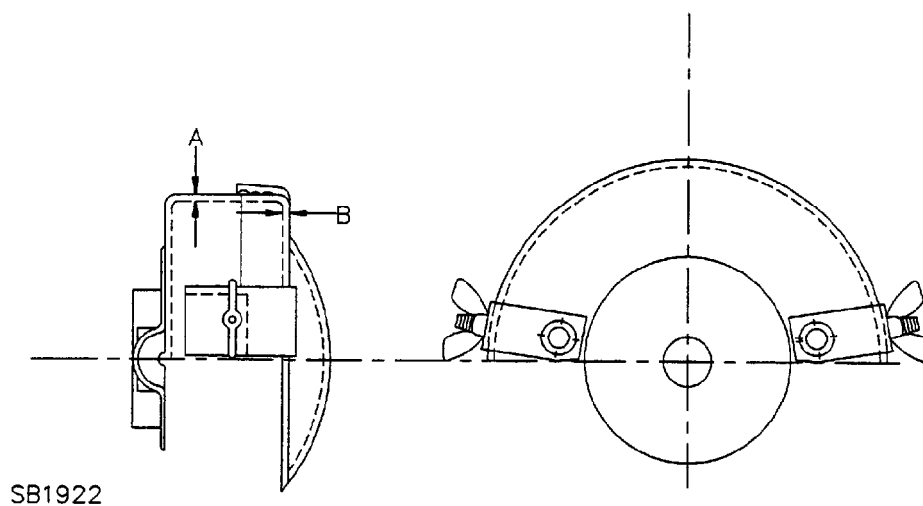
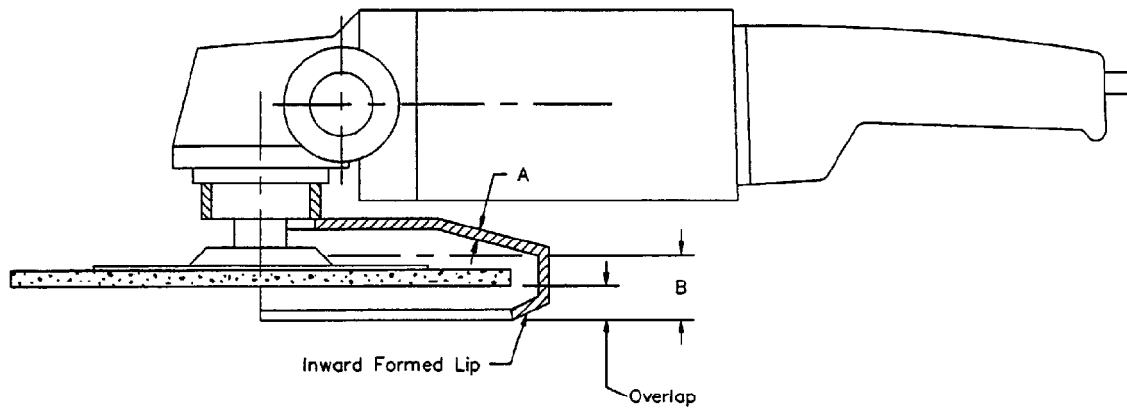


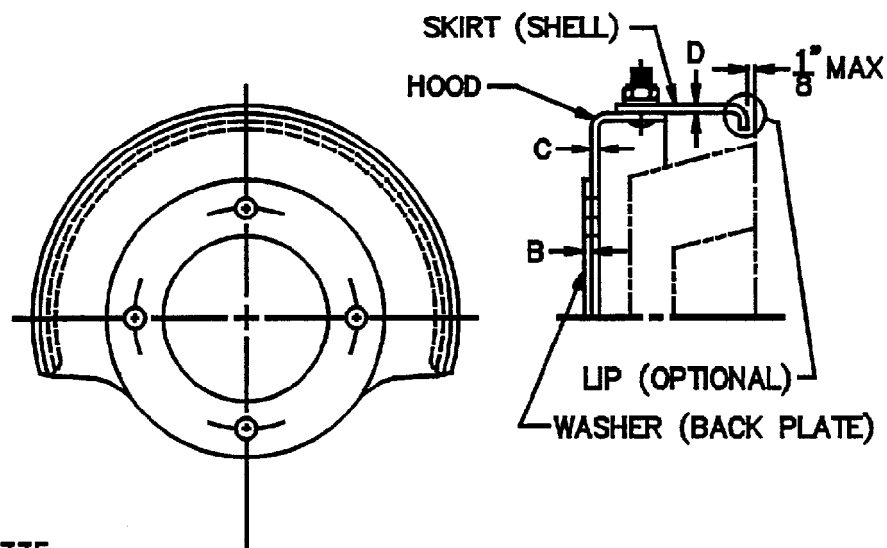
Figure G3
Typical drawn-steel guard for type 27 and 28 wheels



S2176

Figure G4
Typical drawn-steel guard for cup-type wheels, types 6 and 11

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SM335

A P P E N D I X B

DESIGNATED RESPONSIBILITY FOR UL
PRODUCT CATEGORIES
XJYW, PORTABLE ELECTRIC TOOLS
XJYW2, PORTABLE ELECTRIC TOOLS, COMPONENT

The individuals shown in the following table are involved with the investigation of products covered under the subject categories. The Primary Designated Engineer (**shown in UPPERCASE letters**) coordinates the establishment and uniform interpretation of UL requirements applicable to the product categories. The Designated Engineers (**shown in lowercase letters**) work with the Primary Designated Engineer to interpret requirements and maintain standards.

Should you have questions regarding any adopted requirements that affect your product, you are encouraged to contact the individual at the office to which you normally submit your products.

The Industry Advisory Conference (IAC) Chairman for the subject categories is Raffic Ali at UL's Research Triangle Park office. The IAC Chairman oversees the significant interpretations made by the Primary Designated Engineer and arbitrates any differences regarding interpretation of UL requirements.

CCN	Office/Subsidiary	Responsible Engineer	Extension
XJUW, XJYW2	Camas	H. Copley	55612
	Melville	J. Stimitz	22214
	Northbrook	F. Wordlaw	42995
	RTP	M. BELCHER	11649
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Subjects 45 (745, 987)
 (In reply, refer to Subject 45)

12 Laboratory Drive
 Research Triangle Park, NC 27709
 September 12, 1995

TO: Casualty Council of Underwriters Laboratories Inc.,
 Electrical Council of Underwriters Laboratories Inc.,
 Subscribers to UL's Standards Services for:
 Portable Electric Tools;
 The Bi-National Standard for Portable Electric Tools; and
 Stationary and Fixed Electric Tools

SUBJECT: Report of the Joint Meeting of the Industry Advisory Conferences of UL for Portable Electric Tools and Stationary and Fixed Tools; Request for Comments on Proposed Requirements for the Seventh Edition of the Standard for Portable Electric Tools, UL 45; Request for Comments on Proposed Requirements for the Sixth Edition of the Standard for Stationary and Fixed Electric Tools, UL 987; PROPOSED EFFECTIVE DATES

SUMMARY OF TOPICS

The following topics were discussed at the meeting:

(Parenthetical references indicate the applicable UL standards)

1. Extension Cord Lengths (45, 987)
2. Chain Lock vs Pin Lock for Miter Saws (987)
3. Consideration of Revising Existing UL Markings and Developing New UL Marking Requirements in Accordance with Requirements in ANSI Z535.4 (745, 987)
4. Harmonization (987)
5. Allied Standards
6. Angle Grinder Guard Requirements (45)
7. Jointer/Planer Blades and Accessories/Attachments (45, 987)
8. Lockouts on Tool Switches (987)
9. Detail Sanders (45)
10. Vibration and External Wiring (987)
11. Accessories (45, 987)

(Continued)

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SUMMARY OF TOPICS (Cont'd)

12. Abnormal Testing (45, 987)
13. Battery Operated Tool Requirements (45)
14. Update on UL 745 Series (745)
15. Class E Insulation (45)
16. Switches with Electronics (45)

COMMENTS DUE: November 7, 1995

A joint meeting of the Industry Advisory Conferences of UL for portable electric tools and for stationary and fixed tools was held on August 15, 1995 at the O'Hare Hilton Hotel. The purpose of the meeting was to discuss proposed requirements for UL 45, UL 745, and UL 987.

Attached as Appendix A are proposed requirements for UL 45. Attached as Appendix B are proposed requirements for UL 987. Attached as Appendix C is a list of those who attended the meeting. Questions regarding interpretation of requirements should be directed to the responsible UL Staff. Please see Appendix D of this bulletin regarding designated responsibility for the subject product categories.

Please note that proposed requirements are of a tentative and early nature and are for review and comment only. Current requirements are to be used to judge a product until these requirements are published in final form.

PROPOSED EFFECTIVE DATES

The proposed requirements specified in paragraphs 12.1.10, 14.23, and 70.1.7 of UL 987 will necessitate a review and possible retest of currently Listed products. Therefore, UL proposes that the new requirements become effective August 5, 1999. This is intended to provide manufacturers with sufficient time to submit modified products for investigation and to implement the necessary changes in production. Please note that this also includes the time that will be needed by UL to conduct a review of the modified product. These proposed effective dates also correlate to existing future effective dates in each of these standards.

The remainder of the requirements will not necessitate a review or additional testing of currently Listed products. Therefore, UL proposes that these requirements become effective upon publication.

* * * * *

The following report is not intended to be a verbatim transcript of the discussions at the meeting, but is intended to record the significant features of those discussions.

1. EXTENSION CORD LENGTHS (45, 987)

DISCUSSION

UL is considering revising UL 45 and UL 987 to allow tool manufacturers to recommend the use of longer extension cords. For a 120 V tool, UL 45 only allows a reference to cords up to 150 feet. Several tool manufacturers have expressed an interest in recommending the use of a longer cord, such as the cords referenced in UL 1450, the Standard for Motor-Operated Air Compressors, Vacuum Pumps, and Painting Equipment. UL 1450 includes a table identifying the appropriate cords to use for up to 500 feet (for a 120 V tool). Additionally, UL is considering requiring a temperature test using the longer extension cord for tools recommending the use of the longer extension cord.

It was noted at the meeting that the lengths of cord identified in UL 1450 may be too long for a tool application. Additionally, some of the gauges specified were different in UL 1450 from UL 45 for the same length cord and ampere rating; this could be due to loading differences between tools and painting equipment.

It was noted that the gauges currently specified in UL 45 were determined by the Power Tool Institute (PTI). In order to better correlate with the values already included in UL 45, members of PTI plan to determine suitable extension cords gauges for lengths over 150 feet. The information will then be submitted to UL for consideration. The PTI input will be based on calculated values (using the nameplate rating) rather than actual measured values, and the voltage drop will be limited to 5 volts with the maximum length.

It was noted at the meeting that the gauges included in UL 45 represent minimum sizes. A manufacturer may choose to suggest a thicker cord, or a shorter extension cord, if so desired.

RATIONALE

A question also arose regarding the need for the extension cord table in the instruction manual for a permanently-connected tool (in UL 987). UL clarified that the table would not be required for a permanently-connected tool; instead, local installation regulations would apply. UL proposes that the standard be revised accordingly.

IMPACT

If the proposal is adopted then it will be clear that instructions regarding extension cord selection need not be provided for a permanently-connected tool.

2. CHAIN LOCK VS PIN LOCK FOR MITER SAWS (987)

DISCUSSION

Evaluations of miter saws provided with a locking pin for the purpose of carrying are currently being handled differently by CSA and UL. CSA requires the use of a chain for locking down the unit so the unit is not operable while in this position (either as a miter saw or by using in the slide mode, as a radial arm saw). UL does not require the chain due to the following: (1) the pins are described in the instruction manual as being for the purpose of carrying only, and (2) the use of the unit as a radial arm saw would be inconvenient for the user.

This difference in requirements was discussed at the meeting.

The CSA representative present at the meeting indicated that the CSA requirements may need to be revised. He will pursue CSA changes, as necessary.

While discussing the need for a pin, the IAC considered the differences between a pull-through saw and a push-through saw. The IAC developed the following definitions:

- A pull-through miter saw is a saw constructed such that the blade stays behind the fence.
- A push-through miter saw is a saw constructed such that the blade can not travel completely behind the fence.

Although UL is not proposing that these definitions be included in UL 987, by defining them here, these types of miter saws may be better understood.

RATIONALE

UL reiterated at the meeting that the instruction manual needs to stipulate that the pin is to be used for transporting the tool, or changing the blade, and is not intended to be used during cutting operations. This instruction is in accordance with 71.2. UL will continue to accept pins provided proper instructions are included. UL proposes that 72.9.3 be added to specifically indicate that instructions on the pin usage are required.

IMPACT

Since push/pull type miter saws employing a lock down pin currently have instruction manuals indicating proper use of the pin, then a review of current instruction manuals will not be required.

3. CONSIDERATION OF REVISING EXISTING UL MARKINGS AND DEVELOPING NEW UL MARKING REQUIREMENTS IN ACCORDANCE WITH REQUIREMENTS IN ANSI Z535.4 (745, 987)

BACKGROUND

The American National Standards Institute (ANSI) has developed and published a series of standards (the ANSI Z535 series) containing guidelines for developing cautionary and warning markings for use on products. The Standard for Product Safety Signs and Labels, ANSI Z535.4-1991, contains guidelines for the type of cautionary and warning markings most like those required by UL Standards.

DISCUSSION

At the meeting, UL sought to obtain manufacturer's views on the topic of evaluating the existing markings in UL 987 and UL 745 to determine how they correlate with the ANSI requirements. In addition, UL wanted industry input regarding the possibility of revising the existing markings in accordance with the ANSI requirements and relying on the ANSI requirements when developing new markings for the standard.

With regard to UL 745, the IAC representatives indicated that the markings included in UL 745 already reflect this three-part marking structure referenced in ANSI Z535.4. Additionally, the markings in UL 745 were initially developed with the input of the PTI liability coordinators, who used ANSI Z535.4 as a reference. Input at the meeting indicated that the applicable parts of ANSI Z535.4 have been incorporated into UL 745. No additional work will be done in this area.

Although the marking requirements in UL 987 may need to be revised, PTI members present at the IAC meeting reported that PTI has developed a new long-term committee to study markings, icons, and graphics. This committee is using ANSI Z535.4 as a resource, and is also considering international requirements.

One reported goal of the PTI committee is to identify long-term global symbols. The use of text is becoming difficult as the tool market increases because of the issue of translations. A global symbol that is easily recognized can help alleviate this problem.

The PTI committee will keep UL informed of their progress.

The following concerns associated with the ANSI Z535.4 standard were raised with regard to both UL 745 and UL 987:

1. The ANSI standard specifies colors for signal words and warning labels. These color schemes can conflict with existing tool colors, which are associated with specific manufacturers and product lines.
2. Since ANSI Z535.4 does not allow a signal word substitution, multiple signal words may be required on a nameplate. For smaller tools, the nameplate is not large enough to accommodate these markings.

4. HARMONIZATION (987)

DISCUSSION

When the harmonization efforts for portable electric tools were first initiated, the Power Tool Institute (PTI) had indicated possible future harmonization to IEC requirements in the area of Stationary and Fixed Electric Tools, UL 987. UL requested input from the IAC on the desirability of such an action.

The industry representatives present at the meeting suggested that harmonization of UL 987 requirements with IEC requirements be put on hold for now. Although harmonization with IEC requirements is a long-term goal, the industry representatives reported that an immediate goal is to continue to work towards acceptance into the CB Scheme for portable tools while becoming more familiar with UL 745.

5. ALLIED STANDARDS

DISCUSSION

At the 1994 UL/PTI Liaison Meeting, members of the Power Tool Institute (PTI) expressed a desire to learn of the standards development activities in allied, or related standards. This desire was prompted by the activities in UL 2054, the Standard for Batteries, a major component of battery-operated tools. UL indicated to PTI that an update would be provided on activities in other UL standards.

Since the 1994 tool IAC meeting, there have been no revisions in any of the following standards that would result in a significant change to Listed tools:

FUSES (UL 198, UL 248)
ATTACHMENT PLUGS AND RECEPTACLES (UL 498)
MOTORS (UL 519, UL 547)
PLASTICS (UL 746A, UL 746B, UL 746C, UL 746D)
CORD SETS AND POWER SUPPLY CORDS (UL 817)
MARKING AND LABELING SYSTEMS (UL 969)
SPECIAL USE SWITCHES (UL 1054)
SYSTEMS OF INSULATING MATERIAL – GENERAL (UL 1446)

Future meetings will also include an update on activities in UL 1004, the Standard for Electric Motors.

As part of this discussion at the meeting, the effect that the tool industry can have on another industry was discussed. Specifically, a suggestion was made that extension cord manufacturers could be requested to mark the maximum ampacity of an appliance to be used with the cord on the extension cord. A flag-type label may be needed to accomplish this marking.

The UL tool engineers will pursue this suggestion with the UL staff that are responsible for extension cords, UL 817.

6. ANGLE GRINDER GUARD REVISIONS (45)

DISCUSSION

Paragraph 27.84 of UL 45 is intended to require that an angle grinder be constructed in a manner that reduces the risk of injury to the operator's fingers. However, the current wording of the standard puts emphasis on the recommended use of the tool. UL evaluates angle grinders to verify that guarding is provided to minimize the risk of the operator's fingers from coming into contact with the wheel.

UL proposed at the meeting that the standard be revised to eliminate dependence on instruction manual recommendations. The proposal made to the IAC would have required some construction changes to eliminate some of the guard movement presently allowed (currently, a guard could rotate 360° and still meet the requirement).

However, the IAC representatives raised concerns that if the movement of the guard is restricted, the user may simply remove the guard to perform certain functions, such as a side cut. This removal would be even less desirable than a fully-rotational guard. Additionally, there have been no reports of problems or injuries associated with a fully-rotational guard.

Therefore, UL withdrew the proposed change to paragraph 27.84. UL will continue to consider the manufacturer's recommended positioning of the guard when evaluating the angle grinder guard.

7. JOINTER/PLANER BLADES AND ACCESSORIES/ATTACHMENTS (45, 987)

RATIONALE

UL is considering eliminating the impact test on jointer/planer blades since these blades are typically covered by the workpiece. UL requested input on this issue from the IAC.

It was noted at the meeting that UL previously deleted the impact test for carbide-tipped circular saw blades. No reports of injuries associated with tips breaking off of any jointer/planer blades have been received.

Therefore, UL proposes that the impact test no longer be required for carbide-tipped jointer/planer accessories.

IMPACT

If the proposal is adopted, then an impact test will no longer be required on carbide-tipped jointed/planer accessories.

8. LOCKOUTS ON TOOL SWITCHES (987)

RATIONALE

When UL 1624, the Standard for Light Industrial Machine Tools, was withdrawn, and the products evaluated to UL 987, the issue of lockouts for tools was discussed. Lockouts have been required for stationary tools under UL 987; however, lockouts had not been required for larger tools covered by UL 1624. These tools were not intended to be used in a home workshop (i.e., in areas accessible to children), so the lockout was not required.

However, when the two standards were combined, UL determined that the lockout would be required for all tools since the distinction of tool type location is subtle. UL requested input from industry to help define which tools need not provide a lockout. UL received no clearly-defined definitions; however, some tools are obviously not intended for the home workshop.

Therefore, UL proposes that the following tools not be required to provide a lockout if the tool is clearly marked to indicate that the tool is not intended for use in the home workshop:

- A permanently-connected tool;
- A three-phase tool;
- A grinder;
- A brake lathe.

It was noted at the meeting that other tools may not require the lockout feature. However, these should be the exception. As additional tools are identified, a specific proposal will be made to revise UL 987 to exempt the lockout requirements for that particular tool type.

Since grinders and brake lathes are not currently required to be provided with a marking to indicate that the tool is not intended for a home workshop, a review of the markings on those tools will be necessary. UL proposes that 70.1.7 become effective August 5, 1999.

IMPACT

If the proposal is adopted, then a tool as defined above that is clearly intended for use outside the home workshop need not be provided with a lockout if this tool carries the required marking. A grinder or brake lathe not employing a lockout will need to be provided with the additional marking.

9. DETAIL SANDERS (45)

RATIONALE

UL 45 does not currently specify the loading to be used for a detail sander. UL currently conducts the input test with the detail sander loaded using the weight of the sander (i.e., no additional weight), or the force specified in the manufacturer's recommendations, whichever is greater. UL proposes that Table 29.1 be revised accordingly.

A discussion arose at the meeting regarding whether or not additional weight is to be added to the tool, or if the weight of the tool serves as the load. Since additional weight can impair the tool's function significantly, most detail sanders can not perform under these conditions. No additional weight is to be added unless the manufacturer specifies a load greater than operation under the weight of the tool.

Consideration was given to specifying the load required by UL 745 rather than the proposed load. However, since the UL 745 load differs from the proposed load (which reflects present practice), a review of currently Listed detail sanders would be required to comply with the UL 745 specifications. Therefore, the proposal presented in Appendix A simply reflects UL's present practice.

IMPACT

If the proposal is adopted, then the loading of a detail sander will be clear. No review of currently Listed detail sanders will be required.

10. VIBRATION AND INTERNAL WIRING (987)

RATIONALE

Paragraph 11.20 of UL 45 requires that a tool which produces vibration have splicing devices of the thread-on or set-screw type be secured by wrapping the wires and the connector with friction tape. This requirement is not present in UL 987. Since there are tools covered by UL 987 which may create vibration, and since this vibration could result in the severance of a connection, UL proposes that the requirement be added to UL 987. Additionally, UL proposes that the Standard be revised to clarify that a ground connection be secured by a closed loop connector or equivalent means and dismiss the idea of using a thread-on device for ground connections. This revision is needed to reduce the risk of the ground opening and the operator not being aware of the loss of ground.

It was noted at the meeting that all motor products, including tools, produce vibration. Therefore, this proposal applies to all grounded stationary tools.

Additionally, it was noted at the IAC meeting that CSA only required tape to be applied on hand-installed wire nuts (and not on wire nuts that are machine-installed). Since the machine-installed wire nuts are more reliable than hand-applied wire nuts, UL proposes a similar exception.

It was also noted that tape is not required on a terminal block or on wire nuts located in a confined area, such as a handle, where there is not enough room for the wire nut to back off.

IMPACT

If the proposal is adopted, then stationary tools will be required to have splices wrapped with friction tape and ground leads secured by a pressure connector or similar device. A review of Listed stationary tools will be needed.

11. ACCESSORIES (45, 987)

DISCUSSION

UL is considering offering a Classification program for accessories. Currently, no such program exists for the tool categories. A new accessory must be evaluated with each tool that refers to the accessory by catalog number in the tool instruction manual. UL is considering establishing a program to evaluate a particular accessory for use with all applicable tools. The tool manufacturer could then simply reference the accessory, and no (or little) additional testing would be required.

The various types of possible accessory programs were discussed. Listing these accessories is not a viable option since the Listing mark implies a full evaluation of the product; however, a full evaluation will not be feasible because the risk of injury associated with an accessory is not clearly evident until the accessory is installed on the tool. Due to the various tool constructions, all combinations can not be considered.

Therefore, UL's Classification program was discussed as an option. UL can evaluate an accessory with respect to certain qualities, for example, risk of fire or electric shock. The Classification mark can then clearly state what properties have been evaluated, as well as any additional characteristics that may need to be considered. One option considered was to require a warning marking similar to the following to notify the consumer of a potential risk of injury: "Classified with respect to overspeed considerations. Follow all recommendations of the power tool manufacturer during use."

A third testing option is UL's Recognition program. With Recognition, the accessory could have a limited evaluation, and Conditions of Acceptability could be identified. The difference between this program and the Classification program is that with Recognition, the Conditions of Acceptability are not known to the consumer; with the Classification program as outlined above, the marking would notify the consumer of any limitations.

The tool manufacturers raised a number of concerns regarding the establishment of an accessory evaluation program. Some of these concerns include:

- A potential misunderstanding by the consumer that the accessory is suitable for use with any tool construction.
- If some accessories are evaluated, a tool manufacturer may be forced to have accessories evaluated also.
- An otherwise inappropriate accessory may appear to be legitimate because of the UL evaluation for overspin or risk of fire.

However, the industry representatives also discussed the positive aspects of the accessory program, including the reduced testing of accessories by the tool manufacturer, and the ability of the tool manufacturer to recommend an accessory easier. It was also noted that inappropriate accessories currently exist and are being used, and an accessory program may help address this situation.

It was noted at the meeting that ANSI requirements already exist for brushes and grinder wheels. UL could Classify these accessories now.

However, requirements do not exist for other accessories, such as circular saw blades and sander backing pads. UL plans to form an ad hoc committee to address accessories individually. The committee will consist of representatives from the power tool industry, as well as manufacturers of the accessory.

The first accessory to be addressed this way will be circular saw blades. As a proposed program is developed, the tool IAC will be kept informed.

12. ABNORMAL TESTING (45, 987)

RATIONALE

UL proposes that UL 45 and UL 987 be revised to clarify that during the abnormal operation test, the tool is to be connected to a 30A fast-acting fuse. UL currently requires the use of this 30A fuse during the abnormal test.

It was noted at the meeting that a circuit breaker may be used instead of the fuse, since the circuit breaker acts slower than the 30A fuse.

IMPACT

If the proposal is adopted, no review nor retest of currently Listed tools will be required.

13. BATTERY OPERATED TOOL REQUIREMENTS (45)

DISCUSSION

Paragraph 52.15A of UL 45 currently indicates that a battery-operated circular saw be provided with a warning instructing the user to remove the battery when the tool is not being used, or to change blades, or make adjustments. UL proposed in an IAC letter dated March 31, 1995 to allow an exception for a circular saw provided with a lock-off switch. The exception provided alternate wording for these circular saws, that basically required the marking to instruct the user to remove the battery pack when changing blades or making adjustments (and not when the tool is not in use). UL received a number of comments in response to the IAC proposal; therefore, this issue was discussed at the IAC meeting.

At the meeting, industry representatives reported that some tools are shipped with the battery installed. This shipment method is due to the fact that some cases can not accommodate the battery pack separate from the tool. No problems have been reported as a result of this shipping practice.

RATIONALE

UL now proposes that paragraph 52.15A be revised to indicate that a circular saw provided with a lock off switch need not instruct users to remove the battery pack when the tool is not in use. The instruction manual will still require the instruction [See paragraph 55.2(c)(14)].

IMPACT

If the proposal is adopted, then the hang tag on a circular saw will not be required to instruct the user to remove the battery from the tool when not in use.

14. UPDATE ON UL 745 SERIES (745)

DISCUSSION

Background

The series of bi-national standards for portable electric tools was published on March 23, 1995. As with any standard, this series of standards will need updates and revisions to address changes in technology, field problems, and new constructions. To further promote harmonization with international standards, efforts will also need to be made to periodically review and consider other related requirements.

A working group consisting of tool manufacturers and representatives of both UL and CSA will continue to meet to discuss the situations noted above. The working group met on June 24 – 27, 1995; an update on this meeting and on the activities of the working group was provided at the IAC meeting.

Reduction of Deviations

Currently, the goal of the working group is to reduce the number of deviations from the IEC text in the bi-national standard. The purpose of this reduction in deviations is to bring the bi-national standard closer to the IEC 745 standard and to ultimately help with the CB Scheme. The group has tentatively identified possible changes to the standard. These changes are not intended to result in additional construction changes or performance evaluations. For instance, many informational notes appear in the bi-national standard that do not appear in the IEC standard. The working group has reviewed these notes to determine which may be proposed to be deleted, and which may be proposed to be relocated to an informational annex at the back of the standard. Once a proposal has been developed, the working group will review the proposal; the IAC and tool industry will then be given opportunities to review and comment on the proposed changes.

Proposed Revisions to IEC 745

The working group is also developing a list of possible proposals from the US to revise IEC 745. There were a number of deviations in UL 745 that are integral parts of a UL or CSA evaluation of the tool. These deviations will be proposed as changes to the IEC text. The goal of the working group in this area is to try to affect international standards requirements with current UL or CSA requirements which may be superior to the IEC 745 text.

Instruction Manuals

Another issue related to the UL 745 series of standards is the subject of instruction manuals. Currently, similar tools are required to have different instruction manuals depending upon under which standard the tool is Listed. A tool Listed to UL 45 will have an instruction manual complying with UL 45, and a tool Listed to UL 745 will have an instruction manual complying with UL 745.

However, UL has been requested by several manufacturers to accept a manual complying with UL 745 for a tool Listed to UL 45. The benefit to using a UL 745 manual for a UL 45 tool is that a manufacturer could have a single instruction manual for the same family of tools. Once one tool is Listed to UL 745, a manufacturer is currently required to keep two different manuals for very similar tools until all of these like tools comply with UL 745. For a tool being evaluated to UL 745, the instruction manual of the tool shall comply with the requirements of Clause 31.

UL 45 currently allows for equivalency in the instruction manual; UL 745 does not. One way of using the UL 745 manual while still complying with UL 45 would be to use the UL 745 manual verbatim, and then attach additional pages to address the additional instructions required by UL 45 (such as extension cord length information). This option is presently available. However, if wording from UL 745 is chosen, complete compliance with all of Clause 31 will be required.

It was suggested at the meeting that the instruction manual requirements in UL 45 be compared to those requirements in UL 745. A proposal could then be considered to delete these additional instructions from UL 45.

UL requests input on this issue from the industry.

Substituting UL 745 markings in place of UL 45 markings was also considered at the IAC meeting. This option will not be pursued because of the many differences in requirements between the two standards, especially with respect to symbols.

15. CLASS E INSULATION (45)

DISCUSSION

It was noted at the meeting that UL 45 requires a Class E insulation system evaluation. Industry representatives questioned what type of evaluation would be required.

Subsequent to the meeting, UL gathered additional information on this item. A three temperature test will be required in accordance with UL 1446, the Standard for Systems of Insulating Material – General. Questions on testing of insulating systems may be directed to Bob Mayschak at UL's Northbrook office, Extension 42860.

16. SWITCHES WITH ELECTRONICS (45)

RATIONALE

It was noted at the IAC meeting that UL 45 currently requires a component short circuit test. This test has sometimes been applied to components inside of switches. This test need not apply to components inside switches since these components are already stressed by other performance evaluations, such as the locked rotor evaluation. Additionally, the switch is cycle tested, either as part of the Recognition program of the switch, or as part of the end-product evaluation.

It should be noted that Section 43 applies only to discrete components, and not to surface mount components. See 43.2.

IMPACT

If the proposal is adopted, then it will be clear that surface-mounted components inside a switch need not be subjected to a component short circuit.

REQUESTS FOR COMMENTS ON PROPOSALS

Please provide the following:

1. Your comments concerning the meeting report and the proposed requirements; and
2. Your comments concerning the proposed effective dates, should the proposals be adopted.

Written comments should be sent to the attention of Sonya Bird at UL's Research Triangle Park office, 12 Laboratory Drive, Research Triangle Park, NC 27709-3995. Please reference all correspondence to Subject 45.

All comments should be sent by November 7, 1995.

Unless specifically requested to do so, UL will not acknowledge comments indicating concurrence with these proposals.

UNDERWRITERS LABORATORIES INC.

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SR:DES

45RPT.001

PROPOSED REQUIREMENTS ARE OF A TENTATIVE AND EARLY NATURE AND ARE FOR REVIEW AND COMMENT ONLY. CURRENT REQUIREMENTS ARE TO BE USED TO JUDGE A PRODUCT UNTIL THESE REQUIREMENTS ARE PUBLISHED IN FINAL FORM.

APPENDIX A

PROPOSED REQUIREMENTS AND PROPOSED EFFECTIVE DATES FOR THE SEVENTH EDITION OF THE STANDARD FOR PORTABLE ELECTRIC TOOLS, UL 45

For your convenience in review, proposed additions to existing requirements are shown underlined and proposed deletions are shown ~~lined-out~~. Proposed new requirements are identified by (NEW). In the case of extensively revised paragraphs, the original text is identified by (CURRENT) and is ~~lined-out~~, followed by the proposed text identified by (PROPOSED). A paragraph that is proposed to be deleted is identified by (DELETED) and is shown ~~lined-out~~.

Numbered items correspond to the numbered items in the meeting report.

7. JOINTER/PLANER BLADES AND ACCESSORIES/ATTACHMENTS

PROPOSALS

63.1 An accessory or attachment, other than a grinding wheel, or the specific cutting tools mentioned in paragraphs 63.10 and 63.11, that is intended for use with a portable tool shall withstand either the ball-impact test described in paragraph 63.5, or the drop test described in paragraph 63.6 as applicable. Except as noted in paragraphs 63.2 – 63.4, the part shall withstand the appropriate test or tests:

- A. Without cracking that affects the function of the part so as to increase the risk of injury to persons,
- B. Without being affected to the extent that a moving part, likely to cause injury to persons, is exposed to unintentional contact, and
- C. Without affecting the mechanical performance of the accessory or tool so as to increase the risk of injury to persons.

Paragraph 63.1 revised (date of publication)

(DELETED)

63.10 A carbide-tipped planer cutter shall be subjected to the impact of a 2 inch (50.8 mm) diameter steel sphere weighing 1.18 lb (0.535 kg) dropped through 4 3/4 inches (121 mm). For the test, the planer cutter is to be mounted in a vise. Adjustable blades are to be set for maximum height. The ball is to be dropped so that it strikes the carbide inserts at the most unfavorable angle. There shall be no separation of the carbide inserts from the planer cutter.

Paragraph 63.10 deleted (date of publication)

9. DETAIL SANDERS

PROPOSAL

(Only affected items shown)

TABLE 29.1

LOADS FOR TESTS

Tool	Test Procedure	General or Special Use
15A. Sander, Detail	<u>The test is to be conducted with the sander sanding soft pine wood. A 60 grit sand paper is to be used. The force used is to be the weight of the sander (i.e., no additional weight applied), or the force specified in the manufacturer's instructions (i.e., by adding a weight equal to the force specified by the manufacturer minus the actual weight of the tool), whichever is greater.</u>	Special

Table 29.1 revised (date of publication)

12. ABNORMAL TEST

PROPOSAL

47.14 The tool is to be operated under the most adverse condition of abnormal operation such as locked-rotor operation, operation with current-carrying parts short-circuited, and so forth. During the test, the tool is to be connected to a circuit containing a 30A fast acting supply fuse while ~~rest~~ resting on white tissue paper on a softwood surface and is to be operated continuously until the ultimate results have been determined. In most cases, continuous operation will be necessary until constant temperatures are reached, or the 30A fuse opens.

Paragraph 47.14 revised (date of publication)

13. BATTERY OPERATED TOOL REQUIREMENTS

PROPOSAL

52.15A The safety tag mentioned in paragraph 52.14 for a battery operated circular saw with a removable battery pack shall also be provided with the caution marking: "Remove battery pack or battery pack connection from tool when not in use, changing blades, or making adjustments."

Exception: For a circular saw employing a lock-off switch, the instruction required may be replaced with "Remove battery pack or battery pack connection from tool when changing blades or making adjustments."

Paragraph 52.15A revised (date of publication)

16. SWITCHES WITH ELECTRONICS

PROPOSAL

77.1 If a battery-operated portable tool employs one or more semiconductors or capacitors, or a combination of both, no risk of fire or injury to persons shall result when:

- A. The terminals of any capacitor are short- or open-circuited,
- B. Any two terminals of a semiconductor are short- circuited, or
- C. Any semiconductor terminals are open-circuited.

Exception: This requirement does not apply to components located within a switch.

Paragraph 77.1 revised (date of publication)

PROPOSED REQUIREMENTS ARE OF A TENTATIVE AND EARLY NATURE AND ARE FOR REVIEW AND COMMENT ONLY. CURRENT REQUIREMENTS ARE TO BE USED TO JUDGE A PRODUCT UNTIL THESE REQUIREMENTS ARE PUBLISHED IN FINAL FORM.

APPENDIX B

PROPOSED REQUIREMENTS AND PROPOSED EFFECTIVE DATES FOR THE SIXTH EDITION OF THE STANDARD FOR STATIONARY AND FIXED ELECTRIC TOOLS, UL 987

For your convenience in review, proposed additions to existing requirements are shown underlined and proposed deletions are shown ~~lined-out~~. Proposed new requirements are identified by (NEW). In the case of extensively revised paragraphs, the original text is identified by (CURRENT) and is ~~lined-out~~, followed by the proposed text identified by (PROPOSED). A paragraph that is proposed to be deleted is identified by (DELETED) and is shown ~~lined-out~~.

Numbered items correspond to the numbered items in the meeting report.

1. EXTENSION CORD LENGTHS

PROPOSAL

72.1.1 The instruction manual shall include the following warning instructions or the equivalent, as applicable:

(Only affected item shown)

C. FOR ALL TOOLS AS APPLICABLE

9. USE PROPER EXTENSION CORD. Make sure your extension cord is in good condition. When using an extension cord, be sure to use one heavy enough to carry the current your product will draw. An undersized cord will cause a drop in line voltage resulting in loss of power and overheating. Table ____ (see Table 72.1) shows the correct size to use depending on cord length and nameplate ampere rating. If in doubt, use the next heavier gage. The smaller the gage number, the heavier the cord.

Exception No. 1: The reference to the table and the table itself may be omitted if a statement indicating the appropriate gage and length is incorporated into the instruction.

Exception No. 2: The information regarding extension cords need not be provided for a permanently connected tool.

72.1.1 revised (date of publication)

2. CHAIN LOCK VS. PIN LOCK FOR MITER SAWS

PROPOSAL

(NEW)

72.9.3 The instruction manual for a push/pull type miter saw employing a lock down pin, or similar device for positioning the cutter head, shall identify the function of the hold down device and clearly state that it is not to be used for any cutting operation. The manual shall state that it is for carrying and storage only.

72.9.3 added (date of publication)

7. JOINTER/PLANER BLADES AND ACCESSORIES/ATTACHMENTS

PROPOSALS

75.2 Impact testing – jointer cutter

(DELETED)

~~75.2.1 A carbide-tipped jointer cutter shall be subjected to the impact of a steel sphere without separation of the carbide inserts from the cutter. Chipping or breakage of the carbide tips is acceptable.~~

75.2.1 deleted (date of publication)

(DELETED)

~~75.2.2 For the test specified in 75.2.1, the cutter is to be mounted in a vise. Adjustable blades are to be set for maximum height. A 2 inch (50.8 mm) diameter steel sphere weighing 1.18 pounds (0.535 kg) is to be dropped 4 3/4 inches (121 mm) so that it strikes the carbide inserts at the most unfavorable angle. Three separate carbide inserts or tips are to be impacted. The ball may impact more than one insert or tip each time. A separate sample may be used for each impact.~~

75.2.2 deleted (date of publication)

8. LOCKOUTS ON TOOL SWITCHES

PROPOSALS

(CURRENT)

~~31.7 A tool shall be provided with a means for locking the motor-control switch in the off position. See 72.1.8~~

~~Exception No. 1: A grinder need not have a locking mechanism.~~

~~Exception No. 2: A tool that does not have a moving part or cutting edge that may involve a risk of injury to persons need not have a locking mechanism.~~

~~Exception No. 3: A brake lathe need not have a locking mechanism.~~

(PROPOSED)

31.7 A tool shall be provided with a means for locking the motor-control switch in the off position. See 72.1.8.

Exception No. 1: A grinder or brake lathe need not be provided with the lockout if the tool is marked in accordance with 70.1.7.

Exception No. 2: A tool that does not have a moving part or cutting edge that may involve a risk of injury to persons need not have a locking mechanism.

Exception No. 3: A permanently-connected tool or a three-phase tool need not be provided with the lockout if the instruction manual provided with the tool instructs the installer to follow local regulations and ANSI/NFPA 70 National Electrical Code installation requirements.

31.7 revised (date of publication)

(NEW)

70.1.7 A tool not intended for use in a home workshop as indicated in Exception No. 1 to 31.7 shall be marked "WARNING," and with the following or the equivalent: "Risk of injury due to accidental starting. Do not use in a home workshop or other area where children may be present."

Added 70.1.7 effective August 5, 1999

10. VIBRATION AND INTERNAL WIRING

PROPOSALS

(NEW)

14.23 A tool which employs a splicing device (wire nut) of the thread-on or setscrew type (other than in terminal blocks) shall be additionally secured by wrapping the wires and the connector with friction tape or by other equivalent means. Thread-on devices shall not be used to connect a ground lead.

Exception No. 1: This requirement does not apply to double-insulated tools.

Exception No. 2: Tape need not be additionally applied to machine-applied wire nuts, or to wire nuts located in a confined area where the wire nut is not capable of backing off.

Added 14.23 effective August 5, 1999

12.1.10 The equipment-grounding conductor of a flexible cord:

- a) Shall be provided with insulation having an outer surface that is green with or without one or more yellow stripes;
- b) Shall be connected to the grounding member of an attachment plug of the grounding type; and
- c) Shall be conductively connected to:
 - 1) All exposed dead metal parts of the tool that may become energized; and
 - 2) All dead metal parts within the enclosure that are exposed to contact during any user servicing operation and that may become energized. User servicing as mentioned in this item and in 23.5 is considered to include operations, such as changing a blade on a table saw, adjusting a belt on a drill press, and the like.
- d) The conductor shall be secured by a closed loop connector, connector with upturned ends, or equivalent means. Lock washers or equivalent means shall be utilized to hold the conductor in place. Thread-on devices shall not be used in the ground conductor.

Revised 12.1.10 effective August 5, 1999

12. ABNORMAL TEST

PROPOSAL

63.6.2 The tool is to be operated under a condition of abnormal operation appropriate for the specific application, such as stalled rotor, overload, overvoltage, undervoltage, operation with current-carrying parts short-circuited, and the like. During the test, the tool is to be connected to a circuit containing a 30A fast acting supply fuse while rest resting on white tissue paper on a softwood surface. The tool is to be operated continuously until the ultimate results have been obtained. In most cases, continuous operation for 7 or 8 hours will be necessary to determine that the ultimate results have been obtained, or constant temperatures are reached, or the 30A fuse opens.

Paragraph 63.6.2 revised (date of publication)

APPENDIX C

ATTENDANCE AT THE AUGUST 15, 1995 MEETING OF THE JOINT IAC FOR PORTABLE ELECTRIC TOOLS AND STATIONARY AND FIXED TOOLS

Industry Representatives

Robert A. Carson
E. Donald Fiedler
Ferdinand Goebel
Thornton H. Gogoll
David V. Keller
Jim Montgomery
David G. Peot
*Spencer C. Rees
Stan Rodrigues
Richard F. Stavenhagen
*Rudolph W. Wacek
*Y. Yamada

Delta International Machinery Corp.
Emerson Electric Company
Robert Bosch GmbH
Black & Decker (U.S.) Inc.
Porter-Cable Corporation
Milwaukee Electric Tool Corporation
Ryobi Motor Products Corp.
Wen Products Incorporated
Makita U.S.A., Inc.
SB Power Tools
Sioux Tools, Inc.
Hitachi Koki Co., Ltd.

Invited Guests

Ivan Milkovich
Manfred Schulz
Steve Wolfcale

CSA
Metabo
SB Power Tools

UL Staff

Raffic Ali (Chairman) – RTP
Manuel Arce – SC
Mike Belcher – RTP
Sonya Bird – RTP

John Crickmar – RTP
John Niklewicz – NBK
John Stimitz – MEL
Paul Wordlaw – NBK

*Not in attendance

A P P E N D I X D

DESIGNATED RESPONSIBILITY FOR UL PRODUCT CATEGORIES XKFR, PORTABLE TOOLS XKFR2, PORTABLE TOOLS – COMPONENT XKJU, STATIONARY AND FIXED TOOLS

The individuals shown in the following tables are involved with the investigation of products covered under the subject categories. The Primary Designated Engineer (**shown in UPPERCASE letters**) coordinates the establishment and uniform interpretation of UL requirements applicable to the product categories. The Designated Engineers (**shown in lowercase letters**) work with the Primary Designated Engineer to interpret requirements and maintain standards.

Should you have questions regarding the interpretation of the requirements proposed in this bulletin or any adopted requirements that affect your product, you are encouraged to contact the individual at the office to which you normally submit your products.

The Industry Advisory Conference (IAC) Chairman for the subject categories is Raffic Ali at UL's Research Triangle Park office. The IAC Chairman oversees the significant interpretations made by the Primary Designated Engineer and arbitrates any differences regarding interpretation of UL requirements.

CCN	Office/Subsidiary	Responsible Engineer	Extension
XKFR, XKFR2	Camas	L. Copley	55612
	Melville	J. Stimitz	22214
	Northbrook	P. Wordlaw	42995
	RTP	M. BELCHER	1649
	Santa Clara	M. Arce	32520

CCN	Office/Subsidiary	Responsible Engineer	Extension
XKJU	Camas	L. Copley	55612
	Melville	K. Barto	22573
	Northbrook	P. Wordlaw	42995
	RTP	M. BELCHER	1649
	Santa Clara	M. Arce	32520

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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

Portable Electric Tools

UL 745-1, First Edition

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

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.

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



Underwriters Laboratories Inc.
UL 745-1
First Edition



Portable Electric Tools

March 23, 1995

Approved
by
Standards Council
of Canada



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.

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Preface

This is the common CSA and UL Standard for portable electric tools. It is the first edition of CSA Standard C22.2 No. 745-1 *Safety of portable electric tools Part 1: General requirements* and UL 745-1 *Safety of portable electric tools Part 1: General requirements*. 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 745-1 (1982) *Safety of hand-held motor-operated electric tools Part 1: General requirements*. Where Canadian and US deviations have necessitated the deletion of IEC Publication 745-1 text, the IEC text has been retained but has been over-stricken to indicate it as nonmandatory. Text added to IEC Publication 745-1 as mandatory has been redlined (shaded) including, where feasible, Tables and Figures.

This Standard contains general requirements and is intended to be used in conjunction with the appropriate particular requirements Standard (if available), which contains Clauses to supplement or modify the corresponding Clauses in the general requirements Standard, to provide the relevant requirements for each type of product.

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 will be submitted to the Standards Council of Canada for publication as a National Standard of Canada and to the American National Standards Institute (ANSI) for publication 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.

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 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 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

1.1 This standard applies to hand-held portable electric motor-operated or magnetically-driven tools, intended for indoor or outdoor use, in non-hazardous locations, in accordance with the Canadian Electric Code, Part 1 and the National Electrical Code (NEPA70). It applies to tools rated not more than 440V (not more than 250V for tools employing a universal motor).

Hand-held electric motor-operated tools, hereinafter referred to as tools, which can be mounted on a support for use as fixed tools without any alteration of the tool itself, are within the scope of this standard.

Tools with an electric heating element incorporated are within the scope of this standard, but such tools should also comply with IEC publication 335-1: Safety of Household and Similar Electric Appliances, Part 1: General Requirements, as far as it reasonably applies.

Special requirements for battery-powered tools will be determined in Part 2. Requirements concerning mechanical safety, however, will also apply for these tools as defined in UL 745-3 and C22.2 No. 745-3.

Special requirements for exchange-type tools (see definition 2.2(16)) are under consideration. Moreover, the requirements of this standard apply where appropriate.

For tools intended to be used on board ships or aircraft, additional requirements may be necessary, and in hazardous locations, for example, where explosions are liable to occur, special constructions may be required.

For tools intended to be used in tropical countries, special requirements may be necessary.

This standard applies to accessories and mechanical attachments for use with portable electric tools. These requirements are outlined in Appendix F.

This standard applies to attachments that contain electrical and electronic components. In this case, the attachment shall be evaluated with the tool and a determination must be made as to which clauses apply.

This Standard applies to, but the scope is not limited to: hand tools, such as drills, screwdrivers, nut runners, tappers, hammers, impact wrenches, saws, sanders, polishers, buffers, shears, nibblers, grinders, staplers, valve seat grinders and lappers, cylinder borers, and concrete vibrators; transportable tools, such as diamond core drills, drain cleaners, magnetic drills presses, pipe threaders, and pipe benders.

This standard does not apply to fixed or stationary electric tools, gardening appliances, garage equipment, soldering irons or guns, painting equipment, floor-finishing machines, heat guns, or other equipment covered by individual requirements.

Covered within this standard are Class I, II, and III tools.

1.2 This standard is concerned with safety and takes into account the influence on safety of components necessary to achieve a required degree of radio and television interference suppression.

2. Definitions

2.1 Where the terms voltage and current are used, they imply the r.m.s. values, unless otherwise specified.

2.1.1 Where in this standard the expressions "With the aid of a tool," "Without the aid of a tool," and "requires the use of a tool" occur, the word "tool" means a screwdriver, a coin or any other object which may be used to operate a screw or similar fixing means.

2.2 The following definitions apply for the purpose of this standard:

1. **Rated voltage** denotes the voltage (for three-phase supply, the voltage between phases) assigned to the tool by the manufacturer.

2. **Rated voltage range** denotes the voltage range assigned to the tool by the manufacturer, expressed by its lower and upper limits.

3. **Working voltage** denotes the maximum voltage to which the part under consideration can be subjected when the tool is operating at its rated voltage and under normal conditions of use.

Normal conditions of use include changes of voltage within the tool imposed by likely occurrences such as the operation of a circuit breaker or the failure of a lamp.

When deducing the working voltage, the effect of possible transient voltages on the supply mains is ignored.

4. **Rated input** denotes the input at rated voltage assigned to the tool by the manufacturer.

The term "input" refers to input power.

5. **Rated current** denotes the current at rated voltage or at the lower limit of the rated voltage range assigned to the tool by the manufacturer.

If no current is assigned to the tool, the rated current for the purpose of this standard is determined by calculation from the rated input and the rated voltage and/or by measuring the current when the tool is operating at rated voltage under normal load and at normal operating temperature.

6. **Rated frequency** denotes the frequency assigned to the tool by the manufacturer.

7. **Rated frequency range** denotes the frequency range assigned to the tool by tool manufacturer, expressed by its lower and upper limits.

8. **Rated no-load speed** denotes the no-load speed at rated voltage or at the upper limit of the rated voltage range assigned to the tool by the manufacture.

9. **Detachable flexible cable or cord** denotes a flexible cable or cord, for supply or other purposes, intended to be connected to the tool by means of a suitable appliance coupler.

Cord sets are to comply with the applicable standard given in Appendix E covered by IEC Publication 320: Appliance Couplers for Household and Similar General Purposes.

10. **Power supply cord** denotes a flexible cable or cord, for supply purposes, fixed to, or assembled with, the tool according to one of the following methods:

type X attachment which denotes a method of attachment such that the flexible cable or cord can easily be replaced, without the aid of special purpose tools, by a flexible cable or cord not requiring any special preparation;

type M attachment which denotes a method of attachment such that the flexible cable or cord can easily be replaced, without the aid of special purpose tools, by a special cable or cord with, for example, a molded-on cord guard or crimped terminations;

type Y attachment which denotes a method of attachment such that the flexible cable or cord can only be replaced with the aid of special purpose tools normally available only to the manufacturer or the manufacturer's agents;

Type Y attachments may be used either with common flexible cables or cords or with special cables or cords.

type Z attachment which denotes a method of attachment such that the flexible cable or cord cannot be replaced without breaking or destroying a part of the tool.

~~Cross-head, slotted-head, torx, socket head, clutch, and roberts tools are not considered special tools. Stiff wire, used to release push-in type terminals, is not precluded by this sub-clause.~~

11. **Basic insulation** denotes the insulation applied to live parts to provide basic protection against electric shock.

Basic insulation does not necessarily include insulation used exclusively for functional purposes.

12. **Supplementary insulation** denotes an independent insulation applied in addition to the basic insulation, in order to ~~ensure protection against~~ reduce the risk of electric shock in the event of a failure of the basic insulation.

13. **Double insulation** denotes insulation comprising both basic insulation and supplementary insulation.

14. **Reinforced insulation** denotes a single insulation system applied to live parts, which provides a degree of protection against electric shock equivalent to double insulation under the conditions specified in this standard.

The term "insulation system" does not imply that the insulation must be one homogeneous piece. It may comprise several layers which cannot be tested singly as supplementary or basic insulation.

15. **Portable Tool** (in this standard abbreviated to "tool") denotes a hand-held or transportable tool.

i. **Hand-held tool** (in this standard abbreviated to "tool") denotes an electric motor-operated or magnetically-driven machine intended to do mechanical work and so designed that the motor and the machine form an assembly which can easily be brought to the place of operation and which is held by hand or suspended during operation.

Hand-held tools may be provided with a flexible shaft, ~~the motor being either fixed or portable.~~ Hand-held tools may also have provisions for mounting on a support.

Hand-held tools include also hand-supported tools (such as paving breakers).

ii. **Transportable tool** is a tool that is not hand supported during use and which is intended to be taken to the work piece to perform its intended function.

16. **Exchange type tool** denotes a tool which is intended not to be repaired at all, or to be repaired by the manufacturer's service organization only.

17. **Class I tool** denotes a tool in which protection against electric shock does not rely on basic insulation only, but which includes an additional safety precaution in such a way that means are provided for the connection of accessible conductive parts to the protective (earthing) conductor in the fixed wiring of the installation in such a way that accessible conductive parts cannot become live in the event of a failure of the basic insulation.

For tools intended for use with a flexible cord or cable, this provision includes a protective conductor as part of the flexible cord or cable.

Class I tools may have parts with double insulation or reinforced insulation, or parts operating at safety extra-low voltage.

18. **Class II tool** denotes a tool in which protection against electric shock does not rely on basic insulation only, but in which additional safety precautions, such as double insulation or reinforced insulation, are provided, there being no provision for protective earthing or reliance upon installation conditions.

Such a tool may be of one of the following types:

- i) a tool having a durable and substantially continuous enclosure of insulating material which envelops all metal parts, with the exception of small parts, such as nameplates, screws and rivets, which are isolated from live parts by insulation at least equivalent to reinforced insulation; such a tool is called an insulation-encased Class II tool;
- ii) a tool having a substantially continuous metal enclosure, in which double insulation is used throughout, except for those parts where reinforced insulation is used, because the application of double insulation is manifestly impracticable; such a tool is called a metal encased Class II appliance;
- iii) a tool which is a combination of the types i) and ii).

19. **Class III tool** denotes a tool in which protection against electric shock relies on supply at safety extra-low voltage (SELV) and in which voltages higher than those of SELV are not generated.

~~Tools intended to be operated at safety extra-low voltage and having internal circuits which operate at a voltage other than safety extra-low voltage, are not included in the classification and are subject to additional requirements; these requirements are under consideration.~~

20. **Extra-low voltage** denotes a voltage supplied from a source within the tool and, when the tool is operated at its rated voltage, not exceeding 42 V peak between conductors and between conductors and earth or, for three-phase supply, not exceeding 24 V peak between conductors and neutral, the extra-low voltage circuit being separated from other circuits by basic insulation only.

21. **Safety extra-low voltage** denotes a nominal voltage not exceeding 42 V peak between conductors and between conductors and earth or, for three-phase supply, not exceeding 24 V peak between conductors and neutral, the no-load voltage not exceeding 50 V peak and 29 V peak respectively.

When safety extra-low voltage is obtained from the supply mains, it must be through a safety isolating transformer or a convertor with separate windings.

The voltage limits specified are based on the assumption that the safety isolating transformer is operated at its rated supply voltage.

~~The d.c. value is under consideration.~~

Limitations to voltages lower than 50 V a.c. should be specified in the applicable power unit or transformer standard given in Appendix E particular IEC standards, especially when direct contact with live parts is involved.

Separation from the mains by protective impedance is excluded.

22. **Safety isolating transformer** denotes a transformer the input winding of which is electrically separated from the output windings by an insulation at least equivalent to double insulation or reinforced insulation, and which is designed to supply a distribution circuit, a tool or other equipment at safety extra-low voltage.

23. **Normal load** denotes the load to be applied to a tool so that the stress imposed corresponds to that occurring under normal conditions of use, any marking of short-time or intermittent operation being observed and, unless otherwise specified, heating elements, if any, being operated as in normal use.

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

24. **Rated operating time** denotes the operating time assigned to the tool by the manufacturer.

25. **Continuous operation** denotes operation under normal load for an unlimited period.

26. **Short-time operation** denotes operation under normal load for a specified period, starting from cold, the intervals between each period of operation being sufficient to allow the tool to cool down approximately to room temperature.

27. **Intermittent operation** denotes operation in a series of specified identical cycles, each cycle being composed of a period of operation under normal load followed by a rest period with the tool running idle or switched off.

28. **Non-detachable part** denotes a part which can only be removed with the aid of a tool.

29. **Detachable part** denotes a part which can be removed without the aid of a tool.

30. **Thermal cut-out** denotes a device which, during abnormal operation, limits the temperature of a tool, or parts of it, by automatically opening the circuit or by reducing the current, and which is so constructed that its setting cannot be altered by the user.

31. **Non-self-resetting thermal cut-out** denotes a thermal cut-out which requires resetting by hand, or replacement of a part, in order to restore the current.

32. **Creepage distance** denotes the shortest path between two conductive parts, or between a conductive part and the bounding surface of the tool, measured along the surface of the insulating material.

33. **Clearance** denotes the shortest distance between two conductive parts, or between a conductive part and the bounding surface of the tool, measured through air.

The bounding surface of the tool is the outer surface of the enclosure, considered as though metal foil are pressed into contact with accessible surfaces of insulating material.

34. **All-pole disconnection** denotes, for single-phase a.c. tools and for d.c. tools, disconnection of both supply conductors by a single switching action or, for tools to be connected to more than two supply conductors, disconnection of all supply conductors, except the earthed (grounded) conductor, by a single switching action.

The protective earthing conductor is not a supply conductor.

35. **Accessible part** or **accessible surface** denotes a part or surface which can be touched by means of the standard test finger shown in Figure 1, ~~page 122~~. For accessible metal parts, it includes any other metal which is in electrical contact with such parts.

36. The term **body** includes all accessible metal parts, shafts of handles, knobs, grips and the like and metal foil in contact with all surfaces of insulating material; it does not include inaccessible metal parts.

37. **Watertight tools** denotes a tool so constructed that moisture will not enter the tool enclosure under specified test conditions.

38. **Splash-proof tools** denotes a tool so constructed or protected that the exposure to a beating rain will not result in the entrance of water into the enclosure under specified test conditions.

39. **A Type Test** is testing of a representative sample of the equipment with the objective of determining if the equipment, as designed and manufactured, can meet the requirements of this standard.

40. **Routine Servicing** denotes servicing of or replacement of motor brushes or fuses and other service that is recommended in the instruction manual to be performed by the user. It does not include maintenance that the instruction manual recommends be done by authorized service personnel.

41. **Cautionary Markings** denote markings required by this standard that are preceded by the signal words CAUTION, WARNING, or DANGER.

42. **Appliance Coupler** is a means enabling the connection and disconnection at will of a flexible cable or cord to a tool. It consists of two parts, 1) a connector which is the part integral with the tool, or attached to a flexible cable permanently attached to the tool, and 2) the mating connector which is attached to the power supply cord.

43. **Areas not Protected Against Deposition of Dirt** are defined as all points where air drawn through the tool (by the fan) can reach, especially areas where deposits of carbon dust, metal filings, and wood dust occur. The areas of concern are usually around the brush holders and to the rear of the commutator.

3. General requirement

3.1 Tools shall be so designed and constructed that in normal use they function safely so as to cause no danger to persons or surroundings so as to reduce the risk of injury or electric shock even in the event of such careless use as may occur in normal service.

In general, compliance is checked by confirming the tool meets the relevant construction requirements and by carrying out all the relevant tests.

4. General notes on tests

4.1 Tests according to this standard are type tests.

4.2 Unless otherwise specified, the tests are made on a single sample as delivered, which shall withstand all the relevant tests.

The recommended sequence of tests is given in Appendix G.

If it is evident from the design of the tool that a particular test is not applicable, this test is not made.

If the tool is designed for different supply voltages, for both a.c. and d.c., for different speeds, etc., more than one sample additional samples may be required.