Subject 635 (197, 250, 471, 507, 745, 859, 923, 998, 1017, 1026, 1082, 1083, 1240, 1363, 1431, 1727, 2157, 2158, and 60950)
(In reply, refer to Subject 635)

1655 Scott Blvd.
Santa Clara, CA 95050
September 27, 2004

TO: Subscribers to UL's Standards Services for
Insulating Bushings
Commercial Electric Cooking Appliances
Commercial Electric Personal Grooming Appliances
Commercial Refrigerators and Freezers
Electric Clothes Dryers
Electric Clothes Washing Machines and Extractors
Electric Commercial Clothes Drying Equipment
Electric Fans
Electric Household Cooking and Food Serving Appliances
Household Electric Coffee Makers and Brewing-Type Appliances
Household Electric Personal Grooming Appliances
Household Electric Skillets and Frying-Type Appliances
Household Refrigerators and Freezers
Humidifiers
Information Technology Equipment
Microwave Cooking Appliances
Personal Hygiene and Health Care Appliances
Portable Electric Tools
Relocatable Power Taps
Vacuum Cleaners, Blower Cleaners, and Household Floor Finishing Machines

SUBJECT: Request for Comments on Proposed Requirements for the Second Edition of the Standard for Insulating Bushings, UL 635
PROPOSED EFFECTIVE DATE

SUMMARY OF TOPICS

This bulletin proposes the following changes in requirements:

1. Revision of the Scope by listing additional products that are not covered by the requirements of UL 635

2. Addition of requirements for flammability, temperature ratings, materials substitution, and molding considerations to Materials, Section 5.

3. Clarify requirements for conditioning strain relief bushings during the Strain Relief Test.

4. Clarify the requirements for the Humidity Test.

5. Clarify the requirements for conducting the Elevated Temperature Test.

COMMENTS DUE: November 22, 2004

Attached as Appendix A for your review and comment are proposed requirements for UL 635. Attached as Appendix B for your review and comment are the impact statements and proposed effective date. Questions regarding interpretation of requirements should be directed to the responsible UL Staff.

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.

PRODUCTS AND INDUSTRIES AFFECTED BY THE PROPOSAL

UL requests your assistance in identifying other products or industries that might be affected by the requirements contained in this bulletin. UL suggests that all suppliers or customers for these products and industries be made aware of these requirements prior to their proposed effective date. Also, please forward your suggestions to UL so that these products and industries may be identified in future bulletins.

Comments should be made in writing and may be sent by fax to (408) 556-6045 or by mail to the attention of Derrick L. C. Martin at UL's Santa Clara office. Comments may also be sent via E-mail to Derrick.L.Martin@us.ul.com. Please reference all correspondence to Subject 635. Note all comments received are public and may be circulated to others. If you respond by fax or E-mail, please include your full name and company name and address to ensure a reply.

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

UNDERWRITERS LABORATORIES INC.

DERRICK L. C. MARTIN
Project Manager
Engineering Associate
Standards Department
SANTA CLARA OFFICE
Phone: (408) 876-2565
Fax: (408) 556-6045
E-mail: Derrick.L.Martin@us.ul.com
http://ulstandardsinfonet.ul.com

REVIEWED BY:

TOM MAYERHOFER
Principal Engineer – Electrical
Insulation Systems and Materials
NORTHBROOK OFFICE
Phone: (847) 664-2903
Fax: (847) 313-2903
E-mail: Thomas.L.Mayerhofer@us.ul.com

SR: RKM

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APPENDIX A

PROPOSED REQUIREMENTS FOR THE SECOND EDITION OF THE STANDARD FOR INSULATING BUSHINGS, UL 635

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~~.

1. SCOPE

RATIONALE

UL proposes to revise Paragraph 1.2 by indicating that the requirements of UL 635 are not applicable to bushings used in a variety of applications. A description of those bushings is provided in the Proposal section of this item.

The proposal represents UL's current and historical criteria for which types of bushings are covered by the requirements of UL 635. UL does not evaluate (and has never evaluated) the bushings described in the Proposal section of this item for Listing or Recognition in accordance with UL 635. UL concluded that references to those bushings were inadvertently omitted from Paragraph 1.2.

PROPOSAL

1.2 This Standard does not cover bushings used in the following applications:

a) Bushings for the protection of uninsulated conductors.

b) Strain-relief insulating bushings used to hold more than one cable, wire, or cord.

c) Bushings that are an integral part of a flexible cord.

d) Bushings used at the end of a raceway at the point of connection to open wiring and bushings used in conjunction with rigid or flexible conduit, conduit fittings, electrical metallic tubing, armored cable, or non-metallic sheathed cable.

e) Bushings for power circuit breakers, transformers, or similar power apparatus rated more than 600 volts.

f) Bushings intended for outdoor use.

g) Bushings used on armored cable between the conductors and the outer armor.

h) Insulating bushings provided either separately or as part of a conduit fitting.

i) Rainproof or liquid tight bushings.

j) Bushings for use on the ends of rigid or flexible conduit.

k) The following items covered by the Standard for Conduit, Tubing, and Cable Fittings, UL 514B :

1. Cord grips;

2. Insulating bushings;

3. Liquid-tight flexible cord fittings;

4. Mesh grips;

5. Strain relief grips;

6. Strain relief grips for bus drop cables;

7. Strain relief grips for flexible cords; and

8. Strain relief with wire mesh cord grips.

2. MATERIALS

RATIONALE

UL proposes to reorganize the format of Section 5 by adding subsections for requirements for flammability, temperature ratings, materials substitution, and molding considerations. The intent of the proposal is to provide clarity to the current material requirements in UL 635. In addition, the proposal would clarify the material substitution requirements as well as the extent to which the materials may or may not be modified during the molding process.

The proposed revision of Section 5 includes the following changes:

1. Paragraphs 5.1, 5.3, and 5.4 have been re-designated as Paragraphs 5.1.1, 5.1.2, and 5.1.3 respectively. The proposed Paragraphs 5.1.1, 5.1.2, and 5.1.3 have been transferred to the proposed Subsection 5.1, titled “General.”

2. Paragraph 5.2 has been revised to include a reference to the IEC Standard for Test Flames – 50 W Horizontal and Vertical Flame Test Methods, 60695-11-10. Paragraph 5.2 has been re-designated as Paragraph 5.2.2 and has been transferred to the proposed Subsection 5.2, titled “Flammability.”

3. The proposed temperature rating requirements would appear in UL 635 as Subsection 5.3; the proposed requirements for materials substitution would appear in the standard as Subsection 5.4, and the proposed requirements for molding considerations would appear in the standard as Subsection 5.5.

The proposed requirements in Paragraph 5.2.1 and Subsections 5.3 – 5.5 are based on requirements from the Standard for Positioning Devices, UL 1565. UL determined that Standard UL 1565 was the most appropriate source for the proposed requirements because, like bushings, positioning devices are typically made from similar polymeric materials that are mechanically relied upon to maintain the relative position of insulated wires.

PROPOSAL

(CURRENT VERSION OF SECTION 5)

5 Materials

5.1 Ceramic materials and some molded compositions such as phenolic and urea formaldehyde are capable of being used as materials for a separate insulating bushing. Vulcanized fiber is not prohibited from being used when the bushing is not less than 3/64 inch (1.2 mm) thick, and when it is formed and secured in place so that it is not adversely affected by conditions of typical moisture. Other materials, such as nylon, are capable of being used after a suitable investigation. See Humidity Test, Section 11, and Elevated Temperature Test, Section 12.

5.2 Materials employed in the construction of insulating bushings shall be classified with a flammability rating of at least 94 HB as determined by the Standard for Safety for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94.

5.3 Wood, hot-molded shellac, tar compositions, or rubber are not to be used as materials for a separate insulating bushing.

5.4 The wall thickness of an insulating bushing shall not be less than 3/64 inch (1.2 mm) unless a thickness has been determined to be capable of being used as a result of an investigation (see reference to vulcanized fiber in 5.1). This requirement does not preclude the use of narrow slots or openings in the wall of an insulating bushing when the intended cable, flexible cord, or insulated wire is not capable of being pressed into such slots or openings.

(PROPOSED VERSION OF SECTION 5)

5 Materials

5.1 General

5.1.1 Ceramic materials and some molded compositions such as phenolic and urea formaldehyde are capable of being used as materials for a separate insulating bushing. Vulcanized fiber is not prohibited from being used when the bushing is not less than 3/64 inch (1.2 mm) thick, and when it is formed and secured in place so that it is not adversely affected by conditions of typical moisture. Other materials, such as nylon, are capable of being used after a suitable investigation. See Humidity Test, Section 11, and Elevated Temperature Test, Section 12.

5.1.2 Wood, hot-molded shellac, tar compositions, or rubber shall not to be used as materials for a separate insulating bushing.

5.1.3 The wall thickness of an insulating bushing shall not be less than 3/64 inch (1.2 mm) unless a thickness has been determined to be capable of being used as a result of an investigation. See reference to vulcanized fiber in 5.1.1. This requirement does not preclude the use of narrow slots or openings in the wall of an insulating bushing when the intended cable, flexible cord, or insulated wire is not capable of being pressed into such slots or openings.

5.2 Flammability

5.2.1 Materials employed in the construction of insulating bushings shall be classified with a flammability rating of at least HB as determined by the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94 or IEC 60695-11-10, Test Flames – 50 W Horizontal and Vertical Flame Test Methods.

5.3 Temperature Rating

5.3.1 The temperature rating of the device, as indicated in 10.1, 12.3, and 15.4, is to be based on the mechanical-without-impact relative thermal index (RTI – Strength) of the material used in the device. The relative thermal index shall be determined in accordance with the Standard for Polymeric Materials – Long Term Property Evaluations, UL 746B.

Note: The relative thermal index of a material is an indication of the material's ability to retain a particular property (such as physical or electrical) when exposed to an elevated temperature for an extended period of time. For each material, a number of relative thermal indices are established, each related to a specific property, and specific thickness of the material.

5.3.2 The temperature rating of a polymeric device shall not exceed the relative thermal index of the material that is selected for the device, in the device's minimum critical thickness.

5.4 Substitution of Materials

5.4.1 Another polymeric material shall be allowed to be substituted in a device having met the requirements of this Standard only when all of the following conditions are met and compliance is determined through appropriate investigation:

a) There is an identical generic description (for example: Type 66, 30 percent glass filled, FR type, polyamide).

b) Tensile strength of materials, determined in accordance with the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A or ISO 527-1, Plastics – Determination of Tensile Properties – Part 1: General Principles, and ISO 527-2, Plastics – Determination of Tensile Properties – Part 2: Test Conditions for Moulding and Extrusion Plastics, shall be compared, and shall indicate that the substitute material has a strength of at least 95 percent of that of the original material. The tensile strengths used in this comparison shall be generated by either:

1) A previous investigation or

2) Side-by-side testing of both materials.

c) The material's relative thermal indices shall be used for the temperature rating of the device as specified in 5.3.1.

5.5 Molding Considerations

5.5.1 Except as indicated in (a) and (b), polymeric materials used to mold or fabricate devices covered by this Standard shall be made from materials that are 100 percent virgin and unmodified by the molder:

a) Devices made from thermoplastic materials are limited to 25 percent regrind by weight of the same material, unless the results of a separate investigation indicate acceptable performance for the material or the specific device. The Standard for Polymeric Materials – Fabricated Parts, UL 746D, includes guidelines to be considered in such a separate investigation.

b) Devices covered by this Standard shall be allowed to employ colorants, flame retardants, fillers, mold-release lubricants, color concentrates, dyestuff, chemical blowing agents or reinforcements in conjunction with the polymeric material, when the additive or concentrate is tested and found not to adversely affect the critical properties of the material. An additive or concentrate of unknown performance shall not be used. The Standard for Polymeric Materials – Fabricated Parts, UL 746D, provides guidance for the use of specific additives that may be used in the molding process without need for separate investigation.

5.5.2 Devices shall not employ materials that have been blended together unless one of the following conditions have been met:

a) When two materials have already been individually considered acceptable for an application, and are both found to be generically similar, are both produced by the same manufacturer, and are both designated HB in the minimum part thickness when tested in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94 or IEC 60695-11-10, Test Flames – 50 W Horizontal and Vertical Flame Test Methods, these materials may be dry blended in any proportion by the manufacturer without further testing.

b) When two materials have already been individually considered acceptable for an application and are both found to be generically similar, are both produced by the same manufacturer, each is designated V-0, V-1, or V-2 in the minimum part thickness when tested in accordance with the Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances, UL 94 or IEC 60695-11-10, Test Flames – 50 W Horizontal and Vertical Flame Test Methods, and when the results of a separate investigation indicate performance meeting the requirements for the material or the specific device, these materials may be dry blended in any proportion by the manufacturer without further testing. The Standard for Polymeric Materials – Fabricated Parts, UL 746D, includes guidelines for a separate investigation.

A device made from blended material described in (a) or (b) shall be considered to have flammability, mechanical, and thermal properties that are no better than the performance of the weaker of the individual constituents on a property-to-property basis.

3. STRAIN RELIEF

RATIONALE

UL proposes to revise Paragraph 10.1 by indicating that samples of a strain-relief bushing are to be conditioned in an oven set at the rated temperature of the bushing for one hour. After the conditioning, the samples are to be subjected to the strain-relief test described in the requirement.

The proposal represents a clarification of how long it is typically required to condition the sample to assure they are being tested at rated temperature. The proposal reflects UL's current (and historical) method of conducting the test described in Paragraph 10.1. UL concluded that the proposed requirement was inadvertently omitted from Paragraph 10.1.

PROPOSAL

10.1 Six samples of a strain-relief bushing are to be assembled and placed in an oven that has been preset at rated temperature of the bushing. After one hour the bushings are subjected to a strain-relief test while still at the rated temperature. ~~of the bushing~~ Three of the samples are to have the force applied normal to the exit of the cord or wire, and three samples are to be subjected to the strain-relief test applied at a 90° angle to the normal plane of exit. See Figures 10.1 and 10.2.

4. HUMIDITY TEST

RATIONALE

UL proposes to revise Paragraph 11.1 by indicating that samples of the bushings tested in accordance with the requirement are to be subjected to the tests described in Paragraphs 11.2 or 11.3, whichever test is appropriate. The intent of the proposal is to specify exactly when after removal from the humidity chamber the samples are to be tested. This clarification will reduce the possibility of varying interpretations of Paragraph 11.1 resulting in inconsistent results. The proposal represents a clarification of UL's current (and historical) procedure for conducting the test described in the requirement. UL concluded that information for the proposal was inadvertently omitted from Paragraph 11.1.

UL also proposes to revise Paragraph 11.3 by indicating that the weight applied to the strain-relief bushing as described in the requirement be applied in a gradual manner for one minute. The intent of the proposal is to specify how and for how long the force is to be applied to the strain relief bushing. This clarification will reduce the possibility of varying interpretations of Paragraph 11.3 resulting in inconsistent results, and thus not provide a consistent benchmark against which UL can use to determine whether a strain-relief bushing subjected to the Humidity Test would be suitable for its intended use. The proposal represents a clarification of UL's current (and historical) procedure for conducting the test described in the requirement. UL concluded that information for the proposal was inadvertently omitted from Paragraph 11.3.

PROPOSALS

11.1 Three samples of each type of bushing are to be assembled as illustrated in Figure 11.1 or 11.2 in a hole of the intended size and shape in a metal plate along with a length of cable, cord, or wire. The cable, cord, or wire shall be the size and type intended for use with the bushing. The complete assembly is to be placed in a humidity chamber in which the relative humidity has been adjusted to 85 ±5 percent at a temperature of 32°C ±2°C (89.6°F ±3.6°F) for a period of 7 hours. Immediately after removal from the chamber the samples are to be subjected to the tests indicated in 11.2 or 11.3.

11.3 A strain-relief bushing is to be secured and positioned so that a 10 pound-force (44.5 N) can be gradually applied for one minute in a direction normal to the plane of the cord exit from the bushing. See Figure 11.2.

5. ELEVATED TEMPERATURE TEST

RATIONALE

UL proposes to revise the requirements for the Elevated Temperature Test in Section 12 to clarify the number of samples to be evaluated and to clarify that the bushings conditioned in accordance with the current version of Paragraph 12.3 are to be allowed to cool to room temperature before they are visually examined and mechanically tested in accordance with the current Paragraphs 12.1 and 12.2. This proposal reflects UL's current (and historical) method of evaluating feed through and strain relief bushings. UL concluded that information for the proposal was inadvertently omitted from Section 12.

UL also proposes to revise the format of Section 12 by organizing the requirements in Paragraphs 12.1 – 12.3 so they appear in the order in which the test is conducted. UL has concluded that the proposed revision will make it easier for some users of UL 635 to interpret how to conduct the Elevated Temperature Test.

PROPOSAL

(CURRENT VERSION OF SECTION 12)

12 Elevated Temperature Test

12.1 A bushing shall not warp, char, blister, or otherwise unduly alter its characteristics when subjected to the elevated temperature test described in 12.3.

12.2 To determine whether or not a bushing complies with the requirements of 12.1, a thorough visual inspection is to be made (or measurements when required), after which a strain-relief bushing shall comply with the Strain-Relief Test, Section 10. A feed-through bushing shall comply with the Installation Test, Section 9.

12.3 Three samples of a bushing are to be mounted in the intended manner and placed in an air-circulating, draft-free oven for 7 hours at a temperature of 100°C (212°F), or 20°C (68°F) above the temperature rating of the bushing, whichever is greater.

(PROPOSED VERSION OF SECTION 12)

12 Elevated Temperature Test

12.1 Three samples of a feed through bushing, or six samples of a strain-relief bushing are to be assembled in the intended manner in metal plates having the largest intended opening and minimum thickness. The sample assemblies are to be placed in an air-circulating, draft-free oven for 7 hours at a temperature of 100°C (212°F), or 20°C (68°F) above the temperature rating of the bushing, whichever is greater. Following the oven conditioning the sample assemblies were allowed to return to room temperature and subjected to a thorough visual inspection to verify the bushing has not warped, charred, blistered, or otherwise unduly alter its characteristics. Following the visual examination the bushings are to be tested in accordance with 12.2 or 12.3.

12.2 The three conditioned feed through bushings are to be tested at room temperature in accordance with 9.2 and 9.3 with the results complying with the requirements in 9.1.

12.3 The six conditioned strain relief bushings are to be tested at room temperature in accordance with 10.1 and 10.2 with the results complying with the requirements in 10.3.

APPENDIX B

IMPACT STATEMENT AND PROPOSED EFFECTIVE DATE

Standard Number	Paragraphs, Tables, Figures, or Section Number	Impact	Proposed Effective Date
UL 635	Paragraph 1.2	See Impact 1	12 months after date of publication
	Section 5	See Impact 2	12 months after date of publication
	Paragraph 10.1	See Impact 2	12 months after date of publication
	Paragraphs 11.1 and 11.3	See Impact 2	12 months after date of publication
	Section 12	See Impact 2	12 months after date of publication

Impact Statement

Impact 1

If the proposed requirement is adopted, UL will have to review the Follow-Up Services Reports of bushings and strain reliefs currently Listed and Recognized in accordance with UL 635 to determine whether they are among the items specified in the proposal. If the proposed requirement is adopted, manufacturers of bushings and strain reliefs described in the proposal may have to change the construction of their products to comply with requirements of a standard other than UL 635. A retest of those products will not be necessary if the proposed requirement is adopted.

Impact 2

If the proposal is adopted, manufacturers of bushings and strain reliefs currently Listed and Recognized in accordance with UL 635 may need to change the construction of their products to comply with the proposed requirements. Therefore, a review and retest of those products may be necessary if the proposal is adopted.

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