CPSA 6 (b)(1) Cleared
12/9/98
No Mfrs/PrvtLblrs
Products Identified
___Excepted by_____
___Firms Notified,
Comments Processed.

LOG OF MEETING

DIRECTORATE FOR ENGINEERING SCIENCES

SUBJECT: Attendance of UL 746/UL94 Industry Advisory Group/Industry Advisory Council Meeting

DATE(S) OF MEETING: October 14, 1998

PLACE: UL, Melville, NY.

LOG ENTRY SOURCE: Hammad Ahmad Malik

DATE OF ENTRY: October 20, 1998

COMMISSION ATTENDEES: Hammad Malik, ESEE

NON COMMISSION ATTENDEES:

Walter G. Baumgardt, Occidental Chemical
Mik Breza, M A Hanna Engineered Materials
Rinus de Vos, DSM Research
Stephen J. Harasin, Bayer Corp.
Shuichi Hirashima, Matsushita Electric Works Ltd.
Hiroshi Ishiwata, Mitusbishi Engineering Plastics Corp.
Shirish Mehta, Thomsom Consumer Electronics, Inc.
Charles Mulligan, G.E. (Major Appliance Div.)
Richard L. Pescatore, Hewlett Packard
Catherine Ruiz, Allied Signal Inc.
Inder L. Wadehra, IBM Corp.
Steve J. Watson, DuPont Engineering Polymers
Doug Wetzig, The Geon Company
Kibby White, GE Plastics
Marie-Francoise Bottin, Rhodia
Hans Breuer, BASF Germany
Paul Brown, GE Plastics
Kuniko Ito, Chemitox, Inc.
Mark E. Johnson, AMP Inc.
Gerhard Maurer, BASF Germany
Alyce Mayer, Strategic Technology Resources
Wayne Morris, Association of Home Appliance Manufacturers
Richard Nute, Hewlett Packard
Ed Van Vooren, ELTEK International Labs.
Dieter Vondenhagen, BASF Germany
Jessica Hemond, AMP Inc.
Ted Marks, JVC

Sam Cristy, Product Safety Letter
Elias Arias, UL-Melville
Larry Bruno, UL-Melville
Robert Desa, UL-Melville
George Fechtmann, UL-Melville
Gus Gemmiti, UL-Melville
Steve Giannoni, UL-Mellville
Marie Johnston, UL-Melville
Robert Mayshak, UL-Melville
Joe Salvini, UL-Melville
John Stimitz, UL-Melville
Ray Suga, UL-Melville
Robert Delli Valli, UL-Melville
Don Talka, UL-Melville
Andre Miron, UL-Santa Clara
Craig Allen, BASF
Ned Brause, Dekko Technical Center
Stephen N. Keller, Trace Laboratories
Bob Konsowitz, GIL Technologies
Hiten Pandya, Honywell
David Rackowitz, BASF
Robert C. Srubas, Osterman and Co.
Tena M. Shelton, Chevron Chemical Co.
Larry Stover, M A Hanna, Engineered Materials
Scott Suddoth, M A Hanna, Engineered Materials
Jonas Talandis, Atlas Fire Science Products
Peter Walthers, Omron Electronics
Ron Watson, Raychem
David Wildman, Emerson Tools
Arthur Wong, Honeywell
Ranganath Shastri, Dow Chemical
Charles Garufi, UL-Melville
Dan O' Shea, UL-Melville
Kenneth R. Vessey, Jr., UL-Melville

Mr. George Fechtmann began meeting with brief introductions. Ms. Marie Johnston provided a breifing on various projects of interest to the committee that are being funded through the steering committee. A representative from each of the project teams provided a status report. These projects included improvements on the hot-wire ignition test apparatus, IR spectra, relative traking index, etc. Considerable discussion followed about various projects and fund usage.

Mr. George Fechtmann then provided a brief history of the UL Plastics Flammability Ad-Hoc Committee. Mr. Fechtmann indicated that the committee was formed shortly after Mr. Bill King, CPSC, attended the IAG/IAC meeting at Research Triange Park, NC in 1995. In this meeting Mr. King indicated that the CPSC staff was concerned that household electical product related fires were not showing the same downward trend that residential fires were exhibiting as a whole.

Mr. Fechtmann then introduced Mr. Larry Bruno and Mr. John Stimitz as the presentors of the UL Ad-Hoc Plastics Flammability Committee report. Mr. Larry Bruno and Mr. John Stimitz then gave a presentation of the proposals found within the report (attached). Members of the IAG/IAC raised concerns about how large stationary tools would be handled by the proposal.

Mr. Hammad Malik gave an overview of the CPSC staff involvement in with plastics flammability issues and the part taken in the Ad-Hoc Committee. Mr. Malik then passed out copies of the plastics flammability project report "Assessment of Flammability of Plastic Materials Used as Electrical Appliance Enclosures."

Mr. George Fechtmann indicated that the proposed changes to UL 746C are not envisioned to have an effective date of less than five years.

The meeting then broke for lunch. After lunch Mr. Hammad Malik was excused from the meeting. Mr. Kenneth Vessey provided Mr. Malik with demonstrations of the ball-pressure test and a new fully automated Comparative Traking Index (CTI) apparatus.

Subjects 746 (94)
(In reply, refer to Subject 746)

1285 Walt Whitman Road
Melville, NY 11747-3081
September 24, 1998

TO: Industry Representatives on the Industry Advisory Group of UL for
Plastic Materials
Subscribers to UL's Standards Service for
Polymeric Materials – Short Term Property Evaluations, UL 746A,
Polymeric Materials – Long Term Property Evaluations, UL 746B,
Polymeric Materials – Use in Electrical Equipment Evaluations, UL 746C,
Polymeric Materials – Fabricated Parts, UL 746D,
Polymeric Materials – Industrial Laminates, Filament-Wound Tubing,
Vulcanized Fibre, and Materials Used in Printed Wiring Boards, UL 746E,
Tests for Flammability of Plastic Materials, UL 94

SUBJECT: Industry Advisory Group Meeting Agenda

As announced in the Subject 746 (94) bulletin dated July 10, 1998, a meeting of the Industry Advisory Group of UL for Plastic Materials is scheduled for:

October 14, 1998
UL's Melville Office
1285 Walt Whitman Road
Melville, NY 11747
(516) 271-6200
Conference Room #5
9:00am – 5:00pm

SUMMARY OF TOPICS

The following topics will be discussed at the meeting:

1. Plastics Steering Committee Update
2. Activities Update on ASTM D.09 and D.20, IEC TC15, TC61, and TC89, and ISO TC61
3. The Client Interactive Program (CIP)
4. Flammability Ad Hoc Committee Report
5. Consideration of Rapid RTI Methodologies – UL 746B

(Continued)

SUMMARY OF TOPICS (Cont'd)

6. International Draft of UL 746C
7. Revision of Table 8.1 – UL 746A
8. Protocol for Consideration of Increased RTI for PPHOX – UL 746B/746C
9. Testing of Annealed Samples – UL 746B
10. Metallized Parts Ad Hoc Committee
11. Adding PTI (Proof Tracking Index) Test to UL 746C
12. Downrating Guidelines – UL 94/746A/746B
13. Inclusion of ISO/UL Comparable Data Base (Mechanical and Electrical)
14. Standardized Wall-Thickness Representation for Glow-Wire Test
15. Development of Generic Ball-Pressure Temperature Indices
16. Harmonization of Long Term Heat Aging Tests with ISO Methods
17. Gas-Assisted Injection Molding
18. New Product Category "Concentrates"
19. Editorial Revision to Table 10.1 of UL 746B
20. Re-Evaluation of Follow-Up Service Testing Program

Attached is the agenda for the meeting.

This meeting is intended for industry representatives to meet with UL to discuss proposed requirements and/or other standards issues. Space permitting, others may attend as observers. Anyone not on the Group who would like to attend the meeting is requested to contact UL for permission to do so. Such a request should be made by October 5, 1998. This practice is necessary and desirable to maintain the size and effectiveness of the meeting. Please keep in mind that those receiving a copy of this agenda will also receive a copy of the meeting report.

Hotel Accommodations

As stated in the July 10, 1998 announcement bulletin, rooms have been reserved at the Melville Marriott Long Island for October 13, 1998. Rooms have not been guaranteed; therefore, should you elect the use of these accommodations, it is suggested that you contact the Melville Marriott to confirm your reservations. The rate for these rooms is $159, subject to availability . Please mention that you will be attending the UL "IAC 746" meeting when making your reservations. A free shuttle bus to the UL building, which is within walking distance, will be available to hotel guests.

Ground Transportation Arrangements

UL has arranged with the Executive Limousine Service in Coram, New York, to provide ground transportation from JFK and Laguardia Airports to UL Melville (and hotels located in Melville). The standard one-way fare is $50 when the car has just one occupant. The rate can be shared if some attendees are traveling together. Cash or credit card payment will be required, to the driver, at the time of service. Reservations to and from the airports should be made directly with Executive Limousine by calling (516) 696-8000 (800-736-4512 outside of New York) or faxing (516) 696-4845 and asking for the "UL meeting-746 IAC rate" which will be honored from October 12-15.

Attire

To make the meeting more comfortable, it will be appropriate to wear casual business attire.

If you have not already done so, please complete the attached attendance form and return it no later than October 5, 1998. If you have already sent in the completed form, no further action is necessary.

UNDERWRITERS LABORATORIES INC.

RAYMOND M. SUGA (Ext. 22593)
Senior Engineering Associate
Standards Department
(fax: 516-439-6021)
E-mail: sugar@ul.com

REVIEWED BY:

JOHN S. STIMITZ (Ext. 22214)
Associate Managing Engineer
Engineering Services 216P
(fax: 516-439-6046)
E-mail: stimitzj@ul.com

SR:LS;
0746BUL.R04;RS;mc

Subjects 746 (94) September 24, 1998

ATTENDANCE FORM

OCTOBER 14, 1998 IAG MEETING IN
MELVILLE, NEW YORK
PLASTICS, UL 746(94)

(Please Print or Type)

NAME: _____
(As you would like it to appear on your name tag/table tent)

COMPANY: _____

☐ I am an IAG member who will be attending the meeting.

☐ I am an IAG member who will not be attending the meeting.

IAG members that want to bring another person or send a substitute who can contribute substantially to the discussion are requested to contact UL for permission to do so. Such a request should be made as early as possible prior to the meeting.

* * * * * * * * * * * * * * * *

IMPORTANT: If you are not a current member of the IAG but want to attend, and have received this agenda because you are a subscriber to UL's bulletin service, you must complete the following:

☐ I am not on the IAG but wish to attend the meeting as an observer.

NAME:_____
COMPANY:_____
ADDRESS:_____
PHONE/FAX/E-MAIL_____
INDUSTRY BACKGROUND/WHY YOU WANT TO ATTEND_____
_____
_____
_____

Please send the completed form no later than
October 5, 1998 to:

Underwriters Laboratories Inc.
1285 Walt Whitman Road
Melville, New York 11747-3081

Attention: Raymond M. Suga (Ext. 22593)
Senior Engineering Associate

Standards Department
516-271-6200
516-439-6021 (Fax)
E-mail sugar@ul.com

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

AGENDA

MEETING OF THE IAG OF UL FOR PLASTIC MATERIALS

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. PLASTICS STEERING COMMITTEE UPDATE

DISCUSSION

UL will present an update on the research projects being conducted under this program. The following is a list of the specific projects that are currently active:

1. HAI - Phase II
2. Update IR Spectra for Industrial Laminates
3. Performance at Temperature
4. Comparison of CTI Methods
5. LTHA - Effect of Air Changes*
6. Automated UL 94 Test
7. Relational Database for Plastics Data
8. Rigorous Protocol for Establishing New Generic RTI(s)
9. UL 746C Based International Guidance Document
10. 1997 UL Representation on the IEC TC15, TC 61 and TC89 and ISO TC61 Committees
11. Preliminary Evaluation of the Rapid RTI Methodology Proposal and the Feasibility of General Rapid Analytical Methods for RTI Determination
12. Round Robin for ASTM D 635*
13. Risk of Fire Hazards - Phase I
14. UL 94 Training Video
15. Client Test Data Program and ISO Guide 25 (ISO 9000)
16. Correlation of HWI vs. Glow Wire Ignition Temperature for the Pre-Selection of Plastic Materials

* These projects are now concluded and a final report will be available for inspection at the meeting for anyone interested.

2. ACTIVITIES UPDATE ON ASTM D.09 AND D.20, IEC TC15, TC61, AND TC89, AND ISO TC61

DISCUSSION

UL staff will present a summary of their participation on various plastics related working groups and technical committees.

3. THE CLIENT INTERACTIVE PROGRAM (CIP)

DISCUSSION

At the previous meeting, industry representatives asked that UL consider evaluating compliance with ISO 9002, or conversely, to take ISO 9002 compliance into account when conducting UL's Witnessed Test Data Program/Client Test Data Program (WTDP/CTDP) investigations. Industry had perceived a duplication of effort since their facilities are visited separately by different UL personnel for activities having some apparent degree of similarity. UL agreed to identify the common activities of the programs and look into the possibility of eliminating, or reducing, any duplicated efforts.

A subsequent review by UL of the issues has revealed that the scope of ISO 9002 facility registration and WTDP/CTDP laboratory accreditation are in fact different, requiring independent UL personnel having expertise keyed to the particular programs. While ISO 9002 registration is an assessment of corporate integrity, WTDC/CTDP accreditation programs evaluate the ability of laboratories to perform testing resulting in UL product compliance certifications. Although there appears to be no significant duplication of activities, UL would be willing to establish an industry/UL Ad Hoc Committee to further research specific issues.

4. FLAMMABILITY AD HOC COMMITTEE REPORT

DISCUSSION

There has been a great deal of activity, since the last meeting, concerning the Flammability Ad Hoc Committee. An attempt has been made to develop requirements that will increase the resistance to ignition from internal sources within the product, such as electrical connections or faulty components. An approach similar to that used in IEC 60335-1 (Safety of Household and Similar Electrical Appliances, Part 1, General Requirements) is currently under consideration. In this testing scheme, the use of a less flame retardant material (i.e., HB- or V-2- rated) would result in a relatively extensive investigation of the ignitability characteristics of any plastic material in close proximity to potential sources of ignition in the end product. Conversely, when more flame resistant materials are used (such as V-0 and V-1), the testing level on the end product could be considerably lessened.

UL has prepared proposed revisions for UL 746C to be discussed at the meeting. Since this proposal complements the present ignition/flammability evaluation method, UL anticipates making a thorough presentation at the meeting to explain the necessity for these changes as well as to discuss the potential impact for users of UL 746C and various end-product and component manufacturers.

A copy of the report on the most recent Ad Hoc Committee meeting is attached as Appendix B. For brevity, the attachment pages have been left off the report.

RATIONALE

UL considered the input of the Ad Hoc Committee in deciding that some revisions to UL 746C would be necessary to address the possible ignition and fire caused by the malfunction of internal components and connections. After reviewing a number of suggested approaches, UL decided an approach similar to that used in IEC 60335-1 would be both effective and beneficial.

IMPACT

These changes in requirements would result in a possible review and retesting of currently Listed or Recognized products; therefore, if adopted, they would have a significant effect upon manufacturers.

PROPOSAL

See Appendix C for UL's proposal for UL 746C.

5. CONSIDERATION OF RAPID RTI METHODOLOGIES – UL 746B

DISCUSSION

At the previous meeting, a presentation was made of the Fixed Time Frame Method of investigating the long-term thermal properties of Recognized materials. UL indicated it was willing to develop a proposal at a future date based on the positive industry response and the promising initial results in a side-by-side comparison of the present UL 746C test method versus the new Fixed Time Frame Method (FTFM). Since then, UL has contracted to conduct additional confirmation tests to further demonstrate the equivalency of these two Long Term Heat Aging (LTHA) methods.

The FTFM format is, overall, essentially similar to the present 746C LTHA requirements as it is based on the same fundamental principles; however, instead of using the test temperature as the independent (selected) variable and time (length of test) as the dependent (to be determined) variable, the FTFM utilizes the time as the independent variable and the temperature as the dependent variable. The FTFM places a great emphasis on the first 500 hours of testing (referred to as the Screening Test) to determine what test temperatures will produce a 50% loss of properties at the 5,000 hour point. One cited advantage of the FTFM is that, under normal circumstances, testing concludes at the 5,000 hour point whereas it is relatively common for the existing test method to go substantially beyond 5,000 hours.

Based on the comparisons done to date, UL considers the Fixed Time Frame Method to be a viable alternative to the present UL 746C test format for the evaluation of many plastic materials; however, the FTFM method may not be appropriate for all materials - such as when the degradation of properties does not occur in a straight line manner or when degradation only occurs within a relatively narrow temperature band width. It is therefore anticipated that the new sampling method would be used only with materials that, from experience, are known to degrade in a predictable manner and does not warrant special consideration - such as with polypropylenes, nylons, and acrylics.

UL intends to hand-out a tentative proposal for UL 746B revisions at the meeting which will indicate how the alternate test method will be incorporated into the standard.

6. INTERNATIONAL DRAFT OF UL 746C

DISCUSSION

UL has been doing preliminary work to develop a standard that would be roughly equivalent to UL 746C but intended for use in a global marketplace. To maximize this harmonization effort, UL studied other harmonized documents that cover end-products (that would be used in similar environments as UL 746C products) such as IEC 60335-1 (Safety of Household and Similar Electrical Appliances, Part 1, General Requirements) and IEC-60950 (Safety of Information Technology Equipment, Including Electrical Business Equipment, Part I, General Requirements). UL anticipates having a working draft available for discussions at the upcoming meeting.

UL plans to use the feedback from the industry representatives in generating a complete draft that will be circulated for industry review within the next year.

7. REVISION OF TABLE 8.1 – UL 746A

DISCUSSION

UL is developing revised requirements for UL 746A to address the situation where a variation of an existing Recognized material is investigated. Such revisions were previously implemented in Table 19.1 in UL 746B (regarding Long Term Heat Aging evaluations). The Ad Hoc Committee that previously developed the UL 746B proposal is now working to create a similar proposal for Table 8.1 in UL 746A. To date, three teleconferences have been held to work out the specific details. Due to the complexity of the characteristics covered by the table, it has proven more difficult to develop the table than initially planned and the Ad Hoc anticipates that a formal proposal should be ready by the year's end.

8. PROTOCOL FOR CONSIDERATION OF INCREASED RTI FOR PPHOX – UL 746B/746C

DISCUSSION

UL has established a research project to develop guidelines for assigning new or upgraded (higher temperature generic RTIs) for plastics. Tentative guidelines have been developed where the generic RTI could be set at three standard deviations below the mean of normally distributed RTIs determined from full conventional aging programs. UL has received requests to raise the generic thermal index for PPHOX (polyphenylene oxide), and has attempted to utilize the tentative guidelines to determine a suitable generic RTI for PPHOX materials. In this effort, several concerns were identified regarding the minimum size of the data sampling and a suitable measure of the normalcy of the distribution. The existing data base for RTIs was unsuitable for the required analysis and further work was deferred pending completion of a state-of-the-art data base and search engine which is in the final stages of implementation. A status report will be presented.

9. TESTING OF ANNEALED SAMPLES – UL 746B

DISCUSSION

At last year's meeting, several manufacturers volunteered to provide UL with comparative study data that could be used to evaluate whether it is appropriate to anneal samples prior to conducting LTHA test programs. Not enough data was received for UL to reach any definitive conclusion. As this issue is often raised by industry, and since there is both strong support and opposition to annealing samples (to minimize the effects of short-term property changes at the start of aging programs), UL is going to propose to the Plastics Steering Committee that a research project be established to conduct a formal study. The status of that proposal will be discussed at the meeting.

10. METALLIZED PARTS AD HOC COMMITTEE

DISCUSSION

At the last meeting, UL identified several suggestions for improving the requirements for metallized parts that have resulted from the activity of the Ad Hoc Committee since it was created in 1996. UL has now developed the proposal shown below. As there are further revisions to UL 746C that could be made to standardize and clarify various test methods, UL intends to present an update on the activities of the Ad-Hoc Committee and discuss other potential changes.

RATIONALE

UL has become aware of the need to clarify various test methods and procedures which are used to evaluate metallized parts – for example, the evaluation of coating cohesion strength. In addition, editorial changes are needed to promote consistency in the evaluation of these products.

IMPACT

As these revisions clarify present testing practices, a file review is not anticipated.

PROPOSAL

See Appendix D for the proposal for UL 746C.

11. ADDING PTI (PROOF TRACKING INDEX) TEST TO UL 746C

DISCUSSION

At the last meeting, UL announced that it would add the Proof Tracking Index Test to UL 746C to enable evaluation of enclosure tracking resistance where the material used has not already been rated for CTI on a pre-selection basis. The Proof Tracking Test in IEC 112 is already in widespread use by multi-national end-product manufacturers and enclosure/part molders. UL is now proposing the specific wording of the revision of UL 746C.

RATIONALE

The addition of the Proof Tracking Index Test would provide more flexibility for evaluations under UL 746C. The PTI test would be run at the temperature specified in the end-product standard to demonstrate compliance with the end-product requirements.

IMPACT

The addition of this test would not require a review or retesting of current products. This test would only be appropriate when the enclosure materials have not been evaluated for tracking resistance by the CTI test in UL 746A; therefore, UL does not anticipate that it will have a significant effect upon manufacturers.

PROPOSAL

11.4 As indicated in Table 8.1, an insulating material that is in contact with or close proximity to less than 0.8 mm (1/32 inch) uninsulated live parts or such parts and dead metal parts that may be grounded in service or any surface exposed to contact, shall have a maximum CTI PLC of 4 for indoor equipment in a relatively clean environment; a maximum CTI PLC of 3 is required for most outdoor and indoor equipment that may be exposed to moderate contaminate environments; a maximum CTI PLC of 2 is required for equipment that is likely to be subjected to severe contaminate environments.

Exception: In lieu of demonstrating compliance through the use of pre-selection test, The Proof Tracking Test, described in IEC 112, can be conducted on a portion of the product enclosure to determine compliance with the specified Proof Tracking Index (PTI) specified in the end-product standard

11.4 revised Date of Publication

12. DOWNRATING GUIDELINES – UL 94/746A/746B

DISCUSSION

UL has set an objective of formulating guidelines to cover those rare situations where plastics manufacturers may downrate an existing material. Under nearly all circumstances, it is not possible to downrate a material and the manufacturer would have to assign a new or modified material designation to the material in question. This is done to protect end-product manufacturers from using materials with lower performance levels without their knowledge. But there are some very limited instances where downrating may be possible due to factors such as: the original ratings were not yet published in the Recognized Component Directory, none of the material was shipped from the plastic manufacturer's facilities, or the material has a very limited, and easily identifiable, list of customers that can be contacted.

UL will discuss the status of formalizing the guidelines and explain why it is not generally acceptable to downgrade plastic materials once they are available in the marketplace and can be used by an indeterminate number of end-product manufacturers.

13. INCLUSION OF ISO/UL COMPARABLE DATA BASE (MECHANICAL AND ELECTRICAL)

DISCUSSION

As part of the complete Recognition test program, UL conducts a number of mechanical and electrical pre-selection tests on plastics. These tests may include: tensile strength and impact, Izod impact, flexural strength, dielectric strength, volume resistivity and heat deflection. The main use of this data is for comparison purposes in the event of material substitution.

Although the tests are conducted in accordance within ASTM/UL guidelines, concerns have been raised about the comparability of this test data. For example: ASTM D 638 tests for Tensile Strength allow for five different sample configurations. Each configuration could yield slightly different results. While UL recommended the use of Type I samples, they were not always available for testing. Other issues such as: molding conditions, specimen thickness, allowable variations in test methods, and sample conditioning can also affect test results.

UL is considering a proposal for the inclusion of ISO comparable test data. This testing better controls the variables mentioned above, and will result in improved comparability between material properties. A presentation will be made at the meeting.

14. STANDARDIZED WALL-THICKNESS REPRESENTATION FOR GLOW-WIRE TEST

DISCUSSION

UL is considering a standardized wall thickness for the Glow-Wire Testing (GWT). The IEC data for Glow Wire Tests are represented in 1 and 2 mm thicknesses. New indices for this data could be established for this data and noted as GW1 or GW2. This data could be useful for end-product evaluations to determine pre-selection of materials. UL would like to discuss the relevance of this data on the Recognition (yellow) cards. UL uses a different thickness for index testing (i.e., 0.75, 1.5, and 3.0 mm). UL would like to discuss with industry the thicknesses at which the materials should be tested and the manner in which the data should be reported.

15. DEVELOPMENT OF GENERIC BALL-PRESSURE TEMPERATURE INDICES

DISCUSSION

UL has received a request from industry to have standardized Ball-Pressure indices. This data could be useful for end-product testing for the pre-selection of materials. Having standardized data could eliminate the need to conduct this test for each product submittal as the pre-selection data could be used as a basis for waiving the test. UL would like to discuss the concept with industry to consider developing guidelines to implement the use of this pre-selection data.

16. HARMONIZATION OF LONG TERM HEAT AGING TESTS WITH ISO METHODS

DISCUSSION

A new protocol for UL 746B testing has been suggested by a manufacturer and will be presented for consideration at the meeting. The new method includes: (1) using standardized smaller-sized diagnostic property test specimens, (2) using yield energy during tensile tests to replace conventional impact tests, (3) using the Fixed Time Frame Method (FTFM) mentioned in Item 5 of this bulletin, and (4) the elimination of testing a "control" reference material.

17. GAS-ASSISTED INJECTION MOLDING

DISCUSSION

UL would like to discuss whether additional requirements are necessary to address a molding process called Gas-Assisted Injection Molding. This process uses low pressure, conventional molding methods to force a short shot of material into the mold cavity. Then, by using pressurized nitrogen gas, some of the material is displaced in pre-determined thick areas, forming hollow sections of the part.

It appears that this process is becoming more prevalent for molders. The suspected problem is that the hollow areas of parts that are molded using the gas assisted process may reduce the parts integrity, and the wall thickness may be reduced. One concern is the ability of the part to withstand the end-product impact test or dielectric strength test. The thinner wall sections could also affect the flammability rating of parts.

We are looking for input from the IAG on this process and the impact it has on molded parts. UL would like to establish further guidelines and requirements with respect to this process.

18. NEW PRODUCT CATEGORY "CONCENTRATES"

DISCUSSION

UL has been approached to consider allowing the combination of a Recognized base resin with its corresponding additives at the molders location.

The "concentrate" is made by taking the various additives of the formulation and letting them down into a specified generic carrier. These pellets are to be packaged in containers marked with all of the pertinent information for use (i.e., let-down ratio, percentage of glass fiber, percentage of talc). This packaged product will then be dry blended in the proper ratio with the appropriate generic Recognized base resin at a Recognized molders facility. Dry blending by a Recognized molder is necessary to maintain traceability records. The dry blended mixture can then be used by that Recognized molder.

This particular arrangement does not appear to fit any existing Recognized component plastic category. If adopted, UL would establish the new category "Component-Concentrates".

19. EDITORIAL REVISION TO TABLE 10.1 OF UL 746B

DISCUSSION

It has come to our attention that Table 10.1 in UL 746B needs to be revised to improve consistency. As presently written, note b does not include mention of the Flexural Strength test. Also, UL wants to clarify note b to state that, for the Charpy Impact test which uses 4.0 mm samples, note b would allow for a rating at 1.6 mm (and not 2.0 mm as some people would assume).

RATIONALE

These clarifications are necessary to avoid misinterpretation of the standard.

IMPACT

The proposed editorial revision will not result in a review or retesting of existing products; therefore, it will not have an appreciable affect on manufacturers.

PROPOSAL

Table 10.1
List of properties and test methods

Table 10.1 revised (date of publication)

Property [a]	Test Method
Mechanical Properties	
Maximum Tensile Stress, and/or Flexural Strength[b]	UL 746A
Tensile[b], Izod[b], or Charpy Impact[b]	UL 746A
Electrical Properties	
Dielectric Strength	UL 746A
Flammability Properties	
Vertical Burning	UL 94

[a] The list of properties given in this table is not complete. Other properties that are critical in a particular end-use application are to be included in the program.

[b] ~~Tests conducted on the 3.2 mm thick specimens for Tensile and Izod impact and 4.0 mm for Charpy impact are considered representative of other thicknesses, down to 1.6 mm.~~ For Flexural-Strength and Tensile-, Izod-, and Charpy-Impact tests, tests conducted on the 3.2 or 4.0 mm samples would be considered representative of other thicknesses down to 1.6 mm.

20. RE-EVALUATION OF FOLLOW-UP SERVICE TESTING PROGRAM

DISCUSSION

A number of plastic manufacturers have expressed difficulty in supplying UL inspectors with the molded flame bars needed to send to the local UL offices for flammability tests. Manufacturers who don't have on-site molding capabilities must send tagged samples (pellets, granules, etc.) to either another "in-house" location or contract with an outside molder to do the work. This greatly increases the time necessary for the UL tests and introduces the possibility of lost samples. It was suggested that UL look into whether Follow-Up Service tests could be established that would utilize the plastic material in the "as-shipped" form rather than traditional molded flame bars.

UL has decided to form an Ad Hoc Committee to look into the feasibility of such a program. UL is asking for volunteers to serve on that Ad Hoc who may, through their industrial experience, be able to provide suggestions for evaluation and implementation.

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APPENDIX B

IAG OF UL FOR PLASTIC MATERIALS

ITEM 4. FLAMMABILITY AD HOC COMMITTEE REPORT; COPY OF MEETING REPORT

UNDERWRITERS LABORATORIES INC.

September 3, 1998
SU 2181

MINUTES
UL Plastics Flammability Ad Hoc Meeting
June 16, 1998

A meeting of the UL Plastics Flammability Ad Hoc was held on June 16, 1998 at the U.S. Consumer Product Safety Commission in Bethesda, Maryland. A list of meeting attendees is provided in Attachment A. The following is a report of the salient items of the discussions.

1. **Opening and Review of the Agenda:**

George Fechtmann welcomed the participants, both Ad Hoc members and observers, and opened the meeting with self introductions. George provided a brief background, indicating the Ad Hoc had been assembled to review the existing UL746C construction and performance requirements with respect to concerns regarding the potential fire hazard of plastics used in electrical products. This was the fifth meeting of the Ad Hoc group.

William King also welcomed the participants on behalf of the CPSC.

The agenda distributed with the memo dated April 27, 1998 was accepted.

2. **CPSC Test Program:**

William King provided background information on the CPSC proposal with regard to the enclosure flammability requirements of UL746C. The CPSC proposal has evolved into the following three objectives: 1) better definition of "attended" vs. "unattended" portable appliances, 2) clearly defined locations for application of the test flame during end-product tests, and 3) elimination of the exception for insulated component parts.

Hammad Malik provided an overview of the CPSC project on "Assessment of Thermoplastic Enclosure Flammability." Electrical products were selected based on incident reports that included plastic parts that may have ignited. These products were purchased, specimens cut from the molded finished plastic parts and small-scale flammability tests conducted. Hammad indicated that in many cases the test results were not as anticipated. Completion of the CPSC in-house review of the report is anticipated within the next few weeks. The CPSC intends to send the report to all Ad Hoc members.

One of the Ad-Hoc members requested clarification on whether the CPSC had issue with the potential ignition of plastic parts of electrical products from an external fire source. The CPSC confirmed that their concern is regarding the potential fire hazard relating to the likelihood of ignition of the product's plastic parts and propagation of fire from inside the product to its environment (inside to outside).

One of the Ad-Hoc members asked if the CPSC had a threshold incident rate to determine the critical level at which they would take action. The CPSC indicated there has been a decline in household fires in general; however, fires related to wiring and appliances have not declined. It was reported the CPSC has a goal to reduce the rate of fires in these areas and that it is addressing the use of polymeric materials in electrical appliances, the construction of countertop cooking

appliances, and appliance design improvements. It was indicated that statistically these fire incidents are rare events, but collectively represent an important issue.

It was noted that an across-the-board increase in flammability requirements may subsequently require the use of flame retardants that, for some polymers, may contain halogens or bromine. It was reported that some groups are opposed to the use of these flame retardants due to environmental concerns. The CPSC indicated their primary responsibility is to consumers in this country and preventing fires in electrical products and that this outweighs environmental concerns with the use of flame retardants.

It was also noted that efforts are underway to harmonize U.S. and International standards. UL indicated that it intends to promote requirements that are technically appropriate for the specific application.

3. **Review of Recommendations for Revision of UL746C:**

The Chairman reviewed the actions recently taken by UL involving UL746 revisions covering polymeric parts. Requirements for creep have been moved from UL746A to UL746C. UL has issued a proposed first edition of UL 60335-1 for Household Appliances, based primarily on IEC 335-1, with minor national deviations.

In addition, work was started on an international guidance document based on UL746C. It has been planned to 1) more clearly define the end-product flame tests, including examples and reference to connections for application of the test flame; 2) better define "attended" vs. "unattended," wherein the definition of "attended" would only apply to products where there is a high level of confidence that an operator would be present, such as when the equipment is provided with a momentary contact switch; and 3) add requirements for electrical connections within products, wherein a polymeric part spaced 3 mm or less from connections may be subject to Glow Wire and Ball Pressure tests. The requirements in Tables 5.1 and 6.1 would be combined into one table describing specific end product tests and Table 8.1 will be revised to specify preselection tests and requirements for polymeric materials located near electrical connections.

Background information on "UL 60335-1 Resistance to Heat and Fire Concepts" and a draft of the proposed revisions to UL 746C were distributed, see Attachments B and C respectively. UL indicated that a formal proposal for revision of UL746C would be distributed in preparation for the 746 IAG meeting scheduled for October 14, 1998. The CPSC suggested the proposal also be distributed to the connector industry.

It was noted that it would be useful to compare (1) Glow Wire Ignition vs. Hot Wire Ignition test data and (2) Needle Flame vs. V-0, V-1, V-2 test results. UL indicated that a research project will be developed to cover this comparison work.

The CPSC applauded the initiative, especially with regard to electrical connections, and indicated they intend to further review the Glow Wire and Ball Pressure tests.

4. **Fault Model Development and Plastics Data - Ignition Related Characteristics:**

Bob Davidson presented a Generic Enclosure Fire Fault Tree, see Attachment D. This fault tree addresses Scenario 6, presented at the February 11, 1998 Ad Hoc meeting, where a flaming enclosure part propagates fire to the surrounding environment. The arrows on the figure suggest methods to prevent such an occurrence. For example, the top right two boxes represent areas where operator intervention could prevent propagation of fire and could be applied to operator attended products. The letters in triangles are loop markers. For example, the bottom left section of

the fault tree either loops back to the "Internal Flame Heat Source (B)" or the "Internal Electrical Heat Source (A)." Working through the fault tree, the

ultimate root cause of fire would be an internal electrical heat source. It was noted that the fault tree would not be developed into a standard, but could be used as a tool to develop a new standard or evaluate an existing standard or to better understand underlying principles. It was agreed to continue development of the fault tree, with Bob Davidson and Rich Nute to develop the bottom half of the figure on electrical energy sources.

It was reported that plastics data on ignition related characteristics is indicating a temperature of at least 300°C is needed for ignition of plastics. Additional information is also needed to address the minimum energy level that constitutes a risk of fire. It was proposed this be handled under a Plastics Research Project.

5. **Computer Model to Study Energy Transfer:**

It was agreed that further work on a computer model for electrotechnical products would not be pursued at this time.

6. **Action Items:**

Move forward with proposals for UL746C.

Follow-up on status of proposal for courses to be developed on Hazard-Based Safety Engineering (HBSE).

Develop Plastics Research Project Proposals for the following:

1) Develop data for correlation of Glow Wire Ignition vs. Hot Wire Ignition and Needle Flame vs. V-0, V-1, V-2 - Richard Ross (UL)

2) Complete development of the Fault Model and prepare a guidance document - Bob Davidson (UL) and Richard Nute (Hewlett-Packard)

3) Develop test data needed to define the minimum energy level that constitutes a risk of fire - Bob Davidson (UL) and Richard Nute (Hewlett-Packard)

The next meeting was scheduled for October 15, 1998 at 8:30 a.m. at UL's Melville office.

Minutes recorded by: REVIEWED BY:

DEBBIE OATES
Associate Managing Engineer
Engineering Services
NORTHBROOK OFFICE
Tel: (847) 272-8800 Ext. 42643
Fax: (847) 509-6306
e-mail: *oatesd@ul.com*

GEORGE FECHTMANN
Managing Engineer
Engineering Services
MELVILLE OFFICE
Tel: (516) 271-6200 Ext. 22858
Fax: (516) 439-6048
e-mail: *fechtmanng@ul.com*

cc:

Ad Hoc Members

A. Brazauski (UL)
P. Brown (GE Plastics)
L. Bruno (UL)
R. Davidson (UL)
G. Fechtmann (UL) - Chairman
T. Kettering (GEON)
W. King (CPSC)
L. Mecseri (EIA/Sony)
W. Morris (AHAM)
R. Nute (Hewlett-Packard)
D. Oates (UL)
D. Talka (UL)
P. Toner (SPI)
I. Wadehra (IBM)
D. Wetzig (GEON)

UL Staff

C. Barale
R. Bernd
J. Beyreis
A. Cotrone
L. Dosedlo
P. Gandhi
S. Giannoni
G. Gillerman
K. Haas
W. O'Grady
J. Ritchie
R. Williams

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APPENDIX C

MEETING OF THE IAG FOR PLASTIC MATERIALS

ITEM 4. FLAMMABILITY AD HOC COMMITTEE REPORT; PROPOSED REVISIONS FOR UL 746C

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~~.

PROPOSED EFFECTIVE DATE

All of the changes shown in this Appendix are proposed to become effective 5 years from the date revised pages of the standard are issued.

3 Glossary

3.3.1 (NEW) ATTENDED EQUIPMENT – Equipment intended for use where operator presence is required or where operator presence is essential for equipment function but not required for the equipment to operate. This equipment could possibly be left running, but the time of such unattended operation is effectively limited to a short duration due to one or more characteristics of the equipment, such as production of excessive noise or vibrations. Examples include hand-held drills, electric knives, hand-held hair dryers, blenders, and vacuum cleaners

3.6.1 (NEW) CONNECTION – The attachment of two or more component parts so that electrical conduction can take place between them. Examples of the manner in which connections are made are by solder, crimp, quick-connect terminal, screw, wire nut, and the like. For the purpose of applying this definition, metallurgical joints (welds) are not considered as connections.

3.13.1 (NEW) GLOW WIRE END-PRODUCT TEST (GWEPT) – A test performed by applying an electrically heated wire, at a predetermined temperature, to a part under investigation. This test is described in Section 73.

~~3.14 GLOW WIRE IGNITION TEST ON END PRODUCT (GWIT) — Glow wire resistance to ignition performance is expressed as the number of seconds required to ignite a specimen by an electrically heated bar operating at a specified temperature. This test is described in the Standard for Polymeric Materials – Short Term Property Evaluations, UL 746A.~~

3.14 GLOW WIRE IGNITABILITY TEMPERATURE (GWIT) – The glow wire ignitability temperature is expressed as 25°C below the temperature of an electrically heated wire that causes ignition of standardized test specimens. This test is described in the Standard for Polymeric Materials - Short Term Property Evaluations, UL 746A.

3.21.1 (NEW) INTERMITTENT OPERATION EQUIPMENT – Operation in a series of specified cycles each composed of a period of operation under NORMAL LOAD, followed by a rest period with the equipment switched off or running idle.

3.34.1 (NEW) UNATTENDED EQUIPMENT – Equipment intended for use where operator presence is not required or essential for the equipment to function. Operator absence is likely while this equipment is functioning. Examples include, flatirons, toasters, electric fry pans, and coffee makers.

4 General

~~4.1 The requirements for polymeric enclosures, or parts of enclosures of appliances and equipment are contained in Sections 5 – 7.~~

4.1 Equipment having an enclosure, or parts of the enclosure, comprised of polymeric material shall comply with the applicable requirements in Table 4.1.

4.2 (NEW) The requirements in this Section, do not cover the additional considerations that must be given to enclosure materials exposed to oils, acids, solvents, cleaning agents, and the like in use. The performance of the material shall not be adversely affected by such environments (if encountered in the end-use application) as determined by applicable tests as detailed in the Standard for Polymeric Materials – Short Term Property Evaluation, UL 746A.

4.3 (NEW) Polymeric material used to enclose a metal housing that encloses insulated or uninsulated live parts or as a decorative part, shall be classed either 5VA, 5VB, V-0, V-1, V-2, or HB by the burning tests described in the requirements for tests for flammability of plastic materials, UL 94, and comply with the Flame Spread requirements in Section 21 for large mass applications.

Exception No. 1: Decorative parts are not required to be made of a material classed 5VA, 5VB, V-0, V-1, V-2, or HB, providing the part: does not occupy a volume greater than 2 cubic centimeters (0.122 cubic inch), does not have any dimension greater than 3 cm (1.18 inch), and is located so it cannot propagate flame from one area to another or bridge between a possible source of ignition and other ignitable parts.

Exception No. 2: A material is to be considered equivalent if it complies with the requirements in 17.1, 51.1 – 51.5, 19.1, 53.1 – 53.5, when flame tested as used in the equipment. The use of a flame-retardant coating applied to the inside of a polymeric enclosure is not acceptable unless the coating/material interface is found to be acceptable by separate investigation (see Flame-Retardant Coatings, Section 22).

Table 4.1 (NEW)

Table 4.1
Enclosure Requirements

Type of Equipment	Portable	Portable	Stationary And Fixed
Type of Use	Attended	Unattended	
Applicable requirements shown below			
Minimum Flammability Rating	HB[a,d]	V[b,d]	5VA[c,d]
Material Properties per Table 8.1	Yes	Yes	Yes
Impact Test per Section 24	Yes	Yes	Yes
Crush Resistance per 23.1	No	No	Yes
Abnormal Operations Test per 28.1	Yes	Yes	Yes
Severe Conditions Test per 29.1	Yes[e]	No[e]	Yes
Mold-Stress Relief Distortion per Section 30.1	Yes[f]	Yes[f]	Yes[f]
Input after Mold-Stress Relief per 31.1	Yes[e]	No[e]	Yes
Strain Relief Test per 32.1	Yes[g]	Yes[g]	Yes[g]
UV Resistance per 26.1	Yes[h]	Yes[h]	Yes[h]
Water Exposure and Immersion per Sec. 27	Yes[i]	Yes[i]	Yes[i]
Dimensional Stability per 27.2	Yes	Yes	Yes
Conduit Connections	No	No	Yes[j]

[a] HB or the enclosure complies with the 12 mm or 20 mm end-product flame tests as described in section 17 and 18 respectively.

[b] V=V-0, V-1 or V-2 classed materials, or the enclosure complies with the 12 mm or 20 mm end-product flame tests as described in section 17 and 18 respectively. Exception: an HB enclosure material is acceptable if all internal polymeric materials comply with the requirements of Table 8.1.

[c] 5VA or the enclosure complies with the 127 mm end-product flame tests as described in section 19.

[d] May require flame spread per section 21.

[e] This test is only required for materials that are rated HB or did not comply with the 12mm or 20mm end-product flame tests per note b above.

[f] Mold-Stress Relief for HB enclosures use section 62.2. For V or 5VA enclosures use section 62.1.

[g] This test is only required if the means of strain relief is secured to the enclosure or is an integral part of the polymeric enclosure.

[h] This test is only required if the equipment is constructed such that exposure to outdoor weather conditions or UV radiation could increase the risk of fire, electric shock or injury to persons.

[i] This test is only required if the equipment is constructed such that exposure to water could increase the risk of fire, electric shock, or injury to persons.

[j] This test is only required if the equipment is permanently connected electrically in the wiring system. The continuity to the conduit system shall be a metal-to-metal contact. If the integrity of the polymeric enclosure is relied upon to provide for bonding between the parts of the conduit system at any location where conduit may be connected, the bonding shall be evaluated by the requirements contained in the Standard for Enclosures for Electrical Equipment, UL 50. If the polymeric enclosure is intended for connection to a rigid conduit system, it shall acceptably perform when tested using the pullout, torque and bending tests as described in the Standard for Industrial Control Equipment, UL 508.

5 Portable Appliances – Section Deleted (applicable requirements for Portable Appliances moved to Section 4)

~~5.1 Portable appliances having an enclosure of polymeric material shall comply with the applicable requirements in Figure 5.1. The use of Figure 5.1 is explained in 5.7 – 5.11.~~

~~5.2 The requirements in Portable Appliances, Section 5, do not cover the additional considerations that must be given to enclosures employing large masses of polymeric materials. Whether or not such enclosures reduce the risk of electric shock or fire, or both, consideration should be given to the probability of ignition of the material by sources within the equipment or by external sources.~~

~~5.3 A polymeric material which can contact electrically live parts, or is within 0.79 mm (1/32 inch) of uninsulated live parts, shall comply with the requirements indicated in Table 8.1.~~

~~5.4 The requirements in Portable Appliances, Section 5, do not cover the additional considerations that must be given to enclosure materials exposed to oils, acids, solvents, cleaning agents, and the like in use. The performance of the material shall not be adversely affected by such environments (if encountered in the end-use application) as determined by applicable tests as detailed in the Standard for Polymeric Materials – Short Term Property Evaluation, UL 746A.~~

~~5.5 The thermal endurance of a polymeric material shall be considered with respect to the requirements in Sections 33 – 38.~~

~~5.6 Polymeric material used to enclose a metal housing that encloses insulated or uninsulated live parts or as a decorative part, shall be classed either 5VA, 5VB, V-0, V-1, V-2, or HB by the burning tests described in the requirements for tests for flammability of plastic materials, UL 94.~~

~~*Exception No. 1: Decorative parts are not required to be made of a material classed 5VA, 5VB, V-0, V-1, V-2, or HB, providing the part: does not occupy a volume greater than 2 cubic centimeters (0.122 cubic inch), does not have any dimension greater than 3 cm (1.18 inch), and is located so it cannot propagate flame from one area to another or bridge between a possible source of ignition and other ignitable parts.*~~

~~*Exception No. 2: A material is to be considered equivalent if it complies with the requirements in 17.1, 51.1 – 51.5, 19.1, 53.1 – 53.5, when flame tested as used in the equipment. The use of a flame retardant coating applied to the inside of a polymeric enclosure is not acceptable unless the coating/material interface is found to be acceptable by separate investigation (see Flame Retardant Coatings, Section 22).*~~

Figure 5.1 – Deleted
Enclosure requirements for portable appliances

~~5.7 The path shown on Part 1 of Figure 5.1 that matches the conditions of use for the polymeric material under consideration determines the requirements to be met.~~

~~5.8 Following the path in Part 1 of Figure 5.1 (selected using 5.7) leads to Part 2 and the applicable material requirements. It may be necessary to determine whether the equipment is of an attended, intermittent duty, household use type before the applicable material requirements can be selected.~~

~~5.9 Part 2 of Figure 5.1 indicates the required tests (marked with a "yes" and with a footnote reference if necessary) under the applicable path determined in Part 1 of Figure 5.1.~~

~~5.10 For example, a polymeric material used to enclose uninsulated live parts, such as a heating element, of an unattended household-use electric toaster, shall only be made from a V-rated material (second path from the left of Figure 5.1), specifically either V-0, V-1, V-2 or a material that complies with the requirements in 17.1, and 51.1 – 51.5.~~

~~5.11 Using this example, the material shall comply with the applicable requirements for:~~

~~a) Hot-wire ignition per Section 14,~~

~~b) Resistance to impact per 24.1 and 57.3,~~

~~c) Mold stress-relief distortion per 62.1,~~

~~d) Creep per Section 24A,~~

~~e) Strain relief per 32.1,~~

~~f) Abnormal operation per 28.1,~~

~~g) Enclosure flammability per Section 17 or 18.~~

~~h) Mechanical/electrical properties per Table 8.1, and~~

~~i) Thermal endurance per Sections 33 – 39.~~

6 Fixed or Stationary Equipment – Section Deleted (applicable requirements for Fixed or Stationary Equipment moved to Section 4)

~~6.1 Electrical equipment that is fixed or stationary and not easily carried or conveyed by hand and that has an enclosure of polymeric material shall comply with the applicable requirements in Table 8.1 and Figure 6.1. The use of Figure 6.1 is explained in 6.7 – 6.11.~~

~~6.2 The requirements in Fixed or Stationary Equipment, Section 6, do not cover the additional considerations that must be given to enclosures employing large masses of polymeric materials. Whether or not such enclosures protect against electric shock and/or the likelihood of fire, consideration should be given to the probability of ignition of the material by sources within the equipment or by external sources. See 21.1 for large mass flammability considerations.~~

~~6.3 A polymeric material used for the support of electrically live parts, shall comply with the requirements indicated in Table 8.1.~~

~~6.4 The requirements in Fixed or Stationary Equipment, Section 6, do not cover the additional considerations that must be given to enclosure materials exposed to oils, acids, solvents, cleaning agents, and the like in production equipment. The performance of the material shall not be adversely affected by such environments (if encountered in the end-use application) as determined by applicable tests as detailed in the Standard for Polymeric Materials – Short Term Property Evaluation, UL 746A.~~

~~6.5 See Sections 33 – 39 for considerations of thermal endurance and Mechanical/Electrical Property Considerations, Section 8, for additional considerations of the mechanical/electrical properties of enclosure materials.~~

~~6.6 Polymeric material used to enclose a metal housing that encloses insulated or uninsulated live parts or as a decorative part, shall be classed either 5VA, 5VB, V-0, V-1, V-2, or HB by the burning tests described in the requirements for tests for flammability of plastic materials, UL 94.~~

~~*Exception No. 1: Decorative parts are not required to be made of a material classed 5VA, 5VB, V-0, V-1, V-2, or HB, providing the part: does not occupy a volume greater than 4000 cubic millimeters (0.24 cubic inch), does not have any dimension greater than 60 mm (2.4 inch) and is located so it cannot propagate flame from one area to another or bridge between a possible source of ignition and other ignitable parts.*~~

~~*Exception No. 2: A material is to be considered equivalent if it complies with the requirements in 17.1, 51.1 – 51.6 or 19.1, 53.1 – 53.5, when flame tested as used in the equipment. The use of a flame retardant coating applied to the inside of a polymeric enclosure is not acceptable unless the coating/material interface is found to be acceptable by separate investigation (see Flame-Retardant Coatings, Section 22).*~~

~~6.7 The path shown on Part 1 of Figure 6.1 that matches the conditions of use for the polymeric material under consideration determines the requirements to be met.~~

~~6.8 Following the path in Part 1 of Figure 6.1 (selected using 6.7) leads to the applicable requirements and the test considerations to be considered in Part 2 of Figure 6.1.~~

~~6.9 Part 2 of Figure 6.1 indicates the required tests (marked with a "yes" and with a footnote reference if necessary) under the applicable path determined in Part 1 of Figure 6.1.~~

Figure 6.1 – Deleted
Enclosure requirements for fixed or stationary equipment

~~6.10 For example, a polymeric material used to enclose uninsulated live parts (such as the motor windings) of a permanently wired, indoor use ceiling fan shall be made from a 5VA classed material or a material that complies with the requirements in 19.1, 53.1 – 53.5.~~

~~6.11 Using the above example, the material shall also comply with the applicable requirements for:~~

~~a) Electrical/mechanical properties per Table 8.1,~~

~~b) Dielectric strength per 12.1,~~

~~c) Flammability testing per Flammability – 127 mm (5 inch) Flame, Section 19 and Enclosure Flammability – Large Mass Considerations, Section 21,~~

~~d) Crushing resistance per 23.1,~~

~~e) Resistance to impact per 24.1 and 24.3,~~

~~f) Dimensional change per 27.3,~~

~~g) Abnormal operation per 28.1,~~

~~h) Severe conditions per 29.1,~~

~~i) Mold stress-relief distortion per 62.1,~~

~~j) Input after mold stress-relief distortion per 31.1,~~

~~k) Creep per Section 24A.~~

~~l) Conduit connections per footnote h of Figure 6.1, and~~

~~m) Thermal endurance per Sections 33 – 39.~~

7 Alternate Enclosure Material Considerations – Section Deleted (applicable requirements moved to Appendix A)

~~7.1 From time to time, it may be necessary to select alternative or substitute materials for use as an enclosure. These considerations apply only to alternate materials for a given part. Changes in part dimensions and, in particular, reductions in material thickness, generally require an evaluation using all the end-product tests.~~

~~7.2 It may not be necessary that a complete series of end-product tests be required, provided that equivalent or better material properties can be demonstrated by standardized small-scale tests on the candidate material when compared to the properties of a material having acceptable application performance.~~

~~*Exception: A candidate material that does not provide equivalent material properties to the properties of a material having acceptable application performance, may be acceptable providing that the candidate material possesses the minimum performance level required in Figure 5.1 or 6.1 for the application.*~~