

USA 6 (E) cleared
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Mrs. Prvil. Birs. Dr.

**LOG OF MEETING
DIRECTORATE FOR ENGINEERING SCIENCES**

SUBJECT: Thermoplastics and Push-In Terminations

DATE OF MEETING: April 19, 1995

PLACE OF MEETING: CPSC, Bethesda, MD

LOG ENTRY SOURCE: Erlinda M. Edwards, ESEE *EH*

COMMISSION ATTENDEES:

Andy Stadnik, ES
Bill King, ESEE
Ed Krawiec, ESEE
Aaron Banerjee, ESEE
Linda Edwards, ESEE

NON-COMMISSION ATTENDEES:

Dave Dini, Underwriters Laboratories/Northbrook, IL
Bob Davidson, Underwriters Laboratories/Melville, NY
Corriece Perkins, Product Safety Letter
Milton Bush, Inchcape

SUMMARY OF MEETING:

Bill King introduced the subjects to be discussed at the meeting: the applications of thermoplastics, and the use of push-in terminations. Regarding thermoplastics, Mr. King stated that CPSC staff are aware of the extensive program UL has with regard to plastics, and staff regularly review and monitor those standards. However, staff would like to act as a catalyst to look at those areas that may have shortcomings. As a result of discussions, as well as engineering analyses, Mr. King is looking for industry participation in specific product areas, and the plastics industry in general.

Aaron Banerjee discussed an example of a failed slow cooker which exhibited both types of failures under discussion; namely, the poor application of a thermoplastic as an enclosure for a heating appliance, and a switch which had overheated at a push-in termination. The heating element suffered mechanical failure which allowed it to fall onto and melt through the plastic enclosure at the base of the slow cooker.

Ed Krawiec explained that the issue is the use of materials which change dimension under temperatures that are reasonable to expect in the early stages of a failure. There is nothing in current standards which look at dimensional integrity under reasonably foreseeable abnormal conditions.

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Bob Davidson explained that he is involved in a long-range program called Hazard Based Safety Engineering. The program includes hazard analyses and hazard outcomes. Fault tree analyses to address hazards such as fire, thermal burns, and shock do not necessarily consider the effects elevated temperatures may have on likely failure modes; e.g. the consequences of distortion of thermoplastics. To address the issue of misapplication of thermoplastics, likely failure modes which may result in extreme elevated temperatures need to be considered in UL 746C, which is a generic guideline referenced in end-product standards. Currently, problems such as that described by Mr. Banerjee are simply considered as "crock pot failures." If a sufficient number of such failures were to occur, the standard for that category of product only would be revised.

Dave Dini stated that, to be effective (at UL and at other testing laboratories), tests which address the issue of distortion of thermoplastics under elevated temperatures must be definitive and repeatable. Mr. Krawiec stated that such tests could include the examination of a product or component under conditions of heating by an external source that would cause softening of thermoplastic parts.

Mr. King stated that, without any warnings to end-product manufacturers, key design issues which lead to catastrophic failures are missed. He suggested that UL take the lead by addressing this issue in specific product categories such as cooking appliances, temperature regulating thermostats, and switches. As experience is gained in developing test procedures, the wording to be used in the standards could be refined and expanded to other product areas.

Mr. Davidson stated that Task 1, identification of specific product categories, should continue. UL will look at their own files, as well as reports from CPSC. Sanitized PSAs will be forwarded to UL as they become available. In addition to the products mentioned by Mr. King, Mr. Krawiec suggested that the list include recalled products and smoke detectors. He added that UL has data for portable electric air heaters recorded during CPSC testing in 1986-87. Similar data could be obtained for heaters which are currently being tested at UL. Mr. Davidson suggested that UL could also monitor temperatures under abnormal conditions, to be done concurrently with present UL tests.

Mr. Dini offered to prepare a task statement, with input from Mr. Krawiec, for presentation to the steering committee which funds (from a surcharge) plastics research. The task statement would focus on plastics and their applications. An earlier task statement dealing with specific product categories was rejected by the steering committee in mid-April; their next meeting will be in September.

Mr. Davidson stated that there are two ways to approach the problem: as a generic problem affecting a large number of products, or addressing each end-product standard for specific hazards. To influence the largest number of products, the issue might best be handled in UL 746C, which is referenced by a great number of end-product standards.

Regarding push-in terminations, Mr. Dini stated that, based on the Artech report and input from CPSC, UL had made several changes to standard UL 498, which became effective January 1, 1995. Mr. Krawiec asked to see UL's data which showed that the *new* tests included in UL 498 made any positive difference.

Mr. Krawiec explained that the work performed by Artech was limited; Cari Fenstermaker (CPSC) continued some of that work at the CPSC laboratory. It was his conclusion that this connection mechanism should not be used as a means to transfer power. Additional work performed by Dr. Jesse Aronstein over the course of nine years showed that push-in terminations are inferior to wire binding screw terminations.

Mr. Dini stated that, without additional data, it is difficult to support further changes to the standard. As a means to obtain such data, Mr. Dini suggested that the issue could be discussed with attendees at various electrical industry meetings (IAEI Section Meetings, etc.). Mr. Krawiec suggested that, to get a broad base of field experiences, something more formal, such as a survey of electrical contractors and electrical inspectors, would be necessary. That information, in conjunction with field investigations conducted by Epidemiology (CPSC), should provide sufficient information for support of additional changes to UL 498.