LOG OF MEETING
DIRECTORATE FOR ENGINEERING SCIENCES

SUBJECT: Underwriters Laboratories Standards Technical Panel (STP) on Ground-Fault Circuit-Interrupters (GFCIs)

DATE OF MEETING: March 14-15, 2001

PLACE OF MEETING: Underwriters Laboratories (UL), Melville, NY

LOG ENTRY SOURCE: Doug Lee, ESEE DL

DATE OF LOG ENTRY: April 3, 2001

COMMISSION ATTENDEES: Doug Lee, ESEE

NON-COMMISSION ATTENDEES:

Approximately 50% of the STP members
See attached list

SUMMARY OF MEETING:

See attached revised agenda

The meeting started with a review of the STP process by Mr. Snyder of UL. Mr. Dini, from UL's research group, presented the NEMA GFCI Field Test Survey Report and explained the methodologies used in the study. The data was summarized but no recommendations were made. A summary of the surveyed GFCIs is appended to the meeting log. The data indicated non-operational GFCIs with 15% of the circuit breaker GFCIs and 8% of the receptacle GFCIs surveyed. The survey tested 2680 receptacle and only 153 circuit breaker GFCIs. The number of circuit breaker GFCIs was below the original goal for the survey. Mr. Skuggevig from UL then provided information on the background of GFCIs. Mr. Skuggevig emphasized things to consider before deciding to change the GFCI including considering the inconvenience or potential safety problem if a GFCI cannot provide power.

The STP discussed many proposals to improve the surge immunity of the GFCI. Different proposals were made by UL, Leviton, Pass & Seymour, Siemens, Cutler-Hammer, and Square D. One STP member pointed out that the NEMA data in high lightning areas does not correlate with a need to increase surge protection. However, another member indicated that the failure of certain components in the GFCI indicate a need to increase the surge immunity of the GFCI. It was further pointed out that power companies in these areas handle surges better. UL would like to harmonize with some of the IEC requirements if possible. UL would try and find common ground for the surge proposals.

Proposals were made by UL and a manufacturer of GFCIs to address installation of outdoor GFCIs. One proposal was to label GFCIs for indoor installation only and another was to add

conformal coating to all printed circuit boards. One manufacturer did not believe that conformal coating would solve the problem.

Mr. Lee presented the views of the CPSC technical staff relating to the CPSC proposals for different classes of enhanced GFCIs. Data from CPSC In-Depth Investigations (IDIs) was presented which included 3 deaths where GFCIs were involved and seven cases where GFCIs failed but provided power to the receptacle and no shock protection to the user. The data indicated six incidents where a GFCI functioned as designed and probably saved the consumer from a more severe incident. Mr. Lee also stated the CPSC staff supported objectives to improve the level of safety with GFCIs including: add "fail safe" or power lockout, address miswiring, not relying on the consumer for monthly testing, and more tolerance to surges and effects of humidity. Mr. Lee stated that the CPSC staff considers GFCIs failing and not providing any power is a safer condition for the consumer. Mr. Lee summarized the proposals for enhancing the GFCIs and believed that technology was available to provide power lockout if the device cannot pass the supervisory test and provide auto testing with visual and/or audible indicators for the consumer. Mr. Lee further addressed the consumer perception of denying power if the device could not provide shock protection. Mr. Lee stated that the CPSC Human Factors staff believed that this would not affect consumers testing of the GFCI. Furthermore, it was stated that consumers want a GFCI to not provide unprotected power. Mr. Lee also stated that power lockout of a non-functional device was supported by the American Institutes for Research Study, Leviton material, Pass & Seymour material, comments to *NEC* panel 2 proposals on GFCIs from electrical inspectors, the CPSC Engineering staff, and the CPSC Human Factors staff. The CPSC staff viewgraphs are appended to the meeting log.

Mr. Packard explained the Pass & Seymour proposals to increase GFCI robustness. These proposals were based on a study on human behavioral aspects of the GFCI by the American Institutes for Research. One proposal required the GFCI to lockout power in the event of an SCR (Silicon Controlled Rectifier) failure or improper installation. This proposal would not require the consumer to push the test button to lock out the power. Pass & Seymour views the SCR as a common component that fails and accordingly proposed component level tests for the SCR.

Proposals were made by other industry members to provide indicators and to remove the feed through connection for receptacles. It was discussed that indicators could help but would not alert consumers to problems when the receptacle or circuit breaker is not local so that the audible or visual indicator could be seen or heard. The proposal to remove the feed through connection would require that a GFCI receptacle have no load terminals or a GFCI could be used with only a blank faceplate to provide protection to portions of a branch circuit.

Mr. Campolo explained the Leviton proposals and the reset lockout technology. A demonstration of a prototype was also shown. Mr. Campolo stated that his proposals were intertwined and all three had to be done to effectively enhance GFCIs. His first proposal was to improve the surge immunity to reduce the number of inoperable devices. The second proposal was to lockout power if the device could not pass in the test mode. The third proposal would prevent miswiring of receptacles by using the lockout technology. Mr. Campolo stated that there were many ways to address the denying of power of an inoperable device and the miswiring of receptacle GFCIs.

He believed his technology was simple and economical to implement to enhance safety and addressed many of the CPSC staff objectives to enhance the GFCI.

Many discussions were held involving different surge and noise immunity tests. The denial of power of an in-operable device was further discussed. Many STP members including circuit breaker manufacturers believed this would lead consumers to using extension cords and being inconvenienced. Additional discussions were also held on the need to further address improper wiring of the GFCI. The NEMA data was discussed and it was determined that potentially 51 of the 211 receptacle GFCIs that failed could have been mis-wired, although only 13 were confirmed mis-wired.

UL discussed the schedule for the minutes (35 days) and proposals for balloting. The CPSC staff member is a non-voting member of the STP.

943 STP MEETING ATTENDANCE WED 3/15/01

NAME	COMPANY
1) PAUL ORR	UL MEL
2) Bob DeLisi	UL MEL
3) PAUL NOTARIAN	UL MEL
4) George Maguire	UL Mel
5) DAN KISSANE	PASS & SEYMOUR / LEGRAND
6) WALTER SKUGGEVIG	UL – MELVILLE
7) Don Snyder	UL-RTP
8) Artie Mastromarino	UL - MEL 3015L
9) HARVEY GANNON	NEMA
10) DAVE DINI	UL-NBK
11) NELSON BONILLA	HUBBELL
12) CLIVE KIMBLIN	Cutler-Hammer
13) Rich Wagner	UL - MEL
14) JACK WELLS	P&S/L
15) Frank Tse	Leviton MFG
16) AARON CHASE	LEVETON MFG. CO
17) WILL ZIEGLER	LEVITON Manufacturing Co.
18) BILL GRONDE	LEVITON MFG. CO.
19) Randy Dollar	Siemens
20) GEORGE GREGORY	SQUARE D CO.
21) I-LVIS SHATKIN	TOWER MFG CORP
22) VICTOR ARMINI	TOWER MFG. CORP.
23) CHELUR P. RAO	TOWER MFG. CORP.
24) David Nemir	X-L Synergy
25) SAUL ROSENBAUM	SELF (GENERAL INTEREST)
26) JOHN YOUNG	SIEMENS
27) HENRY ZYLSTRA	SQUARE D.

	HOWARD LEOPOLD	COOPER WIRING DEVICES
29)	Jim Beynes	UL
30)	JOHN GOODSELL	HUBBELL
31)	Steve Campolo	LEVITON
32)	Doug Lee	U.S. CPSC
33)	John Dougherty	GE
34)	Jim Jones	UAB/ECE
35)	TOM PACKARD	PTS
36)	Bill Murphy	Cutler-Hammer
37)	John Ronz	UL
38)	Ned Schiff	TRC
39)		
40)		
41)		
42)		
43)		
4)		
45)		

REVISED AGENDA ORDER

Note – The original agenda number is in parenthesis.

1 – (B1) – STP process

2 – (B2) – Summary of Survey by Dave Dini

3 – GFCI background – by Walter Skuggevig

4 – (B4) – Leviton presentation 46

5 – (B3a) – UL surge proposal plus abnormal surge tests

6 – (B5c) – P&S surge proposal

7 – (B6) – Siemens surge proposal

8 – (B7a) – CH surge proposal

9 – (new B10) – Square D surge proposal

10 – Discussion of all surge proposals to formulate unified surge test proposal

11 – (B3b) - UL indoor verses outdoor mounting issue

12 – (B7b) – CH conformal coating proposal

13 – (B9) – CPSC classes for high risk locations

14 – Discussion of GFCIs for indoor and outdoor installation

15 – (B5a, b, d, e) - P&S proposals

16 – (B8) – Hubbell proposals for indicators

17 – (new B11) – Cooper/Eagle – proposals Reset Lockout

18 – Discussion of miswiring solutions 4a, 4c Miswiring

19 – (new B12) – UL Resistance to environmental noise test proposal

Figure 7.2—Main (Totals) Summary

Region (Permutation)	Homes Surveyed	GFCIs Total	Tested Quantity of Type	Inspection Results: Operational Trip/Off/Reset	Non-Operational Trip / On	Non-Operational No Trip	Non-Operational No Reset	GFCIs Recovered
Birmingham, AL (1)	43	107						
Circuit Breakers			23	21	0	2	0	2
Receptacles			84	73	1	8	2	7
Tampa, FL (1)	100	210						
Circuit Breakers			20	17	0	3	0	3
Receptacles			190	171	6	13	0	10
Austin, TX (2)	160	355						
Circuit Breakers			13	10	0	3	0	0
Receptacles			342	313	11	15	3	5
Phoenix, AZ (2)	0	0						
Circuit Breakers			0					
Receptacles			0					
Washington DC (3)	131	286						
Circuit Breakers			30	25	0	5	0	3
Receptacles			256	232	8	14	2	12
Kansas City, KS (4)	136	404						
Circuit Breakers			11	11	0	0	0	0
Receptacles			393	366	5	21	1	16
Los Angeles, CA (6)	183	361						
Circuit Breakers			4	4	0	0	0	0
Receptacles			357	333	5	19	0	10
Portland, ME (7)	9	21						
Circuit Breakers			1	1	0	0	0	0
Receptacles			20	19	0	0	1	0
Seattle, WA (7)	88	273						
Circuit Breakers			6	2	0	4	0	1
Receptacles			267	236	9	21	1	15
Denver, CO (8)	56	158						
Circuit Breakers			12	9	0	3	0	0
Receptacles			146	139	2	3	2	2
Minneapolis, MN (8)	184	505						
Circuit Breakers			33	31	0	2	0	0
Receptacles			472	434	4	31	3	13
Salt Lake City, UT (8)	0	0						
Circuit Breakers			0					
Receptacles			0					
Totals	1090	2680						
Circuit Breakers			153	131	0	22	0	9
Receptacles			2527	2316	51	145	15	90