

**IEEE/PES
Transformers
Committee**

**Meeting Minutes
April 15, 1999**

***IEEE/PES TRANSFORMERS COMMITTEE
MEETING***

April 15, 1999

New Orleans, Louisiana

IEEE/PES TRANSFORMERS COMMITTEE MEETING

NEW ORLEANS, LOUISIANA

APRIL 15, 1999

ATTENDANCE SUMMARY

MEMBERS PRESENT

Aho, David	Anderson, Glenn	Arteaga, Javier	Barnard, Dave
Barnes, Mike	Boettger, Bill	Borst, John	Cambre, Jr., Max
Cash, Don	Chu, Don	Corkran, Jerry	Crouse, John
Dix, Larry	Dohnal, Deiter	Dudley, Richard	Elloit, Fred
Ellis, Keith	Fallon, Don	Foldi, Joe	Galloway, Dudley
Gaytan, Carlos	Ghafourian, Ali	Girgis, Ramsis	Grunert, Bob
Haas, Michael	Hager, Jr., Red	Hanique, Ernst	Hansen, Wayne
Hanus, Ken	Harlow, Jim	Hartgrove, Bob	Hayes, Roger
Holdway, Tim	Hopkinson, Phil	Hunt, John	James, Rowland
Johnson, Jr., Chuck	Juhlin, Lars-Erik	Kallaur, Gene	Kelly, Joe
Kennedy, Sheldon	Khalin, Valdimir	Lackey, John	Lazar, John
Loveless, Mark	Lowe, Don	Lundquist, Tom	Maguire, William
McQuin, Nigel	McShane, Patrick	Mehta, Sam	Miller, Kent
Mitelman, Mike	Molden, Arthur	Moore, Harold	Morehart, Gene
Murray, Chuck	Niemann, Carl	Papp, Klaus	Patel, Bipin
Patton, Jesse	Payne, Paulette	Pekarek, Tom	Perco, Dan
Pierce, Lin	Plaster, Leon	Platts, Don	Preininger, Gustav
Prevost, Tom	Purohit, Dilip	Raymond, Charlie	Risse, Peter
Robinson, Butch	Ruevecamp, Henk	Shertukde, Hemchandra	Sim, Jin
Shigh, Prit	Smith, Jerry	Smith, Jim	Smith, Steve
Stahara, Ron	Sullivan, John	Tuli, Subhash	Wagenaar, Loren
Watson, Joe			

MEMBERS ABSENT

Allan, Dennis	Allustiarti, Raymond	Altman, Mike	Anderson, Greg
Arnold, Jr., Jim	Aubin, Jacques	Ayers, Don	Balma, Peter
Bancroft, Roy	Barker, Ron	Bertolini, Edward	Binder, Jr., Wally
Bishop, Jerry	Brucker, Dave	Clark, Tom	Crofts, Dan
Dahinden, Vincenz	Davis, John	Degeneff, Bob	Diamantis, Tom
Ebert, John	Feghali, Pierre	Fleeman, Jeff	Franchek, Mike
Frank, Jerry	Gillies, Jim	Graham, Richard	Grubb, Bob
Gryszkiewicz, Frank	Hall, Geoff	Heinrichs, Frank	Henning, Bill
Highton, Keith	Hoefler, Pete	Jhonsa, VJ	Jonnatti, Tony
Jordan, Ron	Kennedy, Bill	Kline, Don	Lau, Mike
Lewis, Frank	Lewis, Tim	Light, Hal	Lindgren, Stan
Lowdermilk, Larry	Richard, Lowe	Ma, Joe	Marek, Rick

Massouda, Tito
Musil, R.J.
Patterson, Jr., Wes
Riffon, Pierre
Rowe, Jerry
Saxon, Bill
Skinger, Ken
Stoner, Ron
Thompson, James
Veitch, Bob
Wilks, Alan
Zhao, Peter

Matthews, John
Norton, Ed
Perkins, Mark
Rizvi, Aslam
Sampat, Mahesh
Scheu, Bob
Smith, Ed
Sundin, David
Traub, Tom
Ward, Barry
Wimmer, Bill

McTaggart, Ross
Orehek, Paul
Poulin, Bertrand
Robbins, Chris
Sankar
Sharma, Devki
Stein, Werner
Templeton, Jim
Trummer, Edgar
Weffer, Felipe
Woodcock, David

Mulkey, Daniel
Paiva, Gerry
Puri, Jeewan
Rossetti, John
Savio, Leo
Shenoy, Vic
Stiegemeier, Craig
Thenappan, Vis
Vaillancourt, Georges
Whearty, Bob
Young, Rick

GUESTS PRESENT

Ahmad, Naeem
Balma, Peter
Bimbiris, Alfons
Chiu, Bill
Daubert, Ron
Dugan, Roger
Foster, Derek
Golner, Tom
Henry III, George
Jaroszewski, Marion
Ladroga, Rick
Machado, Jr., Tamyre
Moffat, Jock
Perri, Frank
Reitter, George
Schwartz, Wes
Smith, Henry
Von Holle, Anthony

Anderegg, Don
Bello, Oscar
Blackburn III, Gene
Colopy, Craig
Delvecchio, Bob
Echolz, Klaus
Fyvie, Jim
Goodwin, Tip
Huff, Tim
Kim, Dong
Lee, Roger
Marlow, Dennis
Nguyn, Van Nhi
Pregent, Guy
Ribound, Jean-Christophe
Schweiger, Ewald
Snyder, Steven

Antwieler, Jim
Bergeron, John
Bush, Carl
Culgane, Michael
deCourcelle, Terry
Fausch, Reto
Gauthier, John
Goudie, Jim
Humenick, Noelle
Kirchner, Lawrence
Leuenberger, Boyd
Martinez, George
Nordman, Russ
Purra, Einar
Saldivar, Juan Jose
Shull, Stephen
Thaden, Malcolm

Atout, Khaled
Berrosteguieta, Jaime
Cancino, Alvaro
Darwin, Alan
Diaz, Rafael
Forsyth, Bruce
Gianakouros, Harry
Greely, Thomas
Iman, Mike
LaBean, Jr., Bernard
Lortie, Raymond
McNelly, Susan
Nunnery, Larry
Raymond, Timothy
Shappell, Steven
Simpson, Jr., Bill
Traut, Al

Contents

CLAUSE	PAGE
1.0 Chair's Report - J. W. Matthews.....	1
1.1 Report on the Technical Council Meeting, February 2, 1999 in New York, NY, USA ...	1
1.2 Transformers Committee Report to Technical Council.....	3
2.0 Approval of Minutes of November 11, 1998 - B. K. Patel.....	5
2.1 Meeting Planning Working Group - G. Anderson, Chair.....	5
3.0 Vice Chair's Report - B.K. Patel.....	9
3.1 PES Technical Council Committees.....	9
3.2 Technical Paper Reviews.....	11
4.0 Administrative Subcommittee - J. W. Matthews.....	13
4.1 Introduction of Members and Guests.....	13
4.2 Approval of the Leon Meeting Minutes.....	13
4.3 Additions to and/or Approval of the Agenda.....	13
4.4 Meeting Arrangements, Host Reports, and Committee Finances.....	13
4.5 Old Business.....	14
4.6 Status of ANSI C57 Committee - W. B. Binder.....	14
4.7 Committee Service Award - W. B. Binder.....	15
4.8 Chair's Report - J. W. Matthews.....	15
4.9 Standards Subcommittee - T. A. Prevost.....	15
4.10 Subcommittee Activities - Subcommittee Chairs.....	16
4.11 Vice Chair's Report - B. K. Patel.....	17
4.12 Secretary's Report - H. J. Sim.....	17
4.13 New Business.....	18
4.14 Adjournment.....	19
5.0 Transformers Standards - T. A. Prevost.....	21
6.0 Recognition and Awards - W. B. Binder.....	24
6.1 Working Group Recognition Awards.....	24
6.2 Certificates of Appreciation.....	25
6.3 Transformers Committee Prize Paper Award.....	25
7.0 Reports of Technical Subcommittees.....	26
7.1 Audible Sound and Vibration - J. Puri, Chair.....	26
7.2 Bushings - F. E. Elliott, Chair.....	28
7.3 Dielectric Test - L. B. Wagenaar - Chair.....	40
7.4 Distribution Transformers - K. S. Hanus, Chair.....	50
7.5 Dry-Type Transformers - W. F. Patterson, Chair.....	55
7.6 HVDC Converter Transformers & Smoothing Reactors S. C. - W. N. Kennedy, Chair.....	62
7.7 Instrument Transformers - J. E. Smith, Chair.....	64
7.8 Insulating Fluids - F. J. Gryszkiewicz, Chair.....	66
7.9 Insulation Life - L. W. Pierce, Chair.....	69
7.10 Performance Characteristics - D. J. Fallon, Chair.....	75
7.11 Power Transformers Subcommittee - E.G. Hager, Jr. Chair.....	85
7.12 Underground Transformers & Network Protectors - P. E. Orehek, Chair.....	88
8.0 Reports of Liaison Representatives.....	93

8.1 EPRI - S. R. Lindgren	93
8.2 SCC4 - P. A. Payne.....	96
8.3 TC 14 TAG - P. J. Hopkinson	97
9.0 Old Business	100
10.0 New Business.....	100
11.0 Adjournment	100
Attachment 1 - Committee Standards Status - Numerical Listing.....	100
Attachment 2 - Committee Coordination Activities	115
Attachment 3 - Committee Liaison Representatives.....	120
Attachment 4 - Committee Standards Status - Subcommittee Listing.....	122
Attachment 5 - Committee Attendance Statistics	138

IEEE PES TRANSFORMERS COMMITTEE MEETING
THURSDAY, APRIL 15, 1999

Chair: J. W. Matthews **Vice Chair: B. K. Patel**
Secretary: H. J. Sim

1.0 Chair's Report - J. W. Matthews

The chair, J. W. Matthews, had to be back home early and the vice chair Bipin Patel called the meeting to order at 1:15 P.M. Mr. Patel opened the meeting by complimenting Rowland James for the excellent meeting arrangements despite many meeting conflicts caused by PES T&D Conference and Exhibition. The Committee thanked the Host Committee with a round of applause.

Rowland reported on the attendance and other statistics (see Clause 4.0).

Dennis Marlow provided details about the next meeting in Monterrey, Mexico, on November 7 - 10, 1999. See Clause 4.0 for the details.

The committee secretary, Mr. Jin Sim highlighted the discussions held during the Administrative Subcommittee on April 12, 1999. See the Administrative Subcommittee Meeting Minutes in Clause 4.0 for details.

1.1 Report on the Technical Council Meeting, February 2, 1999 in New York, NY, USA

Chair Jones provided brief highlights and explanation of items contained in his Report to the Technical Council. These included -

- Transactions Editorial Board was established and responsibility transferred on November 1, 1998. This was two months ahead of schedule.
- A total of 1300 copies of each of the paper and the CD-ROM versions of the Meeting Proceedings were produced since it was unclear as to which medium would be selected by the attendees. Up to the meeting date the proceedings were being selected in approximately equal amounts with the printed version a slight favorite. Chair Jones commended Mel Olken and the IEEE Staff for the work that was required to produce the first meeting proceedings.
- Stationary Battery Committee has been founded with Jim McDowell as chair. Technical sessions are anticipated at the Edmonton Meeting.
- Liaison with the IEEE-USA Energy Policy Committee was formally adopted following a review of a position paper of the IEEE-USA EPC as requested by Don Volzka. Jeff Burleson of Southern Company was selected to be that liaison.
- Dispersed or Distributed Generation Task Force formed with Steve Brockschink, Pacific Engineers as Chair. The Task Force was to hold it's first meeting at the New York Winter Meeting. Each committee was encouraged to have a representative at the meeting.
- Jim Harlow was requested to produce a survey for distribution at this meeting requesting input for further areas of technical development work. This survey was available at the

1.0 Chair's Report (cont'd.)

registration area. A desire to complete standards for new technologies within four years was expressed.

- The Edmonton Meeting Technical Committee Program Chairs meeting was held in Chicago. Twelve committees were represented at the meeting. Input was provided by e-mail from three additional committees. Yakout Mansour added that the three tracks for the Edmonton meeting would be Reliability Management in the New Market Structure, Power Quality, and Distributed Generation and that the Chicago meeting was "one of the most productive meetings" that he had attended. Submission deadline for finalizing panel session details and summaries has been extended to March 1.

Additional details will be provided on these items, if requested.

1.1.1 New Standards Development Options

John Posey and Jim Gurney, members of the IEEE Standards Board, gave a presentation on a new way to develop IEEE standards. This new Entity voting method allows organizational participation in the development process and permits only one vote per organization. The present method still exists. Entity (person other than an individual) voting or individual voting will be selected as part of the PAR application. Judy Gorman, IEEE Standards, reported that a new corporation has been developed to provide standards production services to outside organizations.

A new method for correcting substantive technical errors within standards without major changes to the standards has been approved. This method to approve a document called a corrigenda. Mentors are now being assigned by the Standards Board to all rejected documents to provide assistance in obtaining approval at a future meeting.

1.1.2 Future Technical Development Committee - Tom Pinkham

The meeting was held as noted with 16 members and guests present.

The Chair noted the fine technical session on the Y2K issue sponsored by the Committee on Monday. Malcolm Thaden deserves our sincere thanks for making the arrangements for the Session.

Harry Jones discussed the directive from the PES Board to focus on new technologies in the Power business. He is initiating a program to encourage the identification of all such topics through Review articles and questionnaires at all future meetings. He will direct any such suggestions to the Standards Coordination Committee and this Committee for comment and action/ suggested action as appropriate. The Committee willingly accepted this task.

Discussed other future actions and decided on the following:

- Present "An Introduction to PES" at the beginning of each General Meeting to give first time attendees a broad overview of how PES is organized and how it works. Rick Hartlein will lead this task. (Note: This suggestion was approved by Technical Council)
- Suggest to all Technical Committees that each Committee should offer a Tutorial on their organization and activities at appropriate Meetings. (Note: Some Committees already do this and have found them well received.)

1.0 Chair's Report (cont'd.)

- Develop a Session on “Emerging Technologies in the Power Industry” for presentation in Edmonton, Singapore, Seattle and Columbus. Several suggestions for topics were developed for such a session; the exact topics may differ at each General Meeting.

1.1.3 Future Meetings

Winter 2000 - Singapore

Chair Jones requested roll call input from the Technical Committee Chairs as to the sessions that they would sponsor at the meeting. He also reviewed the reduced fare and lodging packages available for the Singapore meeting. The registration fee includes all lunches and an evening banquet. Don Russell also reported on the activities of the Singapore Meeting committee.

Electrical Machinery – Two sessions

Energy Development & Power Generation – Three sessions

Insulated Conductors – One session

Nuclear Power Engineering – None

Power Systems Analysis, Computing and Economics – One session

Power Systems Communication – Two sessions and one committee meeting

Power System Dynamic Performance – Two, possibly three sessions

Power Systems Instrumentation and Measurements – None

Power Systems Operations – Three or four sessions and one committee meeting

Power Systems Planning and Implementation – None at this time

Power Systems Relaying – One session

Substations – Undecided at this time

Surge Protective Devices – One session

Switchgear – One session

Transformers – One session

Transmission and Distribution – Unknown at this time

1.1.4 Topics from Committee Chairs

There were no topics for discussion from the Technical Committee Chairs

1.2 Transformers Committee Report to Technical Council

I reported the following to Technical Council for the Committee:

1.2.1 Committee Meeting Activities

1.0 Chair's Report (cont'd.)

Our Fall 1998 meeting was held November 8-11, 1998 in Leon, Guanajuato, Mexico. Mr. Andrew Lawless, Ferranti-Packard, was our host. A total of 262 members and guests attended the meeting.

Membership of the Transformers Committee currently stands at 174 members and 20 Emeritus members. The regular members consist of 84 producers, 52 users, and 38 general interest. Our invitation list consists of over 500 engineers and managers in the transformer and utility industry. Attendance at our semi-annual meetings is typically near 300. Anyone with an interest in furthering the technology is welcome at our meetings. With active participation, an invitation is extended to become a member.

The Committee goals are to encourage open participation in transnationalization of transformer standards; to promote technical and educational endeavors such as panel sessions, peer review of technical literature on cognizant subjects; and to support the efforts of the Power Engineering Society.

Future Meetings

April 12-15, 1999, New Orleans, LA, USA during the 1999 April T & D Conference

November 7-10, 1999, Monterey, Mexico

April 2-5, 2000, Opryland Hotel, Nashville, TN, USA

October 15-18, 2000, Niagara Falls, Ontario, Canada

Spring 2001, Amsterdam, The Netherlands

Fall 2001, Open - Contact one of the Committee Officers.

Spring 2002, Vancouver, BC, Canada

1.2.2 1999 Winter Power Meeting Technical Sessions

The Transformers Committee is sponsoring one presentation session and one poster session during the Winter Power Meeting.

1.2.3 Transformer Standards and Coordination Activities

The Transformers Committee takes responsibility for development and revision of IEEE Standards that fall within its scope. These Subcommittees currently have fifty Working Groups and Task Forces preparing proposals for standards projects. Information on these standards and projects can be obtained by visiting our WWW homepage:

<http://www.dsUPER.net/~georgev/Transformers.html>

Links to information on our future meeting sites and other information on Transformer Standards can also be found there.

Our WWW site will link you to the IEEE Standards Status Report that contains titles, abstracts, and names of contacts for each of the IEEE standards. This report is updated quarterly by the IEEE Standards Department. The status of transformer standards not listed in the IEEE quarterly report, either because they have been withdrawn, or they are not IEEE standards, are also included on the Transformers Committee Web site.

1.0 Chair's Report (cont'd.)

Transformers Committee officers and Administrative Subcommittee members are also members of the USNC Technical Advisory Group to TC-14 (Transformers and Reactors). We continue to have productive meetings of the TAG at each Committee meeting.

2.0 Approval of Minutes of November 11, 1998 - B.K. Patel

The minutes of the Little Rock meeting were approved as written.

2.1 Meeting Planning Working Group -- J.W. Matthews and G.W. Anderson, WG Chair

The fourth meeting of the new Administrative Subcommittee Working Group -- "Meeting Planning" began at 3:00 p.m., Wednesday, April 14, 1999 at the Ernest N. Morial Convention Center in New Orleans. Fourteen (14) individuals attended. Greg Anderson, WG Chair was not present due to a death in the family. John Matthews facilitated the meeting. The meeting began with introductions by the attendees.

2.1.1 Meeting Finances

VA-Tech/Ferranti-Packard, the host of the previous meeting in Guanajuato, Mexico has graciously returned the Committee funds to a healthy amount of \$15,235.99. It is becoming increasingly apparent that the Committee should maintain between \$10,000 and \$15,000 in the budget to pay for meeting expenses.

2.1.2 Past & Present Meetings

2.1.2.1 Past Meeting - Leon, Guanajuato, Mexico

The host of the previous meeting, Andrew Lawless had to return to Mexico the previous day. Andrew had previously submitted a nice report from his meeting. The meeting in Mexico should be considered a success. Andrew's team at VA-Tech/Ferranti-Packard did a good job in helping ease the concerns of those who have never traveled out of the country. This extra effort should increase interest in the meeting in Monterrey. It was also noted that Andrew did an excellent job of preparing for this meeting even with the last-minute change of meeting host and the "last-second" relocation of the meeting venue.

2.1.2.2 Present Meeting - New Orleans

Rowland James, the host of the meeting, gave a brief welcome to the attendees and a report of how the meeting was progressing. It was noted that Rowland did a great job of arranging the Committee's meeting while assuming other duties for the IEEE T&D Conference.

2.0 Meetings (cont'd.)

The WG will continue to strive for continuity (similar appearance) of future meetings and therefore will attempt to avoid holding a meeting in conjunction with another industry meeting, unless extremely worthwhile.

2.1.3 Future Meetings

2.1.3.1 Locations

The following dates, locations and respective hosts for future meetings were quickly reviewed.

- November 7-10, 1999 -- Monterey, Mexico ... Alfonso Delgado Cruz (GE-Prolec)
- April 2-5, 2000 -- Nashville, TN ... Alan Wilks (ERMCO)
- October 15-18, 2000 -- Niagara Falls ... Roger Hayes (VA-Tech/Ferranti-Packard)
- Spring, 2001 -- Amsterdam ... Ernst Hanique (SMIT)
- Fall 2001 -- Orlando, Florida ... Joe Watson (FPC) and John Progar (Ohio Transformer)
- Spring 2002 -- Vancouver, B.C. ... Mike Lau (BC Hydro)
- Fall 2002 -- open for US meeting; contact Greg Anderson for information
- Spring 2003 -- open for US meeting; contact Greg Anderson for information

2.1.3.2 Upcoming Meeting - Monterrey, Mexico

The Fall 1999 meeting will be held in Monterrey, N.L. Mexico and will be hosted by Alfonso Degado Cruz at GE-Prolec. Dates of the meeting will be Sunday, November 7 to Wednesday, November 10, 1999.

The Crowne Plaza Hotel has been contracted for the event. Thirteen meeting rooms and 220 guest rooms are reserved. The guest room rate will tentatively be \$95.00 (plus 17% tax) each night. A continental breakfast will be included in the registration fee.

Planning for the meeting's social and companion events is progressing well. The hospitality reception is scheduled for Sunday evening. Several sites for the Companion Tour are being studied. Three individuals are being considered for speakers at the Tuesday Luncheon. The Tuesday Evening Social will be held at the Mexican History Museum and will include a sit-down dinner. The event will include regional folk entertainment and a guided museum tour before dinner. Transportation to the Social will be included in the cost of the event.

For meeting information, contact Alfonso Delgado in Mexico at 011-528-156-2133 (from the US) or DelgaCrAM@indsys.ge.com or Carlos Gaytan at 011-528-156-2162 or GaytaCaC@indsys.ge.com.

2.1.3.3 Additional Upcoming Meetings

2.0 Meetings (cont'd.)

Alan Wilks from ERMCO gave a report on the progress of the Spring 2000 meeting in Nashville. Alan has 225 rooms reserved at the Opryland Hotel, including 125 rooms on Saturday night. The room rate will be approximately \$145 plus tax. He has also reserved approximately 50 seats for a show on Saturday evening at the Grand Ole Opry. Cost will be approximately \$17 plus transportation cost. The Tuesday Evening Social will be on the Showboat General Jackson. The cost will be approximately \$55 that includes a prime rib dinner. Alan Wilks can be reached at (901) 285-9121 or awilks@ecsis.net

Tony DiFranco from Ferranti-Packard/VA Tech announced that Roger Hayes has approximately 300 rooms reserved at three hotels near Niagara Falls (on the Canadian side) for the Fall 2000 meeting. All meetings will be held in one hotel. Roger Hayes can be reached at (905) 685-6551 or hayes.roger@vatech.fpt.ca

2.1.4 Host Guidelines

There have been no recent revisions to the Host Guidelines document. GE-Prolec, the host of the upcoming Fall 1999 meeting commented that the preliminary document has been quite helpful in planning their meeting. Greg is hoping to continue to incorporate "lessons-learned" feedback into the document.

2.1.5 Registration Software

Greg will make another contact with the company that markets "Events" software. He will attempt to run a demo of the software at the Monterrey meeting, perhaps in parallel with our normal registration. Software such as events would allow on-line registration for the meeting similar to that used for the IEEE T&D Conference. Some of the benefits would be: on-line registration (also hotel registration); payment by credit card; return e-mail confirmation; compiling registration data for the Host allowing them to focus on other issues; and using the Committee's main database/ mailing list. Cost of the software is approximately \$8,000.

2.1.6 Miscellaneous

There is a new requirement for each meeting host to develop and submit a preliminary budget for their meeting. It was suggested that the budget be submitted at the preceding meeting. The budget will help determine if the registration fee is sufficient and will not significantly deplete

2.0 Meetings (cont'd.)

the Committee's funds. Greg Anderson will send a sample budget (a template) to each upcoming host.

In the future, the meeting host will continue to provide a simple overhead projector and screen in a room if requested by a SC or WG Chair. Due to the increasingly high rental cost, the host will not provide a RGB projector (computer projector) unless someone agrees to compensate the Committee for the rental cost of the equipment. In the future, the meetings will be "BYOP" (bring your own projector).

Greg Anderson is considering assuming the duty of creating the initial meeting schedule himself. Benefits will include: eliminating each Host's "learning curve"; improving the similar appearance of each meeting (one of Greg's goals); and designating one "point man" for schedule input from each SC Chair.

Greg Anderson is now employed with Omaha Public Power District and can be reached at (402) 636-2561 or gwanderson@oppd.com

2.1.7 Future Plans for WG

Additional future plans for the Meetings Planning WG include: continued development of the Host Guidelines Document, automate registration process (possibly web-based), and enhanced information on the Committee's web-page.

The meeting was adjourned.

3.0 Vice Chair's Report - B.K.Patel

3.1 PES Technical Council Committees

The following are reports on activities of PES Committees on which the Vice Chair serves as Committee representative. All of the meetings reported were held at the 1999 Winter Power Meeting in New York, NY during January 31 to February 4, 1999.

3.1.1 Publications Committee

The following dates for submissions for Winter and Summer meetings have been agreed upon. This information is available from the PES website.

For Proceedings Papers:

Activity	Winter Meetings	Summer Meetings
Authors submit abstracts to PES Executive Office	Jul 1	Dec 1
Authors notified by PES Executive Office of conditional acceptance (or rejection) based on review of the abstract	Aug 15	Feb 1
Authors submit complete <i>Proceedings</i> papers to PES Executive Office	Oct 1	Mar 15
Authors notified of final acceptance or rejection based on review of the full paper	Nov 12	Apr 27

For Summary of Panel Presentations:

Activity	Winter Meetings	Summer Meetings
Summary of presentation (2 to 6 pages) submitted to Panel Session Chair	Sep 1	Mar 1
Panelists notified by Panel Session Chair of acceptance or required changes to the summary	Oct 1	Mar 15

Panelists submit revised summaries to Session Chair, if required	Nov 1	Apr 15
Panel Session Chairs submit complete session information to Technical Committee TCPC and PES Executive Office	Nov 12	Apr 27

In addition to the above, the list of sessions and committee meeting rooms must be submitted by the committee TCPCs to the PES Executive Office by September 15 (for Winter meetings) and by March 1 (for Summer meetings)

Mel Olken made a presentation regarding the status of electronic publishing. By 2000 all publishing will be electronic.

The technical committees are requested to submit a story on their committee activities to printing in the PE Review. The editorial content and the length of the article are at the discretion of the author. It may include such as: technical information, announcement of new working groups and task forces and membership information.

3.1.2 Organization and Procedures Committee

3.1.2.1 Technical Committee Activity Reports

No major discussion during the individual TC report.

3.1.2.2 Revision of the Technical Council Organization and Procedures Manual

The TC Organization and Procedures Manual is currently under revision with particular interest in the sections dealing with the officers of the Technical Council. Many other sections are being considered, one being the addition of a section concerning the recently developed Technical Program Chairs who create the technical programs at the Winter and Summer Meetings.

3.1.2.3 Miscellaneous

Insulated Conductors has reduced the number of subcommittees from thirteen subcommittees plus an administrative subcommittee to four subcommittees plus an administrative subcommittee. This action was approved by TCOP. The Technical Council also approved the change.

The TCOP proposed that the IEEE Standard 386 Working Group be moved from the Transmission and Distribution Committee to the Insulated Conductors. Action on this item was

deferred until the Transmission and Distribution Committee reviews the issue and submits a proposal.

Concerns regarding the poster sessions were discussed. Chair Jones said that the issue has been given to the Technical Sessions Improvement Committee for review.

A suggestion was reported for limiting the number of general meetings to only one a year instead of the current two. Chair Jones reported that this was not the forum for this issue although it is being discussed at higher levels.

3.1.3 Technical Sessions Improvement Committee

Following items of significant concern to the members and attendees were discussed:

1. This time session chairs did not receive any packages. In the past each session chair received in advance a package containing papers to be presented in the session, instructions on how to best conduct the session, and session evaluation forms.
2. There is some concern about the quality of papers in the panel sessions and in the poster sessions. To assess the general quality, a survey of the authors and participants will be conducted in the Summer Meeting in Edmonton.
3. Some TCPCs (Technical Committee Program Coordinators) had no advance information if the papers submitted by them were scheduled or not in the program, and/or scheduled on which day at what time. It was suggested that a standardized spreadsheet might be used for giving this information to TCPCs. There was also some concern that not all authors may have been informed of their paper's acceptance and schedule for presentation.
4. There is a need to produce and publicize guidelines for making good presentations. The chair, Bal Gupta, will prepare such guidelines for publication and distribution by May 1, 1999. These guidelines may be included with author's kit.

3.2 Technical Paper Reviews

3.2.1 Technical Paper Review Summary

We received seventeen transaction papers, which included eight resubmits. Eight were accepted, one rejected, five accepted with mandatory comments, and three are under review.

Nine T&D Conference papers were received with eight accepted and one accepted with mandatory comments.

Nine 99 Winter Power Proceedings papers and an abstract for 99 Summer Power Proceedings paper were received. All were accepted except one that was withdrawn by the author.

There were two paper closures received and both were accepted.

3.2.2 1999 IEEE/PES T&D Conference

There will be a panel session on Transformer Thermal Modeling chaired by Linden Pierce. There will also be two Transformer sessions with eight papers scheduled for presentation.

3.2.3 1999 IEEE/PES Summer Power Meeting Papers

There will be a transformer session at the meeting in Edmonton, Canada with four papers scheduled for presentation.

Respectfully submitted,

B.K.Patel, Vice Chair

4.0 Administrative Subcommittee - John W. Matthews

4.1 Introduction of Members and Guests

Chair Matthews called the meeting to order at 8:30 a.m., Monday, April 12, 1999, in Hilton Riverside hotel, New Orleans, Louisiana.

The following members of the Subcommittee were present:

W. B. Binder, Jr.	B. K. Patel
R. F. Dudley	W. F. Patterson
F. E. Elliott	L. W. Pierce
D. J. Fallon	T. A. Prevost
E. G. Hager	J. Puri
K. S. Hanus	H. J. Sim
J. W. Matthews	L. B. Wagenaar
P. E. Orehek	

The following guests were present:

Greg Anderson
Rowland James
Naeem Ahmad
Thomas Greely
Noelle Humenick
Dennis Marlow
Phil Hopkinson

4.2 Approval of the Leon Meeting Minutes

The minutes of the previous Administrative Subcommittee meeting in Leon were approved as written.

4.3 Additions to and/or Approval of the Agenda

The previously communicated agenda was generally followed.

4.4 Meeting Arrangements, Host Reports, and Committee Finances

4.4.1 Meeting Arrangements

Meetings Planning WG chair Greg Anderson reported the following.

- Leon meeting was a successful one.
- Previous meeting (Leon) host Andrew Lawless and Ferranti-Packard contributed the difference in expenses and income so that the balance forwarded is the same (about \$15 K).

4.0 Administrative Subcommittee (cont'd)

- To assist the hosting teams, the WG is evaluating a software (Events) costing about \$8000. After significant discussion, we decided to schedule a demonstration during our next WG meeting in Monterey, Mexico.
- Discussion on the meeting schedule conflicts were made and after considering extending the meeting duration to three full days, Administrative Subcommittee members voted to keep the current format and duration.
- Our next meeting co-host, Dennis Marlow of PROLEC/GE, presented a fall '99 Transformers Committee meeting Status report.

4.4.2 Host Reports

The meeting host Rowland James reported the following registration statistics:

Registrations

Members and guests	256
Life Emeritus Members	6
Total	262

A historical listing of IEEE/PES Transformers Committee meeting locations is attached at the end of these minutes.

4.4.3 Finances

The surplus of \$ 15200 was carried over to this meeting and we expect to maintain this surplus to about the same level after this meeting.

4.5 Old Business

The volume I of the GSU failure survey went to printing and will be available in the PES Summer meeting in Edmonton.

The revision of the IEEE 32, IEEE Standard Requirements, Terminology, and Test Procedure for Neutral Grounding Devices is in process within SPDC with the PAR expiring in March 2000. Transformers Committee has been requested by SPDC to review this draft and prepare comments in time for completion of this revision before the PAR runs out. Committee Secretary, Jin Sim, is coordinating this for many subcommittees with aggressive schedule.

4.6 Status of ANSI C57 Committee - W. B. Binder

- 4.6.1 The IEEE delegation has not responded to a ballot since the meeting in Leon. I have with me affirmative ballots for the 1) C57.12.01 IEEE General Requirements for Dry-Type Distribution and Power Transformers Including those with Solid Cast and/ or Resin

Encapsulated Windings, subject to approval by the IEEE Standards Board and for 2) NEMA Standard TP-2 Standard Test Method for Measuring Energy Consumption of Distribution Transformers.”

4.6.2 The IEEE Transformers Committee will volunteer to maintain the joint C57/C37 Coating Standards.

4.7 Committee Service Awards - W. B. Binder

Wally's full report will be shown in the Committee meeting minutes.

4.8 Chair's Report - J. W. Matthews

John presented his report which will be included in the Committee meeting minutes.

4.9 Standards Subcommittee - T. A. Prevost

4.9.1 Standards and Coordination Activities

Tom Prevost reviewed his report which will be included in the Committee meeting minutes.

4.9.2 Documents Submitted to the Standards Board

See the status report.

4.9.3 PAR

Electronic submittal of PAR is required using the form on the web, then fax the form with signatures. Problems with coordination can be resolved by parallel coordination with Standards Coordinating Committee to meet the PAR due dates.

4.9.4 IEEE Standards Activity (Naeem Ahmad)

Naeem reported that there were 7 complete invitations and 10 ballots in progress. He also reported the following highlights.

- C57.12.34 needs draft for ballot.
- For all future projects, IEEE will require drafts before the balloting pool is formed so that the ballot can take place within weeks of forming the pool.
- ASC C57 balloting is slow and we will ballot all simultaneously. We will need to check if the IEEE delegation can vote prior to Standards Board approval.
- Paul Orehek raised the IEEE requirements on metric conversion is unclear. Naeem will be contacted to see if IEEE can clarify this issue.

4.9.3 Subcommittee Assignments

- C57.12.10 to Power Transformers Subcommittee
- Distribution Substation Transformers to Distribution Transformers Subcommittee
- C57.12.23 to Distribution Subcommittee
- DETC Functional Life Tests to Performance Characteristics Subcommittee

4.10 Subcommittee Activities - Subcommittee Chairs

4.10.1 Audible Sound and Vibration - Jeewan Puri

No Report.

4.10.2 Bushings - F. E. Elliott

No Report.

4.10.3 Dielectric Tests - L. B. Wagenaar

Loren reported that a new Task Force has been established within the Dielectric Tests Subcommittee. It will address the Liquid-Filled transformers dielectric tables in C57.12.00 (Tables 3 through 8). Phil Hopkinson will chair this task force. The motivation for this work are 1) to update these tables, and 2) to harmonize their content with IEC Standards.

4.10.4 Distribution Transformers - K. S. Hanus

Ken reported Clyde Pearson will no longer be participating on the working groups due to a job change within TU Electric. Sam Michael of Detroit Edison has volunteered to replace Clyde as co-chair of the C57.12.34, Three Phase Padmount Transformers working group.

4.10.5 Dry-Type Transformers - W. Patterson

No report.

4.10.6 HVDC Converter Transformers & Reactors - W. N. Kennedy/Richard Dudley

No Report.

4.10.7 Instrument Transformers - J. E. Smith

No report.

4.10.8 Insulating Fluids - F. J. Gryzkiewicz

No presence and no report.

4.10.9 Insulation Life - L. W. Pierce

No report.

4.10.10 Performance Characteristics - D. J. Fallon

No report.

4.10.11 Power Transformers - E.G. Hager

Red Hager reported that a request had been received by a member of the WG on Diagnostic Field Testing and Monitoring of Liquid-Filled Transformers, etc. from the Dielectric & Electrical Insulation Society (DEIS). DEIS would like to have a paper presented at their October meeting in Cincinnati on Transformer Diagnostics & Monitoring. Rick Young was informed by Red that it was a great idea and would clear with the Administrative Subcommittee.

4.10.12 Underground Transformers and Network Protectors - P. E. Orehek

No report.

4.11 Vice Chair's Report - B. K. Patel

Bipin submitted a written report which will be included in the Committee meeting minutes.

4.12 Secretary's Report - H. J. Sim

4.12.1 Membership Review

Voting Members - Eight new members were added at the last meeting in Leon as noted in the meeting minutes. Also there were few changes in voting classification for some members.

Following these changes and prior to the addition of new members at this meeting, membership stands at:

Members -	170
Classifications:	
Producers -	80
Users -	50
General	40
 Emeritus Members -	 20

Poor Attendance Records - The invitation list has been revised by removing guests with poor attendance record and adding new guests by request. Members who have not attended a

committee meeting since Spring of 1997 will be contacted to determine their interest in maintaining membership.

4.12.2 New Member Applications

Five new members were approved and welcomed. They are, Peter Balma (Public Service Electric & Gas Co.), Keith Ellis (Haefely Trench), Carlos Gaytan (GE Prolec), Robert Hartgrove (Carolina Power & Light), and Vladimir Khalin (Kuhlman Electric Corp.)

4.12.3 PES Directory Rosters

Subcommittee chairs are requested to keep the rosters updated as they change constantly.

4.12.4 Meeting Minutes

Minutes of the Leon meeting were reproduced at no cost, again compliments of Ken Hanus and TU Electric. Postage costs were \$ 2126.60 for 538 mailings, which averages \$ 3.95 per mailing. Note that the net cost of the minutes varies for each meeting and the \$10 portion of the registration fee is a valid nominal fee.

I request Subcommittee Chairs to submit their minutes by June 30, 1999 for this meeting. The submittal should be an electronic file on a 3 1/2" diskette (Email preferred), formatted in Word 7.0 (or earlier versions). Please indicate total attendance count for each subcommittee, working group, and task force meeting in your minutes. Please do not send me a copy of attendance listing for this attendance count. If someone is preparing minutes for you please let them know these details about submitting the minutes for publication.

4.13 New Business

TAG meetings of IEC TC14 during the Transformers Committee meetings were discussed. There are majority of TAG members that will not be participating as they feel the fee requirement to be a TAG member is not justifiable. The question of weather to charge for the use of meeting rooms was to be reviewed at the next meeting in Monterrey. It was agreed that the benefits of continuing TAG meetings during our Committee meetings are still there.

Richard Dudley reported problems with the ballot returns and "last round" negative ballot returns by new people in the balloting pool. This issue was discussed with the IEC procedures as an example but we concluded that we follow the IEEE balloting process.

The joint WG C37/C57 produced several standards on Enclosure Integrity mainly through the efforts of the C57 group. C37 group has not been active for several years and the WG wanted to see if IEEE Transformers Committee can take over the responsibility of these four standards. The chair of the IEEE delegation, Wally Binder, will bring this subject up during the next ASC C57 Main meeting.

4.14 Adjournment

John adjourned the meeting at 12:37 p.m.

Respectfully submitted,

H.J. Sim, Secretary

IEEE/PES Transformers Committee Meeting Locations

<u>Year</u>	<u>Spring</u>	<u>Fall</u>	<u>Committee Chair</u>
2002	Vancouver, BC, Canada	Open	Sim
2001	Amsterdam, The Netherlands	Orlando, FL	Patel
2000	Nashville, TN	Niagara Falls, ON, Canada	Patel
1999	New Orleans, LA	Monterey, Mexico	Matthews
1998	Little Rock, AR	Guanajuato, Mexico	Matthews
1997	Graz, Austria (summer)	St. Louis, MO	Binder
1996	San Francisco, CA	Burlington, VT	Binder
1995	Kansas City, MO	Boston, MA	Harlow
1994	Dallas, TX	Milwaukee, WI	Harlow
1993	Portland, OR	St. Petersburg, FL	Borst
1992	Birmingham, AL	Cleveland, OH	Borst
1991	Phoenix, AZ	Baltimore, MD	Veitch
1990	Denver, CO	Montreal, PQ, Canada	Veitch
1989	Chicago, IL	Charlotte, NC	Veitch
1988	Washington, DC	Long Beach, CA	Compton
1987	Ft. Lauderdale, FL	New Orleans, LA	Compton
1986	Little Rock, AR	Pittsburgh, PA	Yannucci
1985	St. Louis, MO	Toronto, ON, Canada	Yannucci
1984	Vancouver, BC, Canada	Boston, MA	Savio
1983	Atlanta, GA	Detroit, MI	Savio
1982	Los Angeles, CA	Philadelphia, PA	McNutt
1981	Portland, OR	Phoenix, AZ	McNutt
1980	Williamsburg, VA	Milwaukee, WI	Bonucchi
1979	San Diego, CA	Houston, TX	Bonucchi
1978	Miami, FL	Chattanooga, TN	Bennon
1977	Charlotte, NC	Montreal, PQ, Canada	Bennon
1976	New Orleans, LA	San Francisco, CA	Honey
1975	Lakeland, FL	Denver, CO	Honey
1974	Pittsburgh, PA	Scottsdale, AZ	Alexander

5.0 Transformer Standards - T. A. Prevost

The standards subcommittee met on Wednesday, April 14, 1999 at 2:30PM with one member and four guests in attendance.

The minutes from the November, 1998 meeting in Leon, Mexico were approved as written.

The next item was the report of Working Groups.

- WG for revision of C57.12.80

The WG on Revision of C57.12.80 met on Wednesday, April 14, 1998 at 1:00 PM.

There was one member and six guests in attendance. The minutes of the November, 1998 meeting in Leon were approved as written.

The status of C57.12.80 was reviewed. Draft two of this revision has been balloted. Five of six negatives have been resolved.

The sixth negative was discussed during the meeting and the WG agreed to terminology offered by Wally Binder and Bob Grubb for the definition of a draw lead bushing. This will be forwarded to Mr. Dan Mulkey who had submitted his negative for approval.

The recirculation ballot should go out in the next month.

A proposal was made to form a continuous Working Group for revision of C57.12.80. This will provide a forum for changes or additions to the document so that we can keep it up to date with the other C57 standards work. The Working Group will be formed after completion of the existing project. Mr. Saurabb Gosh has kindly volunteered to chair this Working Group and once the project has been initiated we will be looking for members.

For New Business we discussed the definition of Distribution Transformer. The present definition has a note which reads:

"Distribution transformers are usually rated in the order of 5-500 KVA."

Because the scopes of the standards no longer reference KVA it was decided that this note should be deleted.

With no other New Business the meeting adjourned at 1:43PM.

Report on Status of Standards

- C57.98 Reaffirmation balloting is complete. The standard has been sent to Rev Com with an addendum for corrections to the document which were picked up during the reaffirmation process. This addendum will be added to the standard.
- C57.12.00 This revision is now at Rev Com to be reviewed at the next Standards Board Meeting in June.
- C57.12.90 Recirculation of draft 5.1 resulted in one negative ballot which has subsequently been withdrawn. We received many additional comments on the draft. Those that are editorial will be incorporated into the draft before it is submitted to Rev Com. Those that are technical will be forwarded to the appropriate Working Groups for review.

Draft 5.1 of C57.12.90 will be submitted to Rev Com for review at the June Standards Board Meeting.

Under New Business we again review the process for continuous revision of C57.12.00 and C57.12.90.

Subhash Tuli as WG Chair will distribute a status report of each standard at the Standards Subcommittee Meeting in the future. This report will include the status of proposed revisions to the standards and which sub committee has that responsibility. The status report will be a valuable tool for coordination of revision activities.

The next cutoff date for submittal to the WG of any proposed revisions for the next draft is September 15, 2000. Any requests after that date will be held for the next revision cycle.

The process for handling the ballot results of these documents was discussed at length. Although there were many very helpful suggestions we did not come to any solid conclusions because many options involved the interpretation of IEEE procedures. Tom Prevost will review these procedures with the Standards Board and submit a procedure to the Administration Committee for review. This will be reported in the next meeting in Monterrey.

The meeting adjourned at 3:47 PM.

6.0 Recognition and Awards - W. B. Binder

6.1 Working Group Recognition Awards

Transformers Committee Working Group Recognition Award for 1999 is the Working Group for Revision of C57.110 – IEEE/ANSI Recommended Practice for Establishing Transformer Capability When Supplying Nonsinusoidal Load Currents. A PES plaque will be presented to Richard P. Marek, Chair at the Main Committee Meeting. In addition, certificates will be mailed to each member of the working group. Those members are:

Roy A. Bancroft	Edward W. Hutter	W. E. Morehart
Mike Butkiewicz	Mike Iman	Dhiru S. Patel
Max Cambre, Jr.	Charles W. Johnson, Jr.	Wesley F. Patterson, Jr.
Jerry L. Corkran	Anthony J. Jonnatti	Linden W. Pierce
James Deffenbaugh	Sheldon P. Kennedy	Guy Pregent
Jerome M. Frank	Lawrence A. Kirchner	Jeewan Puri
Wayne Galli	Alexander D. Kline	Dilip R. Purohit
Dudley L. Galloway	John G. Lackey	Subhas Sarkar
Ramsis S. Girgis	Timothy D. Lewis	Mike Schacker
Micheal E. Haas	Don MacMillan	Wes W. Schwartz
Roger R. Hayes	Jim McIver	H. Jin Sim
Bryce Hesterman	Nigel P. McQuin	Charles E. Simmons
Timothy L. Holdway	Mike I. Mitelman	Ronald W. Stoner
Philip J. Hopkinson		

The PES Working Group Recognition – Technical Report was awarded to M. R. Iravani for “Modeling and Analysis Guidelines for Slow Transients.”

The PES Working Group Recognition – Standard/Guide was awarded to IEEE Guide for Improving Lightning Performance of Transmission Lines”, W. A. Chisolm – Chair and to IEEE Trial-Use Recommended Practice for Data Communications Between Intelligent Electronic Devices and Remote Terminal Units in a Substation”, K. Jackson – Chair.

6.2 Certificates of Appreciation

Transformers Committee Certificates of Appreciation will be presented to the following for service as Working Group Chairs or Co-Chairs:

<u>Name</u>	<u>Service Rendered</u>
Clyde Pearson	Co-chair, of the WG Standard Requirements for Three Phase Padmounted Distribution Transformers C57.12.34
Karen Weismann	Chair, Working Group Guide for Sound Level Abatement and Determination for Liquid-Immersed Power Transformers and Shunt Reactors Rated Over 500 kVA, PC57.136

6.3 Transformers Committee Prize Paper Award

One paper awaiting publication was nominated for possible consideration for 1999 prior to the last meeting (96 SM 539, "The Effects of Long Term Operation and System Conditions on the Dielectric Capability and Insulation Coordination of Large Power Transformers" authored by P.Balma, R.Degeneff, H.Moore, and L.Wagenaar). Any other nominations should be brought to my attention between now and the Summer Power Meeting in July as the deadline for nominations occurs before our next meeting.

The 1999 PES Prize Paper was awarded to "A User-Friendly Simulation Program for Teaching Power System Operation", T. J. Overbye, P. W. Sauer, C. M. Marzinzik, K. G. Gross and to "Digital Relay Reports Verify Power System Models", C. F. Henville.

7.0 Reports of Technical Subcommittees

The following reports are those of the technical subcommittees of the Transformers Committee. In most cases they are the complete minutes of meetings held earlier and they are identified as minutes.

Secretary's Note: The subcommittee reports have been edited to the format of the IEEE Style Manual. No changes have been made to the content of these reports except for typographical errors and obvious improvements (removal of attendance lists and general items covered elsewhere).

7.1 Audible Sound and Vibration - J. Puri, Chair

The Subcommittee met on Tuesday, April 15 at 10:15 A.M. with fifteen members and thirteen guests present. One new member was welcomed to this Subcommittee.

The minutes of our previous meeting at Guanajuato (Mexico) were approved.

The following items were discussed:

7.1.1 New WG Chairperson Announcement

The SC chairman announced that Karen Weissman, chairperson of the WG for Transformer Siting Guide (*Sound Abatement Guide*) had resigned and Alan Darwin has taken over the chairmanship of this WG.

7.1.2 Chairman's report on IEC 60076-10 sound measurement standard.

The IEC WG 25 met in Nijmegen in the Netherlands and finalized the "CDV" for this standard. This draft will now be voted upon by the membership of TC14. This draft recognizes Sound Intensity as a more accurate measurement for sound level as compared to the Sound Pressure measurement.

Our proposal of including Standard sound levels in this document was voted down however, it was agreed that a note stating that "Standard sound levels must be met for North American applications" will be included in this document.

This WG has now initiated writing a users' guide for making sound level measurements as described in this standard.

7.1.3 WG Chairman's report on the "Transformer Siting Guide" (*Sound Abatement Guide*).

The WG met on Wednesday 14 April 1999 at 8:30 am with 11 members and 5 guests present (and also met during the ASV SC meeting).

This WG received 160 comments on Draft 9 of the Siting Guide (*Sound Abatement Guide*) C57.136. The IEC format of receiving and discussing comments was tried and it resulted in an efficient resolution of these issues.

All the 160 comments were resolved and will be incorporated into Draft 10 of the document before it is sent out for balloting.

7.1.4 New Business

This WG will now start writing “Sound Intensity Measurement” procedures for inclusion in IEEE standard C57.12.90. This work will begin in our fall meeting in Monterrey, Mexico.

The meeting was adjourned at 12:30 p.m.

Jeewan Puri

SC Chairman

7.2 Bushings - F. E. Elliott, Chair

7.2.1 Introduction and Membership

Chairman, Fred Elliott opened the meeting at 4:00 in the afternoon and welcomed the members and guests. The meeting was attended by 9 members and 2 guests.

7.2.2 Chairman's Remarks

Mr. Elliott reported the following:

- Next meeting in Monterey Mexico. The meetings will be held in the Crown Plaza Hotel, Sunday to Wednesday schedule. All meetings in the same hotel.
- A new PES Technical Committee on Stationary Batteries has been formed.
- Five year revision cycle for the standards, and four year PAR life means we must all keep moving forward in mind when we make comments and work on standards projects.
- Bob Degeneff will be the coordinator for transformer committee technical papers.
- A new regular agenda item will be included for highlighting bushing related technical papers. This will include a summary presentation and Q & A.

7.2.3 Approval of Minutes of November 10, 1998 Meeting held in Leon, Mexico

The minutes were approved as written.

7.2.4 Working Group / Task Force Reports

7.2.4.1 WG on General Requirements and Test Procedure For Power Apparatus Bushings (C57.19.00)

Keith Ellis reported that his WG met on April 14, 1999 at 8:30 in the morning with 22 Guests present. Five additional requests for membership were received.

1. Approval of last meeting minutes

The minutes were approved as written.

2. Working Group Administrative Guide Lines

The WG Chair passed out guide lines for membership in the working group and guide lines for survey ballots.

3. Discussion on Comments Received on PC57.19.00 Draft 3

The WG is in the process of discussing comments received on draft 3. Details of these comments/discussions will be covered in the WG report.

4. New Business

No new business was discussed.

5. Adjournment

The meeting was adjourned at 2:35 in the afternoon after three sessions.

7.2.4.2 WG on Performance Characteristics and Dimensions for Outdoor Apparatus Bushings (PC57.19.01)

1. Introduction and Membership

P. Singh reported that his WG met on April 13, 1999 at 2:30 in the afternoon with 19 members and 5 guests present.

2. Approval of last meeting minutes

The minutes were approved as written.

3. PC57.19.01 Draft 6 Transformer Committee Ballot Results

A summary of the results from the balloting group is as follows:

Eligible	Affirmative	Negative	Abstentions	Not returned
91	80 (95 %)	4 (5 %)	3	4

An attempt to resolve the four negative ballots by correspondence proved to be unsuccessful.

4. Discussion on comments received on Draft 6 balloting

The WG members then discussed the comments from the balloting group and agreed to the following:

4a. Table 1

- The four negatives ballots and the accompanying comments on the elimination of certain voltage classes were discussed by the WG and it was agreed to maintain the proposed ratings in Draft 6. The WG has discussed this issue in earlier meetings and for this reason a WG position paper explaining the rating selection process was enclosed with Draft 6 as a supporting document.
- A comment to include the WG position paper as an annex was discussed. Mr. Naeem Ahmad who is the Staff Engineer at the IEEE Standards Board agreed to look into the possibility.
- As agreed in the November 9,1998 meeting in Leon Mexico, the creepage distances in columns 4 and 5 will be changed from centimeters to millimeters.

4b. Table 2

7.0 Reports of Technical Subcommittees (cont'd)

- The footnote “*” on draw lead ratings will be reworded as per discussions in the November 9, 1998 meeting.
- A comment to change the metric conversion values for blade lengths in Figures 2-4 and 2-5 was not agreed as these conversions are based on 3.13 and 4.13 inch units.

4c. Table 3

- The footnote “*” on draw lead ratings will be reworded as per discussions in the November 9, 1998 meeting.
- A comment from Jens Frost indicating that 500 kV, 3000 A and 765 kV, 2000 A ratings seemed to be high and unrealistic. This subject was discussed in the October 1996 meeting in Burlington, VT and it was agreed to eliminate the 765 kV, 3000 A rating.

4d. Table 4

- The columns for static cantilever force will be switched to indicate metric units as primary units. Similarly the metric and inch dimensions in footnote 4 will be switched to indicate metric unit as the primary unit.

4e. Table 5

A comment to either specify pico-coulombs or micro-volts was discussed and it was agreed not to change the proposed table as customers specify the requirements in both units.

4f. Table 6

A comment to specify the requirement for C2 power factor and capacitance was discussed and it was agreed not to change the table as C2 power factor is dependent on type of material and has wide variations.

4g. Annex A

A comment to use mm dimensions in place of cm for creepage distance in column 4 was agreed at the last meeting.

4h. Editorial Comment

Appropriate editorial/typographical suggestions will be incorporated in the next draft.

5. WG Paper

Loren Wagenaar submitted a revised copy of the WG position. (See Attachment)

6. Next Step

Since we have four unresolved negative ballots on voltage classes reduction, a recirculation of the ballot would be required on this issue as per the IEEE standard procedure. A copy of the negative comments along with all the correspondence will be included in the recirculation ballot.

Also, the ballot will include the revised draft with all the editorial and other changes. A summary of these changes along with the necessary documentation will be included in this package.

When draft four was balloted in the transformer committee, we had eighty percent affirmative votes. An attempt to resolve all the negative votes was not successful. Meanwhile the WG made significant changes and it was agreed to ballot draft six in the transformer committee. In the process of forming a pool, some of the members from the old pool were not included. It is not clear why this happened. This was discussed with Tom Prevost of Standards Subcommittee and Naeem Ahmad Staff Engineer at the IEEE Standards Board and was advised that the best thing at this time would be to proceed with the recirculation.

7. New Business

A comment to specify PD requirements at voltages higher than 1.5 L-G voltage was discussed. In order to include this requirement in this standard we need to change C57.19.00 which specifies no PD measurements at the 1 minute withstand level. Keith Ellis will take up this matter in his WG for the revision of PC57.19.00.

8. Adjournment

The meeting was adjourned at 4:19 in the afternoon after two sessions.

7.2.4.3 Task Force on Draw-Lead Bushings

Russ Nordman reported that his TF met on April 14, 1999 at 3:00 in the afternoon with 9 members and 11 guests present. One guest requested for membership to the TF. He reported the following:

1. Approval of last meeting minutes

The minutes were approved as written.

2. Dr. Jens Frost's Proposal for Hottest Spot calculations

Bushing manufactures were asked to report on their review of Dr. Jens Frost proposal on hottest spot temperature calculation method. Because of his absence, this discussion will be postponed until next meeting.

3. Test versus calculation information by Chungduck Ko

Data indicates that bushings 350-900KV BIL have consistent Watt loss of 1.2-1.3 Watts/Inch. Results may not exactly agree with all manufactures because of the many factors affecting thermal performance of bushings. This will be discussed in future meetings.

4. Proposal from Fred Elliott

A proposal for establishing a Bushing Thermal Rating, from Fred Elliott was presented. Ideas and issues were discussed. Bushing manufactures will be asked to review and respond in future meetings.

5. New business

P. Singh presented the temperature rise test data for different draw lead cables for 69 kV and 138 kV bushings. Based on these data, he made the following comments/proposals.

- a. Thermal dissipation of bushings may vary between bushing manufactures
- b. We recommend that application guide or the C57.19.00 Standard should ask the bushing manufactures to specify cable sizes for different current ratings
- c. We recommend that Draw-Lead Cable ratings be based on the following:
 - 80C Hot Spot Rise above ambient at rated current
 - 100C Hot Spot Rise as the maximum under overload conditions
 - 65C Rise for the top oil at maximum oil level
 - Not more than 0.031 inch (0.79mm) thermally uprated draw lead cable insulation per side

These will be evaluated by bushing manufactures for discussion in future meetings. It is hoped that this will lead to a standard basis for measuring hot spot temperatures and be used to compare thermal loading and sizing of draw leads.

6. Adjournment

The meeting was adjourned at 3:40 in the afternoon.

7.2.5 Report from Technical Advisor to IEC 36 A

No progress since the last meeting.

7.2.6 Old Business

7.2.6.1 Revision of C57.19.100

Fred Elliott reported the following results from the Survey.

- Eight surveys were returned out of the total 42 sent.
- So far, there is a general agreement with topics included in the survey.
- Additional topics suggested to date to include bushing storage practices and C2 measurements.
- It appears a new WG would be required to address these issues.
- Reaffirmation may be needed because of short time frame before the guide is due for action. (Y2K)

7.2.7 New Business

7.2.7.1 Technical papers

“An improved method of measuring C1 power Factor of Resistance-graded Bushings” By Daxiong Zeng at 1999 Winter Power Meeting, “Development of High current Draw Lead Transformer Bushings designed in accordance with IEEE Standards” By Keith Ellis at the 1999 T & D Conference, and “An Experimental Thermal Siphon Bushing” By Daxiong Zeng at the 1999 Summer Power Meeting.

7.2.7.2 Transformer/Bushing Test levels for PD Measurements

This subject was discussed at the C57.19.01 WG meeting and will be addressed in the WG for C57.19.00

7.2.8 Adjournment

The meeting was adjourned at 4:53 in the afternoon.

Minutes Submitted By,

Pritpal Singh, Secretary

PAPER BY WG ON PC57.19.01 (Attachment to the Bushings Subcommittee meeting minutes)

Introduction

IEEE Standard C57.19.01, Standard Performance Characteristics and Dimensions for Outdoor Apparatus Bushings, has undergone major changes. This paper outlines these changes and briefly describes the rationale leading to the development of the proposed standard.

Background

Utilities face a huge task when obtaining replacement bushings for the many different styles that have been supplied by the transformer manufacturers over the years. There are literally thousands of different bushings styles that have been used for the voltage and current ratings involved. Although a wide range of voltages and currents are involved, the number of styles has been compounded for many reasons. Some of the more important reasons are as follows:

- Special bushings have been designed for rather minor variations. There has been little effort to standardize, and bushings were custom designed to meet individual transformer designs.
- Bushings are applied on the basis of first cost only with practically no consideration given to replacement cost in the future. Therefore, a special bushing may be used to make a savings for one specific case which creates yet another style to be stocked or obtained for replacement purposes.
- Each bushing manufacturer created designs to satisfy specific objectives without consideration to the replacement burdens created.
- Individual utilities specified detailed differences, such as:
 - Plated (silver or tin) vs. non-plated terminals
 - Painted external metal parts
 - Different colors for external parts
 - Specific porcelain detailed specifications, e.g., color, creep distance, strike distance.
- System protection engineers sometimes requested so many current transformers that bushings with extra long ground sleeves had to be designed in order to mount the C.T.s.

The end result is that there is frequently a major problem when replacement is required. In order to provide reliable electrical energy, most utilities provide critical replacements such that the problem can be corrected as quickly as possible. Bushings are in this category, and many utilities stock hundreds of replacement bushings. Inventory costs for stocking a large number of replacement bushings is high. The cost for an old replacement is several times that for a new bushing in many cases because the sources of special porcelain are limited. There have been several cases in which a transformer was off line for weeks until a replacement could be obtained.

Bushings with dimensional interchangeability have been standardized for some 40 years. This portion of ANSI 76.1 was originally developed by the Joint Sections Committee on Outdoor Apparatus Bushings [1] in 1958 and standardized the dimensions on 36 different sizes, dependent on voltages through 230 kV, current ratings for draw leads and bottom connected application, and various current transformer pocket lengths. Although additions and refinements were made in subsequent versions of IEEE 24 and ANSI/IEEE C57.19.01, this set of standard dimensions has well served the basic needs of the industry.

Around the start of this decade, electric utilities were becoming increasingly concerned with reducing operating budgets, and one of the things on which they focused their attention was to reduce the number of spare bushings which must be stocked. The EEI Electrical System and Equipment Committee, in 1990, polled its representatives, and they expressed overwhelming support for additional standardization

of bushings. Over 90 % of 82 respondents indicated interest in standardization, even if it meant that some bushings would cost more and fewer current ratings and special features would be listed in the standard. Advantages of further standardization cited included reduced inventory cost, increased availability of bushings which fit the particular application, and reduced costs for searching out such bushings. The survey also revealed that several utilities had already started bushing standardization programs on their own.

Advantages cited for further standardization of bushings include the following:

- Reduced inventory costs.
- Increased availability of bushings which fit the particular situation. For example, it would be possible for manufacturers to stock a number of the standard bushings which could be shipped to the utility in a matter of hours should an emergency occur. For the higher cost high current and EHV designs, it would not be necessary for the utilities to stock bushings.
- The costs for searching out replacement bushings and lost availability of transformer capacity will be reduced.

Objections to this standardization program have centered around the following:

- **Transformer costs will be increased in some cases because the tank height may be higher.** These cost increases are not large and can be minimized by designs using higher bushing bosses and other methods.
- **Some transformer designers stated it could make their designs non-competitive.** If utilities specify the standard bushings in the order, all manufacturers are on the same basis.
- **The program will tend to stop development of new bushing technology.** New technology can be introduced within the dimensional limits of the standards as long as the bushing can be mounted on the same flange.

IEEE Working Group on the Revision of Standard Dimensions for Bushings

The Working Group on the Revision of C57.19.01 was therefore established within the IEEE Transformers Committee in 1991. Mr. Pritpal Singh volunteered to be the chair of the new working group, and the following two principal objectives were established as:

1. Select the bushing ratings for which standard dimensions should be established. The optimal set of ratings would be those which most closely matched the ratings to the applications.
2. Establish the dimensions of the bushings with standardized dimensions.

Revision of C57.19.01

The first objective proved to be the most controversial and the most difficult. It included the following goals:

1. Reduce the number of bushings with standardized dimensions for use on transformers at voltages below 230 kV. This goal was sensible since all standard bushing voltage ratings had several different current ratings and current transformer pocket lengths. Specifically, all of the bushings for use on 23 through 69 kV transformers had five different combinations of these parameters, and all the bushings for use on 115 through 230 kV transformers had three different current ratings.

2. Add bushings with standard dimensions for use on higher MVA transformers, i.e., for voltages from 345 through 765 kV, and currents through 3000 A. This was a logical progression to the work done during the 30 intervening years to make higher capability transformers more commonplace.
3. Consider elimination of bushings interchangeable between oil circuit breakers and transformers. This goal was in recognition that modern circuit breakers had changed to SF₆ technology during this time frame.

The working group has held a total of 14 sessions at the IEEE Transformer Committee meetings, some sessions lasting up to six hours. During these discussions, several aspects of the philosophy of the revised standard have been forged. The first aspect considers using one voltage class where two or more voltage classes were used previously. Table 1 compares the voltage classes and basic impulse insulation levels (BILs) in the existing and revised standard. The result is that seven voltage classes and BILs have replaced nineteen old voltage classes and BILs. These BILs are in accordance with the highest BIL for the same voltage class in ANSI/IEEE Std. C57.12.00.

Table 1
Comparison of Existing and Revised Voltage Classes and BILs for Bushings

Existing Voltage Class, kV		Revised Voltage Class, kV	
Insulation Class or Maximum System Voltage	BIL	Nominal System Voltage	BIL
15	110	34.5	200
25	150		
34.5	200		
46	250	69	350
69	350		
92TR	450	138	650
115	550		
138	650		
161	750	230	900
161TR	750		
196	900		
362	900	345	1,175
362	1,050		
362	1,175		
550	1,300	500	1,675
550	1,425		
550	1,550		
550	1,675		
800	1,800	765	2,050

Another aspect is that the current ratings on dimensionally standardized bushings have been combined and adjusted. Table 2 shows the current ratings of the dimensionally standardized bushings in C57.19.01-1991, and Table 3 shows the new ratings. Note that there are several changes.

First, bushings interchangeable between oil circuit breakers and transformers have been eliminated altogether. The working group investigated this feature and found that although customers still have an

interest in obtaining these bushings, there were no manufacturers of oil circuit breakers. Therefore, this feature is considered meaningless for new equipment, and it was eliminated.

Second, as is current practice by some bushing manufacturers, bushings for 400 A draw lead and 1200 A bottom connected applications for 34.5 and 69 kV bushings have been combined such that the same bushing can be used for either application. Referring to Tables 2 and 3, note that this combination reduces the twelve bushings in Table 2, shown in the shaded cells, to two in Table 3, also shaded.

Table 2
Current Ratings on Dimensionally Standardized Bushings in Previous Standard

Voltage kV	Current Rating, A								
	400	600	400/ 1200	1,200	1600\ 1200 ^a	1,600	2000\ 1600 ^a	2,000	2,500
15		X*		X				X	
25	X*		X ^{@*}	X					
34.5	X*		X ^{@*}	X					
46	X*		X ^{@*}	X					
69	X*		X ^{@*}	X					
115					X		X		X
138					X		X		X
161					X		X		X
196					X		X		X
345 ^b						X			
500						X			

- Notes: ^acircuit breaker/transformer interchangeable bushing with the corresponding current ratings
^bseparate standard bushings, with identical dimensions, for draw-lead, current rating undefined, and 1600 A bottom connected applications
 X indicates a dimensionally standardized bushing at this current and nominal system voltage
 X^{@*} indicates circuit breaker/transformer interchangeable, draw lead/bottom connected bushing
 X* indicates a draw lead bushing

Table 3
Current Ratings on Dimensionally Standardized Bushings

Nominal System Voltage, kV	Current Rating, A				
	400/1200	800/1200	2,000	3,000	5,000
34.5	X [@]		X	X	X
69	X [@]		X	X	
138		X*	X	X	
230		X*	X	X	
345		X*	X	X	
500		X*	X	X	
765		X*	X		

Notes: X indicates a dimensionally standardized bushing at this current and nominal system voltage
 X[@] indicates a draw lead/bottom connected bushing
 X* indicates a bushing convertible from draw lead to bottom end connected

Third, current ratings for all voltage classes have been expanded to include higher ratings. Standard ratings for all bushings are 2000 and 3000 A, with the exception of 765 kV, which only has 2000 A, an 800/1200 A draw lead/bottom connected rating for all ratings 138 kV and above, and 5000 A for 34.5 kV.

A third area of standardization concerns minimum creep distances. Two creep distances have been standardized for each voltage class given in the revised standard. These creep distances are taken directly from Clause 9.1.5 of IEEE Standard C57.19.100 [2] and correspond to light (28 mm/kV) and heavy (44 mm/kV) contamination levels. Table 4 compares the minimum creep distances in the previous standard to those proposed for the revised standard. Note that for voltages 138 kV and less, the light contamination level in the revised standard is four inches less than the previous standard, whereas the revised standard has distances equal to or greater than the previous standard for voltages 230 kV and above.

Table 4
Comparison of Minimum Creep Distances in Previous and Proposed Standard

Nominal System Voltage, kV	Minimum Creep Distance					
	Previous Standard		Revised Standard			
			Light Contamination		Heavy Contamination	
	in	cm	in	mm	in	mm
34.5	26	66	22	560	35	880
69	48	122	44	1,115	69	1,755
138	92	234	88	2,235	138	3,510
230	140	356	146	3,720	230	5,845
345	220	559	220	5,580	345	8,765
500	318	808	318	8,085	500	12,705
765	485	1,232	487	12,370	765	19,435

Obsolete Ratings

In anticipation that users will still need ratings made obsolete by the revised standard for replacement purposes, an annex has been added to the revised standard showing the electrical characteristics of such bushings. Bushing manufacturers have stated that they will continue to provide these bushings. However, many of these bushings may not be readily available and may take longer to obtain and be more expensive. This will become more true as time goes along as the older equipment fails and eventually goes out of existence.

References

7.0 Reports of Technical Subcommittees (cont'd)

- [1] ASA Std. C76.1/IEEE 21-1943, Requirements and Test Code for Outdoor Apparatus Bushings
- [2] IEEE Standard C57.19.100-1995, Guide for Application of Power Apparatus Bushings.

7.3 Dielectric Test Subcommittee - L.B. Wagenaar, Chair

The Dielectric Test Subcommittee (DTSC) met on April 14, 1999, at 10:00 a.m., in New Orleans, Louisiana, with 34 members and 18 guests present. Eight of the guests requested membership on the subcommittee. The minutes of the last meeting held in Guanajuato, Leon, Mexico were approved as written.

7.3.1 Chair's Remarks

After introductions of the attendees, the Chair reviewed some of the highlights of the Administrative Subcommittee Meeting held on April 12, 1999. (see Section 4.0 of Transformer Committee meeting minutes for details.)

- Next meeting will be held in Monterrey, Mexico, on November 7-10, 1999 at the Crown Plaza Hotel.
- The PAR form is now electronic. In order to fill it out, it first needs to be downloaded then completed. The title in the PAR must match that of the document. The PAR consists of two parts, a technical and a copyright section, both should be sent to Tom Prevost who is our Standards Coordinator.
- When documents are to be balloted, IEEE requires a draft of the document before they will issue the invitation list of the balloting poll. Please include e-mail address, phone and fax numbers on your cover letter.
- A new policy within the IEEE requires each committee to have a Technical Editor for review of technical papers. Bob Degeneff volunteered for this position.
- The Administrative Subcommittee discussed whether we should plan to have the Transformer Committee combined with the T&D conference in the future. The decision was not to do this.

7.3.2 Working Group Reports

7.3.2.1 Working Group on Partial Discharge Tests in Transformers

- **J.W. Harley, Chair**

14 members and 27 guests attended the meeting on April 13, 1999, New Orleans, Louisiana. Attendees introduced themselves. Minutes of the previous meeting November 9, 1998 in Leon, Mexico were approved.

Dr. Hemchandra Shertukde of Diagnostic Devices Inc. discussed the instrument and methods he has developed for the detection and location of partial discharges in transformers using acoustic

emission techniques. This included differentiating the PD signal from noises, identifying multiple sources and locating PD inside windings.

The letter ballot PAR c57.127 Trial Use Guide For the Detection of Acoustic Emissions from Partial Discharges in Oil-Immersed Power Transformers was briefly reviewed. This guide is in the process of being recirculated to the previous voters for their approval of the technical changes. This is in accordance with IEEE procedure.

- a. Four of the six negative ballots have been resolved.
- b. One of the two negative voters believes the guide should not be issued until all of the changes in the next revision are included. This revision is the "Location" guide now being drafted.
- c. The changes requested by the other negative voter have been incorporated in the Guide, but final resolution of his ballot was not determined in time to be included with the recirculation ballot.

The organization and status of the next document being written by the Working Group, Guide for the Location of Acoustic Emissions from Partial Discharges in Oil Immersed Power Transformers and Reactors, were discussed. The path we are pursuing in the Working Group is to ballot the "Detection" guide and then add the "Location" guide to it instead of having two guides so closely related.

Fall 1999 meeting planning: Raymond Lortie of Hydro Quebec will discuss his experience using acoustic emission technique during transformer impulse testing. Raymond has proposed a section for the Location Guide.

7.3.2.2 Working Group on Low Frequency Tests – Mark Perkins, Chair

This working group did not meet.

7.3.2.3 Working Group on Revision of Transient Dielectric Tests - Bertrand Poulin, Chair

This working group did not meet.

7.3.2.4 Task Force on Liquid-Filled Transformers Dielectric Test Tables **- Phil Hopkinson, Chair**

The Task Force met on April 13, 1999 with 28 people present. This was the first meeting of this New Task Force to look at the Dielectric Test Tables for Liquid-Filled Transformers, C57.12.00. In the session the following was covered:

Objectives – Mission and Scope

- Clean-up inconsistencies
- Harmonize with IEC 76-3
- Provide reference considerations
- Simplify tables

Background Information Reviewed – References

- C57.12.00 Tables 3-8
- IEC 76-3
- Puri/Hopkinson Proposal #1 from 11/98
- C57.12.01 – Dry type transformers
- Blume Reference: Voltage versus Frequency 1937 Test Tables
- George Iliff documents
- C62.22 – On Arrestor Standards

ANSI C57.12.00/12.01/IEC 76-3 Dielectric Test Tables:

- Document review (see above)
- Conclusion: Low Frequency Test inconsistently applied

- Correct philosophy?
- Changes needed?

Changes Needed:

1. A table to tie low frequency tests to system voltage.
2. A table to tie BIL to system voltage
3. A table to address long duration tests
4. A table to tie other high frequency tests to BIL
5. A table to address neutral insulation

A review of the proposed table formats for each was conducted.

The question was asked of the Subcommittee, “Who would like to see a separate table put together for delta connected and ungrounded wye transformers?” Most present felt that this would be a good idea. This will be recommended to the Task Force.

A review of the chopped wave and switching surge levels was done with an explanation of how they are currently derived. The question was asked concerning switching surge levels, “Should we have a switching surge applied that covers the reality of a vacuum breaker or SF6 breaker closing in on a transformer?” The feeling of the subcommittee was that it should.

Table 7 of C57.12.00 for minimum insulation levels at a neutral was reviewed.

The dielectric work of Blume conducted in the 1930’s was reviewed.

The graphical relationships between various test levels and system operation voltage for both IEC and IEEE were reviewed.

Next actions of the Task Force:

1. Send reference materials to all 28 attendees at the Task Force meeting.

2. Phil Hopkinson will put together a draft revision of the tables for next meeting in Monterrey, Mexico.

A copy of Phil Hopkinson's presentation is available from Mike Franchek, upon request. Copies will be sent to the members of the DTSC.

7.3.3 Status Reports

7.3.3.1 C57.12.90, Standard Test Code for Liquid-Immersed Distribution, Power and Regulating Transformers – Subhash Tuli

The latest draft of C57.12.90 was re-circulated as draft 5.1. Needs to be at Rev. Committee by May 7, 1999. The intention is to submit it with all corrections and editorial changes before the end of April 1999. The next revision of C57.12.90 is due the end of the year 2000. There is already a proposal from Mark Perkins related to Induced Tests that has already been approved through the Subcommittee approval process. Will incorporate all changes and send out the first ballot right after the fall 1999 IEEE meeting.

7.3.4 Liaison Reports

7.3.4.1 Insulation Coordination – John Crouse

It was thought that this work was finished, but there were some discussions concerning references. The problem with the references were resolved and the document was re-circulated for a review of those changes.

7.3.4.2 Surge Protection Devices – Bob Degeneff

It was reported at the last meeting that Loren Wagenaar and Bob Degeneff had sent a letter to the Surge Protection Committee requesting that they replace the discontinuous volt-time curve with a smooth curve. The main point of conflict is that the SPD curve shows an abrupt change starting at 8 μ sec., whereas the TC curve is continuous at this point. The Surge Protection Committee will take this request under advisement at their May 1999 meeting. Their predisposition is to adopt the smooth curve.

7.3.4.3 IEC TC14/WG24 – Loren Wagenaar

One meeting was attended since the last DTSC meeting in Milan, Italy. Several issues were discussed mostly regarding the Digital Recording Instruments. The last meeting resolved several items, to the extent that the document will be presented to the Technical Committee 14 as a Committee Draft. (CD).

Some of the items that were resolved:

1. Raw data should be presented, rather than the results of mathematical algorithms to curve fit the measured data.
2. The sampling frequency when determining wave shapes is 60 MHz minimum and preferably 100 MHz.
3. The sampling frequency when you record the applied voltage and current waves is 10 to 20 MHz.
4. Also included is a statement that errors have exceeded 10% between measurements that have been made with digital recorders and actual voltage amplitude. There is a recommendation in the CD to use a peak voltage meter to verify the voltage magnitude measured by the digital recorder.
5. There are several other guidelines for interpretation of voltage and current waveforms.

A couple of other things were added to the CD from IEEE C57.98. A lot of Section 2.4 has been added. Section 2.4 of C57.98 has to do with testing low impedance windings and an explanation of what happens when a resistor is applied. Was not able to get Section 2.2 in, it was felt that it was too much like textbook information.

Was not able to get Section 2.2 in, it was felt that it was too much like textbook information.

The second thing that was added was information on what is to be included in the Impulse Testing Report.

Also included was information on the transfer function analysis.

The document will be issued as a CD, the DTSC Chair will get a copy and will send copies to members who request them. There are something in this document that should be added to future revisions of C57.98.

(See attached trip report from L.B. Wagenaar)

7.3.4.4 CIGRE/IEC/PSIM Work on Waveforms and Test Data Generator Program – Bertrande Poulin/Ernest Hanique (reported by L.B. Wagenaar)

This meeting was held on April 12, with approximately 20 people in attendance. The test generator data program was reviewed. This is a program tool for witnesses who go to a factory to observe tests. This data is on a disc, which is fed into the test floors computers to see how well it duplicates the information.

7.3.5.5 Old Business

7.3.5.1 IEEE-4 Art Molden/Bertrand Poulin

A meeting was attended earlier this year, there is a document available that lists all the differences, as revised in 1995 and an earlier revision of, IEEE-4. The chairman has a copy of this document, which was sent to B. Poulin. If anyone would like a copy of the document listing of these differences, please ask L. Wagenaar or Art Molden.

7.3.6 New Business

7.3.6.1 Phase – Ground Clearances

A request has been made to add minimum phase-ground clearances to Table 11 of C57.12.00. The subcommittee discussed the pros and cons of doing such.

Introduction: A Task Force added the phase-phase clearances and established Table 11 of C57.12.00, at that point phase-ground clearances were not included. The Task Force tried to use the criteria that had already been established by NEMA TR-1. NEMA at the time was not very interested in updating their table or even continuing it. There was some discussion whether IEEE should deal with dimensions and it was determined that they should. This decision was reached because these clearances were minimum physical dimensions based on physical phenom and not a standardization of dimensions.

The Chair opened the discussion with the following questions:

“Should the Dielectric Test Subcommittee add phase-ground dimensions to Table 11?” “Or should we keep them out of Table 11?”

The major points of that discussion are included below:

Are phase-ground clearances included in NEMA TR-1? They were included in TR-1 at the time IEEE C57.12.00 Table 11 was established with phase-phase clearances.

Disconnect Switch Standards do include minimum strike clearances. The National Electric Safety Code has some minimum clearances for substations but these may not apply to equipment.

C57.19.01 (Bushing Standard) includes creepage distance, but if there is strike clearances information being added to the bushing standard the transformer standard may want to address the coordination between the bushing and the equipment. Table 1 of C57.19.01 currently has creepage distance but not strike distance.

Is NEMA active on TR-1? Yes, it is active and TR-1 was updated about one year ago.

Maybe we could add phase-ground distances to the first ballot of C57.12.00 and see if there are any negatives to Table 11, with the phase-ground clearances included.

We do not want to include strike distances in the table that are greater than manufacturers have been using for years. This would require them to increase these distances.

Do you need a larger strike then the distance across the bushing? Yes, because along the bushing the field is graded. Other strike distances may need to be larger because they are not graded. This maybe one of the stumbling points, the strike will depend on the actual field configuration and this is a design issue and should not be placed in a standard.

There was a lengthy discussion if NEMA TR-1 or other standards listing minimum strike distances. It was decided that this subject needed to be researched before the next meeting. This would include a review of NEMA TR-1 and SG4 and/or SG6. The chair requested volunteers for this work.

- Subhash Tuli - will research NEMA TR-1 and see what it does include
- Bill Chiu - will assist in the research for phase-ground clearances

There being no additional New Business, the meeting was adjourned after one session.

7.4 Distribution Transformers – K.S. Hanus, Chair

7.4.1 Chair's Remarks & Announcements

The meeting convened at 10:15 AM in Room MCC 209 with the introduction of the members and guests and signing of the attendance roster. There were 21 members and 15 guests in attendance.

Minutes of the meeting in Leon, Mexico were approved with no changes.

The chairman covered key points of the ADCOM meeting from the prior Monday morning. See Clause 4.0 for details.

New Working Group Co-Chair:

Sam Michael - C57.12.34 Three Phase Padmount Transformers

The administrative SC discussed concern over the location of C57.12.36, whether it should be in the Distribution or Power Transformers SC. After discussion it was decided it needed to be in the Distribution SC.

Another item of discussion was the transfer of the four coating integrity standards from the joint C37/57 WG to the PES Transformers committee, Distribution SC. It was agreed to take on these documents and make the proposal at the C57 Main meeting.

Naeem Ahmad stated he would not go out for an invitation to ballot unless he has a draft in his hands from this point on. Noelle Hemenick from IEEE editorial staff attended the meeting and suggested WG chairs submit drafts to editorial staff as soon as possible. This should be done through Naeem.

Paul Ohrehek brought up the issue of English to Metric conversion. He stated there are not definite rules on all conversions. After some discussion it was agreed he and I would coordinate how we are going to convert certain dimensions so the two subcommittees are consistent.

7.4.2 Working Group Reports

7.4.2.1 C57.15 Voltage Regulators

The working group met with 8 members and 1 guests.

The WG met and discussed the results of the recent ballot. The ballot resulted in 87 comments, which were resolved including the three negative votes. Minor changes were made to the document which resulted in the three negatives being withdrawn. A re-circulation is out as a result of these changes as shown in draft 9.

7.4.2.2 C57.12.20 Polemount Transformers

The working group convened with 18 members and 17 guests.

First items of discussion included a review of old business. The first item of old business was the simplification of the grouping of the 1-phase and 3-phase figures. The next draft will include previously agreed upon changes.

Another issue was the removal of the "C" bracket and replacing it with a "Beefy B" hanger. As a result the annex will need revision and Ken Hanus will do this so it can be included in the next draft.

The other item of discussion was the inclusion of lightning arrester mounting provisions. Alan Wilks presented the results of a recent survey on this issue. In summary it was concluded existing dimensions are close and a standard can be developed. Alan & Glenn will put together a proposal and incorporate it into the next draft. The WG voted to put this item in the document.

The WG also discussed the issue of cover dielectric to provide wildlife protection. It was decided further research was needed.

The meeting adjourned with promise of above changes to be incorporated into a new draft and mailed out before the next meeting.

7.4.2.3 C57.12.23 Single Phase Underground Transformers

The Working group met with 16 in attendance with 10 indicating interest in becoming members.

The chair reported on the status of the re-affirmation. There had been 56 ballots returned with 3 abstentions and the ballot still needed 4 more ballots to meet the minimum return.

The working group proceeded with reviewing the existing document for suggested changes. The following changes were agreed upon:

- Change HV & LV descriptions to include phase to phase connected HV units and other low voltage ratings such as 120/240, 240/480 & 480 volt.
- Add high voltage ratings such as 12,000, 17,200, & 20,780 volt. Also remove 15.2 Kv interface option for 16,340 volt units.
- Table 2 - add new table 2 to incorporate new low voltage ratings and associated BIL's and terminal requirements.
- Paragraph 5.2 - Dielectric Tests - Use wording from single phase padmount standard C57.12.25.

The WG will continue reviewing the document for changes at the next meeting.

7.4.2.4 C57.12.25 Single Phase Deadfront Padmount Transformers

The working group met with 30 members and guests.

The first item of business was a review of the status of the current ballot. Of the 93 eligible people in the balloting group 54 have been returned as of 4/8/98 with 16 more votes needed for the minimum return. Of the 54 votes there are 4 negatives.

The rest of the meeting was used to address comments from the negative ballots and other comments from affirmative ballots. Many of the comments were of an editorial nature and are as follows:

- Figure 1(b) - agreed 3" dimension should be from the centerlines of the low voltage bushing instead of from the spade surfaces.
- Figure 1(a) agreed the "C" dimension should have been 3.25".
- Note 4, Table 1: Comment from negative ballot asked this note be removed. After much discussion it was decided to use wording from C57.12.34 which states user should do adequate surge and grounding studies before using 125 kV BIL units at 34,500 volts.
- Figure 2b - It appears the parking stand direction is not correct. This will be investigated and addressed in the next draft.
- Paragraph 6.6.1 - Metric pressures should be in kPAS instead of Kg/m².
- Paragraph 6.6.3 - Change 7/16" boss depth to 11.1 mm.

It was agreed the changes will be made and more than likely a draft will be re-circulated as a result of the negative comments to resolve the negatives.

7.4.2.5 C57.12.33 Loss Evaluation Guide

Currently the document is to be sent out for ballot. Most of the meeting centered around an update on activities of the DOE relating to legislation on efficiency of transformers. A representative from DOE was present and stated the DOE still is in the process of determining the testing methods before going into what the efficiency requirements will be.

John Gauthier briefed the WG on the status of NEMA TP-3, which will cover labeling requirements.

7.4.2.6 C57.12.34 Three Phase Padmount Transformers

The working group met with 15 members and 8 guests.

Draft 3 had recently been sent out and the WG discussed comments on it. The following changes were discussed and agreed upon:

- For 1500 Kva units with 480 volt secondaries, the secondary spade should have 6 holes instead 10 as agreed upon in the last meeting.
- Figure 13, note 3 - A motion was made to change the word "to" to "should" and it failed, a motion was made to change "to" to "shall" and it passed.
- Paragraph 6.2 - Change wording on dielectric testing to match wording in C57.12.25.

- Paragraph 7.5.2 - Correct conversions on pressures and forces from English to metric values.
- Move information contained in the Introduction into a scope to bring the document into alignment with IEEE standards..
- 7.4.2 - A motion was made to eliminate the reference to a "C" nameplate and use the "B" nameplate.
- References - Remove reference to C57.12.20.
- Remove any references to C57.12.91 and change the title listed on references to C57.12.90 to the correct title.
- Paragraph 7.2.4 - Change "connector" to "bushing".
- Note 4 of Table 1 - put a superscript on voltages 2400, 4160, 4800 & 7200 volts referring to note 4 because these units have primary currents at or over 200 amps for the larger kVA sizes and 200 amp interfaces may not be appropriate.

7.4.2.7 C57.12.36 Distribution Substation Transformers

The working group met with 13 members and 9 guests

The first item of discussion was the status of the PAR. One standards board member still has questions about the PAR and Leon will make phone contact to resolve any questions. It is felt the concern can be resolved and the PAR approved at the June meeting.

There was still some debate as to the proper subcommittee in which this WG belongs. It was decided at the ADCOM meeting the WG still belongs in the distribution SC.

John Rossetti provided a brief overview of several inactive NEMA documents (NEMA 201, 210 & TR11) and other ANSI documents. These documents will provide a starting place for developing a draft. It was decided to produce a draft before the next meeting. John Rosettii volunteered to do the scope, Ken Hanus volunteered to do the ratings section and Dave Aho volunteered to do the "Construction" section, of which he will sub-divide and make further assignments.

There was also discussion about including in the document such things as defining weight limits, size limitations, impedance limits. It was decided these type of restrictions should be avoided because of the many existing specifications and designs already in place. The group also entertained the idea of limiting the document to mineral oil insulated only but it was decided not to make any such limitations.

7.4.2.8 Coating Integrity Documents (.28, .29, .31 & .32)

.28 Padmount Enclosures- Document is out for re-ballot due to one negative. The negative relates to the dimension of the probe tip, either a 0.100" or 0.065" dimension.

.29 Padmount Enclosures-Coastal Environments – Same report as for .28.

.31 Polemount – Nothing to report at this time.

.32 Submersibles – The document has been updated and is currently out for working group ballot.

7.4.5 Working group assignments

The current assignments are as follows:

- .36** Leon Plaster/John Rossetti
- .20** Glenn Andersen / Alan Wilks
- .21** Ali Ghafourian
- .23** Al Traut/Roger Lee
- .25** John Lazar / Ali Ghafourian
- P1388** David Rolling/Jerry Smith
- .35** Ed Smith
- .33** Tom Pekarek/Don Duckett
- .34** Sam Michael/Ron Stahara
- 57.15** Tom Diamantis/Craig Colopy

The meeting adjourned at 11:15 am.

7.5 Dry-Type Transformers - W. F. Patterson, Chair

7.5.1 Chair Remarks and Announcements

The Dry Type Transformer Subcommittee met at 8:30 AM on April 15, 1999 with 19 members and 8 guests present. Introductions were made and the attendance roster was circulated. Minutes from the November 10, 1998 meeting were reviewed and approved. Announcements were held until after the working group reports were given.

7.5.1.1 Working Group Reports

The next order of business was the presentation of the reports of the various working groups. See the following sections for the individual reports:

7.5.2.1 WG Dry Type Specialty Transformers	W. Simpson
7.5.2.2 WG Thermal Evaluation C57.12.56/60 and Flammability	R. Provost
7.5.2.3 Dry Type General Requirements	A. Jonnatti
7.5.2.4 TF Dry Type Smoothing Reactors IEEE 1277	R. Dudley
7.5.2.5 WG Dry Type Loading Guide C57.96	M. Haas
7.5.2.6 WG Dry Type Test Code C57.12.91	D. Barnard
7.5.2.7 WG Dry Type Hot Spot Differentials	P. Payne

7.5.1.2 Announcements and New Business

After the working group reports, the following announcements were made by the Chair:

The Chair polled the working group chairs regarding the number of meeting rooms and sessions required for the Monterrey meeting. WG chairman Dudley requested two sessions for the meeting. WG Chair Provost will not have a meeting. The remaining WG chairs requested one session. The SC Chair will forward this information to the main committee.

The chair proceeded to discuss issues from the Administrative Subcommittee meeting. The details of this meeting can be found in the main committee minutes.

WG Chairs were reminded that the draft document title must be the same as appears on the PAR; otherwise, the IEEE will return the document. The cover letter accompanying the draft should include the WG Chair's telephone number, fax number, and email address if available.

The chair once again reiterated the need to return ballots. It was the consensus of the WG chairs that individuals who fail to return ballots will be viewed as non-participating and will be removed from the membership roster of the working group.

Being no further new business, the meeting was adjourned at 9:20 AM.

7.5.2 Working Group Reports

7.5.2.1 Working Group on WG Dry Type Specialty Transformers

Chair: Mr. W. R. Simpson Jr.

There was no meeting of this working group at the meeting. WG Chairman Simpson gave the following report to the subcommittee:

The progress on the submission of IEEE P259 to REVCOM has been slow; the IEEE has not balloted all of the necessary coordinating committees. When editorial changes were required, the document had to be completely rewritten to comply with the new computer format. The document has been resubmitted with all paperwork and should be addressed at the next REVCOM meeting.

IEC/TC 98 Liaison Report: IEC Std. 61858 “Thermal Evaluation of Modifications to an Established Electrical Insulation System (EIS)” has been approved. IEC Publication 85 “Thermal Evaluation and Classification of Insulation Systems” has been approved as a new work item. A test procedure for the thermal evaluation of encapsulated coils has been proposed as a new work item.

7.5.2.2 Working Group on Dry-Type Thermal Evaluation - C57.12.56/60, and Flammability

Chair: Mr. Richard Provost

There was no meeting of this working group at the meeting. SC Secretary Johnson read the following letter for WG Chairman Provost:

“The working group has been charged with two main documents, C57.12.56 and C57.12.60. During 1998, C57.12.60 was published and C57.12.56 was re-affirmed. I would like to thank the working group members for their efforts in finally completing these documents. This means that both documents are not due for review for another five years. We acknowledged in the last working group meeting that the next task for the group would be in three areas – (1) consider a new end point test, such as partial discharge measurement, (2) consider new model designs based on industry feedback on the current procedure, (3) consider combining the two documents into one due to the similarities.”

“Since the scope of this work will most likely require a new PAR, I would like to suggest that the working group not convene for another two years. This will still allow us three years to work on the issues noted and give the industry time to gain experience with the existing procedures. The only other responsibility for the working group is the coverage of flammability issues. There has been reduced interest in this subject for several years and I don’t believe a two year break will cause any problems. If any major industry issues arise, we can always re-convene the working group.”

“Therefore, if the working group and the dry type subcommittee agree, I propose that we submit a new PAR application during the Spring of 2001, and re-convene the working group at that time. If the subcommittee rejects this proposal, I am committed to continue the working group tasks as required.”

A discussion of Chairman Provost’s proposal ensued, there were no objections to his proposal and the SC Chair will inform Mr. Provost of the result.

7.5.2.3 Working Group on Dry-Type General Requirements – C57.12.01

Chair: Mr. Anthony Jonnatti

Secretary: Mr. John Sullivan

Chairman Jonnatti opened the meeting at 4:00 PM April 14 1999. There were 17 members and 1 guest present. Introductions were made and the Leon minutes were approved.

The published standard has been printed but IEEE has not yet mailed it to the working group members. The format was changed to one column instead of two per page to comply with the new computer format.

New PAR for C57.12.01: The new PAR was approved after an initial rejection.

The revision process was discussed. Jewan Puri suggested we revise sections and paragraphs at a time.

The proposed revisions suggested by Chairman Jonnatti were discussed with several modifications recommended by working group members.

To assist in reviewing proposed revisions, Max Cambre requested the use of vertical bars beside the existing text to indicate changes in the circulated document.

There was no new business.

The meeting was adjourned at 5:15 PM.

7.5.2.4 Working Group on Dry-Type Reactors - C57.16

Chair: Mr. Richard Dudley

On April 13, '99 the Dry Type Reactor W.G. met from 1:00 p.m. – 2:15 p.m. and from 2:30 p.m. – 3:45 p.m. in meeting room MCC 211 of the Ernest N. Morial Convention Centre in New Orleans, Louisiana. There were 8 members and 5 guests present; 4 of the guests were present for only a small portion of the meeting. The following are the highlights.

1. The attendance list was circulated.
2. The minutes of the Leon meeting were approved.
3. Draft #8 of “General Requirements and Test Code for Dry Type and Oil Immersed Smoothing Reactors for D.C. Power Transmission” was discussed. Draft #8 had been submitted for ballot of the Dry Type Reactor W.G. and HVDC Converter Transformers and Smoothing Reactor S.C.; 36 ballots were sent out – 20 have been returned to date (12 A, 5 A with C and 3 N). This was a very poor return. The official due date for ballots was April 7, '99. The Chairman has extended the final return date to April 19, '99.

The focus of the W.G. meeting was a discussion of “negative” ballots; substantive

comments were reviewed only. Highlights are as follows.

(i) Einar Purra's A with C ballot was discussed as follows

- Clause 12.9 "Capacitor Discharge Test" was reviewed. Einar Purra submitted that more guidance was required re the performance of this test; W.G. members agreed. The test is essentially a switching surge voltage test but because of the required energy levels a high voltage, high power capacitor bank or banks are employed as the source.
- Clause 9.2.1.3 will specify a standard tolerance on inductance; $\pm 7\%$ to be consistent with IEC 289.
- In Clause 11.4.1.2 the frequency of the supply for the AC Power Test will be specified as being at power frequency (60 Hz or 50 Hz) up to 660 Hz.
- Clause 12.4.1; the temperature rise test will not be divided into 2 parts as is the case for converter transformers (oil rise and winding rise).

(i) The substantive comments associated with Fred Elliott's "negative" ballot were discussed.

- The DC "Pollution Test on Bushings" will be eliminated from Table 5a as this test is covered in the DC bushing standard; C57.19.03-1996. Clause 12.5.9 will be modified accordingly.
- Add to Clause 7.3.1, "Bushings for use on oil immersed smoothing reactors for HVDC application shall comply with ANSI / IEEE C57.19.03-1996".
- Clause 12.4.2.5 is applicable to dry type smoothing reactors only and will be moved to Section 12.4.4 as a separate clause. (Clause 12.4.4.2).
- References to future work within the IEEE Transformers Committee in Clause 12.5.8.2 will be deleted.

- The appropriate switching surge wave shape for dry type SMRs is 250 x 2500 microseconds. Clause 12.6.4.1 will be modified and will only be applicable to dry type smoothing reactors.
- (i) The substantive comments of James Cross's "approved with comments" ballot were discussed.
- Clause 5.2.2.1 was modified to better define dielectric testing considerations for smoothing reactors installed at altitudes between 1000 m. and 3000 m. Considerations include adjustment of dielectric margins in the specification (test levels as specified), support insulators (test at appropriate higher voltage), winding of dry type smoothing reactors (test at appropriate higher voltage), bushings (test at appropriate higher voltage) and windings of oil immersed SMRs (test at nominal voltage levels).
 - Clause 7.1.1. "Tank pressure, under rated conditions, for smoothing reactors shall not exceed two atmospheres (203 kPa) absolute pressure....."
 - Clause 10.1.1.3Operating temperatures should be consistent with the capabilities of the oil/paper insulation system; typically 100°C under normal operating conditions. For"

The meeting adjourned at 3:45 p.m.

7.5.2.5 Working Group on Dry-Type Loading Guide - C57.96

Chair: Mr. Michael Haas

The Working Group met in Room 208 of the Ernest Morial Convention Center in New Orleans, LA at 1:00 PM on April 14, 1999 with 9 members and 5 guests present.

After the introductions, the minutes of the Leon Mexico meeting were approved.

The chairman reported that the re-circulation ballots were received with 100% affirmative votes. There were several editorial comments received with the ballot that the chairman reported would

be incorporated into Draft 5. Draft 5 will then be submitted to REVCOM for approval by May 7th, which is the deadline for submissions to IEEE for the June REVCOM meeting.

Being no further business, the meeting was adjourned.

7.5.2.6 Working Group on Dry-Type Test Code - C57.12.91

Chair: Mr. Dave Barnard

Secretary: Mr. Tim Lewis

Acting Secretary: Mr. Gene Morehart

The working group met at 2:30 PM, April 14, 1999 at the E.N.MORIAL Convention Center, New Orleans, LA. There were 15 members and 7 guests. One of the guests requested membership.

Introductions were made and the minutes of the Leon, Mexico meeting were approved as written.

OLD BUSINESS:

1. The group was reminded of the need to incorporate test procedures for making hottest spot measurements into the standard once the working group on that subject has completed its work. (Later, at the Dry Type Transformer Subcommittee meeting, Len Pierce pointed out that the hottest spot working group is preparing a guide and that it would stand on its own and not require incorporation into C57.12.91.)
2. Don Kline presented a comparison between IEEE C57.12.91 and NEMA TP2. Major differences follow:
 - a. NEMA TP2 load losses are reported at 50% load for liquid filled and high voltage dry transformers. General Purpose dry transformer load losses are reported at 35% load. C57.12.91 requires load losses reported at 100% load current.
 - b. Total loss tolerance for NEMA TP2 is 8% vs. 6% for C57.12.91.
 - c. NEMA refers to ISO 9000 requirements for calibration of test equipment. There is no such reference in C57.12.91.
 - d. NEMA TP2 includes a section on phase angle correction while C57.12.91 has no such correction.
 - e. NEMA TP2 states that no load losses are measured at 20 degrees Celsius +or - 10 degrees Celsius. This change is planned for the next revision of C57.12.91. A temperature correction for those situations where the core temperature is outside these limits will also be incorporated.

- f. A test-sampling plan is included in NEMA TP2 while there is no such plan in C57.12.91.

3. Wording to the effect that load loss measurements shall be made at the customer's connection will be added to the next revision of C57.12.91. Chuck Johnson suggested this at the Leon, Mexico meeting.

NEW BUSINESS:

The Chairman stated plans to ballot the Working group/Sub committee before the next meeting.

There being no further new business the meeting adjourned at 3:15 PM.

7.5.2.7 Working Group on Dry-Type Hot Spot Differentials

Chair: Ms. Paulette Payne

There was no meeting of this working group at the meeting. WG Chair Payne gave the following report to the subcommittee:

The invitation to ballot on the next draft was to close on April 16, 1999. The next meeting of the working group will be in Monterrey, Mexico.

7.6 HVDC Converter Transformers & Smoothing Reactors S. C. - Richard Dudley, Chair

The HVDC Converter Transformers and Smoothing Reactors S.C. met in meeting room MC 211 from 4:00 p.m. – 5:45 p.m. on April 13, '99 and in meeting room MC 213 from 10 a.m. – 1:00 p.m. on April 13, '99 (extra working meeting). Meetings were in the Ernest N. Morial Convention Centre in New Orleans. There were 7 members present for both meetings and 1 guest attended the April 13 meeting. The following were the highlights.

1. The minutes of the Leon meeting were approved.
2. The attendance list was circulated.
3. The Chairman reviewed the status of the converter transformer standard. Negative ballots have been resolved and Draft 10c has been submitted to IEEE for re-circulation ballot.
4. A review of “approved with comments” ballots and “negative” ballots associated with balloting of the Dry Type Reactor W.G. and the HVDC Converter Transformers and SMR S.C. was continued from the previous meeting of the Dry Type Reactor W.G. The following are the highlights; focus was on substantive comments.
 - (i) The substantive comments associated with Lars-Erik Juhlin's “negative” ballot were discussed.
 - Clause 12.8; The second paragraph will be deleted as the information is related more to transient voltage stress and not short circuit stress which is the subject of this clause.
 - Section A.1 of ANNEX A will be significantly condensed; basic information and information not readily found in recognized technical reference sources will only be included. Appropriate textbooks and papers will be referenced. Sections A2, A3 and A4 will be essentially kept as is.
 - (ii) The substantive comments associated with Pierre Riffon's “negative” ballot were discussed. The following are the key points.
 - PR & LEJ will provide realistic percentage figures for core losses in oil immersed SMRs to be included in point (6) of Clause 9.1.1.
 - In Clause 12.4.1 the paragraph dealing with stray losses outside the reactor winding and their negligible affect on temperature rise of both dry type and oil immersed SMRs will be deleted as it is strictly tutorial.
 - The methodology described in Section 12.4.3.3 is not applicable to SMRs; it is applicable to converter transformers only. Clauses 12.4.3.3.1 and 12.4.3.3.2 will be deleted and replaced with:
12.4.3.3 Methodology. The average winding temperature rise over the ambient temperature is the temperature of the winding corrected to the instant of shutdown minus the ambient temperature.

- Clause 12.5.1.2.1 will be modified to indicate that all ancillary equipment must be installed for the design and routine dielectric tests on the first unit of an order. Ancillary equipment that does not affect the internal dielectric stresses does not have to be installed for the routine dielectric tests on the remaining units of an order.
 - Clause 12.5.4.2 will be modified to clarify that for oil immersed SMRs the lightning impulse test is a test applied across the winding only; one end is grounded. The voltage level for the test is the highest of the BIL level specified across the winding or terminal to ground.
 - Clause 12.5.6.4; partial discharge levels are to be documented for the full duration of the polarity reversal test.
 - Clause 12.5.7.2; the a.c. power test is to be carried out at a voltage level equal to 2.0 times the maximum specified continuous harmonic voltage drop; the test duration is 5 minutes. The test voltage and duration are the same for oil immersed and dry type SMRs. Therefore the existing Clause 12.11 will be modified accordingly but will be moved to 12.6. The primary method of failure detection is Q factor measurement.
 - Clause 12.6.2; dry type are core smoothing reactors which utilize an external insulation system design of sufficient margin will ensure that the probabilistic nature of the withstand level of the external insulation system will not be a significant factor.
 - Clause 12.6.7.1; the RIV test should be performed with connectors and bus bar configuration similar to the installed condition. The RIV test is an OTHER test; Table 5b will be modified accordingly.
- (iii) The substantive comments associated with Klaus Papp's approved with comments" ballot were discussed.
- LEJ and KP will provide a schematic of "back to back" configurations for Fig. 1c.
 - KP provided more accurate definitions of routine, design and other tests; 8.2.2, 8.2.3 and 8.2.4.
 - Various fault type operating conditions will be described in ANNEX A. LEJ will provide input.
- Clause 12.4.3.2; the correction for ambient temperatures outside the range 10°C to 40°C will be better clarified. LEJ or Einar Purra will provide input.

The second half of the meeting adjourned at 1:00 p.m., April 14, '99. The Chairman will prepare Draft 9 for official IEEE ballot by May 31, '99.

7.7 Instrument Transformers - J. E. Smith, Chair

7.7.1 Chair's remarks & Announcements:

The subcommittee met on April 15, 1999, with 7 members and 4 guests present

- A report of the Administrative SC meeting was presented.
- The minutes of the November 10, 1998, meeting was approved.

7.7.2 Working Group Reports:

7.7.2.1 WG PC57.13.5 - Working Group on Test Requirements for High Voltage Instrument Transformers 115 kV and above – Joe Ma and Pierre Riffon

The Working group had two meeting sessions. Both were co-chaired by Pierre Riffon of Hydro Quebec.

(1) Session 1 4:00 PM – 5.30 PM, April 14, 1999

Five members and six guests attended the meeting.

Minutes of last meeting at Leon, Mexico were approved without any revision.

Draft 9 of "Trial Use Guide of Requirements for Instrument Transformers rated 115 kV system Voltage and Above" was presented with revisions as per last meeting at Leon, Mexico. The Flowcharts for both routine tests and type tests have also been re-arranged per last meeting and updated with the clause numbers. Section on background is included to help readers to understand the purpose of the document. Concept of composite error and its measurement for CT, suggested by a few members, was added in the document. Such concept will be proposed to the working group dealing with the revision of the standard. Sections on type and special test items have been included in the draft. The terminal designation in the figure for composite error should be changed to be consistent with the Standard designation. Also the composite error is to be defined in reference with the C-rating of the relaying class. The short-time thermal and mechanical rating calculations should be, generally, made with 1 s as the minimum time duration as the projected current for time below 1 s will exceed the first peak value of the asymmetrical current for the mechanical test.

The issues about the time limit of validity of type test report, insulation tests on equipment designed for high altitude installation, and extension of CT type test data to other CT with different configuration or similar ratings were raised. These issues will be addressed in the document.

Members were requested to reviewed draft 9 with their comments sent to the Chair by July 15, 1999 and Draft 10 will be sent via Email for internal survey by September 15, 1999. The goal is to submit the final draft to the subcommittee for final ballot process.

(2) Session 2 8:30 AM – 10.00 AM, April 15, 1999

Five members and seven guests attended the session.

The type test and special test sections were presented. Depending on design, generally, for CT rated higher than 345 kV system, the dielectric loss can be substantial and the temperature rise should be performed at rated voltage. The effects of the thermal mass and the related insulation system of the test specimen on shutdown was highlighted. The purpose, setup and procedure for the endurance chopped wave test, the internal arc fault test, and the sealing test for gas-insulated instrument transformers were presented. The critical aspects of filed tests such as dc test and oil sampling were discussed.

Definitions of different explosion withstand capabilities should be added. Classification about the special test should include the test is not mandatory and performed at client's request.

7.7.2.2 Working Group on C57.13 Revision - Tom Nelson

The working group met on April 14, 1999 in New Orleans, Louisiana. There were 12 members in attendance. A draft of the revised standard was handed out, with some additional changes yet to be incorporated. The changes will be mailed to the working group members by July 15. The decision was made to incorporate tolerances on the burdens, in the working group for instrument transformers used with electronic meters and relays.

7.7.3 Old Business

- C57.13.2 was re-affirmed.

7.7.4 New Business

- A letter for interpretation was reviewed and the Chair will respond.
- A copy of the IEEE Guide for Application of On-Line Monitoring to Liquid Filled Power transformers was distributed for review and comments.

The Chair will request copies of standards that the Relay Committee is developing on Instrument Transformers

7.8 Insulating Fluids Subcommittee - F. J. Gryzkiewicz, Chair

The Insulating Fluids Subcommittee and its Working Groups met concurrently in New Orleans, LA on Tuesday and Wednesday, April 13 and 14, 1999. In attendance were 22 members and 34 guests.

The Subcommittee minutes of the November 9 and 10, 1998 meeting in Leon, Mexico were approved as submitted.

7.8.1 Current Subcommittee Projects

7.8.1.1 C57.104-1991 – IEEE Guide for the Interpretation of Gases Generated in Oil-Immersed Transformers – Frank Heinrichs, Chair

The Working Group on the revision of C57.104-1991 met on Tuesday, April 13 with WG Chair Frank Heinrichs. The WG reviewed Draft 3 of the document. All comments received will be incorporated into Draft 4, and will be sent to WG members prior to the next meeting in Monterey, Mexico. Seven new members requested membership to the WG.

7.8.1.2 C57.106-1991 – IEEE Guide for Acceptance and Maintenance of Insulating Oil in Equipment – Joe Kelly, Chair

The Working Group on the revision of C57.106-1991 met on Tuesday and Wednesday, April 13 and 14 with WG Chair Joe Kelly. The WG reviewed Draft 2.2 of the document. All comments received will be incorporated into Draft 3, and will be sent to WG members. Based upon the comments received from the WG, a revised draft will then be sent to the Subcommittee prior to the next meeting in Monterey, Mexico.

7.8.1.3 C57.139 – Dissolved Gas Analysis in Load Tap Changers – Rick Youngblood, Chair

The Working Group on C57.139 met on Wednesday, April 14 with WG Chair Rick Youngblood. The WG reviewed Draft 2 of the document. All comments received will be incorporated into Draft 3, and will be sent to WG members prior to the next meeting in Monterey, Mexico.

7.8.2 Other Subcommittee Projects

7.8.2.1 C57.121-1989 - Guide for Acceptance and Maintenance of Less Flammable Hydrocarbon Fluid in Transformers

This revision of the Guide was approved by the IEEE Standards Board and has been published. This project is now complete. Our thanks to WG Chairman Patrick McShane and his WG members.

7.8.2.2 C57.130 – Trial Use Guide for the Use of Dissolved Gas Analysis During Factory Thermal Tests for the Evaluation of Oil Immersed Transformers and Reactors – Frank Heinrichs, Chair

This Trial Use Guide has successfully completed a Recirculation Ballot. It has been sent to the IEEE Standards Board for approval and printing.

7.8.2.3 P1258 – Trial Use Guide for the Interpretation of Gases Generated in Silicone-Immersed Transformers – Jim Goudie, Chair

This Trial Use Guide has successfully completed a Recirculation Ballot. It has been sent to the IEEE Standards Board for approval and printing.

7.8.3 Other Business

There was no other business for the Subcommittee to discuss. A motion was made and seconded to adjourn.

7.9 Insulation Life - L. W. Pierce, Chair

The Insulation Life Subcommittee sponsored a panel session #PN31, "Transformer Thermal Modeling", at the IEEE Transmission and Distribution Conferences, Tuesday morning April 13, 1999. Six presentations including three conference papers were made. Attendance at the session was approximately 60 to 70. The presentations were as follows:

Paulette Payne, PEPCO, "User needs and Use of Transformer Thermal Data".

Dale Douglass, Power Technologies, Inc., "Review of Transformer Loading Program EPRI PTLOAD V5".

Don Platts, Pennsylvania Power & Light Co., "PC 1538, IEEE Guide for Determination of Maximum Winding Temperature Rise in Liquid Filled Transformers".

R. M. Del Vecchio and P. Feghali, North American Transformer, Paper 99TD038, "Thermal Model of a Disk Coil with Directed Oil Flow".

J. Declercq and Van Der Vekien, Pauwels Trafo Belgium, Paper 99TD055, "Accurate Hot Spot Modeling in a Power Transformer Leading to Improved Design and Performance".

L. W. Pierce, Consultant, and T. Holifield, Howard Industries, Paper 99TD055, "A Thermal Model for Optimized Distribution and Small Power Transformer Design".

Summaries of the reports of the Insulation Life Subcommittee Working Groups and Task Forces are as follows:

7.9.4 Task Force on Hottest Spot Temperature Rise Determination - Don Platts, Chair

The Working group met on Tuesday, April 13, 1999 at New Orleans with 23 members and 27 guests in attendance. The minutes of the Leon, Mexico meeting in November 1998 were approved as written.

IEEE conducted a ballot on PC1538, "Guide for Determination of Maximum Winding Temperature Rise in Liquid Filled Transformers". The ballot closed on the day of the Working Group meeting. Three negative ballots were reviewed at the Working Group meeting.

The first negative addressed was from Dudley Galloway, ABB, who objected to the wording in Clause 5.1, Basic Requirements. His concern was that guides are to be instructive and informative, but not to include definite requirements. His comment was that distribution and small power transformers are constructed so that the hot spot location is easily determined, and therefore, a model does not have to give values for all points in the winding as stated. He would like the wording to clearly indicate that this is a guide.

The Chair pointed out that the same wording is in clause 1.2, Purpose, where it is quoted from C57.12.00 standard. Linden Pierce noted that this wording appeared in draft 1. This was not the first time members saw it, and that there were no negative votes on this previously. He pointed out that the guide does not require manufacturers to use a specific method. If they claim to use a model that complies with clause 5 of the guide, then it would need the elements listed as the 5 basic requirements in Clause 5.1.

Bruce Forsythe also stated that this is a guide and as such should not have "requirements". He suggested that the wording should reflect, "these are methods that meet the requirements", not "these are the requirements". Neil Kranich, Southwest Electric Co., also supported softening the wording. Pierre Feghali, North American Transformer, pointed out that by softening of the guide, the customer loses his leverage to have an accurate hot spot determined.

The Chair agreed that some of the wording is not correct, since a guide is to use "should" rather than "shall" and agreed to correct the statements according to the IEEE style guide, and to review using terms such as "calculation fundamentals", rather than "calculation requirements".

Both Dudley Galloway and Neil Kranich indicated that these changes would probably be sufficient to resolve their negative votes.

Subhash Tuli, Waukesha Electric Systems, requested that a statement be added to clause 4.1 to prevent problems when a customer specifies direct reading sensors in a unit, but the number and locations are not specified. The requested phrase was, "The strategic locations, and the number of sensors should be agreed upon between the purchaser and the manufacturer before the transformer is designed". After discussion the Working Group agreed to it.

Bill Chiu, Southern California Edison, submitted a vote of approved with comments. The comments were reviewed. The first four comments were suggested improvements to definitions. The Chair pointed out that they are in C57.12.80, and that it would not be appropriate to change them in the guide.

Bill also suggested that clause 4.3 be revised to state that re-testing of a prototype may not be required if the hot spot exceeds the requirements, but that decision would depend on the correlation between the test data and the calculated results. If the model prediction was way off, the changes made to the model to improve it might be insufficient to produce accurate results. Linden Pierce pointed out that thermal tests on prototypes or test windings using numerous direct reading sensors represent a major effort by manufacturers. After the tests the mathematical models are "tweaked" to achieve good correlation. To require a new test may not be feasible due to the cost and time requirements. The Working Group agreed to keep the present wording.

When the ballots are received from IEEE with the remainder of the comments supplied with the negatives, the chair will work to get them resolved or rebutted and do a recirculation before the November 1999 meeting.

7.9.5 Working Group on Thermal Duplicate - Barry Beaster, Chair

The Working Group met on Tuesday, April 13, 1999 with ten members and twenty-four guests attending. An agenda, minutes of the Fall 1998 meeting, and a preliminary draft of the guide on thermal duplicates was mailed to the Working Group membership prior to the meeting. Additional copies were available for guests. The agenda was reviewed and an "old business" item was added regarding the change to C57.12.00.

The minutes of the Leon, Mexico meeting were reviewed and approved as written. An earlier mailing was made to the Working Group as notification that the Insulation Life Subcommittee has successfully balloted the proposed thermal duplicate changes to clause 8.5 in C57.12.00. These changes would be incorporated into the year 2000 revision.

The remaining time was devoted to extensive revision to the preliminary draft of the guide on thermal duplicates. Starting in the scope, the term, "as specified in Table 17 of C57.12.00", will be replaced with "as defined in C57.12.00". Additionally, the last sentence will be rewritten as, "the guide is limited to liquid-immersed distribution, power, and regulating transformers as manufactured under C57.12.00".

In Clause 1.2, the first sentence should be modified and moved to the Definitions. In the second sentence, "the requirements for a transformer", should be rephrased with, "the recommendations for a transformer". Additionally, in the last sentence, the correction, "average winding rise to be used", should be made.

In Clause 2, discussion on the acceptance of the references was made citing the phrase, "Does it need to be used to interpret the document?". After some discussion, most felt that the original three should remain. It was observed that since the equations used later in the guide were related to those in the Loading Guide, it might be included as a reference. After short discussion, it was concluded there might be confusion connecting overload equations and thermal duplicate adjustments together and it may better to write clear definitions in the guide and not use the guide as a reference.

In Clause 3, each term will have to be reviewed to separate the "definition" from any limiting "requirement". The first sentence in the draft's purpose will be identified as the term "Thermal Duplicate" and included in this section. A request was made to define the term, "external cooling dissipation capacity", in greater detail such that all users would have the same interpretation of the term and apply it in a uniform manner.

The historical perspective of the selection of the thermal characteristics was originally to be written by Robert Grubb, Waukesha Electric Systems, previous Chair of the group. It was reported that Bob had retired, and the Chair would explore his future involvement with the group. Another comment relating to historical issues was what happened to the 500 kVA and below sized transformers? The Chair will review the minutes of earlier meetings to determine the reason.

The table and equations in the draft will have to be formatted as a clause of the guide. The symbols used in the equations will have to be defined in greater detail to eliminate confusion when applying the guide.

Future changes to C57.12.00 will require hottest spot calculations. This will have to be addressed in the equations, especially when the thermal duplicate transformer was built previous to these latest requirements. This item will be addressed in the revised draft.

When the Annex is revised, the calculations should reference the formula used by an equation number. This will aid the reader. There were some corrections to be made to the example in the draft.

Before the next meeting all revisions aforementioned will be incorporated into a draft for Working Group review.

7.9.7 Working Group on Revision of Temperature Test Code (Section 11 of C57.12.90) - George Henry, Chair

The Working Group met on Tuesday, April 13, 1999 with three members and 21 guests present. The minutes of the Leon, Mexico meeting in November 1999 were read and approved.

The Chair reported on the interim results of a survey of Draft 7, which was mailed prior to the New Orleans meeting. The deadline for this survey was April 24, 1999 (after the meeting).

The meeting was devoted to discussion of the negative comments of Subhash Tuli, Waukesha Electric Systems. Many of Subhash's comments were editorial and these comments were adopted with minimal discussion. Detailed discussion ensued on revising the subscripts on variables used in Equations 26 and 27 of Clause 11.3.3, Average Winding Temperature-Rise Determination. The Working Group adopted a modified version of Subhash's recommendation. Clause 11.4.1 will be modified to reinstate the requirement that winding test current must not be less than 85 percent of the windings rated current. This limitation applies to equation 28 which allows correction of Average Winding Temperature Rise when test current differs from rated current.

The title of Clause 11.4.3 will be changed to, "Correction of Liquid Temperature Rises for Differences in Altitude". This clause now makes it clear that only the liquid temperature rise component of average winding temperature rise should be corrected for differences in altitude.

This completed the discussion of Mr. Tuli's negatives which were all favorably resolved by the Working Group.

The Working Group turned its attention to Clause 11.2.2, Hot-Resistance Measurements. The Working Group believed that the wording of the clause is still too restrictive, in that it would preclude the use of effective procedures relying on the capabilities of modern, state-of-the-art data acquisition equipment. The Working Group agreed that this clause should be rewritten so that the procedure is less restrictive.

The changes adopted from discussion of Mr. Tuli's negative comments and a re-write of Clause 11.2.2 will be included in Draft 8.

7.9.6 Task Force on Winding Temperature Indicators - M. F. Barnes, Chair

The Task Force on Winding Temperature Indicators met on Wednesday April 14, 1999. There were 6 members and 10 guests in attendance. Minutes of the November 1999 meeting in Leon, Mexico were approved as written.

V. S. Sankar, the Chair of the Task Force resigned. He will continue as a contributing member. Mike Barnes, Qualitrol, was selected as the new Chair.

The purpose of this Task Force is to write a technical paper regarding winding temperature indicators, operation in different situations, different cooling modes, and different size transformers, with particular attention to problems of the present technology in certain circumstances.

A working committee within the Task Force has been appointed. It consists of users, transformer manufacturers and instrument manufacturers. Barry Ward, EPRI, volunteered to coordinate the paper. Barry had prepared a draft outline for the paper which was reviewed at this meeting. Each member of the working committee will write details for the paper, following the outline, and submit them to Barry. Barry will consolidate the thoughts from these submissions into a draft. If there is a disagreement within the writing committee the different viewpoints can be incorporated into the paper.

It was decided that for initial input the paper would not restrict the scope of the comments. There was a considerable discussion concerning the fact that initially the paper was intended to present and define the "problem" for the readers and not "solutions". Comments on the present document by members showed concern over apparent lack of new solutions. It was agreed, at least on initial submission, to also discuss solutions. This would include present technology capabilities and limitations. The paper could serve as background information for the next draft of C57.12.10 for newer devices.

Respectfully Submitted by:

Linden W. Pierce

Insulation Life Subcommittee Chair

7.10 Performance Characteristics - D. J. Fallon, Chair

7.10.1 Introduction/Attendance

The Performance Characteristics Subcommittee (PCS) met at 4:00 p.m. on Wednesday, April 14, with 30 members and 15 guests in attendance.

7.10.2 Approval of Meeting Minutes

The minutes of the November 10, 1998, PCS Meeting in Leon, Guanajuato, Mexico, were approved as written.

7.10.3 Chairman's Remarks

7.10.3.1 Administrative Subcommittee Notes

Several items from the discussions held at the April 12, 1999, Administrative Subcommittee meeting were highlighted, and will be included in the written Minutes:

7.10.3.2 Membership

4 new members were added to the PCS Roster:

Peter Balma, PSE&G; Alan Darwin, Alstom T&D Transformers

Tom Prevost, EHV Weidmann; Juan Jose Saldivar, GE Prolec Mexico

7.10.4 Agenda Changes

None

7.10.5 Working Group Reports

7.10.5.1 PCS Revisions to C57.12.90 - Pierre Feghali

The working group for the revision of C57.12.90 as it relates to performance characteristics met on Tuesday November 13th, 1999 at 2:30pm in New Orleans, Louisiana. The chairman opened the meeting with introductions of members and guests. There were 10 members and 18 guests present. The minutes of the Nov'98 meeting in Leon, Guanajuato, Mexico were approved.

Subash Tuli brought all present up to date on the balloting withdraw of Draft 5.0. Draft 5.1 was balloted with a cutoff date of April 7, 1999. One negative ballot by Jerry Corkran was changed to affirmative, which makes the ballot 100% affirmative. Steve Snyder and Subash Tuli have reviewed the document and will make all necessary editorial changes. Tom Prevost reiterated that Subash is only making editorial changes and not technical ones. Craig Colopy mentioned that some useful comments about C57.12.90 were brought up at the meeting for Standard for Regulators, which he chairs. He will pass the information on to this working group.

The chairman promised that the rest of the technical comments received from the ballot would be discussed in the next meeting. Under new business, Mr. Joe Foldi pointed out an error in Table 9 that deals with the A-weighted frequency correction for one third octave band sound levels. The discrepancy has to do with negative signs that had to be positive. This item will be researched and appropriate changes made.

The meeting was adjourned at 3:00pm.

C57.133 Guide for Short Circuit Testing - Nigel McQuin

The WG did not meet in New Orleans. The ballot pool request closed on this document in April 1998, but due to major IEEE problems the ballot never proceeded. There is now concern that the original paperwork and documentation may have been lost at the IEEE, and the PAR for this project is due to expire in Nov 1999. Mr Tom Provost is to establish the status of this project and provide an action list to the Chairman by 26th April 1999, so that positive action can be instituted to ensure that the ballot on this document proceeds this summer, and is complete before Oct 1999.

The Chairman requests the cooperation of the committee in approving this document, unless there are definite errors in the document. Previous circulation of this document as a draft within the WG only elicited one set of comments, which hopefully has caught any obvious corrections. The intent is to complete the establishment of this material as a separate document from C57.12.90, and then for all received comments at this ballot to be collated for the revision of the stand-alone document in the next revision cycle.

PCS Chair Don Fallon requests members to consider in the ballot process that the Short Circuit Test Guide will go out of publication shortly if this Ballot is not approved, as the Annex has been removed from the revision of C57.12.90. If concerns for the Ballot on C57.133 can be expressed as comments to an approved ballot, then this needed document will stay in print and any comments will be reviewed by the WG for future revision.

7.10.5.3 Revision of C57.110 - R. P. (Rick) Marek

The Working Group for the revision of the IEEE Recommended Practice for Establishing Transformer Capability When Supplying Nonsinusoidal Load Currents did not meet in New Orleans.

The Chairman informed the Subcommittee that C57.110 has been published. The WG will be dissolved. Since the revision involved many changes and additions, the document should be used for a year or two before any revision is considered. This would allow time for general application, which would hopefully provide some feedback.

7.10.5.4 Loss Tolerance and Measurement - Ramsis Girgis

10 members and 16 guests attended . 2 requested membership.

First report was on mtg of TF on " Guide for low p.f. power measurements ". The Chairman Ed So could not attend . Don Kline gave a demonstration of

his current transducer calibrator which is suitable for distribution size transformers with p.f. higher than 4 % . It will be up to the chairman of the TF to determine whether a description of this device will be included in his guide . The loss tolerance and measurement Guide includes generic description of the functionality and purpose of such calibration systems.

Next item presented and discussed in the meeting was the final set of improvements made to the " loss tolerance and measurement " Guide which is now ready to be sent to the PSC members for survey. The feedback will be discussed in the next WG mtg in Mexico and the negative comments resolved before the Guide is finally sent to balloting .

Next item discussed was a proposed text for a section on measuring auxiliary losses which is proposed to be a subsection of section # 9 (Load Loss) in C57.12.90. This test will remain an " other " test in Table 17 in C57.12.00 .

Last item discussed is a plan to get data from a number of transformer manufacturers on relationship between losses and noise at 50Hz vs 60 Hz . The data will be reconciled in an IEEE scientific paper and would be the basis for recommended conversion factors between the two frequencies .

The meeting was adjourned at 2:15 pm.

7.10.5.5 Semi-Conductor Rectifier Transformers C57.18.10 - S. P. (Sheldon) Kennedy

The Working Group met on Tuesday, April 13, 1999 at 1:00 p.m. There were 7 members and 9 guests present. Introductions were made. As the WG did not meet in

Mexico, minutes of the April 27, 1998 meeting in Little Rock, Arkansas, were approved.

The Chairman reported that the Standard was approved by IEEE and printed June 15, 1998. The WG membership should have received copies of the Standard. At least one member did not. Let the Chair know if you did not receive your copy. I will let PCS Chair Don Fallon know so he can follow up with IEEE.

The Chair had asked WG members to forward a list of concerns on outstanding issues, if they thought a new PAR should be requested for further work. This would be done before the next revision, which would be in a couple of years. No issues were received by the Chair during the past year. Therefore, this WG has completed its PAR and a new one will not be pursued at this time.

Under new business, Subhas Sarkar has contacted the Chair for an interpretation of the new Standard. Under Clause 8.1, Routine Tests, Subclause G states the following:

“Temperature test or tests shall be made on one unit when one or more units of a given rating are produced by one manufacturer at the same time, except these tests shall be omitted when a record of a temperature test made in accordance with these Standards, on a duplicate or essentially duplicate unit, is available. The temperature test is a design test, not a routine test.”

Subhas has a customer who interprets the Standard to say that the temperature test is a routine test, since it is under the routine test clause. The original C57.18 Mercury Arc Rectifier Standard was worded the same, except we tried to clarify this in the new C57.18.10 by stating that this was a design test and not a routine test to be performed on all transformers. Subhas requested a written comment from IEEE. Neither the WG Chair nor members should give comment as individuals. Clarifications to this question and any others which might arise should be forwarded to:

Mr. Naeem Ahmad

IEEE Standards

445 Hoes Lane, P. O. Box 1331

Piscataway, NJ 08851-1331

(P):732-562-3931 (F):732-562-1571 (E): n.ahmad@ieee.org

These requests will be forwarded to the Transformers Committee who will form a panel of a few people, undoubtedly WG members, to supply the official response.

Also under new business, Don Fallon, PCS Chair, requested assistance from any WG member who would be willing to help review for revision of IEEE 32 on Grounding Devices. The Chair offered his services, any other interested members should contact Don.

At this point the Chair offered his sincere thanks and appreciation to the WG members and others who contributed time and effort towards completing this Standard. The original PAR was approved in 1981, and I am the fourth WG Chair of this Standard. This work could not have been completed without everyone's help. You are all to be commended.

There was no other old business or new business. This WG has completed its work approved under this PAR and is now dissolved. The meeting was adjourned at 1:45 p.m.

7.10.5.6 Revisions to C57.12.00 - Donald W. Platts

The Working Group met on Wednesday, at 8:30 AM. We had 16 members and 59 guests in attendance.

The minutes of the Nov. 1998 meeting in Leon Mexico were approved.

The chair reported on the status of draft 4 of C57.12.00, The document had been recirculated by Subash Tuli. He has indicated that with a few editorial comments, it has been sent to IEEE for publication.

Work status:

At our last meeting the WG divided into four groups to review the stack of comments that had been submitted in response to the ballot draft 3. Prior to this meeting, the chair collected some of those comments and sent them to members for review so that they could be addressed at this meeting.

We began the review.

Comments regarding GSU transformers were briefly discussed, and we concluded that they would be more appropriate in C57.116. Those comments will be passed on to PCS for consideration.

The comments on impedance issues- the external impedance for fault calculations, the zero sequence impedance, and tolerances were deferred. Chuck Simmons had volunteered to review those and to propose wording that can be sent to members for review by a survey. Then the WG can address the comments resulting from that.

There were two sets of comments on PCBs. The WG reviewed the history of the statement that is now required on the nameplate. We discussed the current detection limits and the standards for making them. We concluded that a paragraph is required in 6.6.1 to state that the transformer must be built without any detectable PCBs, and reference the standards for measuring them. Then the statement required on the nameplate will be shortened to "Contains no detectable level of PCB at the time of manufacture".

We discussed comments suggesting that the losses in ancillary equipment, cooling fans, pumps, etc should be power consumption requirements, and that as losses, they should be measured, or corrected to a reference temperature. After considerable discussion, we agreed to not change the existing wording.

A comment questioned the rating of transformer taps, where the standard says that winding taps shall be full capacity, and notes that LTC taps are commonly built with reduced capacity- for taps below rated voltage. This is confusing. Again after lengthy discussions, we concluded that it would be restated that when a transformer has winding taps for a de-energized tap changer or switch, they shall be full capacity taps.

The remaining issues will be saved for review at another time.

There was no other old business.

In new business, Steve Snyder has agreed to serve as vice-chair of the working group. The meeting adjourned at 9:45.

7.10.5.7 Switching Transient Induced by Transf./Breaker Interaction - Bob Degeneff

The Working Group on Switching Transients Induced by Transformer/Breaker Interaction was called to order at 2:35 PM on Wednesday, April 14, 1999. There were 24 members and 16 guests present. Introductions were made, and the minutes of the November 9, 1998, meeting in Guanajuato, Mexico were accepted without comment.

Bob Degeneff reported that the PAR for this project had been submitted, however, it was returned for some minor revisions. Revisions will be made, and the PAR will be resubmitted as soon as possible.

The meeting continued with an excellent presentation by David Swindler. David provided an overview and tutorial on circuit breaker performance and its relationship to transformer/breaker interaction, including two descriptive handouts. The following items highlight important points of the presentation.

- The latest draft of ANSI C37.010 references the interaction problem.
- System arrangements and the typical associated waveforms were described.
- High frequency oscillations ranging in frequency from 100 kHz to the megahertz region can occur.
- The need to calculate Transient Recovery Voltage when applying a new breaker was stressed.
- Problems can occur with both opening & closing operations, however it is not always clear as to which operation precipitated the failure.
- This is not just a problem for transformers, all equipment must be considered.
- A suggested snubber was described, and an Excel^R program to calculate components would be made available to those interested.

After the presentation, Bob Degeneff indicated he would be contacting members of the group to solicit volunteers to prepare draft sections of the guide for the next meeting in Mexico. The meeting adjourned at 3:55 PM.

7.10.6 Project Reports

7.10.6.1 Reaffirmation of C57.109 - Guide for Transformer Through Fault Current Duration - Ron Barker

Ron was not able to attend, as he is at the Doble Conference. He reported earlier that his review continues, including review in relation to the C37.91 Relay Application Guide. He expects to be contacting Tom Prevost to initiate the Reaffirmation process shortly.

7.10.6.2 Single Phase Harmonic Limits - Rick Marek

No report.

7.10.7 Old Business

STANDARDS INTERPRETATION

There was some follow-up required on a request for interpretation of Temperature Rise Tests as related to Loss determination. The Chairman will check with IEEE Standards to assure appropriate follow-up.

REVISION OF IEEE 519

IEEE 519, Recommended Practices and Requirements for Harmonic Control in Electric Power Systems is up for revision, and input from the Transformers Committee, and in particular from Performance Characteristics Subcommittee members, is requested. Sheldon Kennedy agreed to coordinate response for PCS, and Rick Marek, Nigel McQuin, Jerry Corkran, and Bob Degeneff volunteered to assist. The Chair will work with Sheldon to determine the schedule and procedure for submittal of comment.

REAFFIRMATION OF C57.105

George Reitter reports that the C57.105 Guide for Application of Transformer Connections in Three-Phase Distribution Systems has been reaffirmed

REAFFIRMATION OF IEEE 638 - 1992

George Reitter reports that IEEE Standard 638, Qualification of Class 1E Transformers for Nuclear Power Generating Stations has been given conditional approval. It will need either an Errata Sheet, or a Core Agenda change. Status will be updated at the next meeting.

7.10.8 New Business

REVISION OF IEEE 32

IEEE 32, Standard Requirements, Terminology, and Test Procedures for Neutral Grounding Devices, is being revised by the Surge Protective Devices Committee (SPDC). Contact has been made with the Transformers Committee requesting input and comments on a fairly tight schedule. Some comments have been provided, and any additional comments by PCS representatives should be submitted to Jin Sim by the end of June. Volunteers were requested, and Sheldon Kennedy and Phil Hopkinson stepped forward. Sheldon also suggested that Richard Dudley might be willing to provide comment. The Chair will forward the e-mail communications received on this subject to the volunteers, with requests for comments to be submitted to Jin Sim per the required schedule.

DETC CONTACTS FUNCTIONAL LIFE TEST WG

Phil Hopkinson had submitted a Draft Paper on DETC Contact Life Assessment to several members of the Administrative SC, describing findings on the affect of specific contact material on coking and development of high resistance contacts. He requested that this information be reviewed, expanded, and considered as the basis for

development of a functional requirements for DETC's. The Administrative Subcommittee agreed, and PCS will be the initial sponsor of this work, which will involve coordination with several other Subcommittees within the Transformers Committee, including Insulation Life, Insulating Fluids, Dielectric Tests, Power Transformers, etc., and possibly with areas outside of the Transformers Committee. Phil provided an overview to PCS, suggesting a parallel effort with that in IEC, possibly leading to inclusion of these DETC functional requirements in the present LTC guide. Phil will Chair this new WG, with Larry Dix of Quality Switch assisting. Additional volunteers from PCS were requested to participate in this work - Sheldon Kennedy, Nigel McQuin, Doug Getsom, John Matthews, Jerry Corkran, Bipin Patel, Jim Fyvie, and Russ Nordman volunteered. First order of business will be to develop a Scope and write up a PAR.

INRUSH CURRENT PRESENTATION

Phil Hopkinson volunteered also to share a presentation he had put together on inrush currents, perhaps as a seminar topic at an upcoming Transformer Committee Meeting. The Chair will review with Phil, and with other possible participants in such a seminar, to determine if a recommendation will be made for a presentation, and to coordinate with Meeting planner Greg Anderson for possible scheduling.

There were no other items of new business.

7.10.9 Next Meeting

The next meeting will be held in November in Monterrey Mexico.

The meeting adjourned at 5:25 p.m.

Respectfully submitted,

Donald J. Fallon, PCS Chair

7.11 Power Transformers Subcommittee: Everett Hager - Chairman

The Power Transformers Subcommittee met on Thursday, April 15, 1999 at 8:00 AM with 42 people present including 7 guests.

The minutes from the previous meeting were approved with no changes.

Reports were presented from the Working Groups as follows:

7.11.1 Working Group on LTC Performance: William Henning - WG Chair

The Working Group on Load Tap Changer Performance met on Tuesday, April 13, 1999 at 4:00 PM. There were 15 members and 10 guests in attendance. The first item of business was to approve the minutes of the last Working Group meeting in Leon, Guanajuato, Mexico. Those minutes were approved.

Prior to the meeting, there had been a Working Group survey on Draft 1.2 of the Guide. There were six responses that were either "Negative" or "Approved With Comments." The document is twelve pages long, and there were eleven pages of comments. Some comments were very specific and proposed some exact wording changes to be made. Others were more general and proposed, for example, specific topics to include or not include in the Guide.

One of the changes being proposed is to modify the Purpose Statement. In the original document, the purpose of the Guide was stated as "The Purpose of this Guide is to aid in the selection, installation and field servicing of load tap changers." The proposal would change the statement to say "The Purpose of this Guide is to aid in the selection, component location and field servicing of load tap changers." By making this change, the Purpose Statement would correspond to the main clause headings for clauses 3, 4 and 5 of the Guide. To make this change, however, would require modification and resubmittal of the PAR form. The PAR for this project is currently in circulation to other Committees for coordination requests.

There was not enough time to discuss all of the comments received. The Working Group Chair will produce a new Draft, accommodating all of the comments, and will conduct a Working Group Survey. The meeting was adjourned at 5:30 PM.

7.11.2 Working Group on the Phase Shifting Transformer Guide: Edgar Trummer - Chairman

The Working Group met at 10:00 – 11:15 AM and 1:00 – 2:15 PM on Wednesday, April 14, 1999 with 21 members and 10 guests in attendance. One guest requested membership.

Draft 10 of the Guide had been circulated for a Survey ballot following the last meeting in Guanajuato, Mexico which resulted in several negative ballots and comments. All of these were resolved in the meetings on this day.

Tom Lundquist will obtain a copy of a technical paper on PST protection by H. J. Li, referenced in the Guide, to resolve comments objecting to including references to Figures only found in the referenced paper. The referenced Figures will either be included in the Guide or the references will be deleted.

The Group agreed to change the nameplate requirements and list phase angles at no-load only. Joe Watson and Dan Perco will also develop a requirement to list maximum power flow in both directions or tap ratings, if less than the rated MVA.

Jim Fivey will write a section dealing with testing phase angle shift with voltage test methods and calculations for phase angle.

The Working group adjourned at 2:29 PM.

7.11.3 Task Force and Working Group on On-Line Monitoring - Andre Lux Reporting for Rick Young - Chairman

The Task Force and Working Group on On-Line Monitoring of Liquid Filled Transformers met jointly on April 14 from 2:30 to 3:30 PM. Approximately 20 members and guests were in attendance. Draft 4 of the On-Line Monitoring Guide was distributed and discussed. A call for volunteers was issued for the remaining sections of the guide.

Discussion also centered on the upcoming DEIS Electrical Insulation Conference. The technical program committee and EIC approached the Task Force and asked the Task Force to present a paper on transformer monitoring at the upcoming EIC in October. The Task Force will prepare a contribution in the form of a status report of the On-Line Monitoring Guide.

There was also discussion concerning the CRC/IEEE press Power Engineering handbook. While not strictly a Task Force activity, members of the Task Force will participate in the authorship of this section and portions of the guide will be used with proper permission obtained.

A call was issued for a two-day working session of the Task Force to continue work on the Guide and to finalize the EIC paper and CRC Chapter. Volunteers came forward. The meeting will be held in late May in an as-yet undetermined location.

7.11.4 C57.140: Working Group for Transformer Life Extension: Rowland James - Chairman

The first Working Group meeting was held at the IEEE/PES 1999 Spring Transformers Committee Meeting in New Orleans, Louisiana on April 14, 1999 at 4:00 PM. An initial outline was presented to those in attendance. Additions were proposed and it was suggested that these proposed additions will be weighed against the scope and prioritized. This will be accomplished within the next few weeks, and conveyed to those in attendance.

There were thirty-one in attendance. Twenty persons requested membership in the Working Group.

7.11.5 New Business

It was decided that a new Working Group will be formed for maintenance of C57.12.10, "230 kV and Below 833/958 through 8333/10,417 kVA, Single-Phase, and 750/862 through 60,000/80,000 kVA, Three-Phase without Load Tap Changing; and 3750/4687 through 60,000/80,000/100,000 kVA with Load Tap Changing - Safety Requirements" and reaffirmation of C57.93, "IEEE Guide for Installation of Liquid-Immersed Power Transformers", which are both now under this Subcommittee.

The meeting adjourned at 9:00.

7.12 Underground Transformers and Network Protectors - P. E. Orehek

7.12.1 Introduction/Attendance

The Underground Transformers and Network Protectors Subcommittee met on April 14, 1999, with 10 members and eight guests present.

7.12.2 Approval of Minutes

The minutes of the November, 1998 meeting in Leon, Mexico were approved as submitted.

7.12.3 Membership

There were no changes and membership remains at 14.

7.12.4 Chairman's Remarks

Administrative Subcommittee Notes

- A. The next meeting will be held in Monterey, Mexico from November 7 to 10, 1999.
- B. Nominees for the Transformer Committee Working Group Recognition Award for 2000 are required by July, 1999.
- C. There will be a transformer session at the IEEE Summer Power Meeting in Edmonton, Canada.
- D. The Transformers committee is responsible for the development and revision of ANSI and IEEE Standards that fall within its scope. There are currently 50 Working Groups and Task forces preparing proposals for standards projects. Information on these standards and

projects, future meeting sites and the status of standards can be obtained by visiting the WWW homepage:

<http://www.dsUPER.net/~georgev/Transformers.html>

7.12.5 Working Group Reports

7.12.5.1 Three-Phase Underground-Type Transformers (C57.12.24) C.G. Niemann - Chairman

The working Group met on Tuesday, April 13, 1999 at 2:30 p.m. with seven members and three guests in attendance.

The minutes of the meeting on November 9, 1998 in Leon, Mexico were approved as submitted.

Final editorial revisions were to made to Draft 3 of the document. The Working Group approved the revised Draft and the document will now be processed for balloting.

There being no additional new or old business, the meeting was adjourned at 3:45 p.m.

7.12.5.2 Liquid Filled Secondary Network Transformers (C57.12.40) R. L. Plaster - Chairman

The Working Group met on Tuesday, April 13, 1999 at 1:00 p.m. with 10 members and seven guests in attendance.

The minutes of the November 9, 1998 meeting in Leon, Mexico were approved with two editorial corrections. A change was made to item "k" to read "Para. 6.3.1" instead of "6.2.4." The reference to Paragraph 6.2.4 should have stated to remove the words "to be dark in color and" from the paragraph.

Final editorial revisions were agreed to for Draft #5. Also, the conversion of 7 psig to 150 kPa and 15 psig to 210 kPa was changed to 50 kPa and 105 kPa, respectively which conforms to the Canadian Standards Association conversion.

No action was taken on Part II of the Draft due to the utility representative's absence. The Working Group agreed to make one more attempt to get a review of this section of the draft. If the review is not complete by July 31, 1999, the Working Group agreed to drop Part II from the Standard and submit the revision to ballot.

With the above changes, the Working Group agreed to proceed with balloting of the revised Draft.

There being no additional business the meeting was adjourned at 2:15 p.m.

7.12.5.3 Secondary Network Protectors (C57.12.44) D.H. Mulkey - Chairman

The Working Group did not meet at this meeting since the revised draft of the Standard is out for balloting. The Working Group is planning to meet in Monterey to discuss the results of the ballot.

7.12.5.4 Ventilated Dry-Type Network Transformers (C57.12.57) A. L. Robinson - Chairman

The Working Group met on Tuesday, April 13, 1999 at 4:00 p.m. with three members and two guests in attendance.

The minutes of the meeting on November 9, 1998 in Leon, Mexico were approved as submitted.

The Working Group reviewed Draft #8 of the document. The chairman noted that the text of the document is complete subject to editorial changes. However, the document needs to be put into final form with prefaces, tables, and drawings placed properly in the final version.

Since C57.12.40 and C57.12.57 have similar throat designs, figures 3 and 4 of the document will be modified to agree with the drawings in C57.12.40.

Paragraphs 5.8.2.3 describing lifting facilities will be changed from “A minimum of four lifting points...” to “Four lifting points...”

Paragraph 6.3, Ventilating Opening, will be compared to the other dry-type transformer standards and either rewritten or dropped.

The document will be compared with C57.12.24, C57.12.40 and C57.12.44 for consistency in conversion to metric units.

The drilling pattern for the neutral spade in Figure 2 will be the same as in C57.12.40.

Proper notations will be made for each segment in Figure 2.

There being no additional business the meeting was adjourned at 4:30 p.m.

General

Conversion to Metric

All four standards this Subcommittee is responsible for will be consistent when English units are converted to metric. The Subcommittee will attempt to coordinate with the Distribution Transformers Subcommittee and the Power Transformers Subcommittee to make the conversions the same in all transformer product standards.

Balloting Process

The balloting process was again discussed at length because three of the four standards the Subcommittee is responsible for will be balloted by the NEMA secretariat and the other by IEEE staff. When NEMA issues a standard for balloting, 30 days is usually given to return the ballot and it is sent to only six members in each of the IEEE, EEI and NEMA Delegations of the ASC C57 Committee plus six governmental agencies. Before IEEE issues a standard for balloting, a balloting group must be formed from the Transformer Committee members. When this is completed the standard is issued for balloting in this group and concurrently sent to NEMA to ballot the Delegations previously mentioned. With this system, IEEE cannot complete a ballot within 30 days. It was recommended that IEEE staff review this issue.

7.12.6 Future Meetings

The location and dates for future meetings are as follows:

November 7-10, 1999	Monterey, Mexico
April 2-5, 2000	Nashville, Tennessee
October 15-18, 2000	Niagara Falls, Ontario, Canada
April 8-12, 2001	Amsterdam, The Netherlands

The Subcommittee meeting adjourned at 10:45 a.m.

8.0 Reports of Liaison Representatives

8.1 EPRI - S. R. Lindgren

Memorandum

April 9, 1999

TO: Mr. Jin Sim
Secretary, IEEE Transformers Committee
Waukesha Electric Systems
P.O. Box 268
2701 Highway 117 South
Goldsboro, NC27530

FROM: Stan Lindgren, Manager, Power Transformers

SUBJECT: **EPRI LIAISON REPORT**

The following report is for inclusion in your minutes for the April 15, 1999 meeting in New Orleans, Louisiana.

1. Static Electrification in Power Transformers:

- ï This is the suspected failure mechanism in over 36 core form and shell form FOA transformers worldwide. Recent failures involve 15 year or older transformers worldwide that had just been reprocessed following maintenance work. Failure typically occurs during the first startup or light loading period.
- ï Work has focused on the effects of temperature and moisture transients. Phase I of a comprehensive test program was completed on a 333 MVA single phase 500 kV autotransformer that was fully instrumented to monitor static electrification effects during a series of experiments. A broad range of partial discharge activity was produced. A Phase II second round of tests was completed in October, 1996. A broad range of static electrification activity was again produced. Tests and monitoring results are being evaluated. The transformer was disassembled and inspected. Evidence of static electrification discharges was found at both the bottom and at the top of the unit.
- ï Results of the field tests are being reflected in a quarter-scale flow-model experiment that will simulate the 500 kV transformer under laboratory conditions and controls. The model of the major insulation structure and simulated windings has been completed and experiments are nearing completion.
- ï A symposium, *Transformer Reliability: Management of Static Electrification in Power Transformers*, will be held May 19-21, 1999, in Monterey, California.

2. Moisture Dynamics:

- ï Very rapid load changes can cause bubble formation under some conditions and reduce low frequency and impulse dielectric strength by 40%. This has been demonstrated in models with rapid/high overload.
- ï Additional work has been completed to experimentally study moisture dynamics associated with rapid overloads and cool-down cycles plus detect inception of partial discharges caused by bubble evolution. Moisture moves away from the hot conductor fast and returns very slowly after cool-down. Distribution of moisture in the solid insulation was found to be very uneven and time to dissolve free water is very long. Phase II has been completed to study the correlation between moisture-in-oil with moisture-in-paper for a range of conditions and temperature cycles using winding models with moisture contents ranging from 0.5% to 7.0% in paper and pressboard. Phase III started 1/99 to broaden the experimental work and include prototype field applications of the algorithm starting on core-form transformers.

8.0 Reports of Liaison Representatives (cont'd)

3. High Voltage Instrument Transformers & Bushings

EPRI sponsored a workshop 9/90 to provide a forum to compare and categorize failure information, failure modes and potential mitigation measures. This was an outgrowth of the Transformers Committee roundtable in Washington, DC, 4/88. Proceedings, TR 100205, are published. A Project was completed to study fast disconnect switching transient effects on HVCTs. Mathematical modeling was checked experimentally through laboratory tests and switching tests in a 500 kV substation with very high speed instrumentation. Effects of switching resistors during disconnect switching has been studied and found to reduce bus transients and stresses by up to 80%. A final report is published, TR-104961.

A new project is in process to monitor a large number of HVCTs and bushings in laboratories and in service, including on-line tan delta, partial discharge and other available monitoring methods. Units are being tested to failure to evaluate failure modes, sensitivity of monitoring and to develop "end-of-life" criteria for interpretation of field monitoring data.

A Symposium: *HVCTs & Bushings - Failure Prediction & Prevention*, will be held September 22-24, 1999 in Portland, Oregon.

4. Dynamic Thermal Circuit Ratings - DCTR

This project involves all transmission components including power transformers regarding software development and a field test involving two substations on a utility system. The field test has been completed. A final report is published, TR-105421. An IEEE paper, 94 SM 473-9 PWRD, was presented at the IEEE/PES 1994 Summer Meeting in San Francisco. A second paper, "Field Application of a Dynamic Thermal Circuit Rating Method", was presented at the IEEE/PES 1996 Winter Meeting in Baltimore. The method has been extended to include transmission lines. DCTR2.0 is available to EPRI Substations Asset Utilization, Overhead Transmission, and Underground Transmission Target members.

5. On-Line Transformer Condition Assessment - Green / Yellow / Red

This project is a continuation of earlier EPRI efforts to develop an on-line low cost gas analyzer that were abandoned because of baseline drift of the sensors. A "key gas" analyzer uses metal-insulated-semiconductor (MIS) sensors to monitor individual ppm for hydrogen, acetylene, ethylene and carbon monoxide. A field demonstration program that involved 40 prototypes, starting October 1993, was completed in 1996. An EPRI/Micromonitors/Sandia National Labs collaborative project was initiated early this year to solve technical problems that have delayed commercial production of the MIS sensors. An alternative 9-gas analyzer for nitrogen-blanketed transformers has been developed and is now commercially available. This will be followed by a version suitable for conservator type transformers.

Experimental work is in process to identify the dynamic behavior of gases and other byproducts associated with loading and internal problems. Early results show that gases are developed in the form of tiny bubbles that *are not* quickly absorbed into the oil, including gases with high solubility. Knowledge developed will be used in the development of fuzzy logic expert system modules that can provide Green-Yellow-Red indication of transformer operating condition.

6. Power Transformer Remaining Life Prediction & Extension

ï Furaldehydes in Transformer Oil

A project has been in place since 1994 to develop a correlation between furaldehydes in oil samples with degree of polymerization (DP) found in paper insulation samples taken from a significant number of transformers in service. Additional laboratory experimental work is in process to identify trace chemicals that are an early indication of insulation degradation that can be sensed with on-line monitoring.

ï Vibration & Frequency Response Analysis (FRA)

A project has been in place since 1994 to develop a correlation between existing winding conditions and vibration & FRA tests before and after internal inspection and re-clamping of the same transformers. The objective is to develop noninvasive field test methods and criteria that can be used to predict winding condition in the broad variety of existing power transformers without entering the transformer. Over 40

8.0 Reports of Liaison Representatives (cont'd)

transformers have had the initial FRA and internal inspection, and over 20 have had the follow-up FRA test.

7. Transformer Expert System - XVISOR

Objective of this project is to capture the knowledge of transformer experts and make it usable in an off-line software tool for evaluation of transformer design questions, condition assessment, problem diagnosis, and identification of maintenance needs. Beta testing has been completed, some modifications made, and EPRI's software acceptance testing is done. XVISOR is expected to be available to EPRI Substations O&M members end of April. Expansion to add LTC will follow.

8. Guidelines for Life Extension of Substations

These guidelines, now published in Final Report TR-105070 dated April 1995, include a large section on transformer inspection, condition assessment, testing, and maintenance practices. An updated version is in process.

9. Low Maintenance LTC

Work is completed to identify and categorize specific LTC problems, causes and populations involved; evaluate existing mitigation measures; and identify R&D needed to achieve substantial reduction in LTC maintenance requirements. A workshop was held November, 1996 in Tampa, FL. to provide a forum for discussion of LTC problems / maintenance / and ways to improve reliability and reduce maintenance. Proceedings are published in TR-108398 dated June 1997. EPRI projects are underway to improve understanding of contact coking, oil filtration effectiveness and monitoring concepts.

10. Continuous On-Line Filter

A project is underway to develop a passive on-line filter for mounting on transformers to continuously remove moisture, oxygen and oil degradation products to keep oil in pristine condition

cc: J. W. Matthews, Chairman, IEEE/PES Transformers Committee

Dr. Robert Schainker

8.2 SCC4 - P. A. Payne

Standards Coordinating Committee No. 4

IEEE P1 Working Group reviewed the comments received from the survey ballot on the first draft of *Recommended Practice for Temperature Limits in the Rating of Electrical Equipment and for Evaluation of Electrical Insulation*. Comment resolutions will be incorporated into the second draft and submitted for ballot survey.

The Transformers Committee is one of the Coordinating Committees. Committee Chairpersons have been given an invitation to review drafts and were reminded to notify Paulette Payne, IEEE P1 Chairperson, by April 23, 1999 if coordination is desired.

Respectfully submitted,

Paulette Payne

8.3 TC 14 TAG - P. J. Hopkinson

8.3.1 APPROVAL OF PREVIOUS MINUTES

The minutes for the meeting held November 8, 1998, were approved as submitted.

8.3.2 MEMBERSHIP

Members reviewed the committee roster and made such changes and corrections as needed. It was noted that Mr Nigal McQuinn was not included on the roster.

8.3.3 OLD BUSINESS

The chairman reviewed the listing of documents that are under the purview of IEC TC 14 for review, modification and/or withdrawal. It was noted that TC14 is expected to establish a new Working Group for distribution transformers. The US intended to submit a new work proposal for the development of such standards. Wes Patterson has agreed to serve as the project leader of the program and will likely be designated the convenor of the working group, an important leadership position.

8.3.3.1 Revision of IEC 60076-5 Short Circuit

R. Del Vecchio reported that TC 14 is issuing a document designed to ensure the survivability of the equipment in the test. When short-circuit tested, IEC 76-5 allows an impedance change of only 0.1% compared to 0.2% in the US. If tests are not to be conducted, then calculations should be completed in the context of a unit already tested that has the same transformer typology and within $\pm 10\%$ in kVA. He had sought to have the document accept calculation provisions that were more lenient based on agreement between the manufacturer and the customer. The French and Italians found the calculations too vague – either test everything or a method that will ensure the survivability of the transformer under short circuit. The chairman agreed to add an annex on the calculation method. A task force was established to identify such a method

based on forces and stresses. A draft document is expected to be issued shortly, but the outline seemed vague concerning the stress calculations. The US methodology was offered for consideration for clarifying the procedure.

The next meeting of the WG will be in June in Budapest in conjunction with CIGRE meetings. The members will discuss monitoring, calculations and stresses. It was noted that the notion of calculations is a highly controversial matter, so progress will be slow.

It was reported that there is a suggestion on the use of low frequency signals for fractions of a minute to do the inductance tests (measurements). N. McQuinn expressed concern with the adequacy of that methodology in view of his experience. His concern is that an arching fault may be present that could be missed with an electronic bridge. A proposal to use the technique of transient pressure buildup was also considered, but no action has been taken on it. It was further noted that testing laboratories are seeking as many testing methods or options as possible and the group is monitoring the progress on the revision of IEC Pub 60076-2.

8.3.3.2 Revision of IEC 60076-3 and 60076-3-3 on Dielectric Tests

L. Wagenaar reported that a number of meetings were held by the WG 24. He noted that much of the discussion at the meeting was on digital recorders. The discussion resulted in 6 recommendations being offered by the WG: 1) that the raw data should be presented to curve fit the measured data; 2) the sampling frequency when determining wave shapes should be 60 MHz minimum but preferably 100 MHz; 3) that errors have exceeded 10% between measurements made with digital recorders and actual voltage amplitudes; 4) use a peak voltmeter to measure voltage magnitude; 5) sampling frequency of 10 to 20 MHz for recording applied voltage and current recordings; and 6) additional guidelines for interpretation of voltage and current waves.

He noted that additional actions were taken by the WG:

Transfer admittance function – a method for determining if a problem is in the test circuit or test object.

Impulse test report now included as a result of US recommendation.

The document will be presented to TC14 for circulation as a CD.

L. Wagenaar noted that there were a number of provisions in the IEC document that should be considered for inclusion in the US standard.

Members engaged in a brief discussion of dielectric tests as they relate to IEC and US standards. In ANSI C57.12.00 switching surge is derived from BIL (83% of the crest value). In IEC 76-3, BIL is dependent on switching surge with no fixed relationship. This needs to be better understood.

8.3.3.3 Revision of IEC 60214 on Tapchangers

Members engaged in a brief review of the actions taken at the March 15 – 16 meetings of the WG 26. J. Gauthier, who represented the US, briefly highlighted the actions taken at the meeting. Members engaged in a brief technical discussion of the proposal to include in IEC Pub 60214 for on-load tapchangers a temperature rise factor at 1.2 times rated current. Members agreed that was an issue that should be closely scrutinized to determine how the provision would impact US practices. If there is a significant effect and values reflecting that are not accepted for inclusion in the

standard, then it is likely that the US will seek to include an "in some countries" clause in the revised document.

Members engaged in a brief discussion of a US proposal on the testing of electrical contacts in off-circuit tap changers. It was noted that the proposal was presented to the IEC WG but the WG members requested time to review the proposal before it should be discussed. The discussion will likely take place during the next meeting of the WG in June 1999. P. Hopkinson noted that the proposal should be included in the C57.131 document as a separate section.

It was noted that Pub 60214 includes provisions for transitional testing that are significant and the document should include an informative annex on test circuits.

8.3.3.4 Revision of IEC 60551

J. Puri reported on the December 1998 meeting of WG25, noting that several US proposals on sound levels were not accepted. It was noted that additional discussions of US concerns will be held at the next meeting of the WG in May 1999.

8.3.4 NEW BUSINESS

The only new business discussed was the issue of funding. For 1999, the US National Committee has been charged with the mission of raising approximately \$650,000 to support IEC activities. Shortly, Charles Zegers (USNC Secretary) will be sending dues invoices to all TAG members. While this represents an imposition on those who are doing valuable, technical work for the country, no practical alternative has been identified to date.

8.3.5 TIME AND PLACE OF NEXT MEETING

Members agreed to meet in November 1999, in conjunction with the IEEE Transformer Committee meeting in Mexico.

8.3.6 ADJOURNMENT

There being no additional business, the meeting was adjourned at 5:40 PM

Reported by

John A. Gauthier

13 April 1999

9.0 Old Business

None

10.0 New Business

None

11.0 Adjournment

The meeting was adjourned at 4:00 PM.

Respectfully submitted,
H. Jin Sim, Secretary

Attachment 5

GROUPS	Boston Nov. 95	Sanf Apr.96	Burl Oct.96	Graz Jul.97	St.Louis Nov.97	Little R Apr. 98	Leon, MX Nov. 98	NO, LA Apr. 99	MAX	AVG
Committee Registration: Members and Guests	272	301	287	164	282	267	262	262	301	262
Spouses	51	64	67	91	32	34	49		91	55
Luncheon	165	167	148	108	147	156	262	262	262	177
SC ADMINISTRATIVE	20	21	19	17	19	16	19	22	22	19
SC AUDIBLE NOISE AND VIBRATION	26	34	23	9	22	32	23	28	34	25
SC BUSHINGS	32	32	29	32	23	32	25	11	32	27
WG Revision C57.19.00							36	22	36	29
TF Draw Lead Bushings	25		17		21	23	23	20	25	22
WG DC Applications of Bushings	19	19							19	19
WG Revision C57.19.01	30	30	28	26	24	33	38	24	38	29
SC DIELECTRIC TESTS	71	88	91	58	71	81	80	52	91	74
WG Low Frequency Tests	39	50	49	40	31	42	20		50	39
WG Revision of Transient Dielectric Tests							20		20	20
WG Rev. Dielectric Tests on Distr. Transf.	14	16	13		14	21			21	16
TF Rev. Distr. Impulse Guide	18	16	13						18	16
TF L.F. Transformers Dielectric Test Table								28	28	28
WG Partial Discharge Tests	27	35	44	37	43	51	58	41	58	42
SC DISTRIBUTION TRANSFORMERS	44	37	45	11	37	49	29	36	49	36
WG Dist. Substation Transformers C57.12.36							16	22	22	19
WG Overhead Type Distr. Transfs. C57.12.20	30		23			39	19	35	39	29
WG Single-Phase Submersible C57.12.23	23					41		16	41	27
WG Single-Phase Deadfront Padmount C57.12.25	29		28		35	41		30	41	33
WG Bar Coding	29				25	40			40	31
WG Loss Evaluation C57.12.33	47				55	48			55	50
WG Electronic Data Transmittal	33				20		12		33	22
WG Three-Phase Padmount C57.12.34	28							23	28	26
WG Step-Voltage and Induction Regs C57.15	33				26		16	9	33	21
SC DRY-TYPE TRANSFORMERS	37		33	21	32	22	26	27	37	28
WG Test Code C57.91	27		18		20	23	20	22	27	22
WG Dry-Type Reactors	10	14	8	8	7	9	6	13	14	9
WG Dry-Type Reactors - HVDC Smoothing	7	5	6	12		9			12	8
WG Dry-Type Thermal Eval. and Flammability	21		27	15	24				27	22
WG Dry-Type General Requirements C57.12.01	27	20	27	5	30	28	24	18	30	22
WG Insulation Req. for Specialty Transf.	9	11	17		6				17	11
WG Cast Coil Loading Guide	21	19	18	19	21	18		14	21	19
WG Hot Spot Differentials	28	34	32		27	33	23		34	30
SC HVDC CONVERTER TRANF. & REACTORS		11	9	8	6	6	7	8	11	8
SC INSTRUMENT TRANSFORMERS	18		26	9	10	13	7	11	26	13

Attachment 5

GROUPS	Boston Nov. 95	Sanf Apr.96	Burl Oct.96	Graz Jul.97	St.Louis Nov.97	Little R Apr. 98	Leon, MX Nov. 98	NO, LA Apr. 99	MAX	AVG
WG C57.13.5 Test Req Instr Transf >115 kVA	22	16		7	13	20	13	12	22	15
WG C57.13.6 Instr Transf for Electronic Meters & Relays							9		9	9
WG Revision of C57.13	20	20		9	10	17	8	12	20	14
SC INSULATING FLUIDS	58	68	69	33	71	84	71	56	84	64
SC INSULATION LIFE	57	65	60	18	55	73	58	65	73	56
WG Thermal Eval. of Distr. and Power Transf.		32							32	32
WG Thermal Tests	21	33	32	19		18			33	25
WG Revision of Temperature Test Code	19	37					24	24	37	26
WG Thermal Duplicate	26	20	37		30	34	24	34	37	29
TF Hottest Spot Temp. Rise	52	51	40		56	67	50	50	67	52
TF Winding Temperature Indicators	46	48	41	25	26	32	22	16	48	32
SC PERFORMANCE CHARACTERISTICS	99	106	108	49	74	77	52	45	108	76
WG Loss Tolerance and Measurement	34	37	30	27	18	27	25	26	37	28
WG PCS Rev. C57.12.00	29		46	23	19	36	32	75	75	37
WG PCS Rev. C57.12.90 Part I	23	34	49		21	33	43	28	49	33
WG PCS Rev. Short circuit Testing	5			29	19				29	18
WG Revision C57.110	40	34	42	22	39		11		42	31
WG Semi-Conductor Rectifier Transformers	33	28	26	18	19	13		16	33	22
WG Switching Transients				30	22	31	33	40	40	31
SC POWER TRANSFORMERS						26	25	42	42	31
WG LTC Performance Requirements					34	31	29	25	34	30
WG C57.140 Transformer Life Extension								31	31	31
WG Diagnostic Field Testing & Monitoring	64	89	94	70	66	83	42	20	94	66
TF On-line Monitor Communication				27	28	28	28		28	28
WG West Coast		9	12	15	13				15	12
WG Phase Shifting Transformers	18	36	38	31	26	43	30	31	43	32
SC STANDARDS	14	24	19	9		11	4	5	24	12
WG Continuous Revision C57.12.00	15					8			15	12
WG Continuous Revision C57.12.90	15					8			15	12
WG Terminology, Definitions, Units, & Markings	29								29	29
SC UNDERGRND. TRANF. & NETWK. PROTCS.	12	12	13	6	13	11	14	18	18	12
WG Three-Phase Underground Transfs.	13	10	12	5	13	14	16	10	16	12
WG Liquid-Filled Sec. Network Transfs.	15	12	13	6	16	16	16	17	17	14
WG Secondary Network Protectors	13	11	13	5	16	12	9		16	11
WG Dry-Type Network Transfs.	9					5	7	5	9	7

Note: Data maintained for four years only. filename=tcattend.xls

