IEEE/PES Transformers Committee

Meeting Minutes
October 18, 2000

IEEE/PES TRANSFORMERS COMMITTEE MEETING

October 18, 2000

Niagara Falls, Ontario, Canada

IEEE/PES TRANSFORMERS COMMITTEE MEETING

NIAGARA FALLS, ONTARIO, CANADA

OCTOBER 18, 2000

ATTENDANCE SUMMARY

MEMBERS PRESENT

Allustiarti, Raymond
Anderson, Greg
Antosz, Steve
Arnold, Jr. Jim
Atout, Khaled
Balma, Peter
Barnard, Dave
Barnes, Mike
Barker, Ron
Binder, Jr., Wally
Boettger, Bill
Brown, Charles
Cambre, Jr., Max
Chu, Don
Corkran, Jerry
Crouse, John
Degeneff, Bob
Diamantis, Tom
Dix, Larry
Dohnal, Dieter
Duckett, Don
Dudley, Richard
Elliot, Fred
Ellis, Keith
Fallon, Don
Galloway, Dudley
Ghafourian, Ali
Graham, Richard
Grunert, Bob
Haas, Michael
Hager, Jr., Red
Haggerty, Kent, P.E.
Hall, Geoff
Hansen, Wayne
Hall, Geoff
Hanique, Ernst
Hansen, Wayne
Hanus, Ken
Harlow, Jim
Hartgrove, Bob
Hayes, Roger
Henning, Bill
Highton, Keith
Hopkinson, Phil
Iman, Mike
James, Rowland
Jhonsa, VJ
Jonnatti, Tony
Kennedy, Sheldon
Khalin, Vladimir
Kim, Dong
Lackey, John
Lau, Mike
Lewis, Tim
Lindgren, Stan
Lundquist, Tom
MacMillan, Donald
Marek, Rick
Matthews, John
McNelly, Susan
McShane, Patrick
McTaggart, Ross
Miller, Kent
Mitelman, Mike
Molden, Arthur
Morehart, Gene
Mulkey, Daniel
Musil, R.J.
Niemann, Carl
Orehek, Paul
Papp, Klaus
Patel, Bipin
Patton, Jesse
Perco, Dan
Payne, Paulette
Pierce, Lin
Plaster, Leon
Platts, Don
Preininger, Gustav
Prevost, Tom
Puri, Jeewan
Purohit, Dilip
Riffon, Pierre
Robinson, Butch
Rossetti, John
Sankar, V.S.N
Savio, Leo
Sharma, Devki
Shenoy, Vic
Shertukde, Hemchandra
Shull, Stephen
Sim, Jin
Singh, Prit
Smith, Ed
Smith, Jerry
Smith, Jim
Snyder, Steven
Stahara, Ron
Stoner, Ron
Sullivan, John
Traub, Tom
Trummer, Edgar
Vaillancourt, Georges
Veitch, Bob
Wagenaar, Loren
Ward, Berry
Watson, Joe
Weffer, Felipe
Wilks, Alan
Zhao, Peter

MEMBERS ABSENT

Aho, David
Allan, Dennis
Anderson, Glenn
Aho, David Allan, Dennis
Anderson, Glenn
Altman, Mike
Artega, Javier
Aubin, Jacques
Ayers, Don
Bancroft, Roy
Bertolini, Edward
Borst, John
Cash, Don
Chiu, Bill Borst, John
Cash, Don Chiu, Bill
Clark, Tom
Dahinden, Vincez
Ebert, John
Feghali, Pierre
Fleeman, Jeff
Foldi, Joe
Franchek, Mike
Frank, Jerry P.E.
Gayton, Carlos
Gillies, Jim
Girgis, Ramsis
Grubb, Bob
Gryszkiewicz, Frank
Harley, Jack
Heinrichs, Frank
Hoefler, Pete
Holdway, Tim
Johnson, Jr., Chuck
Juhlin, Lars-Erik
Kallaur, Gene
Kelly, Joe
Kennedy, Bill
Kline, Don
Lazar, John
Lewis, Frank
Light, Hal
Loveless, Mark
Lowdermilk, Larry
Lowe, Don
Lowe, Richard
Ma, Joe
Maguire, Willliam
Massouda, Tito
McQuin, Nigel
Mehta, Sam
Moore, Harold
Murray, Chuck
Paiva, Gerry
Patterson, Jr., Wes
Pekarek, Tom

Perkins, Mark
Robbins, Chris
Smith, Steve
Thenappan, Vis
Wimmer, Bill
Poulin, Bertrand
Sampat, Mahesh
Stein, Werner
Thompson, James
Woodcock, David
Raymond, Charlie
Ruevekamp, Henk
Stiegemeier, Craig
Tuli, Subhash
Risse, Peter
Scheu, Bob
Templeton, Jim
Whearty, Bob

GUESTS PRESENT

Ahrens, Paul
Banjoya, Nagatoshi
Beckman, Stephen
Bush, Carl
Cooper, Tommy
Darwin, Alan
Delvecchio, Bob
Drexler, Charles
Fairris, Bruce
Forsyth, Bruce
Gardner, James
Hardin, Mike
Horning, Mike
Kennedy, Gael
Kranich, Neil
Marlow, Dennis
Moffat, Jock
Oommen, TV
Pillitteri, Paul
Raymond, Tim
Romano, Ken
Schweiger, Ewald
Shertukde, Rekha
Steineman, Andy
Swinderman, Craig
Trivitt, Donnie
Ziomek, Waldemar
Anderegg, Don
Ballard, Don
Betancourt, Enrique
Cancino, Alvero
Corsi, Dom
Daubert, Ron
Dempsey, Patrick
Duart, Jean-Claude
Fausch, Reto
Foster, Derek
Garza, Joseph
Heinzig, Peter
Jaroszewski, Marion
Kerwin, Don
Leuenberger, Boyd
Martin, Mike
Nelson, Tom
Oriti, Samuel
Pregent, Guy
Reitter, George
Rose, Don
Sestito, John
Shteyh, Ibrahim
Stensland, Len
Termine, Guiseppe
Ward, Berry
Antweiler, Jim
Bartley, Bill
Billings, Dave
Christini, Mark
Culhane, Michael
Davis, Eric
DiFranco, Tony
Eckholz, Klaus
Foati, Marc
Fyvie, Jim
Gianakouros, Harry
Henry III, George
Jausch, Tom
Kirchner, Lawrence
Lortie, Raymond
Matthews, Don
Nguyen, Van Nhi
Patel, Sanjay
Progar, John
Riboud, Jean-Christophe
Schappell, Steve
Shah, Dilip
Sparling, Brian
Still, Robert
Thompson, Robert
Wicks, Roger
Arpino, Carlo
Beauchemin, Claude
Bonito, Raul
Colopy, Craig
Darovny, Bill
Declercq, Jan
Digby, Scott
El Hayek, Joseph
Forrest, Alan
Garcia, Eduardo
Graham, John
Holland, J.
Kawashima, Takeshi
Klaponski, Brian
Lu, Franklin
McClure, Phil
Nordman, Russ
Pedro, Pedro
Raye, Martin
Rivers, Mark
Schwartz, Wes
Shekelton, Jim
Spitzer, Tommy
Swift, Glenn
Traut, Al
Zhao, Tony

Contents

CLAUSE PAGE

IEEE PES TRANSFORMERS COMMITTEE MEETING
WEDNESDAY, APRIL 5, 2000
Chair: B. K. Patel Vice Chair: H. J. Sim
Secretary: K. S. Hanus

1.0 Chairs's Report, Remarks & Announcements – B. K. Patel

The chair B. K. Patel called the meeting to order at 8:00 A.M. Mr. Patel opened the meeting by covering a few minor announcements. He then covered the main points of his chair's report shown in full length below.

The current host , Roger Hayes then gave a report on the attendance and other statistics on the meeting. The statistics were:

Registration – 361
Companions – 94
Sunday Evening - 299
Tuesday Luncheon – 217
Tuesday Evening Outing – 288
Monday Companions Tour – 87
Tuesday Companion Tour - 60

The Committee thanked the Host Committee with a round of applause.

Peter Balma made a presentation to the committee to discuss the future of the IEEE Transformers Committee. The presentation, "Growing into the Future - Challenges, Opportunities, Concerns," offered suggestions relative to the visibility of the Committee, improving the standards process, and growing membership. Topics for consideration and areas for improvement included increased communication, mentoring, education, and increased recognition of all involved. Input from all attendees was requested.

Phil Hopkinson made a presentation concerning electric deregulation and a national energy policy. He also talked about issues going on with NEMA, both standards making and government affairs. Phil talked about the fact in past there was a 25% reserve margin and it was assumed if the barriers were broken down this margin in a deregulated market would equate to savings. With growth in the market place and lack of new generation & transmission being built, the outlook for the future is looking like we will be seeing severe shortages in future. Phil covered the details of pending legislation concerning this. Phil covered what should go into a good energy policy. These include sources, regulatory policies to stabilize markets and encourage investments and thirdly energy efficiency.

Ernst Hanique provided details about the next meeting in Amsterdam, The Netherlands on April 8-12, 2001. See Clause 7.3.2 for the details.

1.1 Report on the Technical Council Meeting, July 16-20, 2000 in Seattle

Attendance for the Summer Meeting stood at approximately 1400 at the time of the Technical Council Meeting.

1.1.1 Technical Council Reorganization

Chair Jones began the discussion of Technical Council reorganization by giving some of the history over the last six or seven years that preceded this proposal. He mentioned the formation of two groups – Industry Advisory Group chaired by Bruce Renz and Technical Council committee chaired by Stig Nilsson. Both groups supported a reorganization document distributed in March. Some thirty-seven pages of comments on the proposal were received. The general consensus of these comments did not support the reorganization.

Don Volkska then addressed the meeting discussing these comments and said that the comments have been heard and that reorganization would not be pursued at this time. However, problems still exist and need to be fixed. A list of problems, solutions, and time lines need to be developed. An initial attempt at identifying these problems will take place following the discussion. Jim Harlow will direct that effort. Don thanked the many people who provided thoughtful input to this discussion. Chair Jones then discussed that the problems should be identified. Gary Engmann stated that in his opinion "the primary mission of the IEEE is dissemination of important information to engineers for the benefit of society".

The following bullets were then noted for discussion:

- Standards
- Paper Reviews
- Technical Session Organization
- Deadlines
- Imagination
- New Technologies
- Mission Statement
- Value to Stakeholders
- CIGRE Procedures
- Discussion/Closure Question

Extensive discussion then ensued and the comments captured below:

- Standards
  - More international involvement
  - 13 Administratively withdrawn
  - Committees check reasons
  - Are standards coordinators okay?
- Treat as project (GANTT)
- Training on Standards Process at SM, WM
- SA Staff support functions
- Rewards for proper performance
- Time to resolve negatives
- IEEE-IEC Rules differences
- Training

- Course work supplement
- John Newbury STS
- PEEC more tutorials
- Practical applications of advanced concepts
- Life extension

Advertising
- Advance Program

Marketing Topics (& Policy)
- Committee Level? (Trial Use)
- Special Technical Session (STS) on how various markets operate
- Caution re: "turf" consideration
- Institute "special interest: (TF)
- Define structure for new topics
  - Emerging technologies
  - Marketing

New Technologies
- Future Technical Development Committee
- Incubator for new technologies
- Dispersed Generation
- How to plan
- Each Committee should look at "fringes"

Paper review
- Expand reviewer pool
- Set up tickle procedure
- Status of paper on web

As part of the discussions, Jim Harlow challenged the technical committees to have twelve Special Technical Sessions, similar to the Transformer Noise Session held at the Singapore meeting, at the Columbus meeting.

A trial use technical committee to address marketing issues was discussed. A group to perform this function will be discussed and possibly formed at a later date. Jim Harlow was assigned this task. A similar task to include emerging technologies should also be considered.

1.1.2 Future Meeting Changes

Teddy Puttgen gave a short presentation regarding future PES meetings. He stated that presently four general meetings, one T&D meeting, one PICA meeting, and one ESMO meeting where being held within a two year period. This is planned to be revised to have only four meetings within a two year period. They would be consist of only one general meeting in the spring of each year, a T& D meeting in the fall of each odd year, and a PICA type meeting in the fall of each even year. They would also like the Technical Council to have more involvement in the fall meetings and to have more Technical Committees meet at these meetings at least once a year. These meetings for the foreseeable future would be in NAFTA countries. Regional meetings would be scheduled outside of NAFTA countries.

1.1.3 NERC/PES Partnership for Standards Development

Members of our Power System Operations Committee have met three times with the NERC

Working Group on Policy 8B, Operator Training. This is the document that NERC chose as a demonstration of the partnership between NERC and PES.
Although our members have done a great job in supporting this project, political discussions within NERC have stonewalled the project. Although a draft of the document is completed, NERC has not signed and released the PAR - which PES signed back in January. The PAR will be withdrawn until NERC releases the PAR.

At this point, it is unclear what our role will be in these projects. We have committed our support, but our role is to provide support to NERC if it is desired.

1.2 Committee Liaison and Task Force Reports

1.2.1 IEEE Council on Superconductivity – J. L. Kirtley

The IEEE Council on Superconductivity (CSC) is alive and well. It publishes the IEEE Transactions on Applied Superconductivity and is financially sound.

The Council is sponsored by nine IEEE societies, although only seven have active representatives (members of the editorialboard). The current chairman of the committee is Moises Levy, and Editor in Chief of the Transactions is John Przybysz.

The Council has a web site: http://www.ieee.org/csc

Dr. Levy has asked that Power Engineering appoint a second member to the Editorial Board.

1.3 Transformers Committee Report to Technical Council

I reported the following to Technical Council for the Committee:

1.3.1 Committee Meeting Activities

Our Spring 2000 meeting was held April 2-5, 2000 in Nashville, TN. Mr. Alan Wilks, ERMCO, was our host. A total of 302 members and guests attended the meeting.

Membership of the Transformers Committee currently stands at 179 members and 20 Emeritus members. The regular members consist of 86 producers, 53 users, and 40 general interest. Our invitation list consists of approximately 600 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

Fall 2000:

October 15-18, 2000, Niagara Falls, Ontario, Canada. Contact Roger Hayes, host @ VA-TECH Ferranti-Packard Transformers + (905) 685-6551, fax + (905) 685-9783 or one of the Committee Officers.

Spring 2001:

April 8-12, 2001, Amsterdam, The Netherlands. Contact Ernst Hanique, host @ Smit Transformers + (31) 024-3568744, fax + (31) 024-3568748 or one of the Committee Officers.

Fall 2001:

October 14-18, 2001, Orlando, FL, USA. Contact Joe Watson (co-host) @ Florida Power & Light + (561) 691-2206, fax (561) 694-4161 or John Progar (co-host) @ Ohio Transformer (800) 591-2256, fax + (941) 722-2549 or one of the Committee Officers.

Spring 2002:

Vancouver, BC, Canada. Contact Mike Lau, host @ BC Hydro + (604) 528-3201, fax + (604) 528-3347 or one of the Committee Officers.

1.3.2 2000 Summer Power Meeting Technical Sessions

The Transformers Committee is sponsoring one presentation session on transformers during the Summer Power Meeting.

1.3.3 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.

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.

Bipin K. Patel, Chair

2.0 Approval of Minutes of April 5, 2000 - B.K. Patel

The minutes of the Nashville meeting were approved as written.

3.0 Vice Chair's Report – H. J. Sim

The vice chair covered the main points of his report shown in full length below.

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 2000 Summer Meeting in Seattle, WA on July 16 - 20, 2000.

3.1.1 Technical Sessions

Here are the high points of the discussions held and the report presented at the meeting:

3.1.1.1 Power Engineering Review will continue to publish Technical Committee promotional articles. Each committee will submit their material by their due date as scheduled.

3.1.1.2 Mel Olken, Susan Sacks, George Bouziotis, and Marie D'Alessio (All from PES Staff) presented some information on PES Technical paper, publications, and meetings. Highlights of this presentation are:

Transactions Papers

- Changes in paper review process are a result of requests by authors and reviewers. The papers are now in .pdf format.
- Use web based pick-up instead of email dispatch.
- Flightdeck software keeps track of all process and provide status of any paper.
- Statistics for September 1, 1999 through July 11, 2000 time period is not very good. Total of 555 papers sent for reviews and only 69 decisions have been made.

Proceedings Papers

- 2000 is the second year since PES started using this classification of papers
- Currently, only hard copy papers are submitted for procession.
- The format will change to electronic for 2001 Summer meeting and T&D Conference.

IEEE Xplore

- Reference linking service, went live second quarter of this year (2000)
- 12 leading scientific publications
- Set it's own access standard
- 3 million articles to start (All 1988 and after)

- 500,000 articles per year will be added
- Free service for all PES members for now and will be fee based later

Meetings

- PES office is only the messenger for the procedures
- Technical Council sets the rules
- Meeting room requests for General Meetings must come from the Committee Chairs

3.1.1.3 TSC chair Jim Harlow presented highlights for the new "Guide for the Technical Program Chair (TPC) and Technical Committee Program Chairs (TCPCs)." This is an excellent guide for new and experienced program chairs. Once the suggested changes are incorporated, it will be distributed to all TPC's and TCPC's.

3.1.1.4 Starting with the Summer Meeting (Vancouver, BC), Proceedings papers will not require the submittal and approval of their abstracts. This process was to help the authors to put their efforts into writing papers on those approved abstracts only as well as assist the reviewers to minimize the amount of time required to process large amount of papers in a very short time. However, it was generally believed that the quality of the papers has gone down since this process has been implemented and did not achieve the intended goal of streamlining the process.

Since the "Call for Paper" for the 2001 T&D Conference is already published and sent out, we will not change the current process of requiring the abstracts. The TPC for this Conference will decide what TCPC's should do with these abstracts.

3.1.1.5 TCPC's or their designees will be the only communication channel for Panel sessions, Special Technical Sessions, and Proceedings papers. Some Technical committees process extremely large number of papers and need closer communication to avoid conflicts between sessions. Making the TCPC the official communications channel will improve this in the future.

3.1.1.6 After having very successful Special Technical Sessions (STS) at the Winter meeting in Singapore, where our committee sponsored one of the three STS, all technical committees are challenged to organize their own STS. For the 2001 Summer Meeting at Vancouver, Theme and Tracks for the technical sessions have been published with the following key points. Our committee will try to organize at least one STS that matches the theme.

Theme: Utilization, Reliability and Control of the Power System - MW and Beyond.

Preferential topics for the meeting include:

<u>Utilization</u>

- Utilization beyond conventional limits
- Secondary use of the system for telecommunications and other purposes

- Impact of power electronics on end-use utilization
- Asset management techniques

Reliability

- Market environment
- Reliability standards and compliance - integration of legacy systems into the new reliability standards; reliability versus economics and in-situ testing of components
- Impact of inexpensive, widely dispersed distributed generation and storage, including fuel cells
- Implications of "micro" versus the present "mega" systems

Control

- Direct Load Control
- Wide Area Monitoring and Control
- Distributed generation control

Computation

- Internet and Web based computation for power engineering
- Symbolically assisted computational tools

3.1.2 Organization and Procedures Committee

3.1.2.1 Technical Committee Activity Reports

No major discussion during the individual TC report.

3.1.2.2.1 Revision of the Technical Council Organization and Procedures Manual

Our committee O&P Manual has been revised based on the current revision of the TC O&P Manual and submitted to the committee for approval. It is approved on July 18, 2000 meeting with minor changes in wording. I will get the final version without the signature sent to Steve Brockschink, incoming chair of the TCO&P. A signed copy of the manual will be sent to our secretary, K. Hanus for general distribution. I will also make this available from the Transformers Committee website.

3.2 Technical Paper Reviews

3.2.1 Technical Paper Review Summary

We received 11 transaction papers and review for 9 of them are complete. Our editor had many significant problems getting the papers reviewed. Reviewing assigned papers for approval is one of the key duties of the committee member. Please be responsive and timely when you are requested to serve as a reviewer.

Five 2001 Winter Meeting Proceedings paper abstracts was received and approved.

3.2.2 Technical Paper Session at 2001 Winter Meeting

One transformer session is planned for the Columbus, OH meeting.
Respectfully submitted,

H.J.Sim, Vice Chair

4.0 Administrative Subcommittee – Bipin K. Patel

Chairman Patel covered the key points of the Administrative Subcommittee Meeting held on October 15, 2000. See the Administrative Subcommittee Meeting Minutes in full length below for details.

4.1 Introduction of Members and Guests

Chair Patel called the meeting to order at 2:00 p.m., Sunday, October 15, 2000, in the Haida Room of the Sheraton Fallsview Hotel in Niagara Falls, Ontario, Canada.

The following members of the Subcommittee were present:

K. S. Hanus	B. K. Patel
R. F. Dudley	P. E. Orehek
F. E. Elliott	L. W. Pierce
D. J. Fallon	T. A. Prevost
Wes Patterson	J. Puri
E. G. Hager	H. J. Sim
Ed Smith	J. E. Smith
J. W. Matthews	L. B. Wagenaar
Greg Anderson	Carl Niemann

The following guests were present:

Naeem Ahmad
Alan Wilks
Roger Hayes
Ernst Hanique

4.2 Approval of the Nashville Meeting Minutes

The minutes of the previous Administrative Subcommittee meeting in Nashville 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 – G.W. Anderson

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

4.5 IEEE Delegation Report ANSI C57 Committee – J.W. Matthews

4.5.1 The Delegation has responded to eight ballots since the meeting in Nashville, TN, USA.

Affirmative ballots were returned for the following:

- PC57.12.91/D2 "Standard Test Code for Dry-Type Distribution and Power Transformers"
- C57.19.100-1995 Reaffirmation "IEEE Guide for Application of Power Apparatus Bushings"
- C57.136/D12 Recirculation: "Guide for Sound Level Abatement and Determination for Liquid-Immersed Power Transformers and Reactors Rated Over 500 kVA"
- P1388/D6 Recirculation: "Standard for the Electronic Reporting of Transformer Test Data"
- PC57.135/D11: "Guide for the Application, Specification and Testing of Phase Shifting Transformers"
- PC57.12.70/D3 Second Recirculation: "Standard Terminal Markings and Connections for Distribution and Power Transformers"
- PC57.12.91/D3 Rev. Recirculation: "Standard Test Code for Dry-Type Distribution and Power Transformers"

A negative ballot was returned for PC57.12.80/D2 Rev. Recirc.: "Standard Terminology for Power and Distribution Transformers" because a number of errors were detected in this draft document during the concurrent IEEE balloting.

ASC C57 is presently conducting a ballot on C57.12.32 to which the Delegation has not yet responded. Note that this document is one of the NEMA copyrighted documents covered in the following summary of document development processes.

4.5.2 Processes for Development of IEEE/ANSI/NEMA Copyrighted Documents

We previously obtained the following procedure clarifications for IEEE from Judy Gorman:

For IEEE Copyrighted documents:

- we obtain IEEE project authorization (requires copyright clearance)
- we develop/maintain the document according to IEEE procedures
- IEEE conducts balloting (simultaneously for C57 approval)
- we obtain IEEE Standards Board approval
- we are indemnified by IEEE

For ANSI/NEMA Copyrighted Documents:

- we can maintain (IEEE will not authorize)
- we develop/maintain the document according to IEEE procedures (not required by IEEE)

- IEEE ballot is not required (IEEE will not conduct C57 ballot)
- IEEE Standards Board approval is not required
- we are not indemnified by IEEE

This information was conveyed to ANSI and NEMA.

In order to obtain indemnification for our work in the development process, we asked both ANSI and NEMA if they would be willing to transfer the copyrights to IEEE or indemnify our working groups while working on these documents. ANSI responded that they cannot provide indemnification to our working groups, but they would be "…very happy to assign whatever rights we may have in any of those documents either to IEEE, to NEMA or jointly to IEEE and NEMA…".

NEMA members present at the Nashville meeting took a straw vote which supported the transfer of copyrights of C57 documents from NEMA to IEEE to facilitate the development process. It was indicated that the principal members of the NEMA Section would address the matter shortly thereafter with consideration to the context of revenues from standards and other industry strategies.

A joint meeting of IEEE and NEMA Staffs was held on May 31, 2000. Two action items regarding maintenance of C57 Standards resulted from that meeting:

- ACTION: J. Gauthier and J. Walker verify the relevant C57 standards that are NEMA copyrighted. Complete action by September 1.
- ACTION: J. Gauthier to discuss with the NEMA Transformer Section the proposal to transfer copyright of the pertinent C57 standards to IEEE. Complete action by September 1.

Jerry Walker (IEEE) has produced the following list of NEMA copyrighted C57 Standards:

ANSI C57.12.10

ANSI C57.12.20

ANSI C57.12.22

ANSI C57.12.24

ANSI C57.12.25

ANSI C57.12.28

ANSI C57.12.29

ANSI C57.12.31

ANSI C57.12.32

ANSI C57.12.40

ANSI C57.12.50

ANSI C57.12.52

ANSI C57.12.55

ANSI C57.12.70

This list has not been verified by John Gauthier. I have received no information from John Gauthier regarding discussion of copyright transfer with the NEMA Transformer Section.

4.5.3 The present roster of the IEEE Delegation to ANSI ASC C57 is as follows:

- Matthews, J. W., Baltimore, MD - Chair, IEEE Delegation
- Borst, J. D., Jefferson City, MO
- Hanus, K. S. (alternate), Fort Worth, TX
- Patel, B. K., Birmingham, AL
- Prevost, T. A., St. Johnsbury, VT
- Sim, H. J., Goldsboro, NC
- Smith, H. D., Bluefield, VA

John W. Matthews, Chair

IEEE Delegation to ANSI ASC C57 Committee

4.5.4 SECRETARY's Additional Notes Regarding Discussion of Copyright Issue

Naeem Ahmad reported the "C57" logo has joint ownership by IEEE and NEMA. It was agreed upon by the transformers committee that working groups can continue to do work but cannot do any balloting until the issue is resolved. John Gauthier stated the transformer section of NEMA would need to be balloted before copyright transfer could proceed. Sheldon Kennedy is the current transformer section chair. John Matthews and Bipin Patel will discuss with Sheldon to resolve this matter.

4.6 Committee Service Awards – J. W. Matthews

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

4.7 Chair's Report – B. K. Patel

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

4.8 Vice Chair's Report – H. J. Sim

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

4.9 Secretary's Report – K.S. Hanus

4.9.1 Membership Review

Voting Members - Seven new members were added at the last meeting in Nashville, TN as noted in the Nashville meeting minutes.

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

Members -			182
	Classifications:	Producers -	87
		Users -	53
		General -	42
Corresponding Members -			1
Emeritus Members -			19

John Ebert's status was raised to Emeritus Member with all in favor.

Poor Attendance Records - The invitation list has been revised by removing approximately 95 guests with poor attendance record and adding new guests by request. Members who have not attended a committee meeting since the Fall of 1998 will be contacted to determine their interest in maintaining membership.

4.9.2 New Member Applications

Two new members were approved and welcomed. They are Ewald Schweiger (VA Tech ELIN) and Raymond Nicholas (ABB South Boston).

4.9.3 PES Directory Rosters

Subcommittee chairs are requested to keep the rosters updated as they change constantly. The roster was updated and delivered to the secretary of the Technical Council for the 2001 directory. The secretary thanks all of the subcommittee chairs for getting the rosters revised in a timely manner.

4.9.4 Meeting Minutes

Minutes of the Nashville, TN meeting were reproduced at no cost, again compliments of Ken Hanus and TXU Electric. Postage costs were $ 1,925.75 for 468 mailings, which averages $4.11 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 January 26, 2001 for this meeting. The submittal should be an electronic file via e-mail, formatted in Word 97 (or earlier versions) and it would be appreciated if the minutes are put in the format (numbering, etc.) as shown in the minutes. 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.

A discussion of the continued mailing of "paper" minutes was brought up in keeping with going to a "paperless" system. After much discussion a motion was made to mail minutes out only to all transformer committee members (whether they attend the meeting or not) and to all other attendees who attend the meeting on Wednesday morning. The motion passed with no negatives.

4.10 IEEE Standards Activities – Naeem Ahmad

4.10.1 Naeem covered the following key points:

- The *Standards Board Operations Manual* has been revised for 2000. It is available in hard copy and at http://standardsieeeorg/guides/opman/index/html. A revised *Standards Companion* will be published in a few months. Working Group chairmen will find helpful information on development of standards, balloting and submission to the Standards Board in both publications.

- The PAR form has been revised. Download the type of PAR you wish to submit, and instructions for use, at http://standardsieeeorg/guides/par/index/html. You can submit either html or a text file.

- A PAR has a four-year life. An extension can be requested if progress has been made—such as a ballot has been issued with negative issues under resolution. Extensions are requested by submitting a "Target Extensions Request Form" available at http://standardsieeeorg/guides/par/extension/html.

- Conventions used by NesCom and requirements for PAR submittal and PAR extension requests are posted at http://standardsieeeorg/board/nes/nescomv99html.

- Standards that require over four years to develop may no longer be industry relevant. Yet, the average standard approved in 1999 required six years from PAR approval to standards approval. The Standards Board is considering adoption of "project monitoring" to identify authorized projects that may not be submitted by the target date promised by the Sponsor. A mentor may be offered to assist the Working Group; or an IEEE staff Editor may be assigned, to achieve completion by the agreed target date.

- Draft standards are submitted to the Standards Review Committee (RevCom) of the Standards Board. For RevCom conventions see http://standardsieeeorg/board/rev/revconventions/pdf. For the Guide for Submittal of Proposed Standards see http://standardsieeeorg/guides//revguide/html. For the Form for Submittal of Proposed Standards, see http://standardsieeeorg/rev/submitform.doc or http://standardsieeeorg/rev/submitform.pdf depending on your choice of a doc or pdf.

- Useful training modules in Microsoft PowerPoint can be obtained at http://standardsieeeorg/training. See http://standardsieeeorg/faqs/tpres.html for more information. Working Group chairmen and members will find one or more modules of interest.

- There are now over 5000 members of IEEE-SA with over 25% from Power Engineering Society.

4.10.2 Balloting of Standards

The IEEE Standards Department can assist you in conducting your sponsor level ballot. Following checklist will assist you in providing us with the complete package of materials. Please mail this package to your Standards Staff Liaison.

- **Two copies of the draft on 8-1/2 x 11" paper.**

  (Copies of the draft are not required for reaffirmation ballot.)
  - Each page must be numbered in the proper order.
  - Each page must have project # and draft #. (Example: C57.12.00/D5)
  - Each page must have current date.
  - Complete IEEE copyright statement on the first page of the document is a must.
  - Short IEEE copyright statement in a "footer" on each page is a must.
  - Title must be same as on approved PAR and should have the word "Draft" (Draft: Title)
  - Complete figures, tables and annexes at proper place.
  - Only metric units are allowed in the normative portion of the standard. Inch-pound data may be included in footnotes/annexes. Submit necessary exception request to SCC14.

- **A balloting letter addressed to the balloters explaining the purpose of the ballot.** *(Refer to Annex A of the IEEE Standards Companion for sample correspondence. This document is also available on the Standards home page* http://standards.ieee.org*. Go to policies and procedures under* Standards Development.*)*
  - The person who will receive the ballot summary upon completion of the ballot will write this letter. This is usually the Working Group Chair.
  - This letter will include address, telephone and fax numbers, and e-mail address.

Upon receipt of the above, The Balloting center will:

1. Conduct an invitation-to-ballot to form your balloting group.
2. Prepare a ballot form, which will be read by optical mark reader.
3. Duplicate your draft, send to the balloters /coordination contacts listed on the PAR.
4. Enter names and Interest Categories into database for all balloters.

5. Mail out the ballot form, cover letter and draft, and record responses.
6. Approximately 10 days before the ballot closing, will provide you with contact information for those persons who have not returned their ballots.
7. Provide you ballot summary and comments received, after the ballot has closed.
8. Conduct a recirculation ballot when necessary.

Naeem Ahmad, P. E.

Staff Engineer

IEEE Standards Department, 445 Hoes Lane, P. O. Box 1331,Piscataway NJ 08855-1331, USA

PH: +1 732-562-3931 ;FX: +1 732-562-1571;e-mail: n.ahmad@ieee.org

4.11 Standards Subcommittee - T. A. Prevost

4.11.1 Standards and Coordination Activities

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

4.11.2 Documents Submitted to the Standards Board

See the statu reports starting on page 84.

4.12 Subcommittee Activities - Subcommittee Chairs

4.12.1 Audible Sound and Vibration - Jeewan Puri

Jeewan Puri reported that in order to include the sound intensity measurement procedure in the IEEE standards, a group of nine volunteers form the ASV Subcommittee membership reviewed the present sound level measurement procedures given in C57.12.90 and C57.12.91. Six out of these nine reviewers recommended that the details of this subject, a separate stand-alone should be written for making sound intensity and pressure measurements. Writing a Guide was also recommended by four of these reviewers.

It was agreed that this issue should now be discussed and voted on in the entire ASV Subcommittee before taking a final decision on this subject.

4.12.2 Bushings - F. E. Elliott

No Report.

4.12.3 Dielectric Tests - L. B. Wagenaar

No Report.

4.12.4 Distribution Transformers – E. Smith

No Report.

4.12.5 Dry-Type Transformers - W. Patterson

No report.

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

A brief update on the two standards that the S.C. has been working on is as follows.

P1277 covering smoothing reactors for HVDC application was published in June 2000 as IEEE Std. 1277-2000.

PC57.129 covering converter transformers for HVDC application was published in June 2000 as IEEE Std. C57.129-1999.

Both standards are trial use documents and as such have a 2-year life. However, since usage of these documents depends on new HVDC projects and the timing of such projects is random, it is anticipated that both documents will have to be reaffirmed after their 2 year life in order to allow sufficient time to obtain proper feedback from manufacturers and end users. During this 2-4 year time frame, the S.C. will focus on assessing future needs and refinements for the two documents.

4.12.7 Instrument Transformers - J. E. Smith

No report.

4.12.8 Insulating Fluids - F. J. Gryszkiewicz

No report.

4.12.9 Insulation Life - L. W. Pierce

Lin Pierce reported that he would be resigning as chair of the subcommittee and suggested Don Platts replace him as chair. Don Platts was approved as the new chair of the subcommittee.

4.12.10 Performance Characteristics - D. J. Fallon

1) The C57.133 Guide for Short Circuit Testing has been stalled in

getting to the balloting process. Steve Shappel is working to make the latest Draft ballot-ready. The PCS Chair will work with Tom Prevost to move it to the ballot process and will assure assignment of a PCS member to follow the ballot returns to completion.

2) New WG Chairs in PCS holding meetings for the first time in Niagara Falls are:

* Steve Snyder, taking over for Don Platts as Chair of the WG for PCS Revisions of C57.12.00.

* Bruce Forsyth, taking over for Pierre Feghali as Chair of the WG for PCS Revisions of C57.12.90 (Bruce is unable to attend this meeting due to a last minute emergency at work, and Neil Kranich will chair this meeting in his place).

3) One item of new business to be discussed at the PCS Meeting will be a request from Don Platts for review of application of C57 Standards to transformers operating at 25Hz, or other frequencies than 60Hz.

4.12.11 Power Transformers - E.G. Hager

The transformers committee was made aware of the fact Tom Lundquist was on the agenda of the power transformers SC to discuss concerns with TRV and problems circuit breakers may have due to faults on the secondary side of transformers. It is believed that some transformer designs with high capacitance may cause higher than expected TRV under some fault conditions. The question at hand was whether the SC should get more involved in this matter or not.

Mike Lau of B.C. Hydro will be the West Coast subcommittee chair.

Andre Lux and Mike Chui will co-chair Working Group for Monitoring of Liquid Filled Transformers

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

C57.12.24 is now out in print and John Sullivan will be the new chair for C57.12.24 Three-Phase Underground-Type Transformers.

4.12.13 Meetings & Planning - Greg Anderson

Greg made the committee aware that the e-mail listing on the committee web page was password protected at this time until a firm policy about access to this information has been developed.

Greg asked committee members to help him come up with an anniversary date for when the committee started meeting. He would like to put together an anniversary CD with all of the minutes on it.

4.13 Old Business

See 4.12.1

4.14 New Business

Fred Elliott brought up the question of what responsibility do we have with regards to maintaining balance on subcommittee or working group membership? Chair Patel stated there is no rules requiring set balance on these committees, but suggested that working groups and subcommittee attempt to have membership from all three areas to make sure documents produced will meet all parties needs and not be one-sided. The only place balance is required is on official IEEE ballots.

Peter Balma made a presentation to the Administrative Committee and at the main meeting to discuss the future of the IEEE Transformers Committee. The presentation, "Growing into the Future - Challenges, Opportunities, Concerns," offered suggestions relative to the visibility of the Committee, improving the standards process, and growing membership. Topics for consideration and areas for improvement included increased communication, mentoring, education, and increased recognition of all involved. Input from all members of the committee was requested.

4.15 Adjournment

Bipin adjourned the meeting at 5:20 p.m.

Respectfully submitted,

K. S. Hanus, Secretary

AdSub Attachment 4.4

IEEE/PES Transformers Committee Meeting Locations

Year	Spring	Fall	Committee Chair
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 sub-committee met on Tuesday October 17th at 3:30 PM with five members and twelve quests in attendance.

The minutes from the April 6th, 2000 meeting in Nashville were approved as written.

Chairs Remarks:

- Coordination of Standards
    - Beginning in January 1, 2001 coordination of standards development will no longer be required other than SCC 10 and SCC 18.

Reports/Status of Standards:

- C57.12.70 Tom Prevost/Tom Traub
    - Recirculation Ballot closed on September 12th. Expect to submit to REVCOM this fall. Copyright has been released to IEEE.
- C57.12.80 Tom Traub
    - Recirculation Ballot closed on September 12th. Eight negatives will be addressed.
- Task Force on Metric Conversion Dudley Galloway
    - This task force will develop a guide for metric conversion to be used by the Transformers Committee for standards development. The goal is to have consistency in metric conversions.
- C57.12.00 and C57.12.90
    - A PAR for the next revision of these standards will be submitted early in 2001.

The meeting closed at 4:30.

6.0 Recognition and Awards – J. W. Matthews

6.1 Certificates of Appreciation

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

Name	Service Rendered
Pierre T. Feghali	Chair, Working Group on PCS Revisions to C57.12.90
Roger R. Hayes	Niagara Falls Meeting Host, October 2000
Anthony J. Jonnatti	Chair, Working Group on Dry-Type General Requirements
Carl G. Niemann	Chair, Working Group on Three-Phase Underground-Type Transformers
Paul E. Orehek	Chair, Underground Transformers and Network Protectors Subcommittee
Alan L. Wilks	Nashville Meeting Host, April 2000

6.2 PES Prize Paper Award for 2000

The paper 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 received one of the two PES Prize Paper Awards for 2000.

6.3 Nominations for IEEE, PES, and Technical Council Awards

I have received one nomination for an IEEE paper award for a tutorial presented at the 2000 Winter Power Meeting. Nominations for IEEE Paper Awards are open until March 1, 2001. Nominations for the PES and Technical Council Awards are closed as of October 15, 2000.

7.0 Meetings Planning Subcommittee -- G. W. Anderson

The "Meetings Planning SC" (previously the Meetings Planning WG) holds an open meeting at each TC meeting (generally on Tuesday afternoon) to plan future meetings and assist future hosts by education and mixing of ideas & lessons-learned. The meeting is attended by at least the SC Chair, the present meeting host, future hosts, and hosts from past meetings. Others interested in hosting a future meeting, or assisting with meeting planning are encouraged to attend.

The Meeting Planning Subcommittee meeting began at 2:00 p.m., Tuesday, October 17, 2000 in the Auditorium of the Sheraton Fallsview Hotel in Niagara Falls. Greg Anderson, SC Chair facilitated.

The meeting began with introductions by the attendees.

7.1 Committee Finances

Greg Anderson is determining Committee funds based on income and expenses for the Nashville meeting and will report the final numbers at the Amsterdam meeting.

7.2 Past & Present Meetings

7.2.1 Past Meeting - Nashville, Tennessee

Alan Wilks and the Ermco Host Team did an excellent job planning and implementing the previous meeting. The facilities of the Opryland Hotel were exceptional.

7.2.2 Present Meeting - Niagara Falls, Ontario, Canada

Roger Hayes and the VA-Tech/Ferranti-Packard Host Team were complimented on a very productive, large and well-planned meeting. It was noted that Sherry Baker from Events Extraordinaire, a local events planning company, assisted with the meeting planning and added notable value to the event and allowed Roger and others at FTP to "concentrate on being a host" and selling transformers. Preliminary attendance counts were summarized (see the attachment at the end of the minutes).

7.3 Future Meetings

7.3.1 Summary

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

- April 8-12, 2001 -- Amsterdam, The Netherlands … Ernst Hanique (SMIT)
- October 14-18, 2001 -- Orlando, Florida ... Joe Watson (FPC) and Ohio Transformers
- April 14-18, 2002 -- Vancouver, B.C. … Mike Lau (BC Hydro)
- Fall 2002 -- open for US meeting; contact Greg Anderson for if interested in hosting a meeting
- Spring 2003 -- open for US meeting

Possible locations for future meetings include: Oklahoma City, Minneapolis, New York City, Biloxi, and Montreal to name a few.

7.3.2 Upcoming Meeting -- Amsterdam, The Netherlands

Ernst Hanique was in attendance and gave a brief report on the progress of the Spring 2001 meeting in Amsterdam. The meeting will be at the Hilton Amsterdam Hotel, April 8-12. The meeting will begin with the usual Sunday Evening Hospitality Social. On Monday, all attendees are invited to attend an all-day excursion to the City of Nijmegen on a train pulled by a classic steam-train. The event will be completely complimentary of Smit. Some attendees (primarily customers) will tour the Smit Transformers plant while the remaining attendees will participate in a guided tour of the city. The meetings will be held all day Tuesday and Wednesday and the "Full Committee Meeting" will be held Thursday morning. The Dinner Social (on Wednesday night) will feature a cruise of the Harbor of Amsterdam in a luxury saloon steamer.

Approximately 200 guest rooms are reserved at the Hilton and at a nearby alternate hotel. Room rates will be approximately US$200 at the Hilton; and significantly less at the alternate hotel. Ernst Hanique can be reached at (905) 685-6551 x-263 or e.hanique@smit-trafo.nl.

7.3.3 Upcoming Meeting -- Orlando, Florida

Joe Watson has reserved meeting rooms and 275 guests rooms at the Omni Rosen Hotel (also known as the Rosen Center) in Orlando, Florida. Room rate will be US$165 (without taxes), single or double occupancy. The meeting will be the first to incorporate the "Sunday through Thursday" schedule. The schedule will consist of individual "break-out" meetings all day Monday, Tuesday, and Wednesday, with the "full Committee meeting on Thursday morning" (see more details later). Ohio Transformers will host a tour of their Bradenton Plant on Sunday (probably from 10 am until 4:30 pm). A guided tour of the "Disney Underground" is also being investigated. Although additional planning is in progress, Greg noted that this meeting will be promoted as a family meeting where attendees are encouraged to bring their children. We are investigating the possibility of provided bonded, licensed child-care service in the hotel during the Sunday Evening Reception (in a room next door to the reception). Joe Watson can be reached at (561) 691-2206 or joe_watson@fpl.com.

7.3.4 Upcoming Meeting -- Vancouver, B.C.

Meeting rooms and 250 guest rooms have been reserved at the Westin Bayshore Hotel adjacent to Stanley Park. Room rate will be CAN$180 (approx. US$130, without taxes). Mike Lau can be reached at (604) 528-3201 or mike.lau@bchydro.bc.ca.

7.4 New Business

7.4.1 TC Web-Page

Georges Vaillancourt has registered the Committee's web-page under the following URL: www.transformerscommitte.org. The Committee's web-page has been enhanced to feature more information about upcoming meetings and includes complete documented minutes from recent meetings. The Nashville meeting was the first to post on the web-site essentially all the information sent in the meeting "invitation packages". A big thanks to Georges Vaillancourt for maintaining the site.

Greg has developed a useful "Industry Calendar", also available on the TC web-site, that lists upcoming "transformer-related meetings, through year 2010. This calendar is helpful in planning future Committee meetings and avoiding conflicting meeting dates.

A new working group called "WG Web-page Development" will be developed. The new WG will further develop the TC web-site, encourage productive use of the site (bulletin boards, etc), determine "web content", and develop procedures for adding material to the web-site. Georges has volunteered to co-chair the WG and we are looking for another co-host. Anyone with an interest in assisting is asked to contact Georges or Greg. The new WG will have its first meeting in Orlando.

7.4.2 Meeting Schedule

Due to the increasing problem of fitting all activities into the present meeting schedule, the Administrative Subcommittee decided at the Spring 2000 meeting to extend the meeting to

another day (24 hours). Because several hotel contracts for upcoming meetings have already been signed, the extended schedule will begin at the Orlando meeting. The meeting will begin Sunday evening with the usual Hospitality Reception. Individual "break-out meetings" will begin on Monday morning and will continue through Wednesday afternoon. The "Full Committee Meeting" will be Thursday morning.

The following criteria will be used for the longer schedule.

- Only one timeslot for each SC meeting.
- No more than two timeslots for each WG or TC activity.
- A target maximum of five (6 absolute maximum) meetings per timeslot.

Greg has already started developing the "Orlando Schedule" and has begun working with SC Chairs on desired meeting order. The longer schedule will allow 2-3 time slots dedicated specifically for educational content (tutorials and presentations).

7.4.3 Mailing of Committee Meeting Minutes

Presently, meeting minutes documents are mailed to everyone on the Committee's "mailing list" (presently maintained by Ken Hanus). This database list contains attendance and contact information on approximately 500-600 individuals who have attended at least one of the last several meetings. Complete meeting minutes are now available on the web-site. It was decided at the Administrative Subcommittee meeting on Sunday that minutes associated with this Fall 2000 Committee Meeting (and subsequent meetings) would only be "snail-mailed" to:

- All Committee Members
- Attendees of that associated meeting

This new mailing policy will significantly reduce the cost to print and mailing minutes. We hope, with the increased use of the web-site, to someday stop mailing the traditional paper document and allowing interested parties to download the minutes from the web or perhaps order the document on CD.

7.4.4 "Concentration Banking"

In the past, each meeting host was required to open a non-interest-bearing account at a local bank and maintain the funds. After a host has "closed the books" of their meeting, the remaining funds were passed-on to the next host. The host then had to have checks printed, an endorsement stamp made, etc. This has proved to be a burdensome activity. In Spring 2000, we began using "concentration banking" services provided by IEEE Financial Services. This service allows the Committee funds to be maintained in one location, under supervision of IEEE. Funds can easily be transferred from the on-line registration system to the concentration account. Because IEEE will administrate the tax paperwork, the account is interest-bearing and the account can be monitored via a secure web-site. The system has so-far proven to be a effort-saving device.

7.4.5 IEEE Travel & Conference Management Services

The Nashville meeting was the second meeting where we utilized on-site registration services of IEEE Travel & Conference Services (TCMS). For the second time, two individuals from IEEE

headquarters staffed our on-site registration desk. They were linked by telephone line to the on-line registration system that allowed "walk-up" registrants to register using a major credit-card. These individuals bring with them registration materials, a computers & printer, and credit card scanners. We hope to continue to use IEEE TCMS for pre-registration and on-site registration. We are also investigating other services provided by them including maintaining our mailing lists and tracking attendance at individual "breakout meetings", perhaps using barcode/scanning technology.

It was also noted that IEEE has a "full-service" travel agency that can provide low airfares, car rental, etc. IEEE Global Travel Services can be reached at (800) 879-4333 or at www.ieeetravelonline.org.

7.4.6 Miscellaneous

Greg is investigating the possibility of creating an "Anniversary CD" that will contain an assembly of documents and meeting minutes from the past 5-10 years. He will attempt to determine an "anniversary date" for the Committee and commemorate the date with the issue of this CD. The CD could perhaps be presented to all Committee Members and made available to meeting guests and other interested individuals.

The meeting was adjourned.

8.0 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).

8.1 Audible Sound and Vibration - J. Puri, Chair

The Subcommittee met on October 17 at 1:20 p.m. with 17-members and 30-guests present. Minutes of the last meeting in Nashville, Tennessee were approved.

The following items were discussed:

8.1.1 WG Chairman Report

Alan Darvin, the Chairman of Working Group (WG) for writing Transformer Siting Guide C57.136 has gone through a successful ballot and is being printed for distribution.

8.1.2 SC Chairman's Report on NEMA Activities

Jeewan Puri, the Subcommittee Chairman reported that he has proposed a logical "Validity Check" equation for extending the range of NEMA TR1 and NEMA ST 20 sound level tables for liquid filled and dry type transformers. This approach does not appreciably change the presently tabulated sound levels but it provides a mathematical approach toward extending the range of this information. This proposal will be reviewed by NEMA membership.

8.1.3 New Business

The following new items were discussed:

- The issue of adding sound intensity measurements to IEEE C57.12.90 and C57.12.91, test codes for Liquid-Filled and Dry-Type transformers, was discussed. Jeewan Puri and Jan DeClercq will, jointly, chair the Working Group for changing the test codes for Liquid-Filled and Dry-Type transformers. This addition will make Sound Intensity as an equally valid method for demonstrating compliance with sound level specifications.

- In our Nashville meeting a group of nine volunteers were appointed to evaluate if the sound level test code should be made into a stand-alone standard like IEC60076-10 or should it still remain a part of the present IEEE C57.12.90 and C57.12.91 documents. These volunteers studied the present sound level test procedures and an example of a stand-alone sound level test standard for making sound intensity or sound pressure measurements. A summary of

their recommendations is as follows:

- Six reviewers recommended writing a stand-alone standard. Two of them also recommended writing a guide for making these tests.
    - One reviewer recommended adding this test procedure to the present C57.12.90 and C57.12.91 documents and writing a guide for performing these tests.
    - Two reviewers proposed writing a guide only for making sound level tests.
    - One of the reviewers did not respond.

It was agreed that these recommendations will be sent to all the participants on our Subcommittee meeting and their vote will decide further action in our next meeting.

There being no other business, the meeting adjourned at 3:50 p.m.

8.2 Bushings - F. E. Elliott, Chair

8.2.1 Introduction and Membership

Chairman, Fred Elliott opened the meeting at 9:30 AM and welcomed the members and guests. Nineteen members and nine guests attended the meeting. One request for membership was received. See attachment for membership list.

8.2.2 Chairman's Remarks

The chair discussed issues from the Administrative Subcommittee meeting. The details of that meeting can be found in the main committee minutes.

Membership reaffirmation for active participation

Before Survey	**After Survey**
Users	
8 (23 %)	8 (23 %)
Producers	
25 (58 %)	19 (54 %)
General	
10 (19 %)	8 (23 %)

12 members are being dropped. 4 new members added

The proposal to reorganize the technical committee structure of the PES has been withdrawn. PES will look for ways to make the existing structure more efficient and responsive.

8.2.3 Approval of Minutes of April 4, 2000 Meeting

The minutes were approved as written.

8.2.4 Working Group / Task Force Reports

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

Keith Ellis reported that his WG met on October 16, 2000 at 2:50 PM with 17 members and 21 guests present. Five requests for membership were received. He reported the following:

1. Approval of Last Meeting Minutes

The minutes were approved as written.

2. Discussion on Comments Received on PC57.19.00 Draft 4

Issues /comments on Draft 4 were discussed. The remaining comments will be discussed at the next meeting. Keith will try to resolve the major issues before the next meeting. It is intended that Draft 6 be ready for ballot by spring of 2002.

3. New Business

No new business was discussed.

4. Adjournment

The meeting was adjourned at 5: 30 PM after two sessions.

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

P. Singh reported that his WG did not meet this time. He announced that the new standard C57.19.01 – 2000 was published in March 2000. He thanked the members and guests for their participation.

8.2.4.3 Task Force on Draw-Lead Bushings

Russ Nordman reported that his Task Force meeting was held at 1:20 PM on October 16, 2000 with 11 members and 16 guests present. No requests for membership were received. He reported the following:

1. Approval of Last Meeting Minutes

The minutes were approved as written.

2. Draw Lead Basis of Rating

No feedback was received on the proposal to calculate hottest spot temperature and draw-lead loading proposal. It was concluded that standard methods for calculation and test do not exist and need to be reestablished. Calculation of allowable hottest spot temperature rise as per C57.19.00 would require "K" factors from the manufacturers.

A proposal for defining the initial conditions of test and temperature rise limit will be drafted for review by the manufacturers. Results to be reported in future meetings.

A flow-chart and timetable for completion of Task Force work was reviewed. Anticipate 2002 for the proposal

3. Adjournment

The meeting was adjourned at 2:30 PM.

8.2.4.4 Report from Technical Advisor to IEC 36 A

Russ Nordman reported the following:
1. Russ could not attend the last meeting in Ludivika, Sweden
2. IEC Technical Specification TS 61463, 2000 – 4, " Bushing Seismic Qualification " has been published
3. IEC maintenance group for 60137 has been formed to update the existing standard.
4. IEC is writing a new standard for bushings DC. This will basically follow the IEEE Standard C57.19.03

8.2.5 Old Business

8.2.5.1 Reaffirmation/Revision of C57.19.100

1. Fred reported that the reaffirmation process is progressing. Because of two negatives the standard will be recirculated with the following explanation.

   "Oil-impregnated paper-insulated bushings are built using non-thermally upgraded (55 degree rise) paper because of its lower power/dissipation factor. The increased dielectric losses that would result from the use of thermally upgraded (65 degree C rise) paper could contribute to thermal runaway in bushings. Bushings that pass the thermal basis of rating tests in oil with 55 C oil temperature rise over ambient are suitable for use in 65 C rise oil filled transformers. The oil temperature in these transformers is limited to 95 C averaged over a 24 h period, which is equivalent to conditions used in the bushing thermal tests. If the average ambient temperature exceeds 30 C then the average oil temperature will exceed 95 C. Under such a condition the hottest spot temperature will exceed the 105 C limit and there will be a premature loss of insulation life. Clauses 4.1.1and 5 were included in C57.19.100 to address coordination between the bushing and the transformer."

2. Fred is still looking for a chairman for the revision of this standard

8.2.5.2 Measurement Study Group

Mark Rivers of Doble Engineering will present a write-up/tabulation to show C2 power factor variation by types of bushing. Suggestions are invited.

8.2.6 New Business

There will be dedicated time slots for tutorials in the future transformer committee meetings

8.2.7 Adjournment

The meeting was adjourned at 10:10 AM

Minutes Submitted By,
Pritpal Singh, Secretary Bushing Subcommittee

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

The Dielectric Test Subcommittee (DTSC) met on Tuesday, October 17, 2000, at 2:00 p.m., in Niagara Falls, Ontario, Canada, with 50 members and 46 guests present. Three of the guests requested membership on the Subcommittee. They included: Patrick Dempsey, Dilip Shah and Peter Heinzig.

8.3.1 Chair's Remarks

After introduction of the attendees, the Chair reviewed some of the highlights of the Administrative Subcommittee meeting held on October 15, 2000. (See Section 4.0 of IEEE/PES Transformer Committee meeting minutes from the Niagara Falls, Ontario, Canada meeting for additional details).

The minutes from the April 4, 2000 meeting in Nashville, TN were approved as written.

The chair also emphasized the importance of including the member's e-mail address on the attendance rosters. This speeds the process of getting the members the subcommittee minutes and agenda. It is also much less costly then conventional mail.

8.3.2 Working Group Reports

8.3.2.1 Working Group on Partial Discharge Tests in Transformers - J.W. Harley, Chair, reported by L. B. Wagenaar

15 members and 51 guests attended the meeting. Attendees introduced themselves. Minutes of the previous meeting April 3, 2000 in Nashville, TN were approved.

The letter ballot PAR C57.127 Trial Use Guide For the Detection of Acoustic Emissions from Partial Discharges in Oil-Immersed Power Transformers passed the third ballot with no negative votes. This followed the discussions at the last working group meeting. The IEEE-SA Standards Board approved it as a new guide on September 21, 2000. It is now being reviewed with an editor of the Standards Publications Department to make final editorial adjustments before publication. The Chair thanked all of those who participated in creating and helping pass this guide.

Discussions continued on the follow-on Guide for the Detection and Location of Acoustic Emissions from Partial Discharges in Oil-Immersed Power Transformers and Reactors. The Table of Contents, Scope and Purpose were established. The intent is for this guide to be merged into the recently passed guide C57.127.

Robert Langan of Physical Acoustics Corporation described his company's broad experience with acoustics in industrial, structural and laboratory applications and how this is being brought to use in detection of partial discharge in transformers. The sources of energy, the mechanism for the signal formation and transmission, causes for variations of the signals and examples of field and factory testing were topics covered.

At the next meeting, Dirk Russwurm of HV Technologies, Inc. will discuss the use of devices that provide an electrical trigger for recording of acoustic and electrical signals in both field and factory applications.

8.3.2.2 Working Group on Low Frequency Tests - Mark Perkins, Chair

No meeting was held of this working group at the IEEE/PES Transformer Committee meeting.

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

The working group met at 2:50pm on Monday October 16th with 14 members and 23 guests in attendance.

First, the Chair notified the group that new revisions of C57.12.00 and C57.12.90 have been issued since the last meeting. Any discussion or comments referring to these standards should refer to the latest revisions.

The process of revising C57.98 Guide for Transformer Impulse Test has been initiated one year ago. The work is lead by Subhash Tuli. So far, no comment or proposal for changes has been received neither by Subhash or myself. The Chair will review the document, propose changes or additions as needed and have a draft sent out for survey by the end of the year in order to get the work started. In the meantime, any proposal for change or addition is welcomed and will be circulated within the group. It has been agreed that distribution for survey will be sent out by e-mail to the working group. Only the final balloting will be done by mail.

Next, the proposals submitted by Pierre Riffon about wave shapes for full waves were discussed. At the last meeting, those proposals had been discussed and no consensus had been reached on the issues concerning what to do when the proper wave shape cannot be achieved. It was agreed that the issue will not be addressed in C57.12.90 for the time being but recommendations should be made in the Guide C57.98. Once these recommendations have been accepted in the guide, then the test code can be revised accordingly. Pierre Riffon has agreed to prepare something before the document is circulated. Loren Wagenaar indicated that at AEP, correction factors have been applied for 10 years with great success as an incentive for manufacturers to do their very best effort to achieve proper wave shapes.

The outstanding issues concerning the chopped waves were discussed at the last meeting. The Chair reminded Pierre Riffon to send his final proposal for this issue so that it can be balloted with the next revision of C57.12.90.

The meeting adjourned at 3:25 pm.

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

The Dielectric Tests Working Group met on October 16th at 4:15 PM with 36 members and 10 guests present.

The working group's mission is to develop revised dielectric test tables for liquid filled transformers in C57.12.00.

Mr. Jeewan Puri had (2) proposals:

- Apply algorithms to all tables in addition to the tables.
- Apply a singular logic to all voltage classes, based on the r_2 HV relationship.

The task force unanimously likes the use of visible algorithms but desires to maintain substantially the present test valves at system voltage of $\leq$ 69kV.

The working group proposes that the full subcommittee be surveyed to determine what other comments will surface. This proposal was endorsed by the subcommittee.

The meeting adjourned at 5:30 PM.

8.3.4 Liaison Reports

8.3.4.1 Insulation Coordination – John Crouse

(No report)

8.3.4.2 Surge Protection Devices – Bob Degeneff

The Surge Arrestor Committee is reviewing the tables in IEEE/ANSE C57 and there are some issues. These concerns should be addressed in a letter to the DTSC.

8.3.4.3 IEC TC14/WG24 – Loren Wagenaar

A meeting of the Working Group was held in June, 2000 in Ludvika, Sweden. There were two dielectric projectss. The first was that the Dielectric Test Standard IEC (76-3) has been approved and will be published. The second item corresponds to C57.98 (Impulse Guide), with the exception that it also applies to shunt reactors. Only a few comments have been made on the WG document, and it will go to the Technical Committee for comment and ballot. This process will be completed in the next couple of months and reviewed at the September 2001 meeting in Milian, Italy.

8.3.5 Old Business

8.3.5.1 IEEE - 4 Art Molden/Bertrand Poulin

Bertrand Poulin requested that he be withdrawn as a liaison to IEEE-4 since he is no longer able to attend the meetings. Art Molden reported the following:

There were 15 in attendance at the last IEEE Std. 4 meeting. Most of the meeting was taken up by a comparison of IEC 60 parts 1&2 with Std. 4 and the editorial and technical differences between them. A list of 15 specific differences are noted in the meeting minutes.

It was thought that the IEEE Standards tend to contain more tutorial information than do those of the IEC and so are more acceptable to the technician and therefore more marketable. So that in keeping the harmonizing of IEEE and IEC Standards, the IEEE Standards would have to become more comprehensive.

The attendees determined, by a unanimous show of hands, to do the following:

- Send out a ballot to reaffirm the present IEEE Std. (including the supplement, mentioned later, if approved.
- Start working on the revision of Std. 4

A list of 12 additional items was discussed for inclusion in the next revision and the various sections and chapters of Standard 4 were assigned to "volunteers" to act as leaders for those chapters. Not all the "volunteers" were present at the meeting.

A PAR had been submitted to add a supplement to the 1995 editor of Std. 4 This supplement was to add back and permit the use of certain rod gap, air density and humidity correction factors from the 1978 edition of Std. 4. A ballot on this supplement has been circulated and the results will be made available at the next HVTT meeting.

The present PAR for a general revision of Std. 4 will be withdrawn and resubmitted later.

The next meeting will be in Franksville, WI, in the near future.

8.3.5.2 Phase to Ground Clearances – B. Chiu

Subhash Tuli and Bill Chiu have been working on phase-to-ground clearances. Bill Chiu could not attend the subcommittee meeting, but he sent to many of the members, via e-mail, a Table showing a comparison of clearances from IEEE C57.12.00 (1995), Table 11; NEMA, TR-1 (1993); and the Southern California Construction Standard (see attached table).

B. Chiu believes that we may need to modify the existing Table #13 in C57.12.00 (2000) for phase-to-phase clearances. There has also been some discussion on the need to look at line-to-ground clearances in this table.

Subhash Tuli noted that Table #11 (1993) has been changes to Table #13 in the New Revision of C57.12.00 (2000).

The Chair (L. B. Wagenaar) asked the attendees how the numbers in the table that Bill Chiu supplied line up with what other utilities are using for their clearances? The Chair had checked the clearances against American Electric Power's standards and in general they are pretty close, in some cases a little larger clearance, and in others a little less.

Ray Allustiarti commented that the higher voltage clearances in the Table were about what Pacific Gas and Electric uses.

B. Poulin commented that in the present standard there is a note regarding switching surge tests, especially on transformers with a 3 legged core or transformers that have a delta-connected low voltage winding and a wye-connected high voltage winding. The phase-to-phase clearances in the table presented by B. Chiu would not be sufficient for these types of transformers. The note in the standard must be taken into consideration for these types of transformers and requires a 1.5 per unit phase-to-phase voltage. There is a formula in C57.12.00 (2000) for this.

B. Hartgrove asked if the clearances should be compared to the National Electric Safety Code (NESC) clearances? Substations are subject to this code. The clearances in the NESC are for personnel safety and not for design or working clearances. The chair asked if the NESC

clearances apply for phase-to-phase distances? The chair requested a volunteer to check the NESC and where the clearances apply. No one volunteered.

Bob Veitch asked if there were any known problems with using the current clearances in C57.12.00? Are there any cases where these clearances have been determined not sufficient? No comments were received from the attendees.

S. Tuli suggested that we develop a table comparing the NESC and the IEEE clearances for review of the membership. This table will also have line-to-ground clearances. B. Veitch suggested that we add the clearances from IEC 76-3 for a comparison. This maybe a little difficult because of differences in system voltages in IEC vs. IEEE. S. Tuli volunteered to complete this comparison for the next meeting of the subcommittee.

8.3.6 New Business

8.3.6.1 Altitude Correction Factors

Background:

The DTSC Chair addressed an issue that was raised during a ballot for Smoothing Reactors (1277). One of the Circuit Breaker Liaison members (Mr. Lambert) pointed out that the Altitude Correction Factors in the Smoothing Reactor Document were incorrect and that the Altitude Correction Factors in all the current IEEE Standards are incorrect. He believes it is acceptable not to use any corrections up to 1000 m, but once an altitude of 1000 mis reached, the cumulative correction factor from sea level must be applied.

The current Altitude Correction Factor table from C57.12.00 (1993), Table 1, Dielectric Strength Correction Factors for Altitudes Greater than 3300 ft. (1000m), copied below, was sent to the membership for their review and discussion at this meeting.

"Liquid-Immersed Distribution, Power, and Regulating Transformers IEEE Std C57.12.00-1993

The insulation level at 3300 ft (1000m) multiplied by the correction factor Table 1 must be not less than the required insulation level at the required altitude.

Table 1
Dielectric-Strength Correction Factors

For Altitude Greater Than 3300 ft (1000 m)

Altitude Ft	Altitude (m)	Altitude Correction Factor for Dielectric Strength
3300	1000	1.00
4000	1200	0.98
5000	1500	0.95
6000	1800	0.92
7000	2100	0.89
8000	2400	0.86
9000	2700	0.83
10 000	3000	0.80
12 000	3600	0.75
14 000	4200	0.70
15 000	4500	0.67

NOTE: An altitude of 15 000 ft (4500 m) is considered a maximum for transformers conforming to this standard."

Discussion

A lengthy discussion was conducted on the issue of altitude correction factors and how they should be applied. The current C57.12.00 indicates that there should be no correction factor (1.00) up to 1000 m then a correction factor of approximately 1% (.94%) per 100 m is applied above 1000 m.

Ray Allustiarti's view is that dielectric test that are applied to equipment are applied at such a voltage level that the equipment can be used up to 1000 m. Therefore, no correction factor is needed up to 1000 m, as is currently shown in Table 1.

Fred Elliott pointed out that the current Bushing Standard for unusual service conditions for altitudes greater than 1000 m shows the correction factor starting at 1.0 for 1000 m, which is the same as C57.12.00. This means that there would be additional dielectric margin below 1000 m.

It was the feeling of the group that this subject should be addressed by the High Voltage Test Technique Subcommittee of IEEE-4. The chair will discuss addressing this issue of equipment testing and altitude correction factors with the subcommittee's liaison to IEEE-4 (A. Molden).

There being no new business the meeting was adjourned.

8.4 Distribution Transformers - E. Smith

Meeting Time:2:00pm, Tuesday, October 17, 2000

Attendance: 41 Total

23 Members

17 Guests

1 Guest Requesting Membership

8.4.1 Chair's Remarks & Announcements:

The chair discussed issues from the Administrative Subcommittee meeting. The details of that meeting can be found in the main committee minutes.

Working Groups and Co Chair's Requirements

C57.12.34 (Three-Phase Padmounted Distribution Transformers) – Stephen Shull – Empire District Electric Company accepted the position of "User" Co chair with Ron Stahara – Central Moloney Transformer

C57.12.35 (Bar Coding Distribution Transformers) -User Chair needed, George Henry – Central Moloney Transformer accepted the position of "Producer" Co chair

C57.12.33 (Loss Evaluation Guide) - Producer Chair needed

Standards Copyright Issues

IEEE

ANSI

NEMA

Metric Requirements for Standards

1. Appointment of a new W/G Metric Guide - Dudley Galloway - Chair

2. Dudley to review Distribution Transformer. Standards for Metric Issues to avoid delays. Dudley will Start with C57.12.34 (Three-Phase Padmounted Distribution Transformers).

Fast Track Standardization Process

Developed and Distributed a Working Group Guide/Manual Consisting of,

W/G Meeting Attendance & Participation Requirements

W/G Voting Requirements

W/G Work Assignments At Meetings

W/G Work Assignments Between Meeting

W/G Co Chairs Meeting Following Subcommittee Meetings

8.4.2 Working Group Reports

8.4.2.1 C57.12.20 Single Phase Pole Mounted Distribution Transformers

(Copyright: **NEMA**)

Alan Wilks & Glenn Andersen Co Chairs

(awilks@ermco-eci.com & gwanders@duke-energy.com)

Current Standard Date: 1996

Current Draft Being Worked On: #5 Dated April 2000

Meeting Times: 9:30am, Monday, October 16, 2000

10:55am, Monday, October 16, 2000

1:20pm, Monday, October 16, 2000

2:50pm, Monday, October 16, 2000

9:30am, Tuesday, October 17, 2000

Attendance: 39 Total

17 Members

22 Guests

Issues, Remarks & Announcements:

1. Many of the Distribution Transformer Working Group meetings were cancelled. We therefore utilized the open time slots to accomplish much of the work needed on this Standard. (See time slots above)

2. Figures 4b and 4c were combined into one figure for the "H" &"J" Spades

3. Figure 5 was corrected to show the correct parallel connection for Sub. Polarity.

4. P6.5.2 was changed to show only type "A" & type "B" support lugs and to eliminate the type "C" lugs. We also added dotted lines to figure 14 to show non-parallel legs on the support lugs. The latter was participated by an "USER" experiencing a specific problem.

5. The "L" dimension on figures "1" & "2" . Refer to the above . . . The "L" dimension should be reduced by the metric equivalent of ¾" or 19mm. A vote passed to change the "L" dimension from 610mm to 591mm and 914mm to 895mm.

6. Figure 15, the "C" support lug was included in draft V, it will be eliminated.

7. Figure 14, the notes will be reformatted to be less confusing. Figure 14 will be moved to figure 3 and renumbered. All subsequent figures will be renumbered.

8. Arrester pads were added to figures "1" & "2". It was agreed to add a third section tot these figures outlining the Arrester pad spacing by nominal Arrester KV rating and make the spacing 64mm for Arresters below 24KV and 235mm for Arresters rated 24KV and above. The correct terminology for arrester ratings will be verified.

9. On figure "6" it was greed to show the NP on the LH lower support lug per the common practice. All other figures will be changed accordingly also paragraph 6.3.4.1.1 and 6.3.4.1.2 will be changed.

10. On figures 6 – 13 it was agreed to combine items 11 & 12 and make LV bushing terminals and arrangement.

11. Table 6 should include the statement "for single phase Transformer bushings only".

12. On table 7, there were two columns that should be eliminated by combining the information with the adjacent columns.

13. It was agreed to add a reference to Overhead Enclosure Integrity (C57.12.31 – 1996) to section 6.5 "Tanks".

14. Other non-technical/standard related issues were discussed

15. It was discussed that IREQ was developing a high-pressure impulse test to be used in lieu of the 8000 AMP 1" arc under oil test. Guy Morrissette will keep us advised of this activity and will give our Working Group a presentation at the next scheduled working group meeting

16. Ken Hanus advised to send a draft to IEEE for a general format/style review and section 14 for a metric review.

17. Lance Cole, ORNL and Carl Adams, DOE gave the group an update on the DOE activities related the Efficiency Standards for Distribution Transformers.

18. A framework document is available on the DOE web site at
www.eren.doe.gov/buildings/codes_standards/applbrf/dist_transformer.html

8.4.2.2 C57.12.23 Single Phase Submersible Distribution Transformers

(Copyright: **IEEE**)

Al Traut & Roger Lee Co Chairs

(alant@keco.com & leerj@sce.com)

Current Standard Date: 1992, Reaffirmed 1999

PAR Approved 3/18/1999 (For Standard Revision)

Current Draft Being Worked On: #2 Dated March 17, 2000

Meeting Time:8:00am, Monday, October 16, 2000

Attendance: 18 Total

7 Members out of 11

11 Guests

Issues, Remarks & Announcements:

1. Discussed the metric version of Fig. 2, Spade Terminals

2. Agreed to change the hole centerline spacing form 45mm to 44.5mm. This will assure metric spades will line up with English spades.

3. The issue of "Mineral Oil" vs. "Insulating Fluid" was raised. This is a substantial change and will require a review of the operating parameters (e.g. temp.)

4. This will also have an effect on other DT documents and may require coordination ate the SC level. This issue has been "tabled" until the next Standard revision

5. A footnote will be added to clause 6.5.1 to list the English equivalent of the internal tank pressure. This has passed the scrutiny of the IEEE in the Underground Transformer Subcommittee documents.

6. Clause 6.2.6 changed wording to clarify the treatment of an internally grounded LV neutral (X2)

7. Clause 6.5.5 and fig. 1 changed to coordinate the grounding provisions with the number of HV Bushings.

8. The document is ready for ballot.

8.4.2.3 C57.12.25 Single Phase Padmounted Distribution Transformers

(Copyright: **NOT SURE**)

Ali Ghafourian & John Lazar Co Chairs

(ali.ghafourian@us.abb.com & john.p.lazar@nspco.com)

Current Standard Date: 1990

PAR Approved 12/08/1998 (For Standard Revision)

Current Draft Being Worked On: #7 Dated March 2000

Meeting Time:**DID NOT MEET THIS SESSION**

8.4.2.4 C57.12.33 Guide For Distribution Transformer Loss Evaluation

(Copyright: **IEEE**)

Don Duckett & Tom Pekarek Co Chairs

(don.duckett@fpc.com & tjpekarek@firstenergycorp.com)

Current Standard Date: NEW Standard Under Development

PAR Approved 6/25/1998 (For Standard Development)

Current Draft Being Worked On: #7 Dated February 1999

Meeting Time:**DID NOT MEET THIS SESSION**

8.4.2.5 C57.12.34 Three-Phase Padmounted Distribution Transformers

(Copyright: **IEEE**)

Ron Stahara & Vacant Co Chairs

(rjstahara@msn.com & Vacant)

Current Standard Date: NEW Standard Under Development

This NEW Standard is a combination of the following two Standards

C57.12.22 1989 (Three-Phase Padmounted Distribution Transformers with H.V. Bushings) (Copyright ANSI)

C57.12.26 1992 (Three-Phase Padmounted Distribution Transformers with Separable Connectors) (Copyright ANSI)

PAR Approved 9/21/1995 (For Standard Development) The PAR extension expires 2000

Current Draft Being Worked On: #5 Dated April 1999

Meeting Time:**DID NOT MEET THIS SESSION**

8.4.2.6 C57.12.35 Bar Coding For Distribution Transformers

(Copyright: **IEEE**)

Vacant & Vacant Co Chairs

Current Standard Date: 1996

Current Draft Being Worked On: NONE

Meeting Time:**DID NOT MEET THIS SESSION**

8.4.2.7 C57.12.36 Distribution Substation Transformers

(Copyright: **IEEE**)

John Rossetti & Leon Plaster Co Chairs

(jrossetti@mlgw.org & leon.plaster@us.abb.com)

Current Standard Date: NEW Standard Under Development

Current Draft Being Worked On: #1 Dated March 31, 2000

Meeting Time: 10:55am, Monday, October 16, 2000

Attendance: 37 Total

12 Members

25 Guests

4 Guests Requesting Membership

Issues, Remarks & Announcements:

1. The PAR request for C57.12.36 has not been resubmitted due to the apparent confusion between the intent of C57.12.36 and C57.12.10, PAR's for both of these standards will be submitted at the same time. The C57.12.10 PAR request cannot be submitted until copyright issues are resolved between NEMA and IEEE. It was agreed to continue working on this activity regardless of the copyright issues taking place with C57.12.10

2. A suggestion was made to consider removing all rating information from the title and relocate this to the scope section. For the time being, it was agreed to keep the rating information to prevent any confusion regarding what is meant by Distribution Substation Transformer.

3. An overview was provided of LV Switchgear Transformer coordination requirements. It was agreed that it was too early to try and get any manufacturers involved.

4. Review Network Transformer Standard for LV Bushing spacing (6.5")

5. Define "Mirror Image", "Rt. Hand", "Lt Hand" etc. Bushing requirements.

6. Agreed to use High Voltage and Low Voltage instead of Primary and Secondary.

7. An overview was provided of LV Switchgear Transformer coordination requirements. It was agreed that it was too early to try and get any manufacturers involved.

8. Metric conversions need to be reviewed.

9. Make sure there is consistent use of symbols.

8.4.2.8 P1338 Electronic Reporting of Test Data

(Copyright: **IEEE**)

Dave Rolling & Jerry Smith Co Chairs

(drolling@cooperpower.com & jwsmith@southernco.com)

Current Standard Date: NEW Standard Under Development

Current Draft Being Worked On: #5 Dated February 1999

Meeting Time: **DID NOT MEET THIS SESSION**

Issues, Remarks & Announcements:

UPDATE > > > The recirculation ballot, Draft #6 was closed of July 5, 2000 with a 97% affirmative vote. There were only two negative votes on recirculation which dealt with the fact that not all of the possible Transformer design parameters were included in the list of data items reported. The list was intentionally limited due to the maximum number of characters allowed. Those items most often used were included. The draft Standard has been sent to IEEE and is on the agenda for REVCOM's December 6, 2000 meeting.

8.4.2.9 C57.15 Step-Voltage Regulators

(Copyright: **IEEE**)

Tom Diamantis & Craig Colopy Co Chairs

(diamantist@nimo.com & ccolopy@cooperpower.com)

Current Standard Date: 1986

Current Draft Being Worked On: #5 Dated April 2000

Meeting Time:**DID NOT MEET THIS SESSION**

Issues, Remarks & Announcements:

UPDATE > > > C57.15 for Step Voltage Regulators was printed and published in 1999. The PAR for a 2004 republication has been in the works for 8 months and is now scheduled to go before the board in December 2000. The PAR will address reflection of updated Standard C57.12.00 and C57.12.90 as a review of standard test procedures.

8.4.2.10 C57.12.28, .29, .31 & .32 Standards are reviewed and revised under the NEMA secretariat

(Meetings are normally held in conjunction with IEEE Transformer Committee meetings)

Bob Olen with Cooper Power Systems was appointed Chair of these four Working Groups after Joe Martin of Consolidated Edison resigned. Bob Olen, Cooper Power Systems, P. O. Box 100, Franksville, WI, 53126, Tel: 262-835-3362, rolen@cooperpower.com

8.4.2.10.1 C57.12.28 Pad-Mounted Equipment Enclosure Integrity

(Copyright: **NEMA**)

Bob Olen Chair

Current Standard Date: 1999

Current Draft Being Worked On: NO CURRENT ACTIVITY

Meeting Time:**DID NOT MEET THIS SESSION**

8.4.2.10.2 C57.12.29 Pad-Mounted Equipment Enclosure Integrity For Coastal Applications

(Copyright: **NEMA**)

Bob Olen Chair

Current Standard Date: 1999

Current Draft Being Worked On: NO CURRENT ACTIVITY

Meeting Time:**DID NOT MEET THIS SESSION**

Issues, Remarks & Announcements:

Note: Most, if not all, of the figures in this 1999 published document are in error.

8.4.2.10.3 C57.12.31 Pole Mounted Equipment Enclosure Integrity For Coastal Applications

(Copyright: **NEMA**)

Bob Olen Chair

Current Standard Date: 1996

Current Draft Being Worked On: NO CURRENT ACTIVITY

Meeting Time:2:00pm Wednesday, October 18, 2000

Issues, Remarks & Announcements: NONE

8.4.2.10.4 C57.12.32 Submersible Equipment Enclosure Integrity For Coastal Applications

(Copyright: **NEMA**)

Bob Olen Chair

Current Standard Date: 1994

Current Draft Being Worked On: Draft of Original Dated 1994

Meeting Time:**DID NOT MEET THIS SESSION**

8.4.3 Subcommittee Old Business:

NONE

8.4.4 Subcommittee New Business:

1. A request has been submitted and is under current evaluation for a working group to be formed to address specific requirements for "Pole Mounted Distribution Transformer Low Voltage Bushings".

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

8.5.1 Chair Remarks and Announcements

The Dry Type Transformer Subcommittee met at 10:55 AM on October 17, 2000 with 24 members and 7 guests present. Introductions were made and the attendance roster was circulated. Minutes from the April 4, 2000 meeting were reviewed and approved. Announcements were held until after the working group reports were given.

The chair discussed issues from the Administrative Subcommittee meeting. The details of that meeting can be found in the main committee minutes.

The Tutorials Committee would like to offer tutorials to attract new members.

Phillip Hopkinson gave a short presentation on the activity of the IEC TAG Meeting (TC 14 and TC 106) regarding EMF.

Don Kline gave a report on C57.123 "Guide for Transformer Loss Measurements". This guide covers dry-type transformers as well as liquid-filled transformers. It was noted it is stated in the guide that the test set must be traceable to NIST, not just the instruments in the test set.

The status of several standards under the subcommittee was discussed:

C57.12.58 – this standard will be sent out for reaffirmation

C57.124 - this standard will be sent out for reaffirmation.

C57.16 - this standard will be sent out for reaffirmation. Richard Provost will talk to Tom Prevost to get this one moving.

Richard Provost discussed the working group on Thermal Evaluation. This working group has not been meeting, but it will reconvene to work on updating and combining the two thermal evaluation guides (C57.12.56 and C57.12.60) into one guide. A task force on this issue will meet in Amsterdam.

Being no further new business, the meeting was adjourned at 12:10 PM.

8.5.2 Working Group Reports

8.5.2.1 Working Group on Dry Type Reactors

Chair: Mr. Richard Dudley

On October 16, 2000 the Dry Type Reactor W.G. met from 9:30 a.m. - 10:35 a.m. in the Cree Meeting Room of the Sheraton Falls View Hotel in Niagara Falls Canada. There were 8 members and 3 guests present. The following are the highlights of the meeting.

1. The attendance list was circulated.

2. The minutes of the Nashville meeting were approved.

3. The Chairman informed the W.G. that he had e-mailed Don Fallen, Chairman of the Performance Characteristics S.C. that the official position of the Dry Type Reactor W.G. was that C57.21 should be reaffirmed. During the next 5-year life cycle modifications should be made to

C57.21 to include Annex's on shunt reactor switching and the applicability of C57.21 to thyristor controlled and thyristor switched reactors of SVCs.

4. Pierre Riffon then made a detailed and well thought out presentation on shunt reactor switching. Some of the highlights of his presentation are as follows. Copies of Pierre's presentation will be mailed to W.G. members who were not at the meeting.

(i) The focus of Pierre's presentation was on stresses that SRs can see and must be able to withstand during daily switching operation.

(ii) An IEEE guide on SR switching considers both circuit breakers and circuit switchers and focuses on methodology and formulas to calculate transient stress levels but does not explicitly deal with stresses that SRs should be able to withstand. SR switching is a daily event (and sometimes multiple times per day) and exposes the SR to repetitive stresses; tertiary SRs and direct connect SRs up to 800 kV. How does withstand level for repetitive stresses relate to BIL? Exposure to lightning impulse is considered to be an occasional occurrence.

(iii) Circuit breakers are not ideal. They are subject to current chopping and reignition; levels are a function of the breaker type. For instance air blast breakers are capable of chopping switching currents at peak value.

(iv) HQ's practice re using LAs to protect SRs during switching is to use a .8 factor to account for aging and a .85 factor to provide margin for the repetitive nature of switching transients. Even using these factors (.68 total) the LA may not be able to protect the SR during switching; this is especially critical for higher voltage SRs.

(v) SRs with an ungrounded neutral are a worst case situation.

(vi) Reignition of CBs produce transient stresses of a high rate of rise; high dv/dt. For shunt reactors 69 kV and higher, an LA will not provide protection for reignition dv/dt.

(vii) Mitigation applied to CBs include or have included opening resistors (air blast CBs), an arrester in parallel with the CB (some SF_6 CBs). Neither approach was totally effective; cost, thermal limitations etc. Synchronous switching of CBs is a current preferred solution but has advantages and disadvantages.

(viii) In his conclusions Pierre made a number of observations and recommendations; relevant IEC and IEEE documents should be referenced and C57.21 should define the maximum overvoltage levels that SRs are able to withstand as a daily event; considering aging effects and repetitive switching related safety margin.

Pierre Riffon's presentation was very well received. Members of the W.G. are requested to comment on Pierre's presentation and proposals re C57.21. The Chairman thanked Pierre and asked if Pierre would be willing to give his presentation as a tutorial at a future Transformers Committee meeting; Amsterdam. Pierre agreed to do so and the Chairman agreed to follow up with appropriate members of the Administrative S.C.

The meeting adjourned at 10:45 a.m.

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

Chair: Mr. Mr. John Sullivan
Secretary: Anthony Jonnatti

The spring meeting of this working group was held in the Sheraton Fallsview Hotel and Conference Center, October 16, 2000 at 2:50 PM.

Chairman John Sullivan opened the meeting at with introduction of the members and guests.

Members Present – 11

Guests Present -- 12

Three (3) guests requested membership

The minutes of the Spring meeting in Nashville, Tennessee were approved as written.

Chairman John Sullivan gave the group a status report of the latest draft standard. The revised standard was sent to IEEE headquarters for editorial review. They will review the standard and return it with a list of editorial changes required prior to submitting for ballot.

The first order of business was a discussion on the change to metric units. All standards are require to use only metric units after January 1, 2000. The working group discussed the value to be placed on the nameplate for weight. Using metric units on this item at this time was thought to be a safety issue. **Wes Patterson suggested that the standard read: "…manufacturer shall insure the units applicable to weight are clearly visible on the name plate." This change will be made in the standard.**

It was also suggested that an annex be added to the standard illustrating the conversion of English to Metric units used in this standard.

A question was raised if any comments have been received on the new dielectric table in the standard. No questions have been received on the dielectric table.

Secretary Jonnatti made a short presentation on IEC-60076-11 latest revision of the dry-type standard.

Items that were noted:

Table on modification to transformer rating due to enclosure and cooling.

Partial discharge acceptance levels.

Fire behavior classes.

Guide for evaluation of electromagnetic fields around power transformers.

These items were noted for possible change in future issues of C57.12.01.

Phil Hopkinson made a brief presentation and update on activities related to Electromagnetic fields. EMF considerations are being addressed by the World Health Organization (WHO),the International Commission on Non Ionizing Radiation Protection (ICNIRP), the European Union, ORGALIME (European electrical manufacturers organization), IEEE Standards Coordinating Committee 28 : subcommittees 3 and 4, and IEC TC 106. The frequency range is 0-300 GHZ. All organizations are responding to concerns about Human Health. However, only

the medical fraternity is potentially able to address of establish Human Exposure Limits. The newly formed IEC TC106 has as objectives: measurement, calculations, assessment and product emission limits, but not Human exposure limits. There are two criteria that are of consideration: bodily heating for frequencies in excess of 100 kHz, and electromagnetic stimulation for 50/60 HZ. Electromagnetic stimulation is that level of field intensity that produces noticeable change in Humans.

ICNIRP has determined that 5,000 milligauss (5 gauss) is the level for noticeable change. They wish to set this as the occupational exposure limit and 1000 milligauss as the general public exposure limit. IEEE's Subcommittee 3 has determined that about 7,800 milligauss should apply to general public exposure and about 30,000 milligauss should be the occupational exposure limit. NEMA is opposed to arbitrary limits and wants to work with causal criteria.

I have made some measurements around various appliances and around dry type transformers. Right at the cabinets the peak magnetic field intensity is about 2 milligauss per kVA. The field strength falls off very quickly with distance. A 2000 kVA transformer might have 4,000 milligauss at the cabinet but <25 milligauss at 20 feet from the cabinet.

Phil recommends that we monitor standards activity on EMF. He is a member of the TC 106 TAG and of IEEE SCC 28 and of IEEE Subcommittee 3.

No old business was presented to the members and guests.

No new business was presented to the members and guests.

The working group was adjourned at 3.15 PM

8.5.2.3 Working Group on Dry Type Thru-fault Current C57.12.59

Chair: Ms. Paulette Payne

The Working Group met in Oakes NE at the Sheraton Fallsview Hotel & Convention Centre in Niagara Falls, Ontario, Canada on October 16, 2000 at 1:20pm. There were five members and eleven guests present.

The Chairperson explained that there are two initiatives concerning this project: (1) the project is being fast-tracked and (2) balloting will be conducted by e-mail. Members and potential balloters were urged to provide a current e-mail address.

Since the last Working Group meeting, two ballot surveys have been conducted. The meeting focus was on the latest ballot survey of Draft 3.1. Twenty-six ballots were e-mailed to the Working Group and Dry Type Subcommittee membership. Fourteen responses have been received to date; twenty are required for a seventy-five percent return. There were several editorial comments incorporated into the Draft. Only substantive issues were discussed during the meeting.

Page 8 Table 2: The short-circuit withstand duration for Category II transformers was changed to 2 seconds to agree with C57.12.01. As the current magnitude is dependent upon transformer short-circuit impedance, a note was proposed so stating. A second note proposed gives reference to ANSI/IEEE C57.96 Loading Guide for Dry Type Transformers for loading capabilities at durations longer than two seconds. The membership present accepted the notes, unanimously.

Page 5 Clause 2.0: C57.96 will be added to the list of references.

Being no further business, the meeting adjourned at 1:40pm.

Several members and guest came in after the meeting adjourned. The Chair explained what business transpired. In reviewing the notes to be added to Table 2, an editorial correction was noted and accepted to Note 1:

"For Category I transformers, the maximum ~~load~~ through-fault current depends upon the transformer short-circuit impedance."

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

Chair: Mr. Dave Barnard
Secretary: Mr. Tim Lewis

The working group met at the appointed time with 16 members and 8 guests present. After introductions the Chairman asked for comments and/or corrections to the minutes from the previous meeting in Nashville, TN on April 4, 2000. There being no comments a motion was made and seconded to accept the minutes as written. The motioned passed.

OLD BUSINESS

The Chairman reported that the re-circulation ballot of draft 3 of the standard resulted in 92 % returned ballots and 93% affirmative ballots. Therefore the standard has been forwarded to REVCOM for review at their next meeting scheduled for October 27, 2000. There were 6 negative ballots and one of those was withdrawn.

The Chairman passed out copies of the letter to REVCOM listing the unresolved negative comments and the sponsor's rebuttal. The working group discussed some of these negative comments as follows:

Clause 11.5 Hot Resistance Measurement. Concern was expressed about the accuracy of using a single resistance measurement to arrive at the winding temperature rise using the slope of the curve determined from data collected on one high voltage and one low voltage winding. The working group agreed with the consensus of those voting that the method is accurate.

Clause 13.5.2 Average A-weighted sound level. A concern was expressed about the definition of average sound level. Wes Schwartz volunteered to meet with the respondent, Jeewan Puri, and discuss the issue. Wes will report at the next meeting.

Clause 5 Resistance Measurement. Several issues were pointed out where this clause refers to obsolete measuring methods and equipment. This issue will need to be addressed at future meetings.

Clause 10.8 Insulation Power Factor testing. Wayne Hansen volunteered to review the clause for the next meeting and make suggested changes as deemed necessary.

Clause 10.9.4 Insulation Resistance Measurement. The chairman will review a comment received from Nigel McQuin wherein he refers to IEEE Standard 95. A clarification will be presented at the next meeting.

OTHER OLD BUSINESS

Dirk Russwurm pointed out an omission of a divide symbol in equation 24 of draft 3 of the standard. The chairman will advise the IEEE editor to correct this before the next publication.

There was no new business and the meeting adjourned at 9:55 am.

8.6 HVDC Converter Transformers & Smoothing Reactors S. C. - Richard Dudley

The HVDC Converter Transformers & Smoothing Reactors S.C. met in the Cree Meeting Room of the Sheraton Falls View Hotel in Niagara Falls Canada from 10:55 a.m. - 12:00 noon. There were 6 members and 13 guests present; one of the guests, Peter Heinzig requested membership. The following are the highlights.

1. The minutes of the Nashville meeting were approved.

2. The attendance list was circulated.

3. The Chairman informed S.C. attendees that both the converter transformer and smoothing reactor standards were published in June 2000 as IEEE Std. C57.129-1999 and IEEE Std. C1277-2000 respectively.

4. In discussions it was agreed both 2-year life "trial use" documents should be reaffirmed after 2 years since it could take up to 2-4 years to get sufficient feedback as active HVDC projects are sporadic. However, during the next number of years selected appropriate preparatory work will be carried out on both documents. Subject areas include harmonic loss determination for converter transformers, p.d. measurement etc.

5. Alan Forrest presented measured data re the harmonic losses in single and 3 phase converter transformers. Using an HP Impedance Analyzer the measurement of losses at 10 frequencies and 3 taps took less than 1 hour. His results will be distributed to S.C. members.

   Peter Hernzig presented harmonic loss measurement data for converter transformers; also obtained with an HP Impedance Analyzer. His results will be distributed to S.C. members.

   Pierre Riffon presented a comparison of harmonic loss values for converter transformers obtained using both the IEC and IEEE methods. The IEEE method, based fully on measurement yielded lower harmonic losses vs IEC which uses measurements at 2 points and calculations. The IEEE method resulted in 3.2% lower total losses.

   Discussions focused on a number of issues. What accuracy is required re the determination of harmonic losses? Harmonic losses are a small percentage of total losses. The harmonic loss value is primarily used to set the total losses (current) for the temperature rise test.

Some conclusions included the observation that instruments such as the HP Impedance Analyzer are sufficiently accurate and easy to use for measuring harmonic losses. The IEEE method now in C57.129-1999 should be kept.

Based on results reported to date re determining harmonic losses in converter transformers, an overall summary of the results obtained using the IEEE vs IEC method should be prepared.

6. Peter Heinzig, based on a recent test of a converter transformer, suggested that design and test methodology re the lightning impulse test of the valve windings should be discussed further; specifically different test levels across the winding and to ground.

7. For the Amsterdam meeting, Pierre Riffon will present his thoughts on p.d. testing for the d.c. test, polarity reversal test and induced test.

8. The Chairman requested that any feedback re the use of C57.129 and C1277 be presented at the Amsterdam meeting. He also requested S.C. members to present any other ideas re the further development of these two standards.

The meeting adjourned at 12:00 noon.

8.7 Instrument Transformers - J. E. Smith, Chair

8.7.1 Chair's remarks & Announcements:

The subcommittee met on October 17, 2000 with 9 members and 8 guests present.

- The dates and locations for future meetings were announced
- The minutes of the April 4, 2000 meeting were approved as written.

8.7.2 Working Group Reports:

8.7.2.1 WG C57.13.5 - Working Group on Test Requirements for High Voltage Instrument Transformers 115 kV Nominal System Voltage and above – Joe Ma

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

(1) Total 13 people attended the two sessions.

(2) The minutes of spring 2000 meeting held at Nashville, TN was approved with minor editorial corrections.

(3) The request for extension of the project was approved. The new deadline is December 31, 2002.

(4) There is one negative ballot for the second working group survey. The working group will try to resolve the negative ballot and update the present draft D13.3 based on the discussion in these meeting sessions. The chair will send the clauses revised to the members of the working group for comments. A final revision, if required, based on those comments from the members will be made prior to submission to the chair of

the instrument transformers subcommittee. Subsequently, an internal survey within the subcommittee will be conducted.

(5) R. McTaggart made a presentation of the Transport Test to fine-tune the description and criteria for this new test item. The suggested clauses will be adopted in the draft, as there was no major objection raised in the meeting.

(6) The requirements of secondary short circuit capability and test procedure were reviewed. The pertinent clauses will be revised accordingly.

(7) Arteche's comments regarding to partial discharge test for reduced insulation levels, inter-turn overvoltage will be incorporated in the draft. The comments regarding the sealing test, and mechanical test will be included in the fraft as well.

(8) Pierre Riffon, the co-chair of the working group, made a report on his presentation of our draft concerning the gas-filled instrument transformers to the MT 30 of TC38 working group of IEC in Milan, Italy during summer 2000. Most of our draft has been accepted for consideration. Pierre's conclusion is that harmonization between IEEE and IEC will be a slow process. One way to achieve that is that both side should take small steps in changing or adopting the other's viewpoint.

8.7.2.2 WG C57.13.6 – Working Group on Instrument Transformers for use with Electronic Meters and Relays – Chris Ten Haagen

This meeting was cancelled.

8.7.2.3 Working Group on C57.13 Revision – Tom Nelson

There were 10 members present at the meeting.

Suggested changes to C57.13 were discussed with the majority being left for the next revision. Section 7.7 on short circuit capability needs to be rewritten and will be included in the changes before the next meeting. The other change is the suggested addition of a partial discharge test included below.

PARTIAL DISCHARGE TESTS

A partial discharge test shall be made on instrument transformers to determine the freedom of internal insulation from damaging internal discharges. Instrument transformers of voltage class 5kV shall be given a partial discharge test as a type test. Dry-Type voltage transformers and wound or bar- type current transformers above 5kV shall be given a partial discharge test as a routine test. Liquid filled instrument transformers 34 kV and above shall be given a partial discharge test as a routine test.

8.7.3 Old Business

Study group on C57.13.2 - V. Khalin:

A proposal was presented to remove restrictions in the applicability of this Standard. Clauses 1.2 - 3), 5) and 6), which relate to railway, utility and pole-top installations would be eliminated.

8.7.4 New Business

Reviewed method proposed by Charles Ballantine for determining the saturation curve for bushing type CT's

Discussion of IEC TC 38 activities

8.8 Insulating Fluids Subcommittee - F. J. Gryszkiewicz, Chair

The Insulating Fluids Subcommittee and its Working Groups met in Niagara Falls, Canada on Monday and Tuesday, October 16 and 17 2000.

8.8.1 Current Subcommittee Projects

8.8.1.1 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 was previously sent to the Standards Board for approval. At their last meeting, RevCom voted to Disapprove this Guide due to a problem in the balloting procedure. This document must now go through a Recirculation Ballot before it can be resubmitted to RevCom for approval.

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

Although this Trial Use Guide has successfully completed a Recirculation Ballot, the PAR expired before it could be sent to the Standards Board for approval. A new PAR will be issued and the document will be sent to the Standards Board for approval.

8.8.1.3 C57.111 – IEEE Guide for Acceptance of Silicone Insulating Fluid and Its Maintenance in Transformers

This Guide will be sent out for a Standards Association Reaffirmation Ballot after the next meeting in Niagara Falls, Canada.

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

Draft 8 was sent out for a Subcommittee Survey prior to the Niagara Falls Meeting. The results of this Survey were discussed at the meeting in Niagara Falls. All negative ballots were resolved and several other comments were suggested. The Subcommittee voted unanimously to incorporate these changes and send Draft 9 for a Standards Association Ballot.

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

Draft 5 was sent out for a Subcommittee Survey prior to the meeting in Niagara Falls, Canada. The Subcommittee discussed the results of the Survey at its meeting in Niagara Falls. All negative ballots were resolved and several other changes were suggested. The Subcommittee voted unanimously to send Draft 6 for a Standards Association Ballot.

8.8.1.6 C57.139 - Dissolved Gas Analysis in Load Tap Changers - Rick Youngblood, Chair

Draft 5 was sent out for a Working Group Survey prior to the meeting in Niagara Falls, Canada. The Working Group discussed the results of the Survey at its meeting in Niagara Falls and voted to send Draft 6 for a Subcommittee Survey before the next meeting in Amsterdam.

IEEE Standard 637 - IEEE Guide for the Reclamation of Insulating Oil

And Criteria for its Use

This document is approaching the end of its five year life cycle. This means that it must be either reaffirmed or revised. Revision of this document is not feasible now since it contains test values that are included in a table in C57.106, which is currently under revision. Until C57.106 is revised, the test values in Std. 637 cannot be revised.

In view of the foregoing, a Standards Association Ballot for reaffirmation will be conducted on the condition that revision of Standard 637 will begin after C57.106 is approved.

8.8.2 Next Meeting

The Insulating Fluids Subcommittee and its Working Groups will next meet in Amsterdam, The Netherlands, April 8-12, 2001

8.9 Insulation Life - L. W. Pierce, Chair

The Insulation Life Subcommittee met at 8:00 AM Tuesday, Oct. 17, 2000 at Niagara Falls, Canada. Attendance was 24 members and 42 guests. The minutes of the April 4, 2000 meeting in Nashville, Tenn. were approved.

8.9.1 Presentation by T. V. Oommen

The main business of the subcommittee was a presentation by T. V. Oomment on, "Bubble Evolution from Transformer Overload". A paper of the same title was sent by E mail to the members and copies were given out at the meeting. It is planned that the equation given in the paper for predicting bubble evolution will be incorporated into the next revision of the loading guide, IEEE C57.91.

8.9.2 Status Reports

Status reports were given for the following projects:

Don Platts on PC1538, "Guide for Determination of Maximum Winding Temperature Rise in Liquid Filled Transformers". The document has been approved by IEEE and was printed in August 2000.

George Henry, Chair, Working Group on Revision of Temperature Test Code reported that the Working Group has completed its work. A draft of Clause 11, Temperature rise tests has been forwarded to Subhash Tuli for the next revision cycle for C57.12.90.

Subhash Tuli reported on PC57.119, "Recommended Practice for Performing Temperature Rise Tests on Oil-Immersed Transformers at Loads beyond Nameplate Rating". A PAR has been issued for extend the project. Next step is to conduct a recirculation ballot.

Working Group reports were as follows:

8.9.3 Working Group on Loading of Liquid Immersed Transformer - Linden Pierce, Chair.

The Working Group met at 8:00 AM on Monday, Oct. 16, 2000 with 19 members and 39 guests in attendance. The minutes of the April 3, 2000 meeting in Nashville, Tenn. were approved.

The first session comprised a presentation by Linden W. Pierce titled, "Review of Transformer Loading Guide Equations". The limitations of the Clause 7 loading guide equations, recent test data, and the development of the Annex G Loading Guide equations was covered.

The second session comprised a presentation by Glen Swift titled, "Loading Calculations using Excel". Use of the Excel program was demonstrated.

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

The Task Force on Winding Temperature Indicators met on Monday, October 16, 2000 at 4:15 PM. There were 10 members and 19 guests in attendance. The minutes of the April 2000 meeting in Nashville, Tenn. were approved as written.

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.

No draft paper was available as planned for review, so a brief presentation was made to the attenders to acquaint them with the objectives of the working group. The meeting of the general attenders was adjourned at 4:45 PM. Following this, a small group of members who have volunteered to contribute to the paper met to discuss direction for the paper and review data on-hand regarding transformer temperature behavior. The volunteers, under Carlo Arpino as the main editor, will endeavor to have a draft paper by the next meeting.

8.9.5 Chair' Announcements

Linden Pierce reported that he has resigned as Chair of the Insulation Life Subcommittee effective Nov. 1, 2000. Don Platts agreed to serve as the new chair and this was approved at the ADCOM meeting on Sunday.

8.9.6 Old and New Business

There was no old or new business so the meeting adjourned.

8.10 Performance Characteristics - D. J. Fallon

8.10.1 Introduction/Attendance

The Performance Characteristics Subcommittee (PCS) met at 9:30 a.m. on Tuesday, October 17, with 49 members and 33 guests in attendance. 15 of those guests requested membership in PCS. All members and guests were requested to provide E-mail addresses, as PCS will be moving towards electronic transmittal of minutes and other Subcommittee documentation.

8.10.2 Approval of Meeting Minutes

The minutes of the April 4, 2000, PCS Meeting in Nashville, Tennessee, were approved as written.

8.10.3 Chairman's Remarks

8.10.3.1 Administrative Subcommittee Notes

The chair discussed issues from the Administrative Subcommittee meeting. The details of that meeting can be found in the main committee minutes.

Committee Chair Bipin Patel would like each SC to come up with several possible topics for consideration for future Tuesday afternoon technical sessions or symposiums. PCS will discuss this under New Business

The status of C57.133, the Guide for Short Circuit Testing of Distribution and Power Transformers, was discussed during the Admin. SC meeting. Details are included under WG Reports.

Don Platts will take over as Insulation life Subcommittee Chair when Linden Pierce retires. PCS expressed appreciation for the tremendous contributions of Linden over many years, and welcomed Don to his new position.

8.10.3.2 Membership

15 new members were added to the PCS Roster:

Carl Bush, Pemco Corp.

Max Cambre, GE Co.

Ron Daubert, KAMO Power

Patrick Dempsey, PSEG Power

Reto Fausch, Haefely Test, Inc.

Eduardo Garcia, VA Tech Ferranti Packard Mexico

Richard von Gemmingen, ABB Power SPTD

George Henry, Central Moloney Inc.

Dong Kim, Southern California Edison

Neil Kranich, Southwest Electric Co.

Jim McIver, Nevada Power Co.

Dhiru Patel

Robert Scharnell, Maysteel LLC

Vic Shenoy, Shenoy Transformer Services

David Woodcock, Weidmann Systems Int'l.

The Membership roster will be reviewed shortly. Members who have not attended any of the last 4 meetings will be contacted regarding their removal from the PCS roster – thanking them for past participation, and indicating that they will be welcome to renew their participation and rejoin the group.

8.10.4 Agenda Changes

Add Status of C57.21 as the first item of Old Business

8.10.5 Working Group Reports

8.10.5.1 PCS Revisions to C57.12.90 – Bruce Forsyth

The Working Group met on Monday, October 16, 2000, with 10 members and 55 guests present. There were 20 requests for new membership on the Working Group. Neil Kranich chaired the meeting in Bruce Forsyth's absence.

Minutes from the April 3, 2000, meeting in Nashville were approved as written. A discussion of outstanding issues for C57.12.90 followed. Of the ten points discussed the following four were accepted as submitted:

Clause 5.1.2: The first sentence will be amended to read"…average liquid temperature", to correspond with the definition in clause 11.2.

Clause 5.3.2: Will have a clarification added to call for the averaging of several resistance readings when a switching type DC power source is used.

All references to "radio influence voltage" will be changed to "partial discharge".

All references to cooling designations will be updated to the current standards.

Additional items covered during the meeting included:

Dan Perco offered to rewrite clause 4.3 and its corresponding note to provide a suggested test sequence without implying that dielectric and full voltage testing damages transformers.

A request to change T_K from 234.5 to 235 to harmonize with IEC was rejected due to the number of programs and instructions that currently use 234.5 and the fact that it is a true physical constant.

A request to add the requirement of performing no load loss and excitation at both 100% and 110% to Clause 8.2.4 was rejected because C57.12.00 covers the required levels.

It was felt that recommendations to change Clauses 12.4.5, 12.5.4, and 9.3.3.2 would require clarifications and justifications to be considered. Bruce Forsyth will contact the commenters for this information.

Subhash Tuli, Rowland James, and Wayne Hansen offered to provide wording for new test procedures for:

Operational tests of all devices operated from the control box (Subhash)

Operational tests of tap changer(s) (Subhash)

Single phase excitation tests for class II transformers (Subhash & Wayne)

Core insulation resistance measurements (Subhash & Wayne)

Low frequency tests on auxiliary devices (Subhash)

Test techniques for "Dissolved Gasses in Oil Analysis Test" (Rowland)

Re-introduce front-of-wave test procedure for those who specify it (Subhash)

Consensus on the wording for tests covered by other working groups must be obtained before incorporation into C57.12.90.

There was no Old Business. Under New Business, Tom Prevost remarked that the revised version is slated for ballot by September 15, 2001. There was no more New Business and the meeting was adjourned at 10:45 AM.

8.10.5.2 Loss Tolerance and Measurement - Ramsis Girgis

11 members and 26 guests attended, 6 guests requested membership.

First report was on meeting of TF on "Guide of Low P.F. power measurements". Last two sections of the guide were reviewed in the meeting. The plan is to have the guide ready for final review by the TF at the next meeting.

Next item was reporting on the status of the " Loss measurement " Guide. The Guide is now complete and was sent to IEEE standards to start the formal balloting process. The chairman reviewed the final revisions made to the guide. He also presented measured NLL as a verification of the criticality of the procedures recommended in the guide to obtaining accurate loss measurements. The results of the balloting will be presented and discussed in the spring meeting of the WG along with resolutions of the issues raised. The chairman reported that all parts of the guide have been surveyed before at the WG and SC levels and all issues resolved so he does not expect too many technical issues will be raised from the ballots.

Next item discussed was results of measurements performed by three manufacturers on losses and noise at both 50 and 60 Hz in order to arrive at recommended conversion factors of transformer performance parameters between the two frequencies. The plan is to get more data before a final recommendation is submitted for discussion and acceptance at the spring meeting of the WG.

Don Kline then reported on the activities of the DOE on developing the new government Standards on distribution transformer efficiency and loss measurement techniques. He reported that, on Nov 1, there is going to be a public hearing on these subjects and everyone is invited.

Finally, the chairman announced that Ed teNyenhuis of ABB Guelph, Canada has accepted the responsibility of becoming the secretary of the WG on "Loss Measurement and Tolerance".

The meeting was adjourned at about 5:20 p.m.

8.10.5.3 PCS Revisions to C57.12.00 - Donald W. Platts

The Working Group met on Monday, at 1:20 PM. We had 15 members and 55 guests in attendance. The approval of the minutes of the Nashville meeting was inadvertently skipped.

The chair reported that:

C57.12.00, 2000 was published in August.

Four former members were notified that they no longer met the criteria for membership, and had been asked to respond if they wanted to resume their membership.

The purpose of this meeting was to review comments received from a recent WG survey.

This survey was the first, for this working group to have been conducted electronically. The survey status: 15 Surveys returned; 12 Items approved without comment; 6 Items Approved with comment; 7 Items Not approved.

Our review of the working group comments resolved the following items:

Wording of clause 5.5.3 will be changed to say that taps for de-energized operation shall be full capacity, and taps for LTC's shall be reduced capacity for taps below rated voltage unless specified otherwise. Any reduced capacity taps shall be identified n the nameplate.

Wording of clause 4.5.3g under unusual service conditions will be changed to replace part of the phrase "unusual duty or frequency of operations, impact loading". The term impact loading will be replaced by "high current short duration loads."

Table 2 One of the examples shown for converting from the old cooling class designations to the new will be eliminated. (ONAN/ODAF) Transformers are not built with that configuration.

Wording of clause 8.2.3 will be changed to say when testing the low voltage control wiring, that each terminal may be tested individually, or all terminals in a single cabinet may be grouped together. However, terminals in separate cabinets should not be tied together to perform the test.

We discussed whether Note 10 of Table 19 (in 2000 revision) should be removed since it is redundant to clause 8.2.3, and does not add any additional information. It was agreed to remove it.

A suggestion that any zinc oxide devices used in the tank should be shown on the nameplate led to a prolonged discussion. We discussed whether non-linear resistors or varistors would be a better word. Then there was discussion about explaining why they are used, and the effect on the transformer performance if they should fail. We concluded that we would not deal with those issues. After a vote, Note 9 to Table 10 will be amended to add the sentence: "Any nonlinear devices, capacitors, or resistors installed on the winding assembly, or on any tap changer shall be indicated on the nameplate."

We also voted to revise Table 10 to include not only the manufacturer, but also the location of the factory that built the transformer.

The remaining issues will be reviewed at another time. The 25 items in this survey will be modified as noted above, and a new survey of the Performance Characteristics Subcommittee, will be conducted by year-end. Don Platts will resign as the chair at the end of this meeting, and Steve Snyder has agreed to serve as the new chair of the working group. The meeting adjourned at 2:40.

8.10.5.4 Switching Transient Induced by Transformer/Breaker Interaction - Bob Degeneff, Chair; Peter Balma, Secretary

The Working Group on Switching Transients Induced by Transformer/Breaker Interaction was called to order at 8:00 AM on Tuesday October 17, 2000. There were 23 members and 26 Guests present. The agenda for the meeting was reviewed, followed by approval of the Minutes from the April 4, 2000, meeting in Nashville, TN. A copy of Draft 1a of the guide, meeting minutes, a contribution on Transformer Transient Voltage Response, and an outline for the meeting were distributed. Items covered during the meeting included:

Dr. Gustav Preininger reviewed transformer breaker interaction from the transformer point of view, illustrating salient concepts and considerations.

Peak voltages at resonances are dependent on damping and duration of the excitation.

Resonances relative to ground or inter-winding characteristics have to be considered.

Normal impulse models may not be adequate for analysis, since they may not represent high enough frequencies.

Failures can occur at the line or neutral terminals.

Jeewan Puri provided an update of CIGRE activities on this topic. CIGRE Study Committees 12, 13 and 23 have convened a working group to discuss this area, however, its primary focus is on the interaction between SF_6 switchgear and transformers. The MHZ frequency transients generated by the operation of disconnects, and their impact on transformers, is being studied. The CIGRE group has indicated they would like to expand their effort into the area of medium power gear and vacuum breakers, the focus of this guide. Jeewan has volunteered to provide additional coordination with CIGRE.

Jim Antweiler presented an example of a breaker/transformer interaction failure, which precipitated an active discussion on the how, what and why of this event. Several suggestions on methodologies to study such a failure and how to interpret the results were shared.

Subhas Sarkar presented another example of a breaker/transformer interaction failure. This failure occurred on a circuit with multiple transformers. Contributions from working group members pointed out the importance of understanding both resonance and current chopping as the potential failure modes. This situation was addressed using a snubber circuit.

The chair of the working group requested the members of the group to review the draft guide, and to submit comments in the next several months. Another draft will be distributed at the end of the year.

A question as to whether the guide should include details on snubber design was raised for discussion. Many opinions were expressed, but most indicated the guide should maintain a broad focus. This will be considered in preparation of the next draft.

The meeting adjourned at 9:19 AM.

8.10.5.5 DETC Specification and Test – Phil Hopkinson

The WG on De-energized Tapchangers met at 8:00 AM on October 16 to develop specifications and appropriate tests. There were 32 members and 8 guests present.

It was the unanimous opinion of all present that the functional life test should be included in the standard for de-energized tapchangers. The test describes accelerated testing at 2 times normal load current in an effective 130ºC ambient for 8 hours followed by a 16 hour cool-down, daily for 30 replications. The test is successfully passed if resistance change is less than 25% and stability has been achieved.

The WG also voted to adopt the IEC TC14 60214 document write-up with functional life test inclusion for addition to C57.131. Assuming that IEC 60214 is modified to include the life test, both documents will be harmonized.

Chairman Phil Hopkinson will transmit the appropriate life test wording to the IEC Tapchanger Convener, David Peck, for update.

There also was general support for publishing a report on the functional life test. Several manufacturers were experimenting with the test now and will report in at a later date.

The WG is ready to move to a working Draft document and should proceed to establish a PAR. There was no other new business and the WG adjourned at 9:30 AM.

8.10.5.6 C57.133 Guide for Short Circuit Testing - Nigel McQuin

The WG did not meet in Niagara Falls. The PCS Chair reported status. Editorial changes were required before the Guide is balloted. Thanks to some assistance in the editorial process from Steve Schappell, the document will be ready shortly. Chairman McQuin and the PCS Chair will coordinate with the Standards Subcommittee and IEEE in moving the document to ballot. Volunteers were requested at the PCS meeting to assist if needed during the balloting process, and Dennis Marlow, Bob Delvecchio, and Jerry Corkran stepped forward.

All members of the Ballot Group are urged by PCS to consider voting affirmative, and to note comments with their ballot if there are areas for suggested enhancement of the document. The Short Circuit Test Guide is presently out of publication, as the Annex originally covering this subject 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 be published. PCS will then initiate a new PAR for revision work to cover any topics that arise in the ballot process.

8.10.6 Project Reports

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

The Guide has been reaffirmed in 2000 as an approved publication of the IEEE.

8.10.6.2 C37.91/D13 Guide for Relay Application – Ron Barker (Liaison)

The Guide has been published in 2000 as an approved publication of the IEEE.

8.10.7 Old Business

Status of C57.21, 1990 (R1995) Standard Requirements, Terminology, and Test Code for Shunt Reactors Rated Over 500kVA

C57.21 is reaching the end of its 5 year life. Review by several members of the Dry Type Transformers SC and PCS, including Richard Dudley, Fred Elliott, Pierre Riffon, and Sheldon Kennedy, resulted in the recommendation to PCS, as sponsor of the document, to proceed with reaffirmation. That process will proceed before the next meeting. The Dry Type Reactor WG also recommended several areas for enhancement of the document that should proceed, hopefully after successful reaffirmation, with the development of the new PAR. This work would be a joint effort involving members of both the Dry Type Reactor WG and PCS. These areas include:

An Annex to cover switching issues as they relate to performance and service life of dry and oil immersed shunt reactors. Consideration of the work in Bob Degeneff's WG on Switching Transients Induced by Transformer /Breaker Interaction would be incorporated into this Annex as well.

An Annex to cover application of C57.21 to the Thyristor controlled shunt reactors of static VAR systems.

Richard Dudley and Peter Balma volunteered to take leadership roles in the continuation of work on this Standard.

Status of IEEE 32, 1972 (R1997) IEEE Standard Requirements, Terminology, and Test Procedures for Neutral Grounding Devices

Jin Sim raised a question on the need for maintenance of IEEE 32 as PCS responsibility. The Chair will look into this for the next meeting.

8.10.8 New Business

Special Technical Sessions for Future Meetings

Per the request of Committee Chair Bipin Patel, PCS discussed possible topics for special technical sessions. These included:

Inrush Current – Building from Phil Hopkinson's and Ramsis Girgis' presentations at the previous Meeting in Nashville. Glen Swift has volunteered to discuss impact of inrush current on differential relaying. Others considering possible participation (especially utilities with practice in response to inrush issues) are asked to contact Phil Hopkinson (hopkinsp@squared.com).

Review of the work of Bob Degeneff's WG on Switching Transients Induced by Transformer/Breaker Interaction.

Discussion on Loss Measurement, sponsored by Ramsis Girgis' WG on Loss Tolerance and Measurement.

Discussion on the variability (tolerances) of performance parameters for similar transformers, including parameters such as noise, thermal performance, core loss, excitation, inrush, etc.).

These potential topics will be forwarded on to the Committee Chair. Volunteers who would be interested in developing these ideas further can contact me (donald.fallon@pseg.com).

Scope of C57.12.00 as Related to 25Hz Transformers

Don Platts requested a review of the scope of C57.12.00 regarding applicability to 25Hz transformers, and an understanding of the terminology "special transformers".

There were no other items of new business.

8.10.9 Next Meeting

The next PCS meeting is expected to be scheduled for Wednesday, April 11, 2001, in Amsterdam, the Netherlands.

The meeting adjourned at 10:45 a.m.

8.11 Power Transformers Subcommittee: Everett Hager - Chairman

The Power Transformers Subcommittee met on Tuesday morning, October 17 at 10:55 AM with 51 members, including 19 new members, and 58 guests.

The minutes from the Nashville meeting were approved without changes.

Reports were presented by the various Working Group and Task Force Chairmen as follows:

8.11.1 Working Group for Revision to C57.12.10

Chairman Javier Arteaga, reported for the Working Group for Revision to C57.12.10. The group met at 8:00 am on Monday morning with 8 members and 22 guests. 7 of the guests requested membership in the Working Group.

Administrative Subcommittee Update: The copyright issues between NEMA and IEEE are not yet resolved. IEEE will not indemnify members until NEMA transfers the copyright to IEEE.

The Subcommittee agreed that work can continue so long as information is not distributed outside the Working Group. Otherwise, Working Group members and the Working Group Chair could be held personally liable. Until the copyright issue is resolved, ballots can not be distributed and a PAR can not be applied for.

Document Title Discussion: All ratings will be removed from the title in an effort to simplify. All attempts will be made to co-ordinate the final title with the Working Group for Distribution Substation Transformers (C57.12.36). The plan is to submit the PAR's for both C57.12.10 and C57.12.36 at the same time. The new title will read "Standard Requirements For Liquid Immersed Power Transformers."

Document Scope Discussion: There was a discussion regarding how to state the kVA ratings. The agreement was to state base kVA ratings only. Recommended kVA rating for Forced Air and Forced Oil will be addressed in the ratings section.

- MVA ≤ 10; 125%

- MVA ≥ 10; 133% (1^{st} stage), 167% (2^{nd} stage)

A number of changes were suggested to clarify the introduction and scope.

- The word "application" will be removed from the 1^{st} sentence since this is a product standard.

- Specifically state 50 and 60 Hz

- Clarify that Autotransformers will be included

- Remove the "Forced-Air" kVA ratings.

- Extend the kVA ratings for LTC designs down to 2500

- Replace the product exclusion statement with a reference to C57.12.00.

- Standard "Contents": Currently C57.12.10 has 9 sections. This will be reduced to 7 sections by incorporating the "Other" requirements into their appropriate sections.

A request for volunteers was made to work on the "Rating", "Construction" and "LTC" sections. Current contributors are:

Ratings: John Rossetti, Rich von Gemmingen

Construction: Dennis Marlow, Roland James, Bob Hartgrove

LTC: Jim Harlow

The following are some general comments made regarding the "Ratings":

1. Reference C57.12.00 for the preferred kVA ratings

Provide formulas and examples (ANSI and IEC) to determine FA ratings

2. Review C57.12.00 for voltage and BIL levels. Decide if C57.12.10 should have a table to define preferred voltage and BIL levels. The end user is still responsible for system insulation co-ordination

3. Include specific impedance voltages

4. Avoid getting into tap changing applications for both LTC's and de-energized tap changers when defining the preferred switch location. Consider IEC 76.1 and the established North American practices

LTC- LV winding

DETC- HV winding

The meeting adjourned at 9:15 am.

8.11.2 Working Group on LTC Performance

Chairman William Henning reported for the Working Group on LTC Performance. The W. G. met on Monday, October 16 with 13 members and 8 guests attending. At the previous meeting in Nashville, it was decided to attempt to harmonize IEC terminology in IEC214 with IEEE terminology in C57.131. The Group worked through some examples during the meeting. In the process they came to the conclusion that harmonization of terminology does not mean creating equal language; that is, identical phrases, clauses and sentences. The definition of harmonization of terminology used by the Working Group is that definitions are harmonized if they do not conflict with each other. The exact wording may be different, but the intent and underlying meanings are the same.

Using this definition of harmonization, the Working Group reviewed all of the definitions in IEC214 and IEEE C57.131. Based on the above criterion for harmonization, it was concluded by the Working Group that the current definitions in IEC 214 and IEEE C57.131 are already harmonized. The Working Group will next review IEEE C37.131 to determine if all the terms used in the text are defined in the definitions clause of the document.

Because the IEEE Working Group wishes, as much as possible, to align itself and its work with that of WG26, it was decided to send to Working Group members a copy of the IEC WG26 outline for a Tap-Changer Application Guide, asking IEEE Working Group members to suggest specific topics for the Guide.

The meeting adjourned at 12:10 pm.

8.11.3 Working Group for the Phase Shifting Transformer Guide

Chairman Edgar Trummer reported for the Working Group for the Phase Shifting Transformer Guide, C57.137. The group met Monday afternoon at 2:50 with 45 members and guests in attendance.

The results of the ballot on Draft Revision 11 were discussed

97 eligible balloters

65 affirmations

4 negatives

5 abstentions

This resulted in a total of 74 votes with 94% affirmative or abstained votes.

The rest of the meeting dealt with resolving the four negative votes. There were a number of technical corrections which will be incorporated. All references to "cost" will be removed. The Bibliography will be revised to include volume number and page numbers of references, and manufacturer brochures and technical literature will be made available to the public through the IEEE. All other comments were editorial. It is planned to make the recommended changes and ballot only the revisions.

The meeting was adjourned at 4:10 pm.

8.11.4 Working Group for Monitoring of Liquid Filled Transformers

Chairman Andre Lux reported for the Working Group for Monitoring of Liquid Filled Transformers. The group met for a special session on Sunday, October15 and again on Tuesday morning at 8:00 with 55 members and guests in attendance.

Draft 8 of the Monitoring Guide was discussed. The W. G. met in a working session on Sunday, October 15. The latest contributions to the Guide were reviewed and edited. These sections are §6.2, Sampling Criteria and a section entitled "Selecting Communications Protocols for On-Line Monitoring."

Draft 8 will be submitted electronically to the W. G. members for their comments. Volunteers for additional work were identified. Comments to Draft 8 and the additional contributions will be sent to the Working Group Chairmen by December 15 in order for a new draft, Draft 9, to be circulated to the Working Group membership in the form of a survey. The survey will be performed in order to identify areas of the guide that need to be improved in anticipation of sending the document out to ballot.

The survey will be sent out in early January in order to receive comments back before the Spring 2001 meeting.

The Working Group discussed having a panel session on transformer monitoring in an upcoming Transformers Committee meeting. The session will include representatives of utilities, equipment manufacturers, and monitoring systems manufacturers.

The PAR for this Guide will be applied for prior to the Spring 2001 meeting.

8.11.5 Working Group on Transformer Life Extension

Chairman Rowland James reported for the Working Group on Transformer Life Extension. The working group met on Tuesday, October 17, 2000 at 9:30 A.M. . The formation of task forces to develop specific sections of the guide were identified. Volunteers for these task forces were solicited. There were 26 members and 22 guests in attendance. Fifteen members indicated that they plan to attend the next meeting in Amsterdam.

PC57.140, draft 5, will be e-mailed to members prior to this meeting.

The meeting was adjourned at 10:10 A.M.

8.11.6 West Coast Working Group

Chairman Mike Lau reported for the West Coast Working Group. No meetings were scheduled for the West Coast Working Group during the Niagara Falls meeting. A joint session has been scheduled with the IEEE West Coast Substation Subcommittee and West Coast Working Group in Phoenix on November 6th and 7th, 2000.

The meeting will be held at the Shure Building (Conference Rooms C and D) of Arizona Public Service Company in Phoenix.

A time slot of 1:00 pm to 5:00 pm has been reserved for the meeting of the West Coast Working Group. One item of discussion will be on C57.93.1995, the Guide for Installation of Liquid Immersed Power Transformers, which will be balloted for re-affirmation.

8.11.7 Task Force on a Guide for Standard Control Cabinets

Joe Watson reported for the Task Force on a Guide for Standard Control Cabinets. The group met for the first time on Monday morning at 10:55 with 28 guests, 5 of whom requested membership. The meeting was devoted to discussing the benefits of standardized control cabinet designs and the approach that the Task Force should take if the Guide is to be prepared and accepted. It was agreed that a Tutorial will be presented during the Amsterdam meeting to demonstrate efforts by manufacturers and users on standardization and to discuss the benefits. The Task Force needs more users as members and all users are invited to participate.

8.11.8 OLD BUSINESS

The Balloting of C57.93.1995 was also discussed under Old Business.

8.11.9 NEW BUSINESS

Tom Lundquist discussed concerns with TRV. It is believed that some transformer designs with high capacitance may cause higher than expected TRV under some fault conditions. Manufacturers were requested to assist in a study of the issues by providing test results on several types of transformers.

The meeting adjourned at 12:10PM.

8.12 Underground Transformers and Network Protectors – Carl Niemann

8.12.1 Introduction/Attendance

The Underground Transformers and Network Protectors Subcommittee met on Tuesday, October 17, 2000, in the Sheraton Fallsview Hotel & Convention Centre at 9:30 AM with nine members and nine guests present

8.12.2 Approval of Minutes

The minutes of the April 4, 2000 meeting in Nashville, Tennessee were approved as submitted.

8.12.3 Membership

Membership stands at 16 members

8.12.4 Chairman's Remarks

The chair discussed issues from the Administrative Subcommittee meeting. The details of that meeting can be found in the main committee minutes.

NEMA Board approved transfer of copyrights on C57 Standards to IEEE. Waiting for letter from NEMA to finalize transfer.

8.12.5 Working Group Reports

8.12.5.1 Three-Phase Underground-Type Transformers (C57.12.24) J. Sullivan – Chairman

Met on Monday, October 16, 2000 at 9:25 AM with seven members and eight guests present. One guest requested membership.

Minutes of the April 4, 2000 meeting in Nashville were approved as submitted.

The former chairman gave members a copy of C57.12.24 – 2000 which has been printed.

There were discussions on what needed to be done for the next revision.

Discussion on metric conversions. They should be the same for all Standards

Concern about nameplate, that weight should remain in pounds for safety reasons

Meeting adjourned at 10:10 AM.

8.12.5.2 Liquid Filled Secondary Network Transformers (C57.12.40) R.L. Plaster – Chairman

Met at 8:00 AM, Monday, October 16,2000 with 11 members and four guests present.

Minutes of the April 3, 2000 meeting in Nashville were approved as submitted.

The Chairman distributed copies of C57.12.40 – 2000 which has been published. The membership noted that there type-overs and misspelled words in Fig 3 and 4.

John Rosetti of Memphis LG&W sent the chairman a letter with a few issues that were discussed. They included:

Dimensional requirements for the low voltage adapter block.

Dimensions for the height of the low voltage throat from the ground.

The need for specifications for clamped low voltage bushings.

There was discussion on returning the two position switch back into the Standard.

The chairman will begin wording the new PAR provided the copyright is turned over to IEEE from NEMA.

The meeting adjourned at 9:15 AM.

8.12.5.3 Secondary Network Protectors (C57.12.44) D.H. Mulkey – Chairman

Met on Monday, November 16, 2000 at 1:20 PM with 12 members and two guests present.

Minutes of the April 3, 2000 meeting in Nashville were approved as submitted.

Standards have been published and copies are in the mail to members.

Began collecting items for next revision.

Discussed distributed generation attached to network bus. Chairman will forward email coordination items to members.

Under New Business: Chair will proceed with requesting new PAR.

Meeting adjourned at 2:05 PM.

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

Met at 10:55 AM on Monday October 16, 2000 with eight members and seven guests present.

Minutes of the April 3, 2000 meeting in Nashville were approved as submitted.

Chair asked members to verify their email address since that will be primary mode of communication in the future.

Members were advised that after the corrections had been made from the previous meeting in Nashville the Standard was submitted to NEMA for balloting.

Members were informed that after the copyright was turned over to IEEE from NEMA there probably would be extensive reformatting to do for the next revision.

Meeting adjourned at 11:15 AM.

8.12.6 New Business

Because of the status were these Working Groups are at, only two time slots are requested for the next meeting. One time slot for .24 and .57, and one time slot for .40 and .44.

The Subcommittee adjourned at 10:15 AM.

9.0 Reports of Liaison Representatives

9.1 EPRI – S. R. Lindgren

Memorandum

October 6, 2000

TO: Mr. Ken Hanus

Secretary, IEEE Transformers Committee

TXU Electric & Gas

PO Box 970

Fort Worth, TX 76101

FROM: Stan Lindgren, Manager, Power Transformers

SUBJECT: **EPRI LIAISON REPORT**

The following report is for inclusion in your minutes for the October 18, 2000, meeting in Niagara Falls, Canada:

1. Moisture Dynamics:

   - 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.

   - 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. TR-113390,

Power Transformer Behavior During Overload - Phase I: Dynamic Behavior of Moisture, is now published. 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 a dynamic moisture assessment method on operating conservator-type core-form transformers. TR-114075, *Transformer Moisture-In-Paper Assessment Method – Field trial,* is published. Further experimental work and field trials covering nitrogen-blanketed and shell-form transformers are in process.

2. 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, were 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 project has been completed 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,* was held September 22-24, 1999 in Portland, Oregon. Proceedings, TR-113649, are published. At this time, three different failure detection methods are being tried at three different utility sites.

3. 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. DTCR 2.0 is available to EPRI Substations Asset Utilization, Overhead Transmission, and Underground Transmission Target members. DTCR 2.1 is being developed to add the IEC transformer thermal model and other refinements.

4. 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 2/99 to solve technical problems that have

delayed commercial production of the MIS sensors. An alternative 8-gas analyzer for nitrogen-blanketed transformers has been developed and is now commercially available. A prototype version suitable for conservator-type transformers began a successful field trial May, 2000, and is now commercially available .

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 such as acetylene. 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.

5. Power Transformer Remaining Life Prediction & Extension

- 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 has identified trace chemicals that are an early indication of insulation degradation and could be sensed through on-line monitoring.

- 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 reclamping of the same transformers. The objective was 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 transformers have had the initial FRA and internal inspection, and over 20 have had the follow-up FRA test. Results have been applied to assess the condition of a number of core-form and shell-form transformers. Recent co-sponsored experiments on a retired 345kV auto-transformer comparing the swept-frequency method and the low-voltage impulse (LVI) method were presented at the EPRI Substation Equipment Diagnostics Conference VIII held in New Orleans, February 21-23, 2000 (*Proceedings: Substation Equipment Diagnostics Conference*, EPRI 1000124, June 2000). A variety of problems were introduced individually. In general the study showed that both methods, properly applied, are effective and give similar results.

6. 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. XVISOR Version 1.0 is now available to EPRI Substations O&M members. Expansion to add LTC is in process.

7. 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 extensive update and extension, *Guidelines for the Life Extension of Substations (CD-ROM Version)*, EPRI 1000032 is now available to O&M members.

8. 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 were published in TR-108398 dated June 1997. Two EPRI projects to improve understanding of contact coking, oil filtration effectiveness and monitoring concepts were recently completed. Further work is in process regarding coking, filtration and novel methods for on-line monitoring.

9. Continuous On-Line Filter

Objective is to develop or adopt technologies for a passive on-line filter for mounting on transformers to continuously remove moisture, oxygen and oil degradation products to keep oil in pristine condition. Laboratory experimental work has been completed. Full-scale simulation tests are planned as an interim step to field demonstration.

10. Environmentally Acceptable Transformer Oils

Objectives are to 1) review the state-of-the-art of dielectric fluids, 2) perform laboratory tests & simulations on available candidate fluids for transformer application, and 3) demonstrate promising fluids in operating transformers. Laboratory tests & simulations have been completed on 12 candidate fluids.

cc: Bipin Patel, Chairman, IEEE/PES Transformers Committee

R. Lings, B. Ward

NOTE: Cigre information, including SC 12 (Transformers), can now be found at their web site: www.cigre.org . Attached is a paper, *Cigre's Work on Insulation Condition Monitoring of Power Transformers,* by Philippe Guuinic (Chairman SC 12), presented at ICMEP'2000 September 25-26, 2000, Wuhan China.

DRAFT for ICMEP'2000 (25th 26th Sept. Wuhan China)

CIGRE's Work on Insulation Condition Monitoring of Power Transformers

by Philippe Guuinic (Chairman of Cigré SC12)

1. Introduction to CIGRE'work

1.1 Presentation of CIGRE

CIGRE (International Conference on Large High Voltage Electric Systems) is a permanent non-governmental and non profit-making International Association based in France. It was founded in 1921 and aims to :

- Facilitate and develop the exchange of engineering knowledge and information, between engineering personnel and technical specialists in all countries as regards generation and high voltage transmission of electricity.
- Add value to the knowledge and information exchanged by synthesizing state-of-the-art and world practices.
- Make managers, decision-makers and regulators aware of the synthesis of CIGRE's work, in the area of electric power.

More specifically, issues related to the planning and operation of power systems, as well as the design, construction, maintenance and disposal of HV equipment and plants are at the core of CIGRE's Mission. Problems related to protection of electrical systems, to telecontrol and telecommunication equipment, are also part of CIGRE's area of concern (www.cigre.org). Exchanges are organised on a reciprocal basis with partners of CIGRE (IEC; Eurelectric, IEEE PES, CIRED, ...).

The Cigre technical work is being carried out within 15 Study Committees (SC). The task of these Committees is to initiate and coordinate studies contributing to technical advance in their particular area.

1.2 The Transformer Committee (SC12)

The scope of the SC12 is « Design and construction of power transformers, instrument transformers and reactors, quality assurance, tests and testing technology. Behaviour in and interaction with the system under normal and abnormal conditions, reliability, maintenance and diagnostic techniques in service ».
When CIGRE started in 1921 the transformer concept already celebrated his 36th birthday.

In the past SC12 activities were focussed on design problems related to the rapid increase of rated voltage and power (Fig 1).

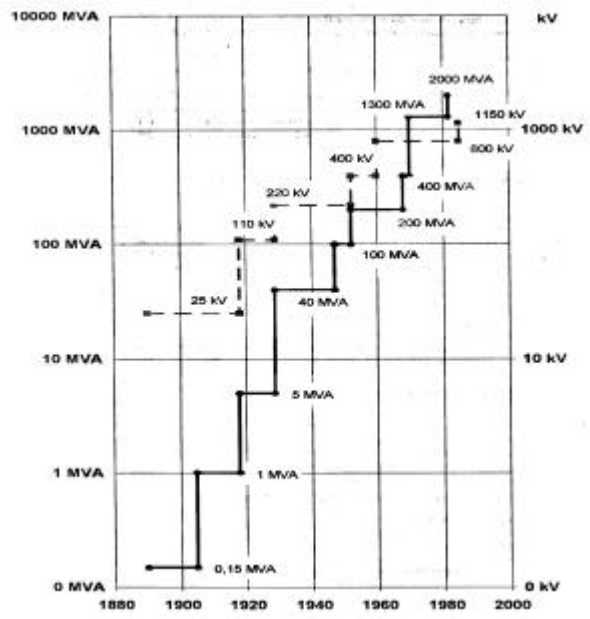

Figure 1 : Development of transformers

Intensive and extended work was dedicated to the aspects of impulse stress in HV windings and relevant test procedures. It led to major influence on the elaboration of the related IEC standards, including partial discharge measurements.

During the last two decades, new areas where covered such as the application of new materials (Joint activities with SC15), service conditions and their impact on the transformer performances (short-circuit, loadability, ..).

Today the SC12 Strategic Plan defines two directions for on-going and future activities :

- Services to Customers (Reliability and availability including impact of accessories, Life management, Economical issues, ...);
- Technology Issues (Safety, New technologies and New concepts, Electrical environment, Pre-standardisation work on the request IEC TC14, ...).

2. Condition monitoring of transformers

2.1 Definition and concept

Transformers are a large part of the asset cost structure of the electricity system. Knowing the condition is essential to meeting the goals of maximizing return on investment and lowering total cost associated with transformer operations.
Diagnostic techniques to understand the condition of a power transformer require much more than the reading of an instrument. They require an infrastructure of knowledge. The effort of Working Group 12.18 Life Management of Transformers [1] has been to systematize the vocabulary, provide identification of failure modes, survey the tests, ... as well as establish the bibliography of references used by transformer experts throughout the world.
This enables the condition of transformer to be known in a common language.

The basic **failure model** (Fig 2), proposed for consideration assumes that there are a number of key functions or parameters (such as dielectric, thermal or mechanical strength) and that failure occurs when the withstand strength with respect to one of these key properties is exceeded by operational stresses.

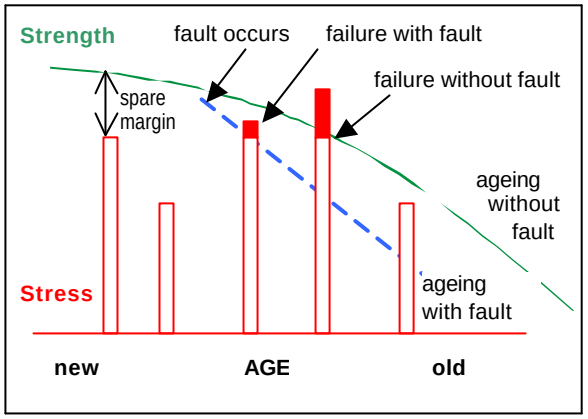

Figure 2 : Failure model

The **withstand strength** of a transformer will naturally decrease over its life due to various ageing processes (normal ageing), but may deteriorate faster than normal under the influence of agents of deterioration, e.g. moisture, or if some abnormal destructive deterioration process, e.g. tracking, occurs. It is desirable, but not always possible, to distinguish between reversible processes, often referred to as **defects**, and irreversible ones, **faults.**

Operational stresses are usually dominated by intermittent events such as lightning strikes or short circuits.

Because of the random nature of these stresses, it is unlikely that it will be possible to predict when the final failure will occur. However, if remaining strength and operational stress could be quantified adequately, it would be possible to determine when the circumstances were such that a **failure could occur**, i.e. the onset of increased unreliability.

In fact, it is not usually practicable to quantify withstand strengths and operational stresses, so instead a more qualitative assessment of the health of the equipment is carried out, often referred to as its **condition**, and this is used to assess the expected reliability. The following classification in terms of required action is useful (Table 1).

Condition	**Definition**
Normal	No obvious problems, No remedial action justified.
Defective	No significant impact on short-term reliability, but asset life may be adversely affected in long term unless remedial action is carried out.
Faulty	Can remain in service, but short-term reliability likely to be reduced. May or may not be possible to improve condition by remedial action
Failed	Cannot remain in service. Remedial action required before equipment can be returned to service (may not be cost effective, necessitating replacement).

Table 1 : The transformer condition

Although the ideal is to base the assessment of the condition of a transformer on the relevant withstand strengths or spare margins, in practice the necessary tools are not always available.
A two-stage condition based methodology has been proposed in Figure 3. In reality many utilities already apply just such an approach with the progression :

Symptoms	**Diagnosis**	Cure

Condition Monitoring

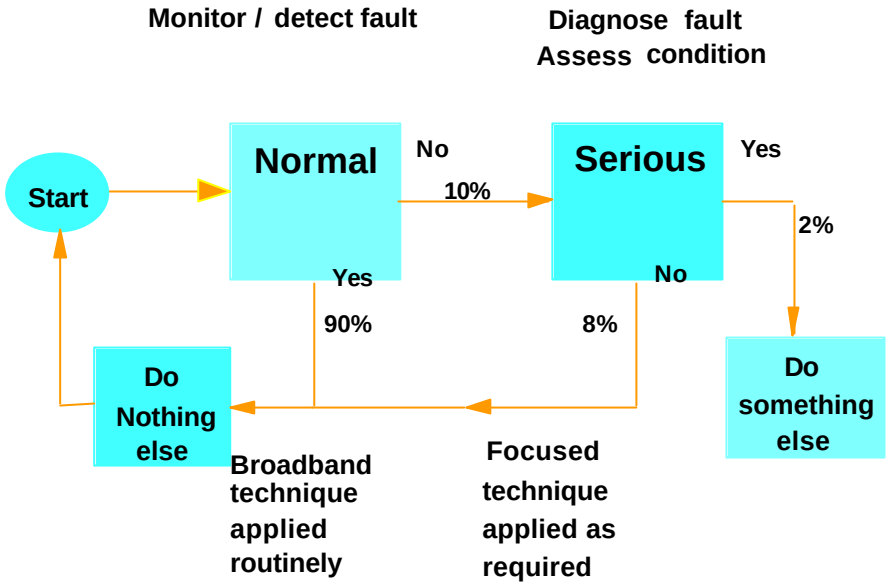

Figure 3 : Condition monitoring model

The main purpose of the **first stage** is to filter out those items of equipment, which are operating normally so that precious resources are only applied where they are needed. The techniques applied to answer this question must be applied regularly to all items of equipment. They need to be inexpensive, and therefore ideally on-line, and yet sensitive and broadband so that any potential problem can be detected at an early stage. Two main techniques commonly used for such routine monitoring are dissolved gas analysis (DGA) performed on oil samples and power factor testing applied on the transformer insulation.

The **second stage** process, which may be described as diagnosis or condition assessment, would normally only be carried out on those few transformers, probably less than 10%, which could not definitely be classified as normal : let say "abnormal cases".

2.2 condition assessment

Tests applied to these **abnormal cases** can be more expensive and off-line, but preferably on-line. They need to be focussed on individual attributes in an attempt to arrive at an unambiguous diagnosis.

Concerning defects and faults in the main tank, examples of tests that might be used include magnetizing currents, frequency responses analysis (FRA), partial discharge (PD) and dielectric responses measurements.
Concerning, bushings and on-load tap changers, other techniques are applied.
The aim is **to prepare the decision making** which depends on many factors (production, transmission, spare transformer units, risks, availability requested, ...).

Another application discussed by experts within the WG12.18 is the assessment or " **fingerprinting** " of transformers during factory tests. Various practices include :

- measuring the gas generation during the heat run tests,
- doing FRA and vibration tests and measuring the tan δ/power factor at 65^{o}C on new transformers and before and after refurbishment (replacement of windings or other extensive repair)
- doing dielectric responses tests and interwinding capacitance tests.

A third view of condition assessment is to evaluate (or to rank) **the remaining life** of a transformer (or a group of transformers).

The former is generally done if the transformer is to be moved or if past a certain age, say 25 years. The latter may be part of an asset replacement or refurbishment strategy of a group of transformers. It was noted during discussions that the exact remaining life depends on many factors and that it is better to use the concepts of suitability and serviceability for the specific application. This encompasses factors such as design, operational history including short circuits and loading, present status and priorities in the network and future expected stresses at its particular location on the network

2.3. On-line monitoring

A number of utilities are now using on-line monitoring devices to respond to the increasing emphasis on reducing unplanned outages and equipment failures, improving power quality, and deferring capital and maintenance expenditures. A further value proposition is now possible with the integration of real time condition monitoring, maintenance management activities and value added optimisation services. An example might be that of automated parts ordering for an On-load Tap Changer with evidence of contacts wearing or drive motor degradation. Systems such as this require robust data analysis to eliminate false alarms.

A list of types of on-line monitoring devices, which show promise in terms of effectiveness, has been developed by WG12.18. These include :

- Hot spot monitoring both by direct (optical) and indirect (thermal model) application
- Dissolved gas-analysis (DGA) with hydrogen only or up to eight failure gas components
- Partial discharge monitoring (electric, acoustic, UHF), including for static electrification
- Bushing on-line power factor and capacitance measurement
- Cooling system: optimisation and components
- Moisture in oil
- Transfer function analysis for both dielectric and dynamic defects
- Clamping force
- OLTC motor current characteristics to detect defects, relative temperature, control relay timing,
- OLTC acoustic emission or vibration monitoring during tap changing.
- OLTC motor drive torque control.

3. Examples of diagnostics and monitoring techniques

Several CIGRE activities are underway in the field of diagnostics and monitoring [2].
The following examples are coming out of recent activities of SC12 and SC15 (Materials for electrotechnology), especially topics relative to power transformer insulation (paper-oil) which are dealt with in cooperation with WG15.01.

3.1. Particles in oil

WG12.17 has completed a final report entitled "Effects of Particles on Transformer Dielectric Strength". This report review transformer failures that have occurred in the field or in factory and that were attributed to an excessive particles content in oil. Means of **particles identification** are reviewed along with **counting method** presently available. Experimentation on contaminated oil, sponsored by the Working Group, has show that significant variation in the particle count can be attributed to the sampling method or handling of the oil sample to prevent settling of particles. The detrimental effect of particles on dielectric strength was reassessed and guidelines are proposed to define **levels of particles that would be acceptable for a transformer in service**.

3.2 Furanic compounds analysis

TF15.01.03 was set up to establish the relationships between the amount of furanic compounds dissolved in transformer oil and the condition of the solid insulation. The relevant High Performance Liquid Chromatography **(HPLC) analysis may be used as a complement to DGA**. A compilation of the work carried out is published in Electra [4].

3.3 Partial discharges

TF15.01.04 scope is "characterisation of different discharges and their harmfulness to transformer insulation". The work so far concludes along some main lines :

- testing procedures for model experiments and transformer tests is important (moisture, temperature, measuring impedance, voltage shape, ...)
- **discharge signatures for different models of defects varies with time, voltage and moisture**
- **different defects has different discharge signatures, but within the great variety** of outcomes, the interpretation of these

signatures must can best be made within the framework of simple physical signatures.

These conclusions are detailed in a publication at the 2000 CIGRE Session [5].

3.4 Dielectric responses

In 1992, the Recovery Voltage Method (RVM) became available in Europe to **determine the moisture level in the paper insulation**. The new technique was investigated by a number of utilities. TF12.18.04 was created to satisfy a need for a better definition of the application of polarisation methods. The main conclusions were to recommend these methods for life management and to request a better interpretation of the dielectric responses.

Summary of the existing knowledge and development of understanding of polarisation phenomena in the paper-oil insulated systems were undertaken by TF15.01.09 early 1999.

Three methods were compared using a model transformer :

- Recovery Voltage Method (RVM)
- Polarisation/depolarisation currents (PDC)
- Dielectric spectroscopy in frequency domain (DSFD)

The main conclusions from the first series of measurements are :

- all methods used lead to consistent results
- controversy of the results interpretation concerning water content in cellulose
- necessity to consider the influence of oil conductivity in further studies.

The future activities include measurements on real transformers. One promising technique is the use of numerical modelling to improve interpretation of dielectric responses.

The progress in the determination of the resistivity of the oil is most helpful [6] [7].

3.5 Frequency Response Analysis (FRA)

The WG12.19 (Short Circuit Performance) scope is to review short circuit duty, design, test verification and service performance. Concerning mechanical strength assessment, the WG have to review existing techniques and to propose assessment methods. The work is underway within TF12.19.04.

During the Cigre Budapest Colloquium [8] techniques for failure detection were discussed. Expert views can be reported as follows :

- Low Voltage Impulse (LVI) and FRA can provide the same results.
- voltage transfer methods seems to be more sensitive in some cases
- some interpretation of results are not so clear : failure criteria is uncertain
- liaison with standardised criteria (reactance variations) must be established
- CIGRE should recommend a method and concentrate on one technique : FRA has been proposed.

4. Future works of the CIGRE Transformer Committee

As far as insulation condition monitoring is concerned, some SC12 future works can be summarized as follows.

4.1 Failure Guide

The overall goal is to provide the framework for a practical guide to the main types of failure and degradation processes suffered by transformers and means of managing these to optimise asset life and usability. The cornerstone of the Guide is a comprehensive **Catalogue of Defects and Faults** covering the main important problems, as well as relevant failure modes. To date over 20 failure examples covering a wide range of thermal, dielectric and mechanical types have been collated by WG12.18.

4.2 Transformer economics

The WG12.20 was established to produce a guide that will assist transformer experts in quantifying the economics of transformer management. For example, the following key topics will be addressed :

- repair or refurbishment or replacement
- redundant and spare transformers
- overloading versus replacement
- postpone maintenance or repair, thanks to on-line monitoring.

Development of economic models for these key topics will require some form of standardised calculation method to evaluate critical parameters such as the life expectancy of new transformers and the residual life expectancy of aged transformers.

Obviously the **condition assessment inputs are extremely important for the decision making** the process of which is mainly economical.

5. References

[1] CIGRE WG 12.18 "Life Management of Transformers, Draft Interim Report", SC12 Colloquium, July 1999, Budapest.

[2] JWG15/33.08 "insulation monitoring and life estimation"
JWG15/33.11.02 "knowledge rules for a PD diagnosis support system"
Panel "Modern maintenance techniques for enhancing the reliability of insulation of power transmission systems" 2000 Paris Session
WG33.03 "HV test and measurement techniques"

[3] WG12.17 "Effects of Particles on Transformer Dielectric Strength" CIGRE Brochure

[4] TF15.01.03 "Furanic compounds analysis : a tool for predictive maintenance of oil-filled electrical equipment " Electra N°175 Dec 1997

[5] "Partial discharges in transformer insulation" Paper 15.222 CIGRE 2000 Paris

[6] TF15.02.04 "Progress in the determination of the dissipation factor and resistivity of dielectric liquids" Electra N°185 Aug 1999

[7] IEC 61620 Standard

[8] CICRE SC12 Transformer Colloquium, Summary on behalf of Study Committee 12, Budapest 14-16 June 1999, (http://www.cigre.org/GB/SC/fsSC.htm) or (http://cigre1.avenda.fr/)

9.2 SCC4 - P. A. Payne

No report was given.

9.3 TC 14 TAG - P. J. Hopkinson

The TC 14 TAG met at the Sheraton Fallsview on Monday, October 16, 2000 at 10:55 AM with 8 members and 29 guests present. The presiding officer was Phil Hopkinson.

9.3.1 APPROVAL OF PREVIOUS MINUTES

The minutes of the meeting held on 3 April 2000 were approved as submitted.

9.3.2 APPROVAL OF AGENDA

The agenda was approved.

9.3.3 OLD BUSINESS

The chairman of the committee reviewed the activities from the meeting of TC14 in Ludvika, Sweden, June 2000 and the status on work on documents of the committee.

A. Revision of IEC 60076-5 – short circuit

The chairman reported on the IEC Committee of Action rule on the French appeal on the use of calculations and individual testing of transformers for acceptance. The matter was returned to TC14 action. The US view was that radial and axial force calculations be made in order to establish a uniform reference between manufacturer and user. CIGRE, the European group, is studying the matter with the objective of providing a recommendation. The CIGRE WG has completed its report and that has been approved. The recommendation has been submitted to WG26 for consideration.

Mr Allen, TC14 chairman, noted that there is a five-year program in both IEC and CIGRE to accomplish the project. If IEC cannot complete its work in five years, the project can be taken up by CIGRE. The expectation is the work will be completed.

B. Revision of IEC 60076-3 and 60076-3-3

Mr Allen advised members that a new document has been released. A shortly.

The committee currently has a revised document under consideration.

A. Revision of IEC 60378-2

B. Revision of IEC 60214

The chairman reported that the goal of the WG headed by Dave Peck is to add reactance tap changers and off-circuit tap changers to the document. There is an absolute parallel between the IEC document and the C57 document addressing the reactance issue. However, the off-circuit tap changer document lacks a functional life test. The chairman reported that at another IEEE WG meeting there was unanimous support for including functional life test in an American document. He reported that he will advise Dave Peck of the IEEE decision and hope that he will give the matter serious consideration.

The chairman reported that the IEC document also addresses through-fault in a manner less conspicuous than he thought desirable. He would prefer than the throught-fault be more clearly spelled out to aid the user in understanding the requirement.

C. IEC 60076-10

J. Puri reported that the IEC WG has completed its work on sound levels using sound levels employing intensity and pressure measurement. The IEEE WG is expected to review this work for inclusion in its version of the standard. The WG is considering whether or not to have a separate document.

He reported that the document will be worked on in meetings scheduled for November 2000. WG members have been conducting studies on progression analysis for possible inclusion in the sound level guide. The guide will also include reference to work in the IEEE.

D. IEC 60076-11

J. Puri reported that work is under way on flame testing for consideration by the TC14 WG. The US expert is expected to address the value of including the fire test in the IEC document.

One member made an inquiry on work of TC98 and inclusion of medium voltage equipment in its standards. Is TC14 coordinating its action with TC98? It was not clear the extent of the coordination between the two committees, thought the chairman is in frequent contact with all interested groups.

J. Puri noted that the group is working on flammability testing. He noted that some of the discussion within the WG has focused on the toxic and non-toxicity aspects. Dry type transformers rarely catch fire, it was noted. It was noted that a flammability test requirement may be excessive. D. Allen reported that a number of countries have done fire chamber tests that have given different results. It is likely that these countries (Itlay, France and Germany) will seek to introduce some proposals on the matter. The varied results make reaching agreement difficult, he said. It would more desireable that inclusion of this test should be resisted, he added. The chairman noted that the implications of the matter are not fully understood by some of the proponents. He noted that this test in not something the US would get involved with.

Additional discussion ensued concerning the experience with fires on transformers that are installed indoors in Europe. The fire test is mainly a dry-type transformer issue because liquid transformers are not normally installed in buildings in isolated enclosures. It was noted that in those instances of fire, the protective equipment failed. In additional discussion it was noted that t is likely that the recommendation would not be eliminated from the IEC document. More likely, it was noted, "in some country" language would be included because the problem is not likely to occur in the US. Discussion continued and concluded with an agreement that work in this area in the IEC should be monitored. It was noted that in the US, the problem is addressed in the insurance arena; in Europe, there is a tendency to address the problem in an equipment standard.

It was pointed out that NFPA and others should be made aware of the issue and urged to join the TAG in addressing it. It was agreed that the chairman would send a letter to US parties that may be interested in the matter and advise them to seek participation in TAG activities.

E. Electromagnetic Fields (EMF)

The chairman reviewed the scope of new IEC Technical Committee 106 that is charged with developing standards on electromagnetic fields and human exposure in the 0 –300 Ghz range of non-ionized radiation. TC106 is charge with developing standards on definitions, measurement techniques, calculations, assessment and emission limits. It is not responsible for establishing human exposure limits. The work impacts a wide range of electrical power products.

The chairman noted that IEEE is looking at specific absorption rates (SAR) in its SCC 28. SAR is impacted above 100 GHz. He reported that the International Commission on Non-ionizing Radiation Protection (ICNIRP) has concluded that 5,000 milligauss produces noticeable cellular change. As a resul, the European Union has issued a precautionary principle based on ICNIRP setting exposure limits of 5,000 milligauss for occupation and 1,000 milligauss for general public.The chairman reported that he is currently serving as the technical advisor to the US National Committee on this matter. He will continue to be involved until such time as the investigation excludes key power equipment products.

It was reported that both IEEE and EPRI have done an extended amount of work measuring on overhead lines since the early 1990s. This may be a source of information and data for use by the TAG. It was also pointed out that DOE has done some work on characterizing the field. The chairman requested that such information be forwarded to him and he be advised where it can be obtained. He noted that considerable amount of study has been done in a number of sectors, including the medical area.

The chairman noted that the next meeting for organizing the technical advisory group for TC106 will take place shortly.

9.3.4 NEW BUSINESS

There was no new business.

9.3.5 TIME AND PLACE OF NEXT MEETING

Members agreed to meet again during the spring meeting of the IEEE Transformer Committee in Amsterdam, Netherlands.

9.3.5 ADJOURNMENT

There being no additional business, the meeting was adjourned at 2:30 PM

REPORTED BY

John A. Gauthier

17 October 2000

10.0 Old Business

None

11.0 New Business

None

12.0 Adjournment

The meeting was adjourned at 11:00 AM.

Respectfully submitted,

Ken S. Hanus, Secretary

ATTACHMENT 4

STATUS REPORT OF STANDARDS OF IEEE/PES TRANSFORMERS COMMITTEE

12-Oct-00

STANDARD / PROJECT	TITLE	WORKING GROUP CHAIR AND PHONE	COMMITTEES REQUESTING COORDINATION	PUB DATE / PAR DATE / REV DUE	STATUS AND COMMENTS
SUBCOMMITTEE:	**AUDIBLE SOUND & VIBRATION**				
CHAIR:	**J. PURI**				
PHONE:	**(704)282-7413**				
C57.136 None	GUIDE FOR SOUND LEVEL ABATEMENT AND DETERMINATION IN OIL-FILLED TRANSFORME	DARWIN, A.		9/20/00 2005	Approved Standard 9/2000
SUBCOMMITTEE:	**BUSHING**				
CHAIR:	**F. E. ELLIOTT**				
PHONE:	**(360)418-2607**				
C57.19.00 PC57.19.00	GENERAL REQUIREMENTS AND TEST PROCEDURES FOR OUTDOOR APPARATUS BUSHINGS (IEEE 21)	ELLIOTT F. E. (614)223-2259	PSIM IEC SC36 IA/PSE ICC	7/23/91 6/20/96 2002	APPROVED FOR REAFIRMATION 1997 PAR extended to 12/2002
C57.19.01	STANDARD PERFORMANCE CHARACTERISTICS AND DIMENSIONS FOR OUTDOOR APPARATUS BUSHINGS (IEEE 24)	SINGH PRITPAL (901)696-5228	ICC IA/PSE IEC SC36A	12/29/00 2005	Revised Standard Approved 12/29/2000
C57.19.03 NONE	STANDARD REQUIREMENTS, TERMINOLOGY AND TEST CODE FOR BUSHINGS FOR DC APPLICATIONS	HEYMAN OLOF 46-240-83152		6/20/96 2001	APPROVED BY STANDARDS BOARD 6/20/96 APPROVED BY ANSI 6/97
C57.19.100 NONE	GUIDE FOR APPLICATION OF APPARATUS BUSHINGS.	ELLIOTT F. E. (503)230-3900	SWGR SUB PSR	3/16/95 2000	Balloting Reaffirmation REPLACES C57.19.101
NEW NEW	TASK FORCE TO STUDY APPLICATON AND PROBLEMS OF DRAW-LEADS FOR BUSHINGS	NORDMAN RUSS (414)547-0121			NEW TASK FORCE

STANDARD PROJECT	TITLE	WORKING GROUP CHAIR AND PHONE	COMMITTEES REQUESTING COORDINATION	PUB DATE PAR DATE REV DUE	STATUS AND COMMENTS
SUBCOMMITTEE:	**DIELECTRIC TESTS**				
CHAIR:	**L. B. WAGENAAR**				
PHONE:	**(614)223-2259**				
C57.113 PC57.113	GUIDE FOR PARTIAL DISCHARGE MEASUREMENT IN LIQUID-FILLED POWER TRANSFORMERS AND SHUNT REACTOR	PERKINS M. [314]382-2100	PSIM IAS/PSE IEC TC14	12/5/91 9/15/99 2000	PAR FOR REVISION APPROVED 9/99 PAR extended to 12/2002
C57.12.00 PC57.12.00	TABLE 3 AND 5 - HARMONIZE VALUES	POULIN B. (408)957-8326			UNDER DEVELOPMENT
C57.127 None	GUIDE FOR THE DETECTION OF ACOUSTIC EMISSIONS FROM PARTIAL DISCHARGES IN OIL-IMMERSED POWER TRANSFORMERS	J. W. HARLEY (216)425-1838	ICC IEC TC42 PSIM IEC TC14	9/20/00 2005	
C57.138 NONE	RECOMMENDED PRACTICE FOR ROUTINE IMPULSE TEST FOR DISTRIBUTION TRANSFORMERS	ROSSETTI J. (901)528-4743	T&D IA/PSE PSIM	3/19/98 9/19/96 2003	PC57.138/D7 APPROVED
C57.98 NONE	IEEE GUIDE FOR TRANSFORMER IMPULSE TEST	POULIN B. (408)957-8326	NONE	12/2/93 2004	REAFFIRMED IN 1999
IEEE 62.1 NONE	GUIDE FOR DIAGNOSTIC FIELD TESTING OF POWER APPARATUS, PART I: OIL-FILLED POWE TRANSFORMERS, REGULATORS AND REACTORS	YOUNG F. N. (216)447-2649		3/17/94	APPROVED BY REVCOM 03/15/95 PUBLISHED

STANDARD PROJECT	TITLE	WORKING GROUP CHAIR AND PHONE	COMMITTEES REQUESTING COORDINATION		PUB DATE PAR DATE REV DUE	STATUS AND COMMENTS
SUBCOMMITTEE:	**DISTRIBUTION TRANSFORMERS**					
CHAIR:	**Ed SMITH**					
PHONE:	**(314)677-3421**					
C57.12.20 NONE	OVERHEAD-TYPE DISTRIBUTION TRANSFORMERS, 500 kVA AND SMALLER: H V 34500 VOLTS AND BELOW, L V 7970/13800Y &	ANDERSEN GLEN WILKS, A.			6/20/96 2001	NEMA HAS COPYRITE
C57.12.21 NONE	STANDARD REQUIREMENTS FOR PAD-MOUNTED, COMPARTMENTAL-TYPE, SELF-COOLED, SINGLE-PHASE DIST TRANSFORMERS	GHAFOURIAN A. (706) 548-3121	T&D IAS/REPC		10/22/79 6/27/91 1985	NEMA HAS COPYRITE
C57.12.22 NONE	PAD-MOUNTED,COMPARTMENTAL-TYPE SELF-COOLED,3-PHASE DIST. TR WITH HV BUSHINGS,2500kVA AND	HANUS K. (817)215-6020	T&D IAS/REPC IAS/PSEC		1/9/95 6/27/91 1999	AWAITING PUB. BY NEMA NEMA HAS COPYRITE
C57.12.23 PC57.12.23	UNDERGROUND-TYPE,SELF-COOLED, 1-PHASE DISTRIBUTION TR WITH SEPERABLE INSULATE HV CONNECT HV 24940GrdY..LV,240..;167kVA.	Traut A., Lee R.	T&D IC IAS/REPC	IAS/PSEC	6/1/99 3/18/99 2004	Reaffirmed June 1999 Par approved March 1999
C57.12.25 PC57.12.25	REQUIREMENTS FOR PAD-MOUNTED COMP-TYPE,SELF-COOLED,1-PHASE DISTRIBUTION TR W/SEP INS HV CONN,HV 34500GrdY...167kVA...	LAZAR/GHAFOUR	T&D IC IAS/REPC	IAS/PSEC	5/11/90 12/8/98 1995	Reaffirmation ballot closed. Send to REVCOM NEW PAR APPROVED DEC 98
C57.12.26 NONE	PAD-MOUNTED COMPARTMENTAL-TYPE SELF-COOLED,3-PHASE DIST TR for USE W/ SEPERABL INSULATED HV CONN.,HV 34500GrdY..2500kVA	PAIVA,G.	T&D IC IAS/REPC	IAS/PSEC SCC14	6/17/92 12/5/91 1997	Standard Withdrawn
C57.12.33 PC57.12.33	GUIDE FOR EVALUATION OF LOSSES IN DISTRIBUTION TRANSFORMERS	PEKAREK T. DUCKETT, D.	PSIM		6/1/98	PAR APPROVED 6-25-98 Ballot closed 4/1999
C57.12.34 PC57.12.34	REQUIREMENTS FOR THREE PHASE PAD-MOUNTED DISTRIBUTION TRANSFORMERS	MICHAELS, S. (313)235-7573	ICC		9/21/95	Target Extension approved to Dec. 2000
C57.12.35 NONE	STANDARD FOR BAR CODING FOR DISTRIBUTION TRANSFORMERS (POLE-MOUNTED, PAD-MOUNTED AND UNDERGROUN	SMITH,E. (314) 677-3421			6/20/96 2001	APPROVED BY STANDARDS BOARD 6/20/96 PREVIOUSLY P1265
C57.15 None	REQUIREMENTS, TERMINOLOGY, & TEST CODE FOR STEP-VOLTAGE REGULATORS	DIAMANTIS T. COLOPY, C.	SUBS IAS/PSE		9/16/99 2004	

STANDARD PROJECT	TITLE	WORKING GROUP CHAIR AND PHONE	COMMITTEES REQUESTING COORDINATION		PUB DATE PAR DATE REV DUE	STATUS AND COMMENTS
IEEE1388 P1388	STANDARD FOR THE ELECTRONIC REPORTING OF TRANSFORMER TEST DATA	SMITH J. ROLLINS (601)892-4661	EEI NEMA ASC X12	PSR CS SAB	12/7/98 0	NO. CHANGED FROM C57.132

STANDARD PROJECT	TITLE	WORKING GROUP CHAIR AND PHONE	COMMITTEES REQUESTING COORDINATION		PUB DATE PAR DATE REV DUE	STATUS AND COMMENTS
SUBCOMMITTEE:	**DRY-TYPE TRANSFORMERS**					
CHAIR:	**W. PATTERSON**					
PHONE:	**(919)848-1860**					
C57.12.01 PC57.12.01	GENERAL REQUIREMENTS FOR DRY-TYPE DIST AND POWER TR INCL THOSE WITH SOLID CAST &/or RESIN-ENCAPSULATED WINDINGS	JONATTI A. (813)442-0414	NEMA U.L. ANSI	IA/I&CPS	9/1/98 3/1/99 2003	Revised Standard Approved Sept. 14, 1998
C57.12.50 NONE	REQ. FOR VENTILATED DRY-TYPE DISTRIBUTION TR, 1-500kVA, 1 PHASE, AND 15-500kVA, 3-PHASE HV 601-34500VOLTS,LV 120-	SULLIVAN J. (813) 228-4111			6/12/89 1994	COPYRIGHT NOT RELEASED
C57.12.51 NONE	REQ. FOR VENTILATED DRY-TYPE POWER TR, 501kVA & LARGER, 3 PHASE, WITH HV 601-34500V, LV 208Y/120 TO 4160 VOLTS	SULLIVAN J. (813) 228-4111			6/12/89 1994	COPYRIGHT NOT RELEASED
C57.12.52 NONE	REQ. FOR SEALED DRY-TYPE POWER TRANSFORMERS, 501kVA & LARGER, 3 PHASE, WITH HV 601-34500V,LV 208Y/120 TO 4160 VOL	SULLIVAN J. (813) 228-4111			6/12/89 1994	COPYRIGHT NOT RELEASED
C57.12.55 NONE	CONFORMANCE STANDARD FOR TR- DRY-TYPE TRANSFORMERS USED IN UNIT INSTALLATIONS INCL. UNIT SUBSTATIONS	SULLIVAN J. (813) 228-4111			4/7/86 1992	COPYRIGHT NOT RELEASED
C57.12.56 PC57.12.56	TEST PROCEDURE FOR THERMAL EVALUATION OF INSULATION SYST FOR VENTILATED DRY-TYPE POWER & DISTRIBUTION TRANSFORMERS	PROVOST R. L. (302)999-2225			3/1/98 2003	REAFFIRMED IN SEPT 1998 WOULD LIKE TO COMBINE WITH C57.12.60
C57.12.58 NONE	GUIDE FOR CONDUCTING TRANSIENT VOLTAGE ANALYSIS OF A DRY-TYPE TRANSFORMER COIL	KLINE A. D. (404)762-1642	IEC IAS		9/19/96 6/28/78 2001	REAFFIRMED 9/19/96
C57.12.59 NONE	GUIDE FOR DRY-TYPE TRANSFORMER THROUGH-FAULT CURRENT DURATION	PATTERSON W. (919)848-1860			1/1/89 9/13/84 1996	WITHDRAWN BY STANDARDS BOARD ON 12/10/9
C57.12.60 NONE	TEST PROCEDURES FOR THERMAL EVALUATIO OF INSULATION SYSTEMS FOR SOLID-CAST & RESIN ENCAP POWER & DIST TRANSFORMER	PROVOST R. L. (302)999-2225	IEC SC15E NEMA		3/19/98 6/26/97 2003	REVISION APPROVED 3/98 WOULD LIKE TO COMBINE WITH C57.12.56
C57.12.91 PC57.12.91	TEST CODE FOR DRY-TYPE DISTRIBUTION AND POWER TRANSFORMERS	BARNARD D. (919)738-4251	SPD EM T&D	SUBS IEC TC14	6/14/95 6/26/97 2000	Sent to Revcom for 12/2000 meeting

STANDARD PROJECT	TITLE	WORKING GROUP CHAIR AND PHONE	COMMITTEES REQUESTING COORDINATION		PUB DATE PAR DATE REV DUE	STATUS AND COMMENTS
C57.124 NONE	RECOMMENDED PRACTICE FOR THE DETECTIC OF PD AND THE MEASUREMENT OF APPARENT CHARGE IN DRY-TYPE TRANSFORMERS	KLINE A. D. (404)762-1642	NONE		6/29/91 6/27/91 2001	REAFFIRMED 9/18/96
C57.134	GUIDE FOR THE DETERMINATION OF HOTTEST SPOT TEMPERATURE IN DRY TYPE TRANSFORMERS	PAYNE P. (202)388-2138			12/29/00 9/21/95 2005	Approved by standards board 12/00
C57.16 NONE	STANDARD REQUIREMENTS, TERMINOLOGY, AND TEST CODE FOR DRY-TYPE AIR-CORE SERIES CONNECTED REACTORS	DUDLEY R. (416)298-8108	NEMA IAS T&D		12/10/96 2001	APPROVED BY STANDARDS BOARD ON 12/10/96
C57.94 NONE	RECOMMENDED PRACTICE FOR INSTALLATION APPLICATION,OPERATION & MAINTENANCE O DRY-TYPE GEN PURPOSE DIST & POWER TR	PATTERSON W. (919)848-1860			12/9/87 2005	Reaffirmed 6/2000
C57.96 None	GUIDE FOR LOADING DRY-TYPE DISTRIBUTION AND POWER TRANSFORMERS	PIERCE L. (706)291-3166	T&D SCC14 SCC10	IA/PSE	6/26/99 2004	
IEEE 259 None	TEST PROCEDURE FOR EVALUATION OF SYSTEMS OF INSULATION FOR SPECIALTY TRANSFORMERS	SIMPSON R. W. JR. (603)284-4362			6/26/99 3/21/96 2004	
SUBCOMMITTEE: **CHAIR:** **PHONE:**	**HVDC CONVERTER TR & REACTOR** **R.DUDLEY** **(416)298-8108**					
C57.129 None	GENERAL REQUIREMENTS & TEST CODE FOR OIL-IMMERSED HVDC CONVERTER TRANSFORMERS AND SMOOTHING REACTORS	R.DUDLEY. (317)286-9387	EM T&D PSIM	SUB	9/16/99 2004	
IEEE1277	GENERAL REQUIREMENTS & TEST CODE FOR OIL-IMMERSED AND DRY-TYPE HVDC SMOOTHING REACTORS	R.DUDLEY (317)286-9387	SUB		3/29/00 2005	Standard approved 3/2000

STANDARD PROJECT	TITLE	WORKING GROUP CHAIR AND PHONE	COMMITTEES REQUESTING COORDINATION	PUB DATE PAR DATE REV DUE	STATUS AND COMMENTS
SUBCOMMITTEE:	**INSTRUMENT TRANSFORMERS**				
CHAIR:	**J. E. SMITH**				
PHONE:	**(919)827-3220**				
C57.13 PC57.13	REQUIREMENTS FOR INSTRUMENT TRANSFORMERS	NELSON T. (301)975-2956	PSIM PSR SPD	6/7/93 6/14/94 1998	REQUIRES REVISION/REAFFIRMATION IN 1998 PAR Extended to 12/2000
C57.13.5 PC57.13.5	TEST REQUIREMENTS FOR INSTRUMENT TRANSFORMERS OF A NOMINAL VOLTAGE OF 115KV AND ABOVE	RIFFON, P. 514-840-3000	SWGR EM TC 38 US T	9/19/96 0	REVISED PAR APPROVED 9/19/96 par extended to 12/2002
C57.13.6 PC57.13.6	REQUIREMENTS FOR INSTRUMENT TRANSFORMERS FOR USE WITH ELECTRONIC REVENUE METERS AND RELAYS	TEN-HAAGEN C. (603)749-8433	PSIM PSC PSR TD		REVISED PAR DISSAPROVED 9 /96 NO PAR EXISTS

STANDARD PROJECT	TITLE	WORKING GROUP CHAIR AND PHONE	COMMITTEES REQUESTING COORDINATION	PUB DATE PAR DATE REV DUE	STATUS AND COMMENTS
SUBCOMMITTEE:	**INSULATING FLUIDS**				
CHAIR:	**F. GRYSZKIEWICZ**				
PHONE:	**(617)926-4900**				
C57.104 PC57.104	GUIDE FOR THE DETECTION AND DETERMINATION OF GENERATED GAS IN OIL-IMMERSED TRANSFORMERS & THEIR RELATION	HEINRICHS F. W. (412)941-6924	PE/IC PE/SUB PE/T&D	6/27/91 12/10/96 2000	Requesting PAR Extension REVIEW DATE EXTENDED TO 12/2000
C57.106 PC57.106	GUIDE FOR ACCEPTANCE AND MAINTENANCE OF INSULATING OIL IN EQUIPMENT	KELLY, J. 330-630-7000	NONE	6/27/91 12/9/97 2003	WG WRITING D2 PAR extended to 12/2001
C57.111 NONE	GUIDE FOR ACCEPTANCE OF SILICONE INSULATING FLUID AND ITS MAINTENANCE IN TRANSFORMERS	(617)926-4900	IAS IEC T&D ED&PG	2/2/89 12/10/87 2000	NEED Reaffirmation or Revision
C57.121 NONE	GUIDE FOR ACCEPTANCE AND MAINTENANCE OF LESS FLAMMABLE HYDROCARBON FLUID IN TRANSFORMERS	McSHANE C. P. (617)926-4900	PSRC IEC T&D IAS	9/16/98 2003	REVISION HAS BEEN APPROVED BY IEEE STANDA
C57.130 NONE	T-U GUIDE FOR USE OF DISS. GAS ANALYSIS DURING FACTORY THERMAL TESTSFOR THE EVALUATION OF OIL-IMMERSED TRANS. AND	HEINRICHS F. W. (412)941-6924	NONE	3/17/93 0	D13 BEING SENT FOR RECIRC. BALLOT NEED NEW PAR
C57.139 PC57.139	GUIDE FOR DISSOLVED GAS ANALYSIS IN TRANSFORMER LOAD TAP CHANGERS	YOUNGBLOOD, C. 317-838-2129	IEC US TA	12/9/97	WG PREPARING DRAFT 1
IEEE 637 NONE	GUIDE FOR THE RECLAMATION OF INSULATING OIL AND CRITERIA FOR ITS USE	(617)926-4900		6/4/84 1997	NEEDS REVISION/REAFFIRMATION
IEEE1258 None	TRIAL-USE GUIDE FOR INTERPRETATION OF GASES GENERATED IN SILICONE-IMMERSED TRANSFORMERS	GRYSZKIEWICZ f. (617)926-4900	T&D ICC	6/15/95 0	PAR Withdrawn

STANDARD PROJECT	TITLE	WORKING GROUP CHAIR AND PHONE	COMMITTEES REQUESTING COORDINATION		PUB DATE PAR DATE REV DUE	STATUS AND COMMENTS
SUBCOMMITTEE: **CHAIR:** **PHONE:**	**INSULATION LIFE** **L.W. PIERCE**					
1538	GUIDE FOR DETERMINATION OF MAXIMUM WINDING TEMPERATURE RISE IN LIQUID FILLE TRANSFORMERS	PLATTS, D.			6/1/00 2005	Approved as new standard
C57.100 None	TEST PROCEDURE FOR THERMAL EVALUATION OF OIL-IMMERSED DISTRIBUTION TRANSFORMERS	LOWDERMILK L. (704)462-3113	PE/PSR IA/PSE PE/T&D	PE/SUB IEC TC 14	6/26/99 12/10/96 2004	
C57.119 PC57.119	RECOMMENDED PRACTICE FOR PERFORMING TEMP. RISE TESTS ON OIL-IMMERSED POWER TRANSFORMER AT LOADS BEYOND NP RATING	S. Tuli 262-547-0121	SWGR SUBS SCC4	PSRC IAS EI	5/16/00 0	
C57.12.00 P1524	DEFINITION OF THERMAL DUPLICATE	BEASTER,B 765-286-9363	EM IAS I&CPS	PESC	6/1/98	PAR approved June 1998 WORK INCLUDED IN C57.12.00
C57.91 PC57.91	GUIDE FOR LOADING MINERAL OIL-IMMERSED TRANSFORMERS	PIERCE L. (706)291-3166	SUB T&D PSE		6/14/95 3/24/00 2000	PAR for corriagenda approved 3/2000
IEEE1276 NONE	IEEE GUIDE FOR THE APPLICATION OF HIGH TEMPERATURE INSULATION MATERIALS IN LIQUID-IMMERSED POWER TRANSFORMERS	FRANCHEK M. A. (802)748-3936	T&D		6/1/97 3/21/96 2002	Approved as full use guide

STANDARD PROJECT	TITLE	WORKING GROUP CHAIR AND PHONE	COMMITTEES REQUESTING COORDINATION		PUB DATE PAR DATE REV DUE	STATUS AND COMMENTS
SUBCOMMITTEE:	**PERFORMANCE CHARACTERISTICS**					
CHAIR:	**D. Fallon**					
PHONE:	**(973)430-8191**					
C57.105 NONE	GUIDE FOR APPLICATION OF TRANSFORMER CONNECTIONS IN THREE-PHASE DISTRIBUTION SYSTEMS	REITTER G. (415)591-4463			6/17/92 2004	Reaffirmed 3/99
C57.109 NONE	GUIDE FOR THROUGH-FAULT CURRENT DURATION	PATEL B. (205)877-7740	PSR		3/18/93 2005	Reaffirmed 6/2000
C57.110 NONE	RECOMMENDED PRACTICE FOR ESTABLISHING TRANSFORMER CAPABILITY WHEN SUPPLYING NONSINUSOIDAL LOAD CURRENTS	MAREK R. P. (804)838-8080	T&D PSR NEMA	IA/PSE	7/2/98 2003	
C57.12.00 PC57.12.00m	GENERAL REQUIREMENTS FOR LIQUID-IMMERSED DISTRIBUTION, POWER, AND REGULATING TRANSFORMERS	PLATTS D. (610)774-4686				INCLUDE IN NEXT REVISION COORDINATE WITH S. TULI
C57.123 PC57.123	GUIDE FOR TRANSFORMER LOSS MEASUREMENT	GIRGIS,R. (765)286-9532			9/16/99 0	Ready for SA ballot
C57.133 PC57.133	GUIDE FOR SHORT-CIRCUIT TESTING OF DISTRIBUTION AND POWER TRANSFORMERS	McQUIN N. (412) 829-1205	T&D,SWG PSR IECTC14	SUBS IAS/PSE IAS/REP	9/21/95	PAR APPROVED BALLOT GROUP FORMED
C57.18.10 NONE	REQUIREMENTS FOR SEMICONDUCTOR RECTIFIER TRANSFORMERS	KENNEDY S. P. (716)896-6500	NONE		3/1/98 2003	STANDARD APPROVED MARCH 1998
C57.21 NONE	REQUIREMENTS,TERMINOLOGY, AND TEST CODE FOR SHUNT REACTORS RATED OVER 500kVA	McGILL J. W. (414)475-3422	EM T&D PSR		4/2/91 6/9/88 2000	REAFFIRMED 1995
IEEE 638 P638	QUALIFICATION OF CLASS 1E TR FOR NUCLEAR POWER GENERATING STATIONS	PIERCE L. W. (706)291-3166	NPE SUB SC2	SCC10	3/19/92 10/29/90 2004	REAFFIRMED 1999

STANDARD PROJECT	TITLE	WORKING GROUP CHAIR AND PHONE	COMMITTEES REQUESTING COORDINATION		PUB DATE PAR DATE REV DUE	STATUS AND COMMENTS
SUBCOMMITTEE:	**POWER TRANSFORMERS**					
CHAIR:	**E.G. HAGER**					
PHONE:	**760-789-3022**					
C57.116 NONE	GUIDE FOR TRANSFORMERS DIRECTLTY CONNECTED TO GENERATORS	REITTER G. (415)508-2850			1/3/89 2005	Reaffirmed 6/2000
C57.117 NONE	GUIDE FOR REPORTING FAILURE DATA FOR POWER TRANSFORMERS AND SHUNT REACTORS	CASH D. (702) 227-2316			6/17/92 2003	REAFFIRMED 1998
C57.120 NONE	LOSS EVALUATION GUIDE FOR POWER TRANSFORMERS AND REACTORS	JACOBSEN R.	SUB EM ED&PG	IAS IEC	12/29/00 5/1/80 2005	Reaffirmed 12/29/00
C57.125 NONE	GUIDE FOR FAILURE INVESTIGATION, DOCUMENTATION AND ANALYSIS FOR POWER TRANSFORMERS AND SHUNT REACTORS	CASH D. (702) 227-2316	T&D ED&PG PSE	SWGR	6/27/91 6/28/87 2003	REAFFIRMED 1998
C57.131 NONE	REQUIREMENTS FOR LOAD TAP CHANGERS	TRAUB T. P. (312)394-2704			3/16/95 2000	Requires Reaffirmation
C57.135 PC57.135	GUIDE FOR APPLICATION, TESTING, INSTALLATION AND OPERATION OF PHASE ANGLE SHIFTING TRANSFORMERS	TRUMMER E. 43-3172-606-404	PSRC EMC IAS/PSP	IEC TC14	 6/20/96 0	Ballot has been sent, Need Recirculation
C57.140 PC57.140	Evaluation and Reconditioning of Liquid Immersed Power Transformers	JAMES, R. (504)576-6246			 9/16/99	
C57.141 PC57.141	GUIDE FOR APPLICATION OF LOAD TAP CHANGERS	HENNING, W. (414)547-0121			 6/26/99	
C57.93 NONE	GUIDE FOR INSTALLATION OF LIQUID-IMMERSED POWER TRANSFORMERS.	GILLIES D. A. (503)622-4847	NONE		12/12/95 2000	Power Trans Sub Comm. will form new WG for rev. INCORPORATED C57.12.11 AND 12.12

STANDARD PROJECT	TITLE	WORKING GROUP CHAIR AND PHONE	COMMITTEES REQUESTING COORDINATION		PUB DATE PAR DATE REV DUE	STATUS AND COMMENTS
SUBCOMMITTEE:	**STANDARDS**					
CHAIR:	**T.A. PREVOST**					
PHONE:	**(802)751-3458**					
C57.12.00 VARIOUS	GENERAL REQUIREMENTS FOR LIQUID-IMMERSED DISTRIBUTION, POWER, AND REGULATING TRANSFORMERS	TULI S. (414)547-0121	T&D PSRC SWG	SUBS IAS IEC-TC14	6/16/93 6/15/95 1998	Draft 5 approved Need new Par for next revision
C57.12.10 ANSI	TRANSFORMERS 230kV AND BELOW - 8333/10417kVA 1 PH, -100000 kVA 3 PH w/o LTC, 100000kVA w/ LTC - SAFETY REQUIREMENTS	(312)394-2704			6/4/87 1993	ANSI STANDARD NEEDS A HOME, DUE FOR REAF.
C57.12.13 ANSI	CONFORMANCE REQUIREMENTS FOR LIQUID-FILLED TRANSFORMERS USED IN UNIT INSTALLATIONS INCL. UNIT SUBSTATIONS				9/2/81 1987	ASSIGN TO SUBCOMMITTEE NEMA STANDARD
C57.12.53 ANSI	REQUIREMENTS FOR DRY-TYPE, UNDERGROUND, SINGLE-PHASE WITH SEPARABLE INSULATED H-V 24940 grdY/14400 V				0	ONLY TITLE EXIST (NO PAR) IS IT REQUIRED?
C57.12.54 ANSI	REQUIREMENTS FOR DRY-TYPE, UNDERGROUND 3 PHASE DISTRIBUTION TRANSFORMERS,2500 kVA OR <, HV 24940				0	ONLY TITLE EXISTS IS IT REQUIRED?
C57.12.70 PC57.12.70	TERMINAL MARKINGS AND CONNECTIONS FOR DIST. & POWER TRANSFORMERS	Prevost, T.A. (802)751-3458	T&D SUBS ICC		6/18/92 6/14/95 1997	Recirculation Ballot complete
C57.12.80 PC57.12.80	TERMINOLOGY FOR POWER & DISTRIBUTION TRANSFORMERS	TRAUB T. P. (312)394-2704	T&D SUBS		5/1/92 6/14/95 1997	Recirculation Ballot complete PAR extended to 12/00
C57.12.90 None	STANDARD TEST CODE FOR LIQUID-IMMERSED DISTRIBUTION, POWER, AND REGULATING TRANSFORMERS & GUIDE FOR SC TESTING OF ...	TULI,S.	T&D PSRC SWG	IECTC14 USTAG	6/26/99 6/15/95 2004	Apply for new PAR for further revision
C57.17 ANSI	REQUIREMENTS FOR ARC FURNACE TRANSFORMERS				1986	LAST REVISED IN 1986 ANSI DOCUMENT

STANDARD PROJECT	TITLE	WORKING GROUP CHAIR AND PHONE	COMMITTEES REQUESTING COORDINATION		PUB DATE PAR DATE REV DUE	STATUS AND COMMENTS
SUBCOMMITTEE:	**UG TR & NETWORK PROTECTORS**					
CHAIR:	**C.G. Niemann**					
PHONE:	**(708)410-5307**					
C57.12.24 PC57.12.24	UNDERGROUND-TYPE 3-PHASE DISTRIBUTION TRANSFORMERS,2500kVA AND SMALLER: HV,34500GrdY..& BELOW,LV,480 V AND BELOW	NIEMANN C. (708)410-5307	T&D IC IAS/REPC	IAS/PSEC IEC TC 14	3/17/94 6/20/96 1999	Who owns copyrite? Need action prior to Dec. 17 1999
C57.12.40 PC57.12.40	REQUIREMENTS FOR SECONDARY NETWORK TRANSFORMERS, SUBWAY & VAULT TYPES (LIQUID IMMERSED)	PLASTER, R.L. (804) 275-2142	T&D ICC IAS/REPC	IAS/PSEC IEC TC14 NEMA	3/19/92 6/26/97 1998	PAR APPROVED ON 6/26/97 NEED REVISION/REAFFIRMATION 1998
C57.12.44	STANDARD REQUIREMENTS FOR SECONDARY NETWORK PROTECTORS	MULKEY D. H. (415)973-4699	T&D SWGR IAS/REPC	IAS/PSEC EEI NEMA	8/1/00 2005	Revised Standard approved 8/2000
C57.12.57 none	REQUIREMENTS FOR VENTILATED DRY-TYPE NETWORK TRANSFORMERS 2500kVA AND BELOW, W/HV 34500V AND BELOW,LV 216Y..AN	ROBINSON, A.	T&D EEI/T&D SCC14		3/18/92 12/5/91 2000	REVISE/REAFFIRM BEFORE MARCH 2000 APPLY FOR NEW PAR

Attachment 5

GROUPS	Graz Jul.97	St.Louis Nov.97	Little R Apr. 98	Leon, MX Nov. 98	NO, LA Apr. 99	Monterrey Nov. 99	Nash, TN Apr. 00	Niagara Oct 00	MAX	AVG
Committee Registration: Members and Guests	164	282	267	262	262	275	302	361	361	272
Spouses	91	32	34	49		35	94	94	94	61
Luncheon	108	147	156	262	262	216	175	217	262	193
SC ADMINISTRATIVE	17	19	16	19	22	23	23	22	23	20
SC AUDIBLE NOISE AND VIBRATION	9	22	32	23	28	31	21	21	32	23
SC BUSHINGS	32	23	32	25	11	27	28	28	32	26
WG Revision C57.19.00				36	22	23	25	38	38	29
TF Draw Lead Bushings		21	23	23	20	16	24	27	27	22
WG DC Applications of Bushings						0			0	0
WG Revision C57.19.01	26	24	33	38	24	22	19		38	27
SC DIELECTRIC TESTS	58	71	81	80	52	68	91	96	96	75
WG Low FrequencyTests	40	31	42	20		54	48		54	39
WG Revision of Transient Dielectric Tests				20		35	43	37	43	34
WG Rev. Dielectric Tests on Distr. Transf.		14	21						21	11
TF Rev. Distr. Impulse Guide									13	0
TF L.F. Transformers Dielectric Test Table					28	37		46	46	37
WG Partial Discharge Tests	37	43	51	58	41	66	47	66	66	51
SC DISTRIBUTION TRANSFORMERS	11	37	49	29	36	34	53	41	53	36
WG Dist. Substation Transformers C57.12.36				16	22		40	37	40	29
WG Overhead Type Distr. Transfs. C57.12.20			39	19	35	28	49	39	49	35
WG Single-Phase Submersible C57.12.23			41		16	10	20	18	41	21
WG Single-Phase Deadfront Padmount C57.12.25		35	41		30		47		47	38
WG Bar Coding		25	40						40	33
WG Loss Evaluation C57.12.33		55	48				45		55	49
WG Electronic Data Transmittal		20		12			22		22	18
WG Three-Phase Padmount C57.12.34					23		42		42	33
WG Step-Voltage and Induction Regs C57.15		26		16	9				26	17
SC DRY-TYPE TRANSFORMERS	21	32	22	26	27	25	25	31	33	26
WG Test Code C57.91		20	23	20	22	18	11	24	23	20
WG Dry-Type Reactors	8	7	9	6	13	9	10	11	13	10
WG Dry-Type Reactors – HVDC Smoothing	12		9						12	11
WG Dry-Type Thermal Eval. And Flammability	15	24							27	20
WG Dry-Type General Requirements C57.12.01	5	30	28	24	18	26	23	23	30	22
WG Insulation Req. for Specialty Transf.		6				10			17	8
WG Cast Coil Loading Guide	19	21	18		14				21	18
WG Hot Spot Diferentials		27	33	23					33	28
WG Dry-Type Thru Fault Current							15	16	15	15

Attachment 5

GROUPS	Graz Jul.97	St.Louis Nov.97	Little R Apr. 98	Leon, MX Nov. 98	NO, LA Apr. 99	Monterre Nov. 99	Nash, TN Apr. 00	Niagara Oct. 01	MAX	AVG
SC HVDC CONVERTER TRANF. & REACTORS	8	6	6	7	8	13	7	19	19	9
IEC TC 14 TAG								37	37	37
SC INSTRUMENT TRANSFORMERS	9	10	13	7	11	10	10	17	13	11
WG C57.13.5 Test Req Instr Transf >115 kVA	7	13	20	13	12	13	10	13	20	13
WG C57.13.6 Instr Transf for Electronic Meters & Relays				9		20	11		20	13
WG Revision of C57.13	9	10	17	8	12			10	17	11
SC INSULATING FLUIDS	33	71	84	71	56	68	75	66	84	66
SC INSULATION LIFE	18	55	73	58	65	56	51	66	73	55
WG Loading Liq. Transformer						108		58	108	83
WG Thermal Tests	19		18						19	18
WG Revision of Temperature Test Code				24	24	29			29	26
WG Thermal Duplicate		30	34	24	34	40	27		40	32
TF Hottest Spot Temp. Rise		56	67	50	50				67	56
TF Winding Temperature Indicators	25	26	32	22	16	25	27	28	32	25
SC PERFORMANCE CHARACTERISTICS	49	74	77	52	45	58	69	82	82	63
WG Loss Tolerance and Measurement	27	18	27	25	26	29	33	37	37	28
WG PCS Rev. C57.12.00	23	19	36	32	75	65	49	70	75	46
WG PCS Rev. C57.12.90 Part I		21	33	43	28		42	65	65	39
WG PCS Rev. Short circuit Testing	29	19							29	24
WG Revision C57.110	22	39		11					39	24
WG Semi-Conductor Rectifier Transformers	18	19	13		16				19	17
WG Switching Transients	30	22	31	33	40	0	52	49	52	37
WG DETC Functional Life Testing						50	49	40	50	46
SC POWER TRANSFORMERS			26	25	42	59	66	109	109	55
WG LTC Performance Requirements		34	31	29	25	30	24	21	34	26
WG C57.140 Transformer Evaluation & Reconditioning					31	46	62	48	62	47
WG Diagnostic Field Testing & Monitoring	70	66	83	42	20	54		55	70	56
TF On-line Monitor Communication	27	28	28	28			54		54	33
WG Revision of C57.12.10							37	30	37	34
WG West Coast	15	13							15	14
WG Phase Shifting Transformers	31	26	43	30	31	34	26	45	45	33
SC STANDARDS	9		11	4	5	23	38		38	15
WG Continuous Revision C57.12.00			8						8	8
WG Continuous Revision C57.12.90			8						8	8
WG Terminology,Definitions,Units,& Markings						0			0	0
SC UNDERGRND. TRANF. & NETWK. PROTCS.	6	13	11	14	18	21	26	18	26	16
WG Three-Phase Underground Transfs.	5	13	14	16	10	14	27	15	27	14
WG Liquid-Filled Sec. Network Transfs.	6	16	16	16	17	15	16	15	17	15
WG Secondary Network Protectors	5	16	12	9		12	10	14	16	11
WG Dry-Type Network Transfs.			5	7	5	10	10	15	10	9

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