

**IEEE/PES
Transformers
Committee**

**Meeting Minutes
April 29, 1998**

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

April 29, 1998

LITTLE ROCK, ARKANSAS

**IEEE/PES TRANSFORMERS COMMITTEE MEETING
LITTLE ROCK, ARKANSAS
APRIL 29,1998
ATTENDANCE SUMMARY**

MEMBERS PRESENT

D. Aho	R. Allustiarti	G. Anderson	J.C. Arnold, Jr.
J. Arteaga	R.L. Barker	W.B. Binder, Jr.	W.E. Boettger
J.D. Borst	M. Cambre, Jr.	D. Chu	J.L. Corkran
D.W. Crofts	J.C. Crouse	T. Diamantis	L.E. Dix
K.D. Edwards	F.E. Elliott	D.J. Fallon	D.L. Galloway
A.A. Ghafourian	R.S. Girgis	R.D. Graham	R.L. Grubb
R.L. Grunert	E.G. Hager, Jr.	E. Hanique	K.S. Hanus
J.H. Harlow	R.R. Hayes	W.R. Henning	T.L. Holdway
P.J. Hopkinson	J. Hunt	V.C. Jhonsa	C.W. Johnson, Jr.
A.J. Jonnatti	R.D. Jordan	L.E. Juhlin	E. Kallaur
J.J. Kelly	S.P. Kennedy	A.D. Kline	J.G. Lackey
M.Y. Lau	T.D. Lewis	S.R. Lindgren	M.C. Loveless
D.L. Lowe	W.A. Maguire	J.W. Matthews	R. McTaggart
C.K. Miller	H.R. Moore	W.E. Morehart	D.H. Mulkey
C.R. Murray	C.G. Niemaun	P.E. Orehek	G.A. Paiva
B.K. Patel	J.M. Patton	P.A. Payne	L.C. Pearson
M.D. Perkins	L.W. Pierce	R.L. Plaster	D.W. Platts
B. Poulin	T.A. Prevost	J. Puri	C.T. Raymond
P. Riffon	P.G. Risse	A.L. Robinson	J.R. Rossetti
V.S.N. Sankar	H.M. Shertukde	H.J. Sim	P. Singh
J.E. Smith	J.E. Smith	J.W. Smith	S.D. Smith
R.J. Stahara	R.W. Stoner	J.C. Sullivan	J.B. Templeton
E.R. Trummer	S.C. Tuli	R.A. Veitch	L.B. Wagenaar
B.H. Ward	J.D. Watson	A.L. Wilks	W.G. Wimmer
F.N. Young	P. Zhao		

MEMBERS ABSENT

E.J. Adolphson	D.J. Allan	M.S. Altman	G. Andersen
D. Ayers	R.A. Bancroft	E.A Bertolini	J.H. Bishop
D.S. Brucker	D.J. Cash	T.F. Clark	V. Dahinden
J.N. Davis	R.C. Degeneff	R.F. Dudley	J.A. Ebert
P.T. Feghali	J.A. Fleeman	M.A. Franckek	J.M. Frank
D.A. Gillies	F.J. Gryszkiewicz	M.E. Haas	G.H. Hall

N.W. Hansen	F.W. Heinrichs	K.R. Highton	P.J. Hoefler
W.N. Kennedy	J.P. Lazar	F.A. Lewis	H.F. Light
L.A. Lowdermilk	R.I. Lowe	T. Lundquist	J. Ma
R.P. Marek	K.T. Massouda	N.P. McQuin	C.P. McShane
S.P. Mehta	M.I. Mitelman	R.J. Musil	E.T. Norton
K. Papp	W.F. Patterson, Jr.	T.J. Pekarek	D. Perco
D. Purohit	S.M.A. Rizvi	C.A. Robbins	G.W. Rowe
M.P. Sampat	L.J. Savio	W.E. Saxon	R.W. Scheu
D.N. Sharma	V. Shenoy	K.R. Skinger	W.W. Stein
D.W. Sundlin	V. Thenappan	J.A. Thompson	T.P. Traub
G.H. Vaillancourt	F.N. Weffer	R.J. Whearty	D.J. Woodcock

GUESTS PRESENT

J. Abbott	P. Ahrens	D.C. Anderegg	S. Antosz
J. Antweiller	W.C. Avent	D. Ballard	M.F. Barnes
O.M. Bello	T.E. Blackburn III	J. Bosiger	F.M. Bray
R. Butani	A. Cancino	D. Caverly	B. Chiu
J.M. Christini	C.A. Colopy	R.A. Colquitt, Jr.	D. Corsi
A.W. Darwin	D. de la Cruz	R.M. Delvecchio	D.A. Duckett
K.P. Ellis	J. Foldi	B.I. Forsyth	J.D. Fyvie
J. Garza	J.A. Gauthier	C. Gaytan	D.F. Goodwin
J.L. Goudi	A.C. Hall	J.W. Harley	R.H. Hartgrove
B. Hayman	G.E. Henry III	L. Hensley	L. Hillier
M. Horning	T. Huff	I. Hussain	E.W. Hutter
M. Iman	R.I. James	E.T. Jauch	B. Jensen
D. Jones	R.J. Lee	R. Lortie	V.M. Khalin
E. Khutoryansky	D. Kim	L.A. Kirchner	B. Klaponski
N. Kranich	T.L. Machado, Jr.	D. MacMillan	J. Marschall
G. Mason	S. McNelly	W. Metzger	S.E. Michael
G.N. Miller	A. Molden	R. Mullikin	R. Nicholas
S.Y. Pate	F. Perri	P. Pillitteri	G. Pregent
G. Preininger	J.L. Progar	E. Purra	T. Raymond
J.C. Riboud	G. Richey	H. Ruevekamp	R. Scharnell
W.W. Schwartz	S. Searcy	S. Scholl	C. Simmons
R.W. Simpson	S.L. Snyder	L.R. Stensland	C.L. Stiegemeier
P.H. Stiller	S. Tatiner	R.S. Thompson	J. Tuohy
K. Weidmann	K. White	F. Wolfe	

Contents

CLAUSE	PAGE
1.0 Chair's Report - J. W. Matthews.....	1
1.1 Report on the Technical Council Meeting, February 3, 1998 in Tampa, FL, USA1	
1.2 Transformers Committee Report to Technical Council.....	2
2.0 Approval of Minutes of July 18, 1997 - J. W. Matthews.....	5
2.1 Meeting Planning Working Group - G. Anderson, Chair.....	5
3.0 Vice Chair's Report - B.K. Patel.....	8
3.1 PES Technical Council Committees.....	8
3.2 Technical Paper Reviews.....	10
4.0 Administrative Subcommittee - J. W. Matthews.....	11
4.1 Introduction of Members and Guests.....	11
4.2 Approval of the St. Louis Meeting Minutes.....	11
4.3 Additions to and/or Approval of the Agenda.....	11
4.4 Meeting Arrangements, Host Reports, and Committee Finances.....	11
4.5 Old Business.....	13
4.6 Status of ANSI C57 Committee - W. B. Binder.....	13
4.7 Committee Service Award - W. B. Binder.....	14
4.8 Chair's Report - J. W. Matthews.....	14
4.9 Standards Subcommittee - T. A. Prevost.....	14
4.10 Subcommittee Activities - Subcommittee Chairs.....	15
4.11 Vice Chair's Report - B. K. Patel.....	17
4.12 Secretary's Report - H. J. Sim.....	17
4.13 New Business.....	19
4.14 Adjournment.....	19
5.0 Transformers Standards - T. A. Prevost.....	21
5.1 Working Group Reports.....	21
5.2 New Business.....	22
6.0 Recognition and Awards - W. B. Binder.....	23
6.1 Working Group Recognition Awards.....	23
6.2 Certificates of Appreciation.....	23
6.3 Transformers Committee Prize Paper Award.....	24
6.4 Transformers Committee Fellow Certificate Presentation.....	24
6.5 IEEE Steinmetz Award.....	24
7.0 Reports of Technical Subcommittees.....	25
7.1 Audible Sound and Vibration - J. Puri, Chair.....	25
7.2 Bushings - F. E. Elliott, Chair.....	27
7.3 Dielectric Test - L. B. Wagenaar - Chair.....	34
7.4 Distribution Transformers - K. S. Hanus, Chair.....	44
7.5 Dry-Type Transformers - W. F. Patterson, Chair.....	50
7.6 HVDC Converter Transformers & Smoothing Reactors S. C. - W. N. Kennedy, Chair.....	58
7.7 Instrument Transformers - J. E. Smith, Chair.....	60

Contents (cont'd)	PAGE
7.8 Insulating Fluids - F. J. Gryzkiewicz, Chair.....	64
7.9 Insulation Life - L. W. Pierce, Chair.....	68
7.10 Performance Characteristics - D. J. Fallon, Chair.....	71
7.11 Power Transformers Subcommittee - E.G. Hager, Jr. Chair	77
7.12 Underground Transformers & Network Protectors - P. E. Orehek, Chair.....	80
8.0 Reports of Liaison Representatives.....	84
8.1 EPRI - S. R. Lindgren	84
8.2 SCC4 - P. A. Payne.....	87
8.3 CIGRE SC12 - W. N. Kennedy	88
8.4 TC 14 TAG - P. J. Hopkinson	89
9.0 Old Business	92
10.0 New Business.....	92
11.0 Adjournment	92
Attachment 1 - Committee Standards Status - Numerical Listing.....	92
Attachment 2 - Committee Coordination Activities	106
Attachment 3 - Committee Liaison Representatives.....	111
Attachment 4 - Committee Standards Status - Subcommittee Listing.....	113
Attachment 5 - Committee Attendance Statistics	131
Attachment 6 - Special presentation on IEEE Standards Style Template	133

IEEE PES TRANSFORMERS COMMITTEE MEETING
WEDNESDAY, APRIL 29, 1998

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

1.0 Chair's Report - J. W. Matthews

J. W. Matthews called the meeting to order at 8:00 am. Mr. Matthews opened the meeting by complimenting Ed Smith and his associates for the excellent meeting arrangements. The Committee thanked the Host Committee with a round of applause.

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

Gordon Denny provided details about the next meeting in Guanajuato, Mexico on November 8 - 11, 1998. See Clause 4.0 for the details.

Mr. Matthews highlighted the discussions held during the Administrative Subcommittee on November 17, 1997. See the Administrative Subcommittee Meeting Minutes in Clause 4.0 for details.

1.1 Report on the Technical Council Meeting, February 3, 1998 in Tampa, FL, USA

At of the time of the Technical Council meeting there were 2035 persons registered.

It was noted that the poster sessions were very well organized and have been well received at this meeting.

1.1.1 Guide for Special Publications

Members received a handout showing revisions to the Guidelines for submission of special publications. (This revised Guideline appeared at first to simplify the publication of our special publication of the Survey of Generator Step-Up Transformer Failures. I spoke with Steve Lambert and Mel Olken who reviewed the documents and made minor revisions to the cover page. Ed Cromer made the proposed revisions and then last week we found that publication was held up for legal questions and establishing a price. Wally Binder was able to convince Steve Lambert that the legal questions had been answered and the price was established at \$70 US. It will now go to publication.)

1.1.2 Balloting of Standards

Members were cautioned that effective January 1, 1998, an individual must be a member of the Standards Association in order to ballot a standard. Persons who wish to become members, but who did not receive the IEEE solicitation should contact IEEE for a membership application.

The request made at the 1998 Summer Meeting for PES to pay the \$10.00 membership fee for PES members involved in the writing of standards was disapproved by the Governing Board.

1.1.3 Position of International Standards Engineer

Anne O'Neill has a new position within IEEE (Executive Director of the Solid State Circuits Society) and no longer serves the PES as International Standards Engineer. The position will be refilled, perhaps with changes to the position description.

1.1.4 Technical Council Self Assessment

At the 97 Summer Meeting Chair Lambert appointed a Task Force, headed by Wally Binder, then Chair of the Transformers Committee, to review the various operations and activities of the technical committees. In particular, the task force was charged with assessing such topics as 1) what do we do, 2) why do we do it, 3) what should we be doing, 4) what are our resources, 5) are the resources adequate, 6) what are our problems and how can we fix those problems? The report was sent to all members prior to the meeting.

1.1.5 Letter of PES President B. Don Russell of January 8, 1998

This item will be detailed in the Vice Chair's report.

1.1.6 General Meetings

This item will be detailed in the Vice Chair's report.

1.1.7 Singapore Meeting, 2000 WM

It is the request of the Governing Board that the technical committees which meet at the Winter and Summer meetings plan to meet in Singapore.

There will be no organized alternative location designated for Working Groups to meet which do not go to Singapore.

Don Volzka reported that it is charged to the PES leadership to:

1. Send a strong message to the U. S. utilities that we are in a global economy. Your input is need in Singapore.
2. Make arrangements so that the meeting is not substantially different in cost to a meeting in New York.

1.1.8 Future Technical Development Committee - Tom Pinkham

The Future Technical Developments Committee:

1. Co-Sponsored a very successful Special Session on Monday entitled "The Expanding Use of Fibre Optics by Power Utilities".
2. 10 members attended the Committee meeting on Tuesday.
3. Plan to sponsor a Session at the '98 SPM on the Firewall for Electronic System Security.
4. Will explore the possibility of Video taping the Session for use by Student and Regional Chapters.

1.2 Transformers Committee Report to Technical Council

I reported the following to Technical Council for the Committee:

1.2.1 Committee Meeting Activities

Our Fall '97 meeting was held November 16-19, 1997 in St. Louis, MO, USA. Mr. Jerry Bishop of Union Electric was our host. A total of 282 members and guests attended the meeting.

Membership of the Transformers Committee currently stands at 169 members and 20 Emeritus members. The regular members consist of 77 producers, 54 users, and 38 general interest. Our

invitation list is well over 400 engineers and managers in the transformer and utility industry. Attendance at our semi-annual meetings is typically near 300. Anyone with an interest in furthering the technology is welcome at our meetings. With active participation, an invitation is extended to become a member.

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

Future Meetings

April 26-29, 1998, Excelsior hotel, Little Rock, AR, USA

November 8-11, 1998, Guanajuato, Mexico

April 11-16, 1999, New Orleans, LA, USA

November 8-11, 1999, Monterey, Mexico

March 12-15, 2000, Opryland Hotel, Nashville, TN, USA

October 16-19, 2000, Niagara Falls, Ontario, Canada

Spring 2001, Amsterdam, The Netherlands

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

Spring 2002, Vancouver, BC, Canada

1.2.2 Technical Paper Activities

Five papers were accepted for presentation at the General Poster Session in Tampa.

1.2.3 Special Tutorial Session

Wednesday afternoon we are sponsoring an innovative product information session titled "Active Transformer Quieting" to be presented by Mr. Mark Dietrich of QuietPower Systems, Inc.

1.2.4 Transformer Standards and Coordination Activities

The Transformers Committee takes responsibility for development and revision of IEEE Standards that fall within its scope. The Subcommittees currently have fifty Working Groups and Task Forces preparing proposals for standards projects. Information on these standards and a detailed status report on over 100 transformer standards is available from our Committee Standards Coordinator. Anyone wishing to receive a copy should contact Mr. Thomas A. Prevost at (802) 748-8106. They can also be accessed on the Transformers Committee Web page:

<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.

2.0 Approval of Minutes of November 19, 1997 - J.W. Matthews

The minutes of the St Louis meeting were approved as written.

2.1 Meeting Planning Working Group - G. W. Anderson - Chair

The second meeting of the new Administrative Subcommittee Working Group - "Meeting Planning" began at 3:30 p.m., Tuesday, April 28, 1998 at the Little Rock Excelsior Hotel. Twenty-six (26) individuals attended. Greg Anderson, WG Chair facilitated the meeting.

This is the second meeting of the new WG. The first meeting, held in Fall 1997, consisted essentially of determining the need of the WG, initially defining the overall scope of the WG, and setting precedence for future WG meetings.

The meeting began with each attendee introduced themselves. There were no additions or subtractions to the meeting agenda distributed earlier.

2.1.1 Host Guidelines

Greg Anderson gave a brief report of the status of the "Host Guidelines" document. Development of the document is proceeding slowly. It is organized into three portions: Part 1 - "What to do before the meeting"; Part 2 - "What to do during the meeting"; and Part 3 - "What to do after the meeting". Greg is also adding a new fourth portion, "Helpful Hints". Part 1 is essentially complete and work is progressing on Parts 2 & 3 which will hopefully be completed shortly. Greg will provide Part 1 to the next two or three meeting hosts. Gordon Denny will use the new Part 1 document as "a test" while planning his meeting and add any worthwhile information.

Rowland James commented that there is a similar document used in planning T&D Conferences. Rowland will attempt to locate the document (note: Rowland located the document and forward to Greg in April 1998).

2.1.2 General Fund Surplus/Meeting Registration Fees

There is an undesirable surplus of approximately \$17,000 in the "general fund" of the Transformers Committee. Because the Committee is a not-for-profit organization, proper stewardship of the fund is necessary. An amount of \$5,000 to \$10,000 is desired and is necessary to use as "seed money" for such things as down payments for meeting social events and accommodations. The WG will maintain vigilance of the fund and look for ways to reduce it and maintain a proper balance.

The Administrative Subcommittee (ADSUBCOM) discussed the fund surplus in their meeting on Sunday afternoon (see meeting minutes). The Subcommittee made a recommendation to the WG that, unless warranted otherwise, future meeting registration fees can be lowered to \$95 (from \$110) for members and guests; and lowered to \$30 (from \$45) for spouses/companions.

The Meetings Planning WG may set fees for future meetings. The registration fee may be raised (or lowered further) if deemed necessary to fund the cost of a non-typical meeting venue. For instance, if it is foreseen that the costs will be unusually high for a particular upcoming meeting,

the WG may raise the fee to accommodate it, while keeping in mind the short-term endeavor to lower the amount in the general fund.

There was also a request by the ADSUBCOM to consider charging a lower registration fee for "full members" of the Committee than non-members. A cost difference of perhaps \$20 (\$95/\$75) was proposed. This difference would perhaps provide an incentive for non-members to join the Committee while helping reduce the general fund. It was suggested that, although it is hopefully that all the meeting attendees are IEEE members, perhaps a similar fee difference (incentive) could be used for IEEE member and non-IEEE members. A comment was made to the difficulty in verifying whether a meeting attendee was truly an IEEE member. Greg Anderson will contact IEEE headquarters and determine whether a fee difference was allowed.

It was also suggested, in an attempt to lower and maintain the general fund, that perhaps the Committee could routinely award a couple of college scholarships to local IEEE student member (perhaps one who assisted with meeting registration). The WG will consider each of the above suggestions and further discuss them at the next meeting.

2.1.3 Past Meetings

Jerry Bishop, F97 St. Louis Meeting Host, and Ed Smith & LuAnn Hensley, S98 Little Rock Meeting Co-hosts were not in attendance to discuss their recent meetings. Greg Anderson thanked the Little Rock Host Team for making and donating the nice signs to be placed outside the meeting rooms.

2.1.4 Future Meetings

2.1.4.1 Locations

The following locations for future meeting were quickly reviewed.

- Guanajuato, Mexico - November 8-11, 1998 ... Gordon Denny, Host
- New Orleans, LA - April 12-15, 1999 ... Rowland James, Host
- Monterey, Mexico - November 7-10, 1999 ... Alfonso Delgado Cruz, Host
- Nashville, TN - March 12-15, 2000 ... Alan Wilks, Host
- Niagara Falls - October 15-18, 2000 ... Roger Hayes, Host
- Amsterdam - Spring 2001 ... Ernst Hanique, Host
- (open) - Fall 2001
- Vancouver - Spring 2002 ... Mike Lau, Host (tentative)

2.1.4.2 Upcoming Meeting - Guanajuato, Mexico

Gordon Denny gave a short preview of the upcoming Fall 1998 meeting in Guanajuato, Mexico. Ferranti-Packard is taking extra steps to ensure extra security and service for the meeting attendees. Gordon will address the full committee meeting on Wednesday and answer any questions.

2.1.4.3 Upcoming Meeting - New Orleans

The Spring 1999 meeting in New Orleans will be held in conjunction with the T&D Conference. Rowland James is coordinating the Transformer Committee meetings. Preliminary plans are to schedule meetings Monday through Thursday, with no meetings on Wednesday (all day) to allow attendees to visit the conference exhibits.

Details of hotel accommodations still need to be finalized. There will be no meeting registration fees. Attendees will be required to pay full registration fees for the T&D Conference. A table or kiosk will be provided as a "home base" for our meeting and provide a location to "check-in" (to a copy of the minutes of the committee minutes).

There will not be the usual "extracurricular" events associated with the Transformer meeting; i.e. Sunday Evening Reception, no Tuesday Speaker Luncheon, no Tuesday Evening Social/Dinner, and no Companion Tours. Attendees and companions will be able to attend ample events planned for the T&D Conference. Present plans are to provide morning continental breakfasts and breakout snacks.

2.1.4.4 Additional Upcoming Meetings

Brief reports were also given by Alfonso Delgado Cruz (F99 meeting host), Alan Wilks (S00 meeting host), and Roger Hayes (F00 meeting host).

It was noted that Ms. Brenda Rankin, who will assist Alan Wilks in preparing for the Nashville meeting, graciously attended the Little Rock meeting and assisted with the registration. This extra "training effort" can be a very worthwhile in preparing for future meetings.

2.1.5 Discussion - "Offshore Meetings"

A brief open discussion advanced about the recent concern of the unusual amount of "offshore meetings". It was noted that there has been a recent shortage of willing domestic meeting hosts. It is desired, that in order to maintain its "global agenda", the Transformers Committee should continue a precedence of holding occasional (but less frequent) meetings in locations other than the US. Future WG meetings should develop "marketing tools" to help encourage future willing hosts; i.e. typical meeting finances, benefits to host company, etc.

2.1.6 Future Plans for WG

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

The meeting was adjourned at approximately 5:00 p.m.

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

3.1 PES Technical Council Committees

The following are reports on activities of PES Committees on which the Vice Chair serves as Committee representative. All of the meetings reported were held at the 1998 Winter Power Meeting in Tampa, Florida during February 3 - 6, 1998.

3.1.1 Publications Committee

There were two major items discussed at the meeting without any decision made:

Electronic Publishing - The IEEE has initiated an investigation to determine how the fact that most authors now prepare their technical papers in electronic format may be used to advantage in the overall publishing process. Ms. Fran Zappulla, Staff Director of IEEE Periodicals, presented her thoughts for "Future Directions in Electronic Publishing". The move to electronic publishing is seen to have the potential to save considerable time, effort and expense. The PES will be the lead society of IEEE to work with Fran for its implementation.

Paper Review Process - The portion of President Russell's letter of January 8, 1998 on "Technical Committees and the Dissemination of Information - A Change in Paradigm" dealing with paper review process was discussed so as to let everyone express their thoughts. Lengthy discussion ensued on pros and cons. The general sentiment was against any changes in the current procedure. The following is a summary of the proposed changes in the letter:

- Form an Editorial Board for each of the Transactions.
- An Editor-in-Chief for each of the Transactions would be named with an Editorial Board consisting of a cross-section of experts in the applicable areas.
- Management of the paper review process for each of the Transactions would be transferred to these Editorial Boards.
- Each Editorial Board would be responsible for establishing review panel consisting of experts in the requisite technical areas. Many of these reviewers would be drawn from the membership of the Technical Committees. Experts from outside organizations, societies, and the general PES membership can also be utilized.
- Transactions papers will be judged solely on the basis of technical merit, quality, and archival value -- no presentation requirement will exist.
- Each Editorial Board would establish the review cycle schedule and manage the procedures and requirements that a paper must meet in order to be published.
- The Editorial Board would interact and coordinate with PES and IEEE staff under the general oversight of the Editor-in Chief and the Vice President of Technical Information Services.

This item was discussed in various committee meetings with similar results - a lot more for and against arguments. No consensus but biased in favor of no more changes until the current process has a chance to gain experience.

As you are aware the paper submission dates have been separated from PES meetings. There are no paper submission deadlines. The papers are reviewed as they are received. Authors will still be allowed to express a desire to present at a specific meeting; however, we will only allow them to specify this after their paper has been accepted.

3.1.2 Organization and Procedures Committee

3.1.2.1 Technical Committee Activity Reports

The Editorial Board proposed in President Russell's letter was discussed and voted 10 to 4 in opposition to the idea presented.

John Matthews made a motion to remand the proposed Editorial Board topic to the Publication Committee for further study of all the problems involved and to make a detailed proposal to the Technical Council at the San Diego meeting.

3.1.2.2 Revision of the Technical Council Organization and Procedures Manual

The Technical Committees have submitted their O&P Manuals in line with the recently revised Technical Council O & P Manual. These manuals will be reviewed for acceptance prior to the 1998 Summer Meeting.

The revised draft of the Transformers Committee O & P Manual is under review and is expected approval soon. Based on the discussion with the Chair the Transformers Committee can proceed with the changes proposed in the manual.

3.1.3 Technical Sessions Improvement Committee

The following is summary of the discussions held at the meeting:

President Russell's letter of January 8,1998 dealing with the suggested changes to procedural matters relating to General Meetings and Transactions was discussed. The general feeling expressed is that the system has had many recent changes. We have not yet have a good basis for assessing the present system so it's too early to introduce new changes.

A motion was made that the Good Slide/Bad Slide presentations at the authors' breakfasts be suspended. The motion was passed by 11-6.

The TCIC will pursue question of computer derived presentations.

3.2 Technical Paper Reviews

3.2.1 Technical Paper Review Summary

We received twelve papers including one conference paper for review.

Five papers were submitted with requests for publication only. Two of these papers were accepted with mandatory changes. The remaining papers are under review.

Seven papers were submitted with requests for presentation. One of these papers was conference paper that was accepted as written and two were accepted with mandatory changes. The remaining four papers are under review.

Now since the papers are not tied to any particular meeting, they are reviewed as they are received. The technical paper review will be an on-going process.

3.2.2 1998 IEEE/PES Summer Power Meeting Papers

There are no accepted papers. There will not be a Transformers Session at the 98 Summer Meeting.

Respectfully submitted,

B.K.Patel, Vice Chair

4.0 Administrative Subcommittee - John W. Matthews

4.1 Introduction of Members and Guests

Chair Matthews called the meeting to order at 2:30 p.m. in Room Caraway 1 of the Excelsior Hotel and Statehouse Convention Center.

The following members of the Subcommittee were present:

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

The following guests were present:

Ed Smith
Greg Anderson

4.2 Approval of the St. Louis Meeting Minutes

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

4.3 Additions to and/or Approval of the Agenda

The previously communicated agenda was generally followed except there was a special presentation during the Standards Subcommittee reports by Susan Tatiner, IEEE Standards Project Editor.

4.4 Meeting Arrangements, Host Reports, and Committee Finances

4.4.1 Meeting Arrangements

Meetings Planning WG chair Greg Anderson reported the following.

- We have a good backlog of meeting sites and hosts.

- Arrangement for our next meeting in Guanajuato, Mexico is set.
- Some concerns on New Orleans meeting in concert with IEEE/PES T&D Conference since the host Ken Bow had to be replaced with a new host, Roland James. We need to work out the details to address issues with number of days and schedule of our meetings.
- There are perception problem with our meeting sites in Mexico, Canada, and Europe. We need more hosts from continental US.

4.4.2 Host Reports

The meeting co-host Ed Smith reported the following registration statistics:

Registrations

Members and guests	267
Life Emeritus Members	11
Companions	34
Total	312

Tuesday Luncheon 156

Tuesday Evening Social 207

Companions Tours

Monday Tour, Hot Springs 29

Tuesday Tour, Marslgate 27

Gordon Denny, host of our next meeting at Guanajuato, Mexico, announced that meetings will be held on November 9-11, 1998. The room rates at several nearby hotels will be about the same as Little Rock and the airfares will be about the same as traveling to a US city of similar distance. Gordon will send out the invitation in June which will include information on Visa and other traveling. (Gordon's report was given on Wednesday morning main committee meeting.)

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

4.4.3 Finances

Report was not available for this meeting. We have over \$ 17 K surplus after Graz and St. Louis meetings. After significant discussion, we decided on the following.

- Pay for the Transformers Committee Web Page expenses. (~ \$ 200/year)
- Purchase Awards plaque materials. (~ \$ 300/year)

Wally Binder made a motion to pay for the IEEE Standards Association fee for the Transformers Committee members. (\$ 10 per person per year.) After substantial discussion, the motion did not pass with 2 members for and 12 members against the idea.

Ken Hanus made a motion to reduce the registration fee for all attendees by \$ 15 for the next meeting. This motion passed unanimously.

Lin Pierce wanted us to consider reducing registration fee for the Transformers Committee members and/or increase the fee for nonmembers. John Matthews will bring this up as an agenda item for Meetings Planning WG on Tuesday. The WG will check with IEEE to make sure that this is acceptable practice since most of the other IEEE sponsored activities treat all IEEE members equally.

4.5 Old Business

Our O&P Manual is not approved by the Technical Council yet. John Matthews was advised by the TC Chair Steve Lambert to proceed with changes.

Web page expense is about \$ 200 a year. Georges Vaillancourt is now retired but will maintain the web page for the committee. He will be advised to indicate that meeting minutes posted are “Draft until approved during the next meeting” as a disclaimer.

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

The IEEE delegation has voted affirmative on the following ANSI Standards:

- C57.12.50 REQ. FOR VENTILATED DRY-TYPE DISTRIBUTION TR, 1-500kVA, 1 PHASE, AND 15-500kVA, 3-PHASE HV 601-34500VOLTS,LV 120-600V
- C57.12.51 REQ. FOR VENTILATED DRY-TYPE POWER TR, 501kVA & LARGER, 3 PHASE, WITH HV 601-34500V, LV 208Y/120 TO 4160 VOLTS
- C57.12.52 REQ. FOR SEALED DRY-TYPE POWER TRANSFORMERS, 501kVA & LARGER, 3 PHASE, WITH HV 601-34500V,LV 208Y/120 TO 4160 VOLTS
- C57.12.55 CONFORMANCE STANDARD FOR TR- DRY-TYPE TRANSFORMERS USED IN UNIT INSTALLATIONS, INCL. UNIT SUBSTATIONS
- C57.13.2 CONFORMANCE TEST PROCEDURES FOR INSTRUMENT TRANSFORMERS

4.0 Administrative Subcommittee (cont'd)

- C57.19.01 STANDARD PERFORMANCE CHARACTERISTICS AND DIMENSIONS FOR OUTDOOR APPARATUS BUSHINGS (IEEE 24)
- C57.110 RECOMMENDED PRACTICE FOR ESTABLISHING TRANSFORMER CAPABILITY WHEN SUPPLYING NONSINUSOIDAL LOAD CURRENTS
- C57.138 RECOMMENDED PRACTICE FOR ROUTINE IMPULSE TEST FOR DISTRIBUTION TRANSFORMERS

The IEEE delegation was endorsed by the IEEE Standards Board at its March 19, 1998, meeting. The delegation consists of those representatives announced at the preceding meeting.

- Wallace B. Binder, IEEE Delegation Chair
- John W. Matthews, Chair, IEEE/PES Transformers Committee
- Bipin K. Patel, Vice Chair, IEEE/PES Transformers Committee
- Tom Prevost, Standards Coordinator, IEEE/PES Transformers Committee
- John Borst, Chair, ASC C57
- Jin Sim, Alternate Delegate, Secretary, IEEE/PES Transformers Committee
- an IEEE/IAS representative.

Wallace B. Binder

IEEE Delegation Chair

4.7 Committee Service Awards - W. B. Binder

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

Subcommittee Chairs were requested to identify prize papers (published within the last 3 years) deserving an award at the next meeting.

4.8 Chair's Report - J. W. Matthews

John presented his report which will be included in the Committee meeting minutes. It was reported that Tony Ferfari replaced Ann O'Neal. We will provide the address and phone numbers for Tony as soon as we verify that with Susan Tatiner during the Wednesday Committee meeting.

4.9 Standards Subcommittee - T. A. Prevost

4.9.1 Standards and Coordination Activities

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

4.9.2 Documents Submitted to the Standards Board

See the status report.

4.9.3 IEEE Standards Association

PES Standards Coordinating Committee chair Bal Gupta made comments to express some concerns regarding the new balloting procedure associated with IEEE SA. Standards Board meeting in March 1998 decided that individuals in a ballot group initiated prior to 6/1/98 does not need to be a member of the IEEE SA. WG chair needs to be a member of the SA to submit a PAR. During the PES Standards Coordinating Committee meeting held on February 2, 1998, Sue Vogel of the IEEE Standard staff reported that of the 300,000 IEEE members the IEEE has 40,000 in their database and the SA has 1,223 members. John Matthews will attempt to find out the list of the SA members and how the SA requirements are going to be enforced. John recommended that all Transformers Committee members to join the SA.

4.9.4 IEC Category D Liaison

IEEE has gained Category D Liaison status and the Transformers Committee is encouraged to develop a direct relationship with the IEC counterpart, TC14. Substantial discussion followed after John Matthews passed out the copy of February 1998 issue of the Standards Bearer. We already have a Technical Advisory Group established and this group meets during our committee meetings. We will continue this TAG (Phil Hopkinson, TA) activity and closely monitor the situation to assess the need for taking advantage of this Category D Liaison.

4.9.5 Special Presentation - Susan Tatiner, IEEE Standards Editor

A copy of Susan's presentation is attached as Attachment 6.

4.10 Subcommittee Activities - Subcommittee Chairs

4.10.1 Audible Sound and Vibration - Jeewan Puri

Jeewan reported that Sound Intensity measurement is viable and will start a WG.

4.10.2 Bushings - F. E. Elliott

Fred brought up an issue with a candidate to chair C57.19.00 WG. This candidate has been active, qualified, and willing but does not have degree in engineering discipline. After a short discussion, we decided that type of a degree is not a requirement as long as the candidate is a member of IEEE and PES.

4.10.3 Dielectric Tests - L. B. Wagenaar

No report.

4.10.4 Distribution Transformers - K. S. Hanus

Ken reported that Al Traut and Roger Lee will cochair C57.12.23, Single Phase Underground Transformers with Separable Connector and Leon Plaster will chair the new WG on Small Power Transformers.

4.10.5 Dry-Type Transformers - W. Patterson

No representation and no report.

4.10.6 HVDC Converter Transformers & Reactors - W. N. Kennedy

Richard Dudley reported that Bill Kennedy had a minor problem with formality for reference during the December meeting of the Standards Board meeting .

4.10.7 Instrument Transformers - J. E. Smith

No representation and no report.

4.10.8 Insulating Fluids - F. J. Gryzkiewicz

No representation and no report.

4.10.9 Insulation Life - L. W. Pierce

Lin reported that he is coordinating for Transformers Committee with IEEE PSRC on the Adaptive Transformer Thermal Overload Protection. He also is planning a panel session during the IEEE/PES T&D and reported that a call for paper will be announced in May 1998 issue of the PES Review.

4.10.10 Performance Characteristics - D. J. Fallon

Don raised a few questions on the process of continuous revision of the C57.12.00 and C57.12.90. There are some concerns and questions on addressing the technical comments returned with ballots. Don also had concerns on schedule conflicts and the chair John Matthews will bring this up during the Meetings Planning WG on Tuesday.

4.10.11 Power Transformers - E.G. Hager

Red reported that IEE 693, Guide for Seismic application, has been approved and can officially be used.

Red reviewed the work scope of this new SC as follow.

From West Coast:

C57.93 (Combination of C57.12.11 & C57.12.12) Guide for Installation of Liquid-Immersed Power Transformers.

C57.120 Loss Evaluation Guide for Power Transformers and Reactors.

C57.128 Fire Protection of Outdoor Liquid-Immersed Power Transformers.

C57.135 Guide for Application, Testing, Installation and Operation of Phase Angle Shifting Transformers.

From Performance Characteristics:

C57.116 Guide for Transformers Directly Connected to Generators.

C57.117 Guide for Reporting Failure Data for Power Transformers and Reactors.

C57.125 Guide for Failure Investigation, Documentation and Analysis for Power Transformers and Shunt Reactors.

C57.131 Performance Requirements for LTC.

New WG - LTC Application Guide (Bill Henning, chair)

From Dielectric Tests:

WG - Diagnostic Field Testing and Monitoring (Rick Young, chair)

From ANSI C57

C57.12.10 Power Transformers rated 230 kV and below, 100 MVA and below (Jin Sim)

C57.17 Requirements for Arc Furnace Transformers

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

Paul reported that Al ("Butch") Robinson will replace Bruce Nutt as the chair for C57.12.57.

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

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

4.12 Secretary's Report - H. J. Sim

4.12.1 Membership Review

Voting Members - Van Pham has resigned from the membership, Russ Minkwitz has changed his status to emeritus, and P.Iijima, D.W. Whitley and C.W.Williams have been dropped because of either poor attendance or lack of interest. Four new members were added at the last meeting in St.Louis as noted in the meeting minutes. Also there were few changes in voting classification for some members.

After the Administrative subcommittee meeting, two new members were approved and welcomed. They are, H. M. Shertukde (University of Hartford) and J. D. Watson (Florida Power & Light.)

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

Members -	165
Classifications: Producers -	78
Users -	51
General Interest -	36
Emeritus Members -	20

Poor Attendance Records - The invitation list has been revised by removing guests with poor attendance record and adding new guests by request. Members who have not attended a committee meeting since Spring of 1996 will be contacted to determine their interest in maintaining membership.

4.12.2 New Member Applications

No new application has been received since last meeting.

4.12.3 PES Directory Rosters

Revised directory information for 1998 IEEE Directory listing for the Transformers Committee was submitted to Secretary of TC on September 12, 1997. The next updating will be discussed the meeting in Little Rock, AR.

4.12.4 Meeting Minutes

Minutes of the St. Louis meeting were reproduced at no cost, again compliments of Ken Hanus and TU Electric. Postage costs were \$ 1975.05 for 523 mailings, which averages \$ 3.78 per mailing. Note that the net cost of the minutes varies for each meeting and the \$10 portion of the registration fee is a valid nominal fee.

I request Subcommittee Chairs to submit their minutes by June 12, 1998 for this meeting. The submittal should include a printed copy and an electronic file on a 3 1/2" diskette, formatted in Word 6.0 (or earlier versions). Please indicate total attendance count for each subcommittee, working group, and task force meeting in your minutes. Please do not send me a copy of attendance listing for this attendance count. If someone is preparing minutes for you please let them know these details about submitting the minutes for publication.

4.13 New Business

All members liked the new time schedule for Administrative Subcommittee and we will meet at 2:00 pm next time so that we have sufficient time before the reception.

Meeting conflicts were again discussed and the issues including extended (to 4 days) meeting duration will be addressed in the Meetings Planning WG.

Adaptive Transformer Thermal Overload Protection report by the WG K3 - Substation Subcommittee of the Power System Relaying Committee was discussed again. Lin Pierce pointed out that this report is a tutorial paper rather than a guide.

4.14 Adjournment

John adjourned the meeting at 6:33 p.m.

Respectfully submitted,

H. J. Sim, Secretary

IEEE/PES Transformers Committee Meeting Locations

<u>Year</u>	<u>Spring</u>	<u>Fall</u>	<u>Committee Chair</u>
2001	Amsterdam, The Netherlands	Open	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

4.0 Administrative Subcommittee (cont'd)

5.0 Transformers Standards - T. A. Prevost

The Standards Subcommittee met on Tuesday April 28th at 8:00 Am with six members and five guests.

The minutes of the St. Louis meeting were approved as written.

David Ramsden, the Staff Engineer assigned to the Transformer Committee, has left IEEE. Until a replacement has been found please direct inquiries to Sue Vogel (732) 562-3817.

5.1 Working Group Reports

WG on C57.12.70 “Standard Terminal Markings and Connections for Distribution and Power Transformers” and C57.12.80 “Standard Terminology For Power and Distribution Transformers”
- Tom Traub

The Working Group met at 4:15 PM on Monday, April 27 with four members and four guests in attendance. The minutes of the St. Louis meeting were approved as written.

Since the previous meeting a recirculation ballot had been conducted for C57.12.70, Standard Terminal Markings and Connections for Distribution and Power Transformers. The results were as follows:

123 total ballots sent out

105 Affirmative

2 negative

2 Abstentions

109 votes = 88% return, 1% abstention

98% Affirmative

The two negative ballots were carryovers from the initial ballot because they did not return the recirculation ballot to change their votes to affirmative even though their comments were incorporated into the latest draft. The chair contacted both of the negative balloters. They have confirmed in writing that their concerns have been addressed and that their votes should be considered changed to affirmative.

The following will need to be done before the standard is sent to IEEE for approval and publishing:

- 1) Some minor editorial changes will be made.
- 2) The figures will be re-done.
- 3) The chair will make changes to the draft that were submitted by the IEEE project editor and obtain confirmation from IEEE that the changes will not require a re-ballot.

The second part of the meeting consisted of a review of comments received with the six negative ballots and other comments received with the initial ballot for C57.12.89, Standard Terminology

for Power and Distribution Transformers. Based on discussions at the meeting, the Chair will reissue the draft and have it submitted to IEEE for a recirculation ballot.

The meeting adjourned at 5:30 PM.

Continuos Revision of C57.12.00 and C57.12.90- Subash Tuli

Draft 2 of C57.12.00 has been balloted . Balloting resulted in 17 negatives and many affirmatives with comments. Because the intention of the continuous revision is to get a standard into publication which incorporates the latest changes suggested by contributing Working Groups these negatives were discussed with the balloters and any editorial and simple changes along with the comments will be incorporated into the next revision for a recirculation ballot. Subash has discussed the remaining negatives with the contributors with the agreement that these will be incorporated into the next revision of the standard. He has been able to resolve the negatives in this fashion and the recirculation ballot should be sent out in about a month. One issue for the final draft will be to get the electronic version of the figures included in the standard. Subash will work with IEEE to get these figures.

Draft 4 of C57.12.90 has been balloted with seven negatives and many comments. As with C57.12.00 these comments and non-technical negatives will be incorporated into the recirculation ballot. All technical negatives will be given to the appropriate working group to be resolved for the next revision. Again the intention is to get this draft published. The recirculation ballot for C57.12.90 should be sent out in the next month.

For C57.12.00 and C57.12.90 we intend to get these standards on a two year revision cycle.

5.2 New Business

Tom Traub expressed objection over the number of meetings outside of the US and Canada. It makes it difficult for volunteers to attend these meetings especially those without a sponsor.

Susan Tatiner , Manager of Electronic Publishing, joined the meeting. She will be giving a presentation on the role of the IEEE Project Editor and the use of templates to prepare documents.

The meeting adjourned at 8:40 AM.

6.0 Recognition and Awards - W. B. Binder

6.1 Working Group Recognition Awards

The Transformers Committee Working Group Recognition Award for 1997 is being presented to the members of the Working Group on C57.131: Standard Requirements for Load Tap Changer. Chair: T. P. Traub, Members: M. S. Altman, A. Bartek, D. Chu, J. C. Crouse, D. Dohnal, P. T. Feghali, , R. H. Frazer, R. L. Grubb, N. W. Hansen, J. H. Harlow, J. G. Lackey, S. Lindgren, J. W. McGill, S. P. Moore, B. K. Patel, D. W. Platts, L. J. Savio, G. Sparagowski, C. L. Stiegemeier, , R. W. Stoner, R. A. Veitch, R. D. Wakeam, J. G. Wood, W. E. Wrenn.

Nominations are being sought for the 1998 Transformers Committee Working Group Recognition Award.

6.2 Certificates of Appreciation

Transformers Committee Certificates of Appreciation were presented to the following persons at the Transformers Committee meeting.

Name	Service Rendered
Wallace B. Binder	Chair, Transformers Committee
Everett G. Hager	Chair, West Coast Subcommittee
James H. Harlow	Chair, Awards and Recognition Subcommittee
Ron Jordan	Co-Chair, Working Group for C57.135 - Bar Coding of Distribution Transformers
Angelynn D. McCain	Co-Chair, Working Group for Electronic Data Submittal
C. Patrick McShane	Chair, Working Group for C57.121 - IEEE Guide for Acceptance and Maintenance of Less-Flammable Hydrocarbon Fluid in Transformers
John R. Rossetti	Chair, Working Group for C57.138, Recommended Practice for Routine Impulse Tests for Distribution Transformers.
H. Jin Sim	Chair, Performance Characteristics Subcommittee
Robert W. Scheu	Chair, Working Group for C57.12.23 - Single Phase Submersible Distribution Transformers
Stephen D. Smith	Chair, Working Group for Continuous Revision of C57.12.90 - Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and Shunt Reactors.
Thomas P. Traub	Chair, Working Group for C57.12.80 - Standard Terminology for Power Transformers and Reactors

Thomas P. Traub Chair, Working Group for C57.12.70 - Standard Terminal Markings and Connections for Distribution and Power Transformers

6.3 Transformers Committee Prize Paper Award

Nominations are being sought for the Transformers Committee Prize Paper Awards for 1998.

6.4 Transformers Committee Fellow Certificate Presentation

R. A. Veitch, Transformers Committee Chair from 1989-1991 has been elected a Fellow of the IEEE. His citation reads, "for leadership in the development and design of very large and extra high voltage transformers, shunt reactors and associated equipment."

6.5 IEEE Steinmetz Award

William J. McNutt, longtime member of the Transformers Committee, and an IEEE Life Fellow received the Charles Proteus Steinmetz Award at the Winter Meeting in Tampa "For sustained contributions and leadership in the development of standards for power transformers."

7.0 Reports of Technical Subcommittees

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

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

Following each report is a listing of the current status of each of the subcommittee's assigned standards.

7.1 Audible Sound and Vibration - J. Puri, Chair

The Subcommittee met on Tuesday, April 28 at 10:55 A.M. with twelve members and twenty guests present. Seven new members were welcomed to this Subcommittee.

The minutes of our previous meeting at St. Louis were approved.

The following items were discussed:

1. WG Report - Transformer Siting Guide C57.136 (Ms. Karen Weissman - WG Chairman)
Draft 7 of this Guide was sent to five users for providing comments toward enhancing the value and technical content of this document. This WG met at 9:30 A.M. and worked on incorporating these comments toward producing Draft 8 of this guide. This draft will be circulated in the W.G. and the S.C before our next meeting.

2. Chairman's Report - Participation in IEC TC 14 activities - WG 24: This WG has now completed the Committee Draft 14/308/CD for the revision of IEC 551 standard for Sound Level measurements. This document now recognizes Sound Intensity and Sound Pressure as equally valid measurement procedures.

Even though this document is a bit different in its character from typical IEEE standards, it provides valuable input for adopting Sound Intensity as a measurement procedure in our Standards C57.12.90 and C57.12.91.

We had proposed that the Standard Noise Levels listed in NEMA Tables TR 1 should be made a part of IEC Standard 551. WG 24 did not accept this proposal and in stead suggested that this information should be included in an application guide on this subject.

The Chairman (J. Puri) will submit a New Work Proposal for writing an Application Guide and suggest including the contents of our Transformer Siting Guide in this document.

3. Noise Intensity measurements: It was agreed that we should discuss all the issues involving Noise Intensity measurements in our next meeting before incorporating this procedure in our standards. The chairman will send a copy the Committee Draft 14/308/CD to all the subcommittee members for their review. Mr. Rams Girgis will present a discussion on this subject in our next meeting.

There being no new business, our meeting adjourned at 12:10 PM.

Jeewan Puri

Chairman

7.2 Bushings - F. E. Elliott, Chair

7.2.1 Introduction and Membership

Chairman Fred Elliott opened the meeting at 10:55 AM and welcomed the members and guests. The meeting was attended by 18 members and 14 guests. Three guests requested membership to the subcommittee. Mr. Robert Thompson from CINERGY has resigned and will no longer be able to attend the Bushing Subcommittee meetings. See Attachment – 1 for membership list.

7.2.2 Chairman's Remarks

Mr. Elliott reported the following:

- IEEE Standards Board has created the IEEE Standards Association (IEEE-SA). According to the current procedure, IEEE members involved in the development of standards and balloting process must be members of the Standards Association. See Attachment –2.
- IEEE Transformer Committee needs more domestic hosts for hosting these meetings. Some members are finding it difficult to attend the international meetings.

7.2.3 Approval of Minutes of Nov. 18, 1997 Meeting Held in ST. Louis, MO

The minutes were approved as written.

7.2.4 Working Group / Task Force Reports

7.2.4.1 WG on Performance Characteristics and Dimensions for Outdoor

Apparatus Bushings (PC57.19.01)

Chairman P. Singh reported that his WG met on April 27, 1998 at 9:30 AM with 22 members and 11 guests present. He reported the following:

7.2.4.1.1 Approval Nov. 17, 1997 Meeting Held in ST. Louis, MO

The minutes were approved as written.

7.2.4.1.2. PC57.19.01 Draft 5 Ballot Results

The final results from the Bushing Subcommittee and the WG ballot were as follows:

Sent	Returned	Affirmative	Negative	Abstentions
73	64(88 %)	54(84%)	10(16%)	0

Out of 12 negative votes received initially, two were resolved through correspondence

7.2.4.1.3. Discussions on comments received on Draft 5 ballot

The WG members discussed the comments on the ballot and agreed to the following changes:

3a. Table 1, Electrical Insulation Characteristics

The following changes were agreed,

- Some comments were received indicating that we put back into the proposed standard, 25, 46, 115, 161 kV ratings that were taken out from the existing standard.

The WG has discussed this issue before and then again at yesterday's meeting and decided once again to maintain the present voltage classes. It was pointed out by some of the user/members present that the criteria for the selection of the voltage classes in this table is based on the feed back from the EEI and Doble. The feed back indicated an overwhelming desire to reduce the number of rating so that in the long run the end users do not have to keep too many bushings in their inventory.

It was indicated by some of the end users that the inventory cost is so high that they could buy a new bushing every few years. The users present at the meeting expressed a strong desire to maintain the voltage classes as per Draft 5. It was however agreed that the WG will write a paper/report. The purpose of this paper would be to educate and explain to the members/end users, the approach, the WG has taken for the revision of this standard and describe the resulting benefits. Harold Moore, Loren Wagenaar, and Bert Hughes volunteered to work on this paper. Russ Nordman, C. Ko, Craig Stiegemeier, and P. Singh will provide the necessary support. The paper should be available for review at the next WG meeting

- A question as to why the maximum line to ground voltages are higher by 5 % when compared to C57.12.00 was discussed. It was explained that the bushing standard has always maintained the maximum L-G voltage at 10 % above the nominal voltage. This gives a margin of 5 % above the transformer operating voltages. It was agreed not to change these levels.

3b. Table 2, Dimensions for Bushings Through 69 kV

- A comment about the diameters of 69 kV 3000 A rating was discussed. It was agreed to change the dimensions for this rating as follows:

D	P	Q	BCD
6.5	7	9.25	10.25

The other information for this rating will remains unchanged.

- The note (*) for draw lead application will be revised as per the agreement at the Graz meeting as follows:

- A new figure similar to Fig.2 Detail D Table 6 of the existing standard C57.19.01 will be added and this figure will be designated as Figure 3-4. The existing figure numbers will be changed as follows:

Fig. 3-4 to Fig. 3-5

Fig. 3-5 to Fig. 3-6

- In Figure 3-2, the note about the gasket surface overhang will be revised to conform to the existing C57.19.01 standard as follows:

“No overhang on this surface outside the “Q” dimension”

- The note (*) for draw lead application will be revised as per the agreement at the Graz meeting as follows:

“For draw lead application, the continuous current rating is minimum and is limited by the draw lead terminal rating stated on the bushing nameplate and/or by the size of the draw lead cable/conductor applied to the bushing.”

- A suggestion to eliminate the lower support/nut thickness in Fig. 3-5 was not accepted as it affects the location of the lower shield when bushings are interchanged between manufactures.
- A suggestion to reduce the D dimensions of bushings 138 kV and above was again discussed at this meeting. This change could not be accepted, as every bushing manufacturer can not support it. It was however pointed out that the present draft has a reduced D dimension for the 230 kV rating.
- A suggestion to change the top threaded terminals to bladed terminals was not accepted, as every bushing manufacturer can not support it.

7.2.4.1.4 Table 4, Cantilever Design Test Requirements

A suggestion to change the angle of inclination for the cantilever design test force from 20 to 30 degrees was not accepted as the present method is more conservative and requires additional force when the angle exceeds 20 degree.

7.2.4.1.5 Table 6, Power Factor and Capacitance Limits

A suggestion to include PF correction factors as per C57.12.90 was not accepted, as the correction factors are different between different bushing manufacturers.

7.2.4.1.6 Editorial Comments

Appropriate editorial suggestions will be incorporated in the next draft.

7.2.4.1.7 Next Draft

The WG decided to prepare Draft 6 with the revisions and ballot within the main Balloting Group.

7.2.4.1.8 Adjournment

The meeting was adjourned at 12:15 PM after two sessions.

7.2.4.2 Task Force on Draw-Lead Bushings

Chairman Russ Nordman reported that his TF meeting was held at 2:50 PM on April 27, 1998 with 11 members and 12 guests present. He reported the following:

7.2.4.2.1 Minutes from the previous meeting

These were approved as written.

7.2.4.2.2 Information on Draw leads

- Requests were sent to bushing manufacturers regarding test data available on draw leads. No significant information was received.
- A possible computer simulation was presented by Chungduck Ko for calculating draw lead temperatures. It was discussed and work will continue. The thermal model could be a part of Bushing Application Guide.
- Agreement on test conditions was not reached within the Task Force. This will need review of preliminary work on temperature simulation. A temperature limit of 105 C was considered. This may be conservative for draw leads but may be appropriate for the main bushing insulation. Temperatures of 120 C may be acceptable for short duration on draw leads.

7.2.4.3.3 Future Activity

If the task force can not find a significant problem with the current draw lead practices, the TF may advise Bushing Subcommittee to disband future activities.

Meeting was adjourned at 3:50 PM

7.2.4.3 Revision of C57.19.00

- Several comments/proposals were submitted on Clause 5.4.1, Thermal basis of Rating, Draft 2 PC57.19.00 - XXX

- Keith Ellis submitted a proposal (Attachment - 3) suggesting 65 C HS rise (105 C total temperature) with 55 C rise oil at the minimum level. This is similar to the existing standard. In addition, Keith submitted revised wording for Clause 5.4.2.
- Chung-Duck Ko submitted comments (Attachment - 4) indicating that based on their testing on several bushings, the proposed standard is equivalent to the existing standard but the oil volume in their designs needs to be increased by 8 %.
- Singh submitted a proposal (Attachment - 5) which is similar to the proposed standard with the exception that it adds 30 C average ambient air temperature, and 95 C average oil requirements in Clause 4.1 and addition of Clause 6.4 on existing designs where retesting would be optional rather than required. P. Singh's proposal is similar to CSA - C88.1 – 96.

The above proposals were discussed and it was decided to include P. Singh's suggestions in the next revision of Draft 2.

- After reviewing the existing seismic standards, Keith submitted a report (Attachment - 6) indicating that IEEE 693 has been approved. The WG discussed the seismic requirements and decided to include seismic requirement as per IEEE 693 as a special test. This standard basically requires a static pull test for bushing ratings below 161 kV. Bushings 161 kV and above would be qualified by a time history shaker – table test. This is a very expensive test and can cost in excess of 30 K.

Note: Upon checking, I find that the latest version of the approved draft is 6.2. Please refer to IEEE 693 standard for latest information. I have not included in the minutes, pages of Draft 6.1 distributed by Keith. Thanks. P. Singh 5/26/98

- Russ Nordman commented on FOW test and indicated that this test is quite common for transformers. See Attachment - 7. Bob Hartgrove indicated that they require this test on reduced BIL transformers because it tests full lead structure. Bert Hughes indicated that TU still use this test as they had some test failures and suggested that bushings should be tested in the factory. The WG discussed this and decided to keep the FOW test as a special test in the next revision of Draft 2.
- Lapp Insulator Co. suggested the elimination of 20 kV production test for the voltage tap and instead do it as a design test. Members were requested to comment on this proposal. Mark Rivers of Doble will contact their clients to get some feed back. It was indicated that this tap could see 6-10 kV when it is used with a potential device.
- Also lapp questioned the validity of 1 hour pressure test. It was decided to leave it alone until a concrete proposal is submitted.

7.2.5. Technical Advisor to IEC/SC36

No report was presented as Bill Saxon has resigned. Russ Nordman volunteered for this position.

USNC has advised that all TAGs must, within one year transition period have an Organizational Administrator which shall be an ANSI member or pay an equivalent fee as defined Resolution 3. See Attachment - 8.

7.2.6 Old Business

Fred Elliott informed that C57.19.00 and 01 have been reaffirmed.

7.2.7 New Business

- A question was raised whether a new WG is needed for the revision of C57.19.00. Fred Elliott will proceed to get PAR.
- For C57.19.100, the initial work could be done within the Bushing Subcommittee.
- Chung-Duck Ko expressed his desire to add a new method to determine C1 power factor for RG bushings in Section 10.2.1 of Bushing Application Guide.

7.2.8 Adjournment

The meeting was adjourned at 3:11 PM

Minutes By:

Pritpal Singh, Secretary, Bushing Subcommittee

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

The Dielectric Test Subcommittee met on April 27, 1998, at 9:30 a.m., in Little Rock, AR with 38 members and 43 guests present. The minutes of the last subcommittee meeting held in St. Louis, MO, were approved.

The Chairman covered the key points of the Administrative Subcommittee meeting held on April 25, 1998. (See section 4.0 of the Transformer Committee Meeting minutes for details.)

- As of June 1, 1998, you must be a member of the IEEE Standards Association to vote on an IEEE Standard. The fee is \$10 per year and applications can be obtained from IEEE.
- The Operations and Procedures manual was presented at the Ad. Com., but was not discussed. The new Power Transformer Subcommittee was included and the Working Group on Diagnostics and Field Testing of Power Transformers, chair Rick Young, will report to this new Subcommittee.
- A recent response rate to a ballot was only 32%. The Dielectric Test Subcommittee roster will be reviewed before the next meeting and names of inactive members will be removed.
- A survey of C57.12.00 and C57.12.90 will be conducted with the Dielectric Test Subcommittee. These surveys will include changes due to the issues raised from the ballots. A ballot will be conducted after the next meeting in Mexico.
- Updated membership rosters are due to IEEE by September, 1998. Working Group Chairs should forward rosters to L. B. Wagenaar by August 15, 1998. He will compile them and send them to IEEE.

7.3.1 Working Group on Partial Discharge Tests in Transformers -

J. W. Harley - Chair

The meeting was attended by 10 members and 41 guests.

Attendees introduced themselves. Minutes of the previous meeting November 17, 1997 in St. Louis, MO were approved.

PAR C57.127 Trial Use Guide for Detection of Acoustic Discharges in Oil-immersed Power Transformers is expected to be balloted in the near future. This Guide had been previously balloted and approved by the Transformers Committee. It was submitted for publication and, after some delays, the Transformers Committee was informed it would be necessary to re-ballot because the paperwork for the Standards Board approval could not be found.

The path we are pursuing is to ballot the "Detection" guide and then add the "Location" guide to it instead of having two guides so closely related.

Meeting planning: Fred Elliott presented a paper at the St. Louis meeting authored by D. L. Berent about Bonneville Power Administration's field experience with acoustic monitoring. Two other speakers have been invited to discuss the methods and types of systems they use for the location of acoustic emissions from partial discharge. Tord Bengtsson of ABB Vasteros, Sweden will speak at the November meeting in Mexico and Hem Shertukde at the April, 1999 meeting in New Orleans.

The review of the latest draft of the Trial Use Guide for Location of Acoustic Discharges in Oil-immersed Power Transformers and Reactors was continued. Break-out groups were led by Ron Barker, Gordon Denny, Fred Elliott, Norman Field and Hem Shertukde. The next draft of the guide will be sent to Working Group attendees before the November meeting.

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

The working group met on Monday, April 27, 1998, at 1:20 p.m. with 10 members and 32 guests present. Seven guests requested membership in the working group.

After the usual introduction of members and guests, the minutes of the last meeting in St. Louis were approved as written.

The first order of business was the approval of changes in the induced test in C57.12.90 which will be forwarded to the Chairman of the working group on revisions to C57.12.90. The chairman also reported on the status of the PAR for revisions to C57.113 Guide for partial

discharge measurements. The PAR is currently in process in the IEEE Standards Board. The revised Standard is expected to be ready for ballot before the end of the year.

The proposal for revision to the induced test on transformers with series/multiple corrections was approved by voice vote of the working group and it was agreed to include this in a large survey of the Dielectric Test Subcommittee. The working group recommended that all the latest recommended changes in C57.12.90 dielectric tests be included in one large survey of the subcommittee with the goal of having this ready by year's end.

The working group then discussed the need for updated changes in temperature correction factor for the power factor measurement and the need for a temperature correction factor table for the insulation resistance measurement. Several manufacturers agreed to make measurements of power factor and insulation resistance at various temperatures in order to develop updated correction factors. Volunteers to make such measurements on distribution transformers are needed. Data on these measurements should be sent to the working group chair, Mark Perkins.

The final order of business was a review of comments on the last ballot of C57.12.90 low frequency tests. The results of this effort will be included in the survey of the Dielectric Test Subcommittee.

The working group adjourned at 2:35 p.m.

7.3.3 Working Group On Revision Of Transient Dielectric Tests -

Bertrand Poulin - Chair

The Working Group met on Monday, April 27th at 4:15 p.m. with 21 people present.

The first topic discussed was the revision of C57.98, the Guide for Transformer Impulse Test, work lead by Subhash Tuli. Subhash reported that a successful reaffirmation ballot was conducted. Very few comments were received, all editorial. The WG will therefore go ahead with the procedure to have the guide reaffirmed while the process for the next revision will be started so that the next revision date can be met.

Under old business, Loren Wagenaar indicated that he is working on correction factors for lightning impulse wave shapes that do not meet the current Standard and he requested some help

to continue his study. He would be interested in receiving frequency transforms of full wave voltages. The intent is to see if wave shapes can be corrected with this information.

Under new business, during the last ballot of the draft 4 of C57.12.90, a series of comments were received by the Chairman of the Dielectric Test Subcommittee and some of these were referred to the WG for discussion and resolution.

The first comment from Pierre Riffon from HQ refers to the voltage wave shape during SI test on EHV transformers. In brief, Pierre suggests that if the required tail of 1000 uSec cannot be achieved, a shorter tail may be used provided that a minimum energy of 100 kJ is available from the impulse generator. The audience did not agree with this comment as it was mentioned that the time at which a transformer core saturates is not a function of the available energy. The chairman will clarify the question with Mr. Riffon.

The second comment, also from Mr. Riffon, proposes again a minimum energy of 100 kJ for the impulse generator for the lightning test (full wave). Once again, the audience disagreed. It was mentioned that the wave shape is a function of the capacitance of the generator, not the energy available. The two are related, but the capacitance dictates the tail of the wave. The chairman will clarify this issue with Mr. Riffon.

The third comment from Mr. Riffon concerns the chopped wave test. The present standard allows the overswing of the opposite polarity to be limited to 30%, which is not in accordance with IEEE Std 4, where 50% is stated. Mr. Riffon suggest that 50% should be adopted for transformers. The issue was discussed briefly at the meeting. It was mentioned that changing from 30% to 50% would make the test much more severe for transformers, which is not the case for other devices tested with chopped waves. Loren Wagenaar mentioned that he had suggested 40% in the past and it had not been accepted. It was agreed at the meeting that the question would be analyzed before the next meeting. Information should be forwarded to the WG Chair, Bertrand Poulin.

The fourth comment was from Mark Perkins from ABB. He suggests a new sequence for the lightning impulse test on transformers equipped with non-linear devices. It would be reduced wave, full wave, two chopped waves, full wave and reduced wave. The two full waves, before and after the chopped waves, would be compared and must match, and also the two reduced waves, before and after the chopped waves would be compared and must match. The people present agreed with the proposal. This practice is already used by several manufacturers.

The next comment, from Mark Perkins, suggests to add the words "when required" to the clause 10.3.3 concerning the impulse tests on transformer neutrals as they might not be required every

time. Some years ago, a successful ballot was conducted on the subject and it was agreed at the time that impulse test on neutral terminals below 200 kV BIL would not be required by the standard. Anyway, it does not hurt to insert the words "when required" to this particular clause.

The last comment refers to clause 10.3.4.1 of the standard, regarding the interpretation of the current oscillograms at impulse test. Mark Perkins suggests that "any difference" should be replaced by "any abnormal difference" as with today's digital recorders, there is always a visible difference. The people present mentioned that the word abnormal might be too soft, but a new wording will be proposed for the next revision and balloted with the rest of the changes proposed.

The meeting adjourned at 5:30 p.m.

7.3.4 Working Group on Diagnostic Field Testing & Monitoring - Rick Young - Chair

The working group on Diagnostic Field Testing and Monitoring of Liquid Filled Power Transformers, Regulators and Reactors, met on Monday, April 27 with 56 members and guests in attendance. The meeting consisted of reports and activities associated with the two Working Group Task Forces.

The Task Force for On-Line Monitoring Communications had met earlier Monday with 28 members and guests in attendance. Efforts continued on development of Chapter 9, "Transformer Object Models", of GOMSFE, which stands for Generic Object Models for Substation & Feeder Equipment, for the UCA (Utility Communication Architecture) System. This system will provide a standard industry communication protocol for all electronic devices. The Task Force established the ranges for monitoring several previously identified transformer parameters and identified several new parameters that could be monitored. It's planned to expand the object models to include instrument transformers.

The Task Force Developing a Guide for On-line Monitoring of Power Transformers met as part of the Working Group meeting. Draft 1 of the "IEEE Guide for the Application of On-Line Monitoring to Liquid Filled Power Transformers" was presented and discussed. Comments included the need to review work in this area being done by others including Canadian organizations and CIGRE. The document should also be consistent with the monitoring parameters being developed in the communication Task Force. Additional Task Force assignments were made for development of the various sections of the Guide so that Draft 2 can

be prepared before the next meeting. The Working Group chairman will begin a PAR application for this Guide.

7.3.5 Status Reports

7.3.5.1 Status Report on C57.138, Recommended Practice for Routine

Impulse Test for Distribution Transformers, John Rosetti:

A letter was received from IEEE Standards informing him that PC57.138 was approved as a new recommended practice by the IEEE-SA Standards Board on March 19, 1998. A copy will be forwarded to the IEEE Standards Publication Department for editing and publication.

7.3.5.2 Working Group Report on Continuous Revision of IEEE Standard

C57.12.90, C57.12.00 and C57.98 - Subhash Tuli

A. IEEE Std. C57.12.90 Test Code

As a result of ballot of Draft 4 of this Standard, there were seven (7) negative ballots on various matters; six negative ballots are resolved pending few technical matters which are not included in Draft 5, but will be considered during the next revision of this Standard. All pending items are being forwarded to respective Working Group Chairs for future discussion. Draft 5 will be re-circulated in two weeks time.

B. IEEE Std. C57.12.00 Standard General Requirements for Liquid Immersed Transformers

Draft 3 of this Standard was balloted during February/March, 1998, and this ballot turned out to be an affirmative ballot, as affirmative response was greater than 75%. There were 17 negative ballots. Majority of these negative ballots were targeted towards Table 17 and the remaining comments are being sent to the respective Subcommittee Chair for consideration during the next meeting and will be incorporated into the next revision of this Standard. All members who have cast negative ballots to this Standard have sent their written consent to this effect.

Within the next two weeks, Draft 4 of this Standard will be re-circulated to all eligible balloters, as the changes to Table 17 are quite extensive and very important in nature.

C. IEEE Std. C57.98 IEEE Guide for Impulse Test on Transformers

Ballots for re-affirmation of this Guide were sent during March, 1998 and the final ballot summary is as follows:

Total Ballots Sent:	169
Affirmative Ballots:	119
Negative Ballots:	0
Abstentions:	3
Ballot Approved:	83%

Therefore, this Guide will be reaffirmed in a few weeks. The revision to this Guide will continue and is being assigned to the Working Group Chair of the Transient Dielectric Test Committee.

7.3.6 Liaison Reports

7.3.6.1 Insulation Coordination - John Crouse

The Insulation Coordination Working Group has completed the revision of P1312, Standards for Insulation Coordination-Part 2, Application Guide. The document has been sent to the IEEE for processing and balloting.

7.3.6.2 Surge Protection Devices - Bob Degeneff

No Report.

7.3.6.3 IEC TC14/WG24 - Loren Wagenaar

IEC 76-3, meeting last September of the Technical Council, several changes to final documents.

- One hour test for transformers 345 kV and above, below 345 kV, the test duration will be thirty minutes. The reasoning for this is that it may be harder to remove moisture on larger units and a PD (partial discharge) problem may show up later in the test.
- The Working Group's next project is IEC 722, the Guide for Transformer Impulse Tests. This corresponds to C57.98, which has recently been re-affirmed. An electronic version will be compiled.
- The next meeting of WG24 will be in June in Nijmegen, The Netherlands.

7.3.7 Old Business

7.3.7.1 Voltage Test Levels for 735/765 kV Transformers - Loren Wagenaar

A survey on Table 3 and 5 of C57.12.00, Test Levels for 765 kV Transformers was sent to the Dielectric Test Subcommittee in March. This change had placed 735/765 kV (Nominal System Voltage) on one line. The survey suggested that it be two lines or categories:

1. 735 kV - 1st Category
2. 765 kV - 2nd Category

With the appropriate test levels for each category based on what is currently used by users of these voltage class transformers. Hydro Quebec specifies 735 kV Nominal with 1950 kV BIL, one hour level at 750 kV Enhancement Level of 850 kV. It was decided to use these levels for the 735 kV category as a separate line. Table #3 will also be changed to reflect this. This change will be included in the next ballot of C57.12.00.

7.3.7.2 Factory Dielectric Tests on Repair Transformers - Mark Perkins

Have revised the second paragraph of Clause 10.1.8 in C57.12.90 with updated wording which will be included in the survey ballot. This item is complete and will be dropped from old business.

7.3.7.3 Low Frequency Test Voltages - Phil Hopkinson

- Recommendations have been made for revision to Table 3, 4, 5 and 6 of C57.12.00. These will be considered and a Working Group level and will be assigned by the Subcommittee to work on these Tables. This matter will be discussed at the next meeting of the Subcommittee.
- C57.12.01 Standard General Requirements for Dry Type Distribution and Power Transformers Table 3a and 3b. The relationship between low frequency tests and Nominal System Voltage had changed over the years and were currently being tied to BIL. Since BIL is typically selected based on impulse exposure level, this does not make sense. Table 3a and 3b of C57.12.01 have been combined into one table and re-structured with Low Frequency Test and Nominal System Voltage now related. These changes have been approved for C57.12.01 and the changes which now need to be incorporated into C57.12.00 and IEC 76-3. A copy of the new Table 3, C57.12.01 was received.

7.3.8 New Business

7.3.8.1 CIGRE/PSIM Work on Waveforms and Test Data Generator Program - Bertrand Poulin and Ernst Hanique

This CIGRE/IEC Working Group is working on two tasks:

- Establishment of new waveforms for impulse tests
- Build a TDG program (Test Data Generator)

The TDG program was originally developed with 16 fixed standard wave shapes, no transformer wave shapes included. The new version will have transformer wave shapes included. These will be with inputs on wave shapes from European manufacturers. The IEEE Transformer

Committee should participate in North America for transformer wave shapes to be included. The TDG will be ready in October 1998, with the European transformer wave shapes. The Chairman believes that the Dielectric Test Subcommittee should be involved in gathering this type of information. The Subcommittee will send a liaison member to participate in the upcoming meeting.

A few issues were then discussed concerning the evaluation of the TDG program by participants and system compatibility.

This matter will be referred to the Working Group.

Liaison has been set up with PSIM, Ernst Hanique and Bertrand Poulin will represent the Dielectric Test Subcommittee.

7.3.8.2 Comments on C57.12.90

- Test Sequence

A discussion was held on the sequence of dielectric test with the following concluded: Full wave impulse always conducted before low frequency tests. Switching surge also before low frequency tests. The induced test should be the last dielectric test conducted.

7.3.8.3 IEEE 4

- DTSC has not reviewed IEEE Std 4-1978 (1995). The Chairman requested a small group to review the changes to IEEE Std 4 since 1978. A. Molden will bring the changes to the next meeting. B. Poulin will also review and report. These changes will then be reviewed by the Subcommittee and referred to the Working Group Chairs.

A brief discussion on standard dielectric test sequence currently used and specified was held.

The meeting adjourned at 11:35 a.m.

7.4 Distribution Transformers - K. S. Hanus, Chair

7.4.1 Chair's Remarks & Announcements

The meeting convened at 2:00 PM in the Fulton room with the introduction of the members and guests and signing of the attendance roster. There were 26 members and 23 guests in attendance. Minutes of the meeting in St. Louis, MO were approved with no changes.

The chairman covered key points of the ADCOM meeting from the evening before. See Clause 4.0 for details.

New Working Group Co-Chairs are:

Jerry Smith - Electronic Data Transmittal

Al Traut - C57.12.23 Single Phase Submersible

Roger Lee - C57.12.23 Single Phase Submersible

7.4.2 Working Group Reports:

7.4.2.1 Small Power Transformers

This was first meeting of The Small Power Transformers Working Group. There were 39 attendees, of which, 22 requested membership. The purpose of this first meeting was basically to establish the scope of the proposed new standard.

The discussion during the meeting covered a wide range of thoughts as to what the definition of a Small Power Transformers should be and what should be included in this standard. There was general agreement in a number of areas as it relates to defining the scope of the standard. However, it was agreed that these areas would be included in the minutes and disseminated to the attendees for further thought. The general agreements are as follows:

- kVA range 10 mVA
- primary voltage 69kV class
- secondary 34.5 kV class
- single stage cooling
- substation type
- switchgear
- cover and wall mounted bushings
- LTC and Non-LTC applications

There was some discussion about the inclusion of padmounted transformers whose rating exceed the present standards scope (480 volt secondary and 2500 kVA). It was agreed that this could better be dealt with by extending the present padmount standard.

The attendees expressed the desire to have more NEMA participation in the process in creating this standard, in particular the NEMA Secretariat.

The chairman asked for feedback on IEC standards or other standards that the new document should be coordinated with.

The attendees agreed not to prepare a PAR for this new standard at this time, but wait until after the Mexico meeting to do so.

Hopefully, by that time, all input will be received for a more complete definition of the document scope. All are encouraged to submit the input to the chairman.

7.4.2.2 C57.15 Voltage Regulators

The working group did not meet. The document has been submitted to IEEE to form a balloting group with balloting to follow.

7.4.2.3 C57.12.20 Polemount Transformers

The working group convened with 21 members and 20 guests.

The working group reviewed the status of the draft IV dated February 1993 which has been approved. The document is at the printers and will be available soon. Glenn will make sure all WG members receive a complimentary copy.

The working group then proceeded to discuss the current draft 3.

Mark Loveless reported on the re-organization of the figures. He handed out a proposed organization of the tables and figures into 3 sections - "General Details Common to 1 & 3 Phase Units", "Details for Single Phase Units" & "Details for Three Phase Units". The group accepted the proposal and it will be incorporated into the document.

Ken Hanus discussed the progress in resolving the "Type C" hanger problem. It was determined the reference to a MIL spec in the current document is not valid anymore. The group talked about several solutions and came to a proposed solution which consists of a requirement which defines the interface between hanger bracket and the pole (or whatever you are bolting the transformer to) and a safety factor for the strength requirements. This would allow the manufacturer to connect the hanger bracket to the transformer in any way they wanted as long as they met the safety factor.

Glenn Andersen briefed the WG on the results of his survey regarding surge arrester mounting bosses and specifying locations. From the results it appeared a standard spacing was achievable. Glenn is to survey the manufacturers again to collect further information so a final proposal can be prepared.

The working group briefly discussed including functional gasket requirements in the document. There was not enough interest indicated by the members so the issue will have no further action.

Lastly the WG discussed including cover dielectric specifications in the document. After discussion it was realized there is a great variance in the requirements from the different users. Also it was realized even if a value could be reached, the defining of a test method would be very complicated. The working group decided to survey EEI members to collect further information on this subject.

7.4.2.4 C57.12.25 Single Phase Deadfront Padmount Transformers

The working group met with 11 guests and 30 members present.

The working group reviewed the minutes of the last meeting and the numerous changes contained within it relating to draft 7, which was handed out at the meeting.

Mark Loveless presented a review of the tank pressure withstand requirements in the document. It was concluded the current requirements were still valid and no changes were needed.

The working group reviewed a survey of users which purchase units built in accordance with figure 2B. The result was the figure is still valid and no change is needed.

The working group also discussed the matter of showing metric dimensions in the document. After discussion it was determined an effort was needed on a subcommittee level to come up with uniform guidelines.

Draft VII was unanimously approved by the working group and will be forwarded to the IEEE as soon as a balloting group has been identified.

7.4.2.5 C57.12.34 Three Phase Padmount Transformers

The working group met with 24 members and 16 guests present.

Minutes of the St. Louis meeting were approved. Draft 2 of the document was handed out.

The working group discussed the issue of the correct number of secondary terminal holes on 1500 kVA units with a 480 volt secondary as shown in figure 13. The WG agreed this unit should have a 10 hole spade.

The group looked at two proposals addressing the issue of impedance values for units up thru 500 kVA. After much discussion it was agreed the chart in 5.0 would contain nominal values. The word "Nominal" was added to the title of 5.2 and the word "nominal" was added to the second column heading.

The following impedance values were agreed upon as follows:

KVA	Nominal Impedance
75	1.10 - 5.75%
112-300	1.40 - 5.75%
500	1.70 - 5.75%

WG members were asked to review the Draft 2 and return any comments within 60 days.

In new business the Small Power WG recommended the expansion of this document to include sizes above 2500 kVA up to 10 Mva and secondary voltages up to 15 kV in the next revision of the document.

7.4.2.6 .33 Guide for Evaluation of Losses in Distribution Transformers

The meeting convened at 2:50 PM on Monday, April 28, 1997, with co-chairman Don Duckett of Florida Power presiding. There were 27 working group members and 21 guests who signed the attendance sheet.

John Borst, ABB, provided an excellent summary of the current initiatives and time lines of the Department of Energy actions on the proposed efficiency regulations on Distribution Transformers mandated by the Energy Policy Act of 1992. Summarized, a Notice of Proposed Rulemaking on the 1st step, i.e., defining Testing Procedures, will be published by November of 1998 with adoption expected in 1999. A review period will follow with adoption, if required, of Distribution Transformer Efficiency standards expected by 2002 or 2003, possibly no later than 2004.

NEMA is looking for approval of TP-1 as an ANSI standard to better improve it's chances of either becoming, or strongly influencing, the anticipated DOE regulation. The Distribution Transformer Loss Evaluation Guide being developed by this working group is viewed as a companion document to provide definitions and a methodology that can be used to determine and specify the value of losses when users need to go beyond the minimum efficiency tables in

NEMA TP-1, or the future adopted DOE levels. References to both procedures are being added to each document.

Draft 5 of the Loss Evaluation Guide was passed out to the working group and a general poll of the working group indicated that it should be sent out this spring for final review and comment prior to a ballot of the Transformers Committee later this summer after final resolution of the PAR issues in June.

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

.29 Padmount Enclosures-Coastal Environments - The document has basically one minor issue to be resolved concerning the dimension of the probe tip, either a 0.100" or 0.065" dimension. Once the dimension is resolved the document will be submitted to NEMA for publication.

.28 Padmount Enclosures- Same report as above for .29.

.31 Polemount - The document has been balloted, approved and released for publication. Currently the document is in the publication process.

.32 Submersibles - The document will require minor changes to referenced standards and will be re-affirmed as its 5 year cycle is coming up for renewal.

7.4.3 New Business

The SC discussed the need for a uniform guide concerning converting English values to Metric values in the various documents under the subcommittee. Apparently there are several IEEE/ANSI/CSA documents which address this. The SC chair will work with IEEE staff to develop a guideline for the WG chairs to follow. This will promote uniform changes.

Tom Pekarek found an item of possible concern in the ballot for C57.12.00/D3, specifically the tolerances on losses. It appears the requirement for No Load and Total Losses for the average of all units (on an order of 2 or more units) not to exceed the specified losses was removed from the document. For units purchased in large quantities the document as written would allow a manufacturer to ship all units with the 10% and 6% tolerances. John Borst stated the intent behind dropping out the requirements for average losses was because it was felt this was a contractual issue between the user and the manufacturer on how to deal with loss guarantee's. If a re-circulation ballot is sent out, persons should consider if they want to change their vote.

The SC discussed the issue concerning NEMA TP-1 and it's interaction with the .33 document. It was suggested to take the information in TP-1 and roll it into the .33 document. Concern was noted that this may slow the progress of the document since it is ready to go out for ballot. It was suggested to do this on the next revision. The decision whether to proceed or not will be looked at based on the outcome of the ANSI C57 meeting.

7.4.4 Working group assignments

The current assignments are as follows:

Small Power	Leon Plaster
.20	Glenn Andersen / Alan Wilks
.21	Ali Ghafourian
.22	Ken Hanus
.23	Al Traut/Roger Lee
.25	John Lazar / Ali Ghafourian
.26	Ken Hanus
P1388	David Rollins/Jerry Smith
.33	Tom Pekarek/Don Duckett
.34	Clyde Pearson/Ron Stahara
.35	Ed Smith
57.15	Tom Diamantis/Craig Colopy

The meeting adjourned at 2:50 PM.

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

7.5.1 Chair Remarks and Announcements

The Dry Type Transformer Subcommittee met at 10:55 AM on April 28, 1998 with 17 members and 5 guests present. Due to the absence of the chair Wes Patterson, subcommittee secretary Charles Johnson chaired the meeting. Introductions were made and the attendance roster was circulated. Minutes from the November 18, 1997 meeting were reviewed and approved. Announcements were held until after the working group reports were given.

7.5.2 Working Group Reports

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

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

7.5.2.1 Working Group on Dry-Type Specialty Transformers - P259

Chair: Mr. William Simpson

1. WG259 met at 10:55AM on Monday, April 27, 1998 in Caraway II Room of the Excelsior Hotel/Statehouse Convention Center in Little Rock, Arkansas. There were six members and four guests present; Dhiru Patel of Hammond Manufacturing requested membership.
2. Introductions were made and the minutes of the November 17, 1997 meeting in St. Louis, Missouri were approved as written.
3. The Chairman noted that P259 was revised to include editorial corrections as agreed to in the St. Louis meeting and the requisite paperwork was prepared for submission to REVCOM.
4. IEC/TC 98 Liaison Report: IEC Std. 61857, "Test Procedure for Thermal Evaluation of Electrical Insulation Systems," was approved and is being circulated as a FDIS (Final Draft International Standard); it is recommended that USTAG's, e.g., TC 14, submit New Work Proposals to include test models/test specifications per IEEE Std.259 and C57.12.56 as additional parts to IEC Std. 61857.
5. As there was no new business, the meeting was adjourned at 11:15AM.

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

Chair: Mr. Anthony Jonnatti

Secretary: Mr. John Sullivan

The Working Group met in the Arkansas Excelsior Hotel in Little Rock, Arkansas on April 27, 1998 with 12 members and 16 guests present. The introductions were made and the minutes of the St. Louis meeting were approved.

The Working Group was questioned about member addresses as some ballot mailings were returned.

Results of the Transformer Committee ballot were discussed. 92% of the ballots were affirmative. There were 6 negative ballots. Of those, REVCOM questioned the handling of one negative ballot and would not approve the standard pending its resolution and other changes noted. Chairman Tony Jonnatti made the requested changes and resubmitted the standard for approval. The chair also submitted a new PAR for C57.12.01. This will entail a total revision of the standard.

A number of agenda items concerning revision items were then discussed.

It was determined that C57.12.50 and C57.12.51 should not be combined with C57.12.01. The former standards are product specific and the latter is a general standard.

The revision of Tables 3A and 3B was continued from the St. Louis meeting with a discussion of Phil Hopkinson's and Max Cambre's proposals. The discussion centered around the full wave test for low voltage windings. Hopkinson proposed a fast 0.5 x 1.5 μ -second wave instead of a 1.2 x 50 μ -second full wave impulse. Cambre's proposal eliminated a full wave test for low voltage windings. A voice vote was taken on Hopkinson's proposal. The determination was to continue the discussion at the next meeting.

A note to the table – low frequency insulation level is coordinated with nominal voltage, not BIL was discussed. The note will be included in the future discussion of the table.

Wes Schwartz and Gene Morehart will be devising a way to include 600 volt General Purpose Transformers into this standard. Their recommendation is due for the next meeting.

The chairman noted that the 80 °C rise Dry-Type Transformer is now a 90 °C transformer. This coordinates with IEC.

Test accuracy requirements were discussed by the chairman. It was pointed out that a +/- 1% tolerance with thermocouples was impossible and that +/- 2% is adequate.

The need to update the standard reflecting newer surge arrester technology was pointed out. Improved protective margins with metal oxide surge arresters need to be noted.

The issue of revising the sound level table will be included in the next revision. However, if REVCOM does not approve the present submitted standard, the sound level issue will be addressed at the next meeting.

It was proposed that the toxicity issue of combustion by products from Power-cast transformers undergoing internal arcing be addressed in this standard. It was felt by the Working Group that CENELEC addresses the issue and C57.12.01 does not need to.

Similarly, the Working Group decided that the issue of BIL rating for 25 kV grounded Wye and 25 kV Delta was already addressed by the standard.

The remaining comments from the balloting group will be tabulated and mailed to the members.

Jeewan Puri requested that the sound levels proposed in the standard be reviewed by his Working Group on sound. The chairman indicated he had no objection to this suggestion.

With no new business, the meeting adjourned at 4:05 PM.

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

Chair: Mr. Richard Dudley

On April 27, '98 the Dry Type Reactor W.G. met from 8:00 a.m. - 9:15 a.m. in the Quapaw Room and from 9:30 a.m. - 10:45 a.m. in the Caraway II Room of the Excelsior Hotel in Little Rock, Arkansas. There were 8 members and 1 guest present. The following are the highlights.

1. The attendance list was circulated.
2. The minutes of the St. Louis meeting were approved.
3. D6 of the HVDC smoothing reactor standard was discussed; the focus was on major issues. The Chairman requested that comments of an editorial or clarification nature be handled by written input.
 - (i) Pierre Riffon submitted written comments to D6. The Chairman will incorporate these into D7 which will be prepared prior to the meeting in Guanajuato, Mexico.
 - (ii) The impulse type test was discussed at length. Key points are as follows:
 - In the case of dry type smoothing reactors, is the air portion (external) of the winding insulation system restoring or non self restoring in nature? i.e. Is the dielectric withstand probabilistic in nature? A good insulation system design will not be probabilistic in nature. As is the case for all equipment installed outdoors, in-service factors can affect dielectric withstand. Can these be addressed by applying more "shots" in test or specifying more margin for insulation coordination? Practice appears to result in lower insulation coordination margin in HVDC systems vs AC systems.

- For the lightning impulse type test it was agreed to incorporate a RECOMMENDED procedure and an OPTIONAL procedure. In the case of the RECOMMENDED procedure it will be "Procedure C" of IEEE Std. 4 consisting of 3 shots of positive and negative polarity applied to each terminal. If a flashover occurs then nine shots of that polarity are applied; no additional flashover is allowed. It also must be demonstrated that the flashover did not damage the winding. The OPTIONAL procedure will be "Procedure B" in IEEE Std. 4 and will consist of 15 shots of positive polarity applied to each terminal; 2 flashovers are allowed. Again, it must be demonstrated that the flashover (if one occurs) has not damaged the winding. A separate test code will be maintained for oil immersed and dry type SMRs; test philosophy will be consistent.
- It was noted that SMRs for HVDC seldom see a lightning surge in service; overvoltages due to ground faults and commutation failures are more common. Such overvoltages are lower in magnitude.
- It was noted that 3 shots of each polarity from each terminal is statistically significant.
- Bushings used on oil SMRs are tested on their own per IEEE STd. 4; 15 shots.

(iii) The switching impulse test was discussed. Switching impulse performance is deemed important but obtaining the required wave shape of 100 μsec front, 200 μsec at over 90% of required crest, and 1000 μsec to the first zero crossing is probably not possible for any lab in existence today. The following are key points discussed.

- Actual in service wave durations may be up to 10,000 μsec; especially for long cables.
- Some typical achievable wave shapes for a 200 kjoule generator are:

200 mH	150 μsec (zero crossing)
1000 mH	400 μsec

For a 400 kjoule generator (IREQ) the tail will increase by a factor of 2. Note doubling the inductance of the test object will increase the tail by a factor of $\sqrt{2}$.

- BIL levels are less than 10% higher than SIL levels.
- For a switching impulse applied across the winding of a dry type or oil immersed SMR, it is impossible to obtain the required wave shape. For this reason, the switching impulse across the winding of a SMR should be classified as "OTHER". The number of shots will be as defined for the lightning impulse test.
- For the switching impulse test to ground there is no difficulty in obtaining the required wave shape (as opposed to the switching impulse across the winding where it

- is almost impossible). In the case of dry type SMRs, it is a test of the support insulators and since they constitute a self restoring insulation system, the test should consist of 15 shots of negative and positive polarity on a 15/2 basis.
- (iv) All references re bushings should be to C57.19.03 e.g. Subclause 12.5.1.2.3.
 - (v) In general, equipment specification requirements should not be mixed with insulation coordination practice; the two should be treated separately.
 - (vi) Section 6.6.1 will be modified and a note added to Table 5b re the effect of operating temperatures on the dielectric capability of dry type SMRs. The temperature of the cooling air may have an effect on the dielectric capability (impulse). The manufacturer, when requested, should demonstrate that the SMR dielectric strength is adequate for in service operating temperatures (cooling air). This factor can also be addressed in the specification. It is not possible to carry out dielectric tests at operating temperatures. Klaus Papp will supply some sample calculations prior to the next meeting.
 - (vii) The “AC Power Test Across the Winding With Partial Discharge Measurement” was discussed for oil SMRs. The basic issue is that there will be no p.d. even if there is damage to the turns insulation. Measurement of Q factor or losses at harmonic frequency is more appropriate. This test is equivalent to the “60 Hz Power Test” for dry type SMRs. The purpose is to verify winding insulation system integrity after all dielectric tests are completed. For loss guarantee purposes the harmonic losses will still be calculated for oil SMRs. The Q factor or losses at harmonic frequency will be measured at the beginning of the test sequence and these values will be compared to those measured during the “AC Power Test”; relative values vs absolute value. It should be noted the test voltage for this test is based on the ripple voltage in service which has typically a peak value of 8-10% of rated dc voltage.

The meeting adjourned at 10:45 a.m. The Chairman agreed to include all changes in D7; to be prepared prior to the Guanajuato meeting.

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

Chair: Mr. Michael Haas

The Working Group met at 9:30 AM in the Lasalle Room of the Excelsior Hotel in Little Rock, Arkansas with 10 members and 8 guests present.

After the introductions, the minutes of the St. Louis meeting were approved as written.

Following the approval of the minutes, the chairman reported on the results of the survey of Draft 2 sent out to the Working Group and the Sub-Committee. It was reported that of 48 ballots sent out, only 16 were returned. Of the 16 ballots returned, five were “Approved with comments”, 10 “Approved”, and 1 was “Negative”. The chairman said that he was incorporating all of the comments, including the comments on the negative ballot, into Draft 3. He reported that he would try to make all of these changes and submit the document to IEEE for balloting by 6/98.

There being no further business, the meeting was adjourned.

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

Chair: Mr. Dave Barnard

Secretary: Mr. Tim Lewis

The Working Group met at 8:00am in the Excelsior Hotel with thirteen (13) members and ten (10) guests.

Introductions were given and the minutes of the St. Louis meeting were approved.

Under old business, Mark Rivers of Dolby gave comments pertaining to NETA specifications.

Afterwards, this group discussed the power factor rating of 2% for Dry-Type transformers and 5% for Distribution transformers. Comments made were:

- 1) A formal paper would need to be written and have a peer review before acceptance.
- 2) A limit will depend on insulation or insulation system used, temperature, construction, etc.
- 3) At this time, no values for power factor will be used in C57.12.91.

Regarding a reference temperature for core loss measurements, Don Kline stated that the NEMA standard TP-1 uses $20^{\circ} \text{C} \pm 10^{\circ}$ for reference. The consensus of the working group was to also use $20^{\circ} \text{C} \pm 10^{\circ}$ for C57.12.91.

Being no further new business, the meeting adjourned.

7.5.2.6 Working Group on Dry-Type Hot Spot Differentials

Chair: Ms. Paulette Payne

The Working Group met at 8:00am in the Caraway II Room of the Excelsior Hotel with fourteen (14) members and nineteen (19) guests.

The minutes of the November 18, 1997 meeting were approved as written.

The Chair reminded members of their obligation regarding attendance and participation, and that she would be reviewing participation to take necessary action to remove inactive members.

The Chair gave results of Draft 1.4 balloting:

- 49 ballots sent; 37 ballots required for a 75% return
- 31 ballots received (includes 1 received after the meeting)
- 20 approved
- 9 approved with comments (includes the ballot received after the meeting)
- 1 negative
- 1 abstention.

The Chair stated balloting remains open until receipt of 75% ballot return, or 60-day extension (May 26, 1998). If a valid ballot is not achieved, comments received will be incorporated and the revised Draft balloted. If a valid ballot is received, the changes to Draft 1.4 will be balloted in a revised Draft.

Working Group discussion focused on substantive comments of balloters, **as all editorial comments are being incorporated into the next Draft.**

1. Annex B, Clause 2.0 *Hot Spot Location*: David Barnard's comment was that the hottest spot temperature might not be in the duct. Richard Dudley, the author of the Annex, stated that the basis of its development was reactors. As transformer manufacturers concurred the duct may not be the hottest spot temperature location; **the clause will be revised. Editorial comments provided by Lin Pierce on Annex B will also be incorporated in the Draft.**
2. Clause 4.0 – *Temperature Measurement*: Lin Pierce commented that the reason for his negative vote being only surface temperature measurement is addressed; it is not a true measure of winding hottest spot temperature. Richard Dudley stated that surface temperature measurement saves tests cost. It was agreed that the text would be revised to include both winding temperature and surface temperature measurement, the latter, requiring the differential temperature to the winding to be known. **The Chair will revise the text, accordingly.**
3. Clause 5.4.2.1 and Note: Gene Morehart, Timothy Lewis, Sheldon Kennedy and Dick Weddleton commented that 100-300 sensors are too many. Lin Pierce gave the basis for the range of sensors as for developing a comprehensive mathematical model. Chuck Johnson related experience of 100 – 150 sensors required for modeling. Wherein the manufacturer has a proven model giving indication of the vicinity of hottest spot locations, fewer sensors may be required. From the ensuing discussion, the number of sensors required is dependent upon size and experience with the model. The Working Group members voted unanimously to

change the note as follows: “Approximately 25 – 300 sensors for qualifying a prototype transformer, depending on transformer size.”

4. *Introduction:* Lin Pierce expressed concern that the first two paragraphs are not precisely correct as hot spot allowance is not specified in the Standards, but is derived, and the paragraphs would not be applicable after revision of C57.12.01. Phil Hopkinson commented that the information is of historical significance providing basis of hottest spot temperature limits. **Lin Pierce agreed to revise the paragraphs.**

5. *Clause 5.5 Thermal Test - Production Units:* Lin Pierce commented that this section could mislead the user, as testing of production units is not practical. It was unanimously agreed by the members to **remove this clause in its entirety** due to impracticalities of making such measurements on production units.

The Chair entertained any other comments. Being none received, and no further business, the meeting adjourned at 8:40am.

7.5.3 Announcements and New Business

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

The chair commented on the responsibility of working group members to return ballots in a timely manner. Len Pierce also addressed the issue of chronically late ballots.

Richard Dudley discussed issues raised at the ADCOM meeting.

Don Kline informed the working group about the upcoming IEC meetings in Houston Texas on October 19 – 21 1998.

Being no further new business, the meeting was adjourned at 11:42 AM.

7.6 HVDC Converter Transformers & Smoothing Reactors S. C. - W. N. Kennedy, Chair

The HVDC Converter Transformers and Smoothing Reactors S.C. met in the Quapaw Room of the Excelsior Hotel on April 27, '98 from 2:50 p.m. to 4:10 p.m. in Little Rock, Arkansas. There were 5 members and 1 guest present. The following are the highlights.

1. The minutes of the St. Louis meeting were approved.
2. The attendance list was circulated and is attached.
3. The status of the converter transformer standard was updated; pending successful final ballot it will be submitted for the next suitable meeting of the IEEE Standards Board. Reballoting was necessary to include proper reference to C57.19.03; the standard for bushings for DC application.
4. D6 of the SMR standard was reviewed with an emphasis on inputs from Lars-Erik Juhlin. The following are the highlights.
 - (i) Harmonic loss (Q factor) measurements made prior to dielectric testing will be used to arrive at the effective DC test current level for the temperature rise test.
 - (ii) Note (7) of Table 5b will be augmented to include more insight into the ability of a dry type SMR to withstand a switching surge applied across the windings under wet conditions. Since a proper wave shape cannot be obtained for the switching impulse test, there is no point in doing this test wet. Dielectric performance under wet conditions should be verified based on agreement between purchaser and manufacturer. Lightning impulse tests under wet conditions have been carried out on prototype windings; but lack the effect of a long tail. The capacitor discharge (OTHER) test could be done wet. Section 12.9 describing this test will also include a discussion on performing it under wet conditions.
 - (iii) Clause 5.2.1 dealing with unusual temperature conditions will be rewritten. Since SMR's cannot be derated (current) the temperature rise must be modified to meet site ambient operating temperatures. IEC 76.2, Clause 4.3 will be adopted.
 - (iv) Clause 5.2.2.2 will be rewritten to be in line with IEC 76.2; the temperature rise of a SMR must be reduced to meet high altitude requirements and not the current rating. Current rating for a SMR is fundamental.
 - (v) Clause 5.2.3 ("Loading At Other Than Rated Conditions") will be modified; specifically the second paragraph.

"If the smoothing reactor is to be operated at various loading conditions (DC plus harmonics), these conditions must be included in the specification for the smoothing reactor."
 - (vi) In Clause 5.2.4 ("Unusual Service Conditions"), subclause (ii, dripping water will be removed as it is not applicable to HVDC SMRs. ANNEX B will also be referenced re additional information on pollution.

(vii) Clause 6.4.1 (“Incremental Inductance”) will be written.

“A minimum value of inductance must be maintained over the range of direct current and harmonic current (at harmonic frequency) superimposed. The value of inductance is important to limit the amplitude of fault current. For oil immersed iron core smoothing reactors the inductance must be defined as the incremental inductance from zero up to maximum peak surge current. The rated inductance is the incremental inductance at rated d.c. current. In the case of dry type air core smoothing reactors inductance is constant; linearity is inherent.”

(viii) The contents of LEJ’s Fax of Oct. 31, ’97 will be included in D7.

(ix) D6 will be the basis for discussion at the next meeting or possibly a modified D6.

The meeting adjourned at 4:15 p.m.

Richard F. Dudley

7.7 Instrument Transformers - J. E. Smith, Chair

7.7.1 Chair's remarks & Announcements

The subcommittee met on April 28, 1998 with 7 members and 6 guests present.

Three of the guests requested membership.

- The dates and locations for future meetings were announced
- The minutes of the Nov 18, 1997 meeting were approved as written.

7.7.2 Working Group Reports:

7.7.2.1 WG C57.13.5 - Working Group on Test Requirements for High Voltage Instrument Transformers 115 kV and above – Pierre Riffon

The WG had two sessions. It met on April, 26 and April 27, 1998. Six members and 14 guests attended the meetings. Two guests requested membership. The meeting was chaired by Mr. P. Riffon since Mr. J. Ma was not able to attend the meeting.

The minutes of the St-Louis meeting were approved.

The preliminary draft (Ed. 15.03.1998) on Trial-Use Guide of Test Requirements for Instrument Transformers Rated 115 kV System Voltage and Above was discussed. The meeting was focused on the routine and type testing procedures and flowcharts.

A) The outstanding points for routine tests were:

- A DGA test should be included at the beginning of the routine test sequence. This DGA test before routine tests may be useful to judge the possible degradation of the insulation system during routine tests. Nevertheless, this oil sampling before routine tests shall not be mandatory. If not performed before routine tests, the gas content before test is deemed to be below the acceptance levels;
- The "Open circuit secondary voltage magnitude test" shall be moved before the dielectric tests on the secondary winding(s);
- The "Verification of terminal markings and Polarity" shall be moved at the start of the test sequence;
- Some participants raised the point that Lightning impulse tests as a routine test should be limited only to Instrument Transformers rated 230 kV and above. After discussion, the majority of the participants did agree that the lightning impulse tests as a routine test shall be required for Instrument Transformers rated 115 kV and above;
- The majority of the participants were against the use of chopped-wave tests during the lightning impulse routine test sequence. Some other participants questioned the fact that the number of required impulses is too high. After discussion, it seems that a reasonable compromise would be to use Procedure A of IEEE Std.4-1995 which involves 3 full impulses of negative polarity;

- Some participants questioned the fact of performing capacitance and dissipation factor at high-voltage (rated voltage and maximum rated voltage). It seems that some manufacturers do not have the test set-up to perform such a measurement. As for the bushings, and as required by IEC, the measurement at high-voltage is very important to detect a possible breakdown of the insulation system after dielectric tests. Doing only a measurement at 10 kV (Doble test-set) is not enough to detect possible damage to the insulation system. This point still has to be discussed in the next meeting;
- The text related to the applied voltage test and partial discharge test needs to be improved since it seems that the proposed text is not clear enough for instrument transformers rated 230 kV and above;
- The waiting time for the sampling of the oil after routine tests should be oil-volume and insulation thickness dependent. Some participants raised the point that for small units (e.g 115 kV to 230 kV), the waiting time could be shorten (e.g 48 hours instead of 72 hours);
- The text for the sealing test shall be improved in order to explicitly says that all proposed methods are deemed to be equivalent. The actual text is not clear in this respect. Other manufacturers are welcome to send other proposals to J. Ma;
- The value of the maximum quantity of dissolved gas after tests shall be reviewed. The hydrogen content shall be raised from 15 p.p.m. to 20 p.p.m. The water content seems to be too high. A value around 5 p.p.m. would be more appropriate;

B) The outstanding points for the type tests were:

- The mechanical test shall be moved before the dielectric tests since it may cause damage the insulation system;
- The mechanical stresses produced during transportation should be addressed. A general paragraph can be added to the existing draft that mechanical tests representing transportation stresses may be required as special test(s). The methodology used shall be agreed upon the end user and the manufacturer. These tests may include shaking table tests with the unit in horizontal position or road tests;
- A routine accuracy test shall be added prior to the test sequence. This seems to be a good tool to detect any damage on the core or winding.
- The applied voltage test together with the partial discharge measurement shall be added in the type test flowcharts;
- A sealing test shall be added to the VT type test flowchart;
- The "secondary open circuit voltage withstand test" shall be only limited to the current transformers having an open secondary voltage at rated current exceeding 3500 V peak. For all current transformers having open secondary voltage equal to or less than 3500 Volts peak, the open circuit withstand capability is deemed to be demonstrated by the "open circuit secondary voltage magnitude test".
- The Temperature Rise Test, the Short-Circuit Withstand test and the Secondary Open Circuit Voltage Withstand Test shall be withdrawn from the type test flowcharts. These tests may be

performed at any time if the complete routine test sequence is performed after these individual type tests;

- The quantity of allowable hydrogen before tests, as shown in table 8, seems to be too low. A value of 10 p.p.m. would be more appropriate;
- The participants were not in favor to perform the impulse tests (lightning and switching) with only one of the secondary terminal pair(s) grounded. We had a general consensus that all secondary windings during impulse tests shall be short-circuited and grounded as the actual worldwide practice. The lightning impulse tests with open terminals, as proposed in the draft, may be added in the group of "Special Tests".
- The reduced full-wave amplitude should be between 60-70%;
- The chopped-wave tests shall be done after the first full-wave shot. Then, the fourteen remaining shots shall be carried out after the chopped-wave tests;
- The number of external flashovers during lightning impulse tests and switching impulse tests shall be equal to or less than 2 per series of 15 consecutive impulses;
- The comparison of the wave shape during chopped-wave tests shall be done up to the chopping instant. After chopping, it is recognized that the comparison of the waveshape is difficult to achieve since the chopping time may vary for one test to the other;
- The chopped-wave tests shall be limited to negative polarity only;
- The wave-shape for Switching impulse tests shall be the standardized waveshape (e.g. 250/2500 μ s);
- The Switching impulse tests under wet condition shall be performed in both polarities;
- The terms "There is no detectable noise..." should be changed for "there is no audible noise...";
- The duration of the partial discharge measurement has been discussed. Some participants pointed out that a measurement similar to IEC (reading 30 seconds after the pre-stress level) is meaningful while other feel that a longer duration (e.g. 1 hour as for the type tests on bushings) can also be useful. Some other participants feel that the actual text is fully appropriate (test duration up to 5 minutes) This matter still has to be discussed in the next meeting since the meeting adjourned before we had time to conclude on this subject.

C) General concern

- All participants agreed that a flowchart is a good tool to use in order to determine the test sequence to be performed. Nevertheless, some of the tests do not need to be performed in sequence as shown in the flowcharts. These tests shall be clearly identified by a note in order to give more freedom to the manufacturers.

7.7.2.2 Working Group on C57.13 Revision - Tom Nelson

The working group met on April 28, with 17 members and guests present. A draft copy of the standard was not ready before the meeting, but will be circulated before the next meeting. A request for an extension to the PAR will be submitted by Jim Smith, since it will otherwise expire this year.

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

The working group met on April 28, with 16 members and guests present.

Old Business

Approval of minutes, St Louis, MO

New Business

The draft guide of C57.13.6, circulated for review at the St. Louis meeting, received no feedback, positive or negative. The document was re-issued to the group and the key reasons for the proposed standard were reviewed:

- The standard reflects commercially available performance
- Alignment of instrument transformer test point with meter light load test point (1/4 A)
- Range of allowed instrument transformer error in closer agreement with electronic meter

An error was found in Table 2 – the resistance and impedance for Burden E-0.02 was changed from 0.02 to 0.04.

An informal polling of the group indicated that a survey could be taken with favorable results. This will be accomplished before the next meeting.

7.7.3 Old Business

C57.13.2 will be re-balloted. 60% were returned with zero negative ballots. It will be re-sent to a new pool. Those who did not respond previously will be removed from the pool.

7.7.4 New Business

- J Smith agreed to determine the ownership of the CVT Std. C93.1
- The subject of terminal loading was discussed – all members will come to the next meeting prepared to discuss further and possibly to form a WG.

7.8 Insulating Fluids - F. J. Gryzkiewicz, Chair

The Insulating Fluids Subcommittee and its Working Groups met concurrently in Little Rock, AR on Monday and Tuesday, April 27 and 28, 1998. In attendance were 22 members and 62 guests. Five of the guests requested Subcommittee membership.

The Subcommittee minutes of the November 17 and 18, 1997 meeting in St. Louis, MO were approved as submitted.

7.8.1 Current Subcommittee Projects

7.8.1.1 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

The WG Chair was not able to attend the Little Rock meeting, so there was no formal meeting of this WG. It was reported that all negative ballots resulting from Draft 11 of this document have been resolved. Draft 12 will be prepared shortly for Invitation to Ballot.

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

There was no formal meeting of this WG. Draft 9 of this document has been sent to IEEE Headquarters for Invitation to Ballot.

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

The WG Chair gave a brief background on this project, and stated that the PAR for the revision has been approved. It was agreed that the document should include a discussion on the maintenance and testing of oil for Load Tap Changers, since this topic is presently not included in C57.131. LTC manufacturers will be surveyed and asked for their recommendations on oil maintenance and testing.

The Chair contacted the C37 circuit breaker committee Chair to discuss the possible inclusion of circuit breaker oil in this document. Indications resulting from this conversation were that C37 looks to C57.106 for guidance on oil handling, so it was decided to include this topic in the revision.

The WG Chair asked for volunteers to review and re-draft (if necessary) the seven sections of this document. The volunteers were John Lackey (Section 1), Harold Moore and Mike Lau (Section 2), Ted Hauptert (Section 3), Charlie Raymond (Section 4), Mike Lau (Section 5), Tom Traub (Section 6), and Gene Kallaur (Section 7). Additionally, Frank Gryzkiewicz was volunteered to draft Section 8 (References), and Bob Turcotte to draft Section 9 (Revised Table of Contents). Ted Hauptert volunteered to draft a discussion on water-in-oil, but it was not decided whether this will be a separate section or incorporated into a new section.

The Chair asked all volunteers to have their respective sections prepared and sent to Bob Turcotte by the end of June 1998.

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

The WG Chair was not able to attend the Little Rock meeting, but he had made arrangements in advance of the meeting to discuss this project. Draft 1 of the document had been sent to all WG members prior to the Little Rock meeting for review and discussion at the meeting. Unfortunately only three members of the WG were in attendance, so discussion on the draft was limited.

Discussion of the draft yielded significant comments. Some of these comments had already been sent to the Chair by mail prior to the meeting. The comments discussed during the meeting will be forwarded to the Chair. Draft 2 of this document will be prepared and circulated to the WG prior to the next meeting.

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

The Chairman of this WG was not able to attend the Little Rock meeting. Therefore, no formal meeting of the WG was held. It was reported that the PAR for this project has been approved. The Chairman asked WG members to develop ideas for the scope of this document and send them to him.

7.8.1.6 Revision of C57.121 - Guide for Acceptance and Maintenance of Less Flammable Hydrocarbon Fluid in Transformers - Patrick McShane, Chair

This document has been approved by the IEEE Transformers Committee and sent to the IEEE Standards Board for approval and printing. The WG has therefore finished its work on this project, and will be disbanded.

7.8.2 Other Business:

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

7.9 Insulation Life - L. W. Pierce, Chair

The Insulation Life Subcommittee met April 28, 1998 at Little Rock with 30 members and 43 guests in attendance. The minutes of the Nov. 18, 1997 meeting in St. Louis were approved as written. Summaries of the reports of the Working Groups and Task Forces are as follows:

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

A PAR application for a "Guide for Determination of Maximum Winding Temperature Rise in Liquid Filled Transformers" has been completed and mailed to IEEE for approval.

A survey on draft 1.0 of the Guide was sent to members of the Working Group, and the Subcommittee. 32 of the 65 ballots were returned, with three negatives, and 9 comments. Negative ballots were received from;

Mark Perkins, ABB
Barry Beaster, ABB
Subhash Tuli, Waukesha Electric.

The meeting was devoted to reviewing the comments submitted with the Negatives. Their common point was requesting again that a simplified method of calculation, similar to the IEC method be included. The other comments were not discussed, but were given to attenders. Several of them were editorial, and will be accepted.

Mark Perkins presented a summary of the comments supporting his negative. He proposed that study in Europe had concluded that the methods we have documented will not produce accurate results. This was based on his conclusion that often direct measurements do not read a true hot spot temperature, and underestimate it. He also commented that efforts by ABB to calculate a hottest spot do not coincide with tests of prototypes, due to unpredictable factors such as circulating currents and variances in oil flow.

He also summarized data from a CIGRE report. The report provided tested values of the H factor used in the IEC equation. He provided a histogram of those results. He then suggested that the variation in the data should not be used to discredit the approach, but rather to demonstrate that a statistical approach to determining an appropriate factor is practical. With this approach, a manufacturer would be able to establish criteria and make a statement that with a 90% confidence factor; his hottest spot temperature would be less than a specific value. He also provided some data from temperature tests they have done, to demonstrate that it would be necessary to establish different factors for different groups of transformers based on size and design.

There was again much discussion. Bob Delvecchio, North American Transformer, explained that their experience has shown that their detailed thermal modeling, test data and the IEC method with an H factor of 1.2 all provide similar hot spot predictions.

Linden Pierce pointed out that several major manufacturers of power transformers have published reports that they have sophisticated thermal models and yet their employees are voting negative on the use of modeling as a tool for predicting the hottest spot temperature rise. He also noted that the distribution manufacturers represented in this survey group have voted to approve.

Linden Pierce volunteered to rewrite portions of the guide to revise the wording that now prevents use of the IEC method. Other comments from the survey will also be incorporated. The new draft #2 of the Guide will be sent to Working Group and Subcommittee members prior to the November meeting.

7.9.2 Working Group on Thermal Duplicate - Barry Beaster, Chair

Bob Grubb presided for Barry Beaster who could not attend. A survey of proposed changes to C57.12.00 regarding thermal test requirements was conducted of members of the Working Group and Insulation Life Subcommittee. These changes will more clearly define when thermal tests are required and define thermal duplicate. This survey was successful. These changes will be forwarded to the Standards Subcommittee for balloting of the next revision of C57.12.00.

A presentation was made by Dave Aho, Cooper Industries, of a comparison of two transformers using the proposed thermal duplicate equations. The temperature rises predicted by the thermal duplicate calculations were within the defined tolerances for all thermal characteristics except for the watts per pound of conductor. The importance of this characteristic were questioned. It was agreed to omit this item from the requirements and insert a discussion of this characteristic into the document.

The next activity of the Working Group will be to prepare a Guide document with details of evaluating a thermal duplicate transformer.

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

A survey of Draft 5 of proposed changes to section 11 of C57.12.00 was completed with six negative ballots. There were many issues to resolve. The major difficulty is that the present standard leaves many of the specific details of the thermal test to the discretion of the manufacturer. All manufacturers do the thermal test somewhat differently. Some of these issues are the number and timing of hot resistance readings, cooling curve calculation procedure, average winding temperature rise definition, and liquid temperature rise determination. Additional work is needed on the document. Agreement has been reached to omit the empirical method of correction to shutdown. The plan is to address as many revisions as practical and save the more controversial changes involving the cooling curve procedure for a later revision or perhaps a Guide document. Draft 6.0 will be surveyed before the next meeting.

7.9.4 Task Force on Winding Temperature Indicators - V. S. N. Sankar, Chair

Six volunteers from the Task Force gave presentations to the group on actual test data. They were Bob DeVeChhio, Joe Foldi, Bob Grubb, Sam Hall, Donald Lowe, and Bob Whearty. Data was presented that showed the time response of the winding temperature during step load tests. The data was obtained from direct sensors and calculated estimates. In a couple of the cases, comparative results with typical winding temperature indicators were shown as well. One major conclusion from the data presented is that for the condition with no pumps activated and a step load applied the winding time constant is very short compared to the time constant of the winding temperature indicator. The goal of the Task Force is to write a technical paper or Task Force Report identifying the problem, the phenomena observed, and suggest possible solutions in order to provide direction to users and manufacturers for future winding temperature indication approaches.

7.9.5 Status Reports

Status reports were provided as follows:

Michael Franchek reported that IEEE Std 1276-1997, "IEEE Trial-Use Guide for the Application of High-Temperature Insulation Materials in Liquid-Immersed Power Transformers", has been printed. IEEE order no. is SH94544.

Bob Grubb reported on PC 57.119, "Recommended Practice for Performing Temperature Rise Tests on Oil-Immersed Power Transformers at Loads Beyond Nameplate Ratings". This document has been successfully balloted. Bob is working on editorial changes and preparing the documentation for submittal to the IEEE Standards Board.

Linden Pierce reported on IEEE PC57.12.100, "IEEE Standard Test Procedure for Thermal Evaluation of Liquid-Immersed Distribution and Power Transformers". Draft 5 dated Feb. 26, 1998 has been sent to the IEEE balloting service with a request to issue an Invitation to Ballot and to conduct a ballot of this document.

7.9.6 Announcements by Chair

New members added to the Insulation Life Subcommittee are Wally Binder, Pierre Feghali, Don Lowe, Mark Perkins, Steve Snyder, Subhash Tuli, and Bob Whearty.

A panel session at the 1999 IEEE T&D Conference will be arranged by the Insulation Life Subcommittee. This was based on a suggestion by Bob Grubb after the Graz meeting. The panel session will address thermal issues with transformers. A Call for Papers giving a preferential subject will appear in the May issue of the Power Engineering Review.

Respectfully Submitted by:

Linden W. Pierce

Insulation Life Subcommittee Chair

Attendance:

Group	Members	Guests	Total
SC Insulation Life	30	43	73
WG Hottest Spot Determination	23	44	67
WG Thermal Duplicate	9	25	34
TF Winding Temp.Indicators	11	21	32
WG Rev. of Thermal Test	8	10	18

7.10 Performance Characteristics - D. J. Fallon, Chair

7.10.1 Introduction/Attendance

The Performance Characteristics Subcommittee (PCS) met at 8:00 a.m. on Tuesday, April 28, with 42 members and 35 guests in attendance. The group acknowledged with appreciation Jin Sim's leadership of PCS and wished him well in his new responsibilities with the Main Committee

7.10.2 Approval of Meeting Minutes

The minutes of the November 18, 1997, PCS Meeting in St. Louis, MO, were approved as written.

7.10.3 Chair's Remarks

7.10.3.1 Administrative Subcommittee Notes

Several items from the discussions held at the April 26, 1998, Administrative Subcommittee meeting were highlighted as follows:

1. Discussion was held on means of dealing with an approximate \$17,000 budget surplus. A motion was passed to reduce fees by \$15 for attendees and spouses for coming meetings.
2. The next Transformers Committee meeting will be held in Guanajuato, Mexico, November 8-11, 1998
3. Tom Prevost reported that the C57.125 Failure Analysis Guide had been administratively withdrawn by the Standards Board as we were preparing for reaffirmation. (Subsequent to the meeting Don Cash has been in contact with the Standards Board, and is in process of preparing the necessary documentation to rescue the guide from withdrawal.)
4. Several areas that had been under sponsorship of PCS will move with the next meeting to sponsorship by the new Power Transformers Subcommittee, chaired by Red Hager. These include:
 - Bill Henning's WG on the LTC Application Guide
 - Future work on reaffirmation/revisions for C57.116, C57.117, and C57.125

PCS expressed thanks to those who worked under PCS sponsorship for these activities, and success in their new sponsorship.

7.10.3.2 Membership

New Members: Jim Fyvie (Rolls-Royce Peebles Transformers), Carlos Gaytan (Prolec GE), Chuck Simmons (ABB), and Craig Stiegemeier (ABB Components) were added to the roster.

7.10.4 Agenda Changes

None

7.10.5 Working Group Reports

7.10.5.1 Revisions to C57.12.90 - Pierre Feghali, Chair

The Working Group for the continuous revision of C57.12.90 met on Monday April 27, 1998, at 9:30 am. There were 18 members and 15 guests present. The Chairman opened by informing the group that a ballot will be sent out for the addition of the OLTC tap changer testing at the transformer factory. The ballot will be within the Working Group, and will be held before the next meeting. The meeting continued with discussion on several comments resulting from the recent ballot of C57.12.90.

Subhash Tuli mentioned that all editorial comments were incorporated in the new Draft. All negative comments were either resolved or scheduled for discussion for the next revision. It was suggested that C57.12.90 be updated to comply with IEEE rules on metric and English designations, metric first followed C57.12.90 will be recirculated in the Main Committee.

Under new business, V. Sankar brought up 3 issues related to loss measurements. These comments will be referred to the Loss Tolerance and Measurement Working Group.

The meeting adjourned at 10:10 am.

7.10.5.2 C57.133 Guide for Short Circuit Testing - Nigel McQuin, Chair

The Working Group did not meet in Little Rock. The Chairman reports that a final version of the document is available for ballot, based on the comments received at the St.Louis meeting. A ballot pool invitation was issued, with a closing date of April 27, 1998. The ballot is expected to proceed from that point, hopefully with a result before the Fall 98 meeting.

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

The Working Group for the Revision of the IEEE Recommended Practice for Establishing Transformer Capability When Supplying Nonsinusoidal Load Currents did not meet at the Spring Meeting in Little Rock. The ballot was successful on the re-circulation of Draft 7 and the final results were as follows:

Members:	180	
Returns:	154	85%
Affirmative:	138	97%
Negative:	4	
Abstain:	12	7%

The document was submitted to the IEEE Standards Board on April 1, 1998, well in advance of the May 8, 1998, deadline for the June 25, 1998, meeting.

7.10.5.4 Loss Tolerance and Measurement - Ramsis Girgis, Chair

The WG on Loss Tolerances and Measurement met on Monday, April 27, 1998 with 7 members and 20 guests attending.

The meeting started with a report on the activities of the Task Force on Low P.f. power measurement. A correction, to the sign of the wattmeter phase-angle in the phase-angle correction of load loss in Standard C57.12.90, was proposed. The present sign was based on electrodynamic wattmeters which generically have a lagging phase-angle. The correction will be implemented immediately in the C57.12.90 revision. The Task Force is continuing with developing the low P.f. power measurement guide. A draft of Section 4 of the Guide, on sources and types of uncertainties, was discussed.

The guide on no-load loss and load loss measurement is practically complete with the figures added to the text electronically. A section was added to it to resolve the three negative votes on the proposed change of the loss tolerances in C57.12.90. A statement will be added to the proposed change in C57.12.90 that clearly states that the new loss tolerance is only an acceptance criteria and does not replace the manufacturer's guarantee on loss for penalty consideration.

The plan is to have the guide ready for voting at the Transformers Committee level before the next standards meeting in Mexico.

A proposed new addition to C57.12.90 on measurement of auxiliary losses was also discussed and will be added to the next revision of this standard.

The meeting was adjourned at 5:30 p.m.

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

The Working Group met on Monday, April 27, 1998, at 8:00 AM. There were 11 members and 2 guests present. Introductions were made. Minutes of the November 17, 1997, meeting in St. Louis were approved.

The Chairman reported on progress of the Standard. Draft 12 was approved in an IEEE ballot. Editorial comments were discussed at the St. Louis meeting. These were incorporated into Draft 12 - revision 1. This was re-circulated to the Working Group, and to those who had comments, in January. No further comments were received. Draft 12 - revision 1 was submitted to REVCOM in February.

On March 18, 1998, REVCOM approved the Standard. The Chairman is now working with the IEEE editors to produce the final Standard.

There are still several outstanding issues of concern regarding this Standard. Details of several items, such as single way transformer thermal tests, interphase transformer losses, and the refinement of loss and thermal tests are still issues requiring much discussion. The Chairman asked the Working Group to supply him with a list of these issues. The Working Group will disband when the Standard is produced. If we wish to continue to function as a Working Group, or if a new Working Group needs to be formed, we will need to procure a new PAR so that these issues may be resolved before the Standard is due for revision.

There were no other items of old or new business. The meeting was adjourned at 8:20 AM.

7.10.5.6 Revisions to C57.12.00 - Donald W. Platts, Chair

The Working Group met on Monday, April 27, 1998, at 1:20 PM. We had 18 members and 18 guests in attendance.

The minutes of the November 17, 1997, meeting in St. Louis were approved.

All of the items that we have previously approved were included in the draft of C57.12.00, recently balloted. Subash Tuli has resolved most of the negatives, and collected a number of items for our working group to address in the future. A new revised draft is ready to be sent to IEEE for re-circulation to the balloting pool.

Subash reported on the ballot results, and reviewed some of the items from PCS that had produced negatives. One was a correction to the clause on cooling class designations we worked on. A footnote had been omitted.

The most controversial item appears to be the elimination of Table 19 Tolerances for Single-Phase and Three-Phase Transformer Losses. It was discussed briefly, although the working group on loss tolerance is the appropriate forum for resolution of those issues.

There was no other old business, and no new business.

The meeting adjourned at 1:35 PM.

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

The WG on Switching Transients Induced by Transformer/Breaker Interaction was called to order at 4:15 PM on Monday April 27, 1998.

There were 12 members and 19 guests present. Introductions were made and the minutes of the November 17, 1997, meeting in St. Louis were accepted with corrections.

The first topic of new business was agreement on a Scope and Purpose statement for the PAR submission.

Scope: This Guide covers the application of transformers in the presence of oscillatory switching transients induced by transformer, breaker, and system interaction. Additionally, it addresses mitigation methods.

Purpose: The purpose of this guide is to provide aid in the recognition of problems transformers encounter when subjected to oscillatory switching transients, provide means to quantify their effect, and present mitigation methods.

The proposed outline of the guide, agreed to at the November 17, 1997, WG meeting, was again presented and reviewed. After some discussion it was agreed that a section on the System Configurations of Potential Concern should be added. The outline of the guide is as follows:

- Overview
- Scope / Applicability / Limitations
- Transformer Characteristics
- Supply characteristics
- Load characteristics
- Circuit Breaker characteristics
- System Configurations of Concern
- Transient Recovery Voltage
- Mitigation Methods
- Numerical Examples
- Bibliography
- Appendix

Bob Degeneff agreed to draft the overview, scope, transformer characteristics, and transient recovery voltage. Jeewan Puri agreed to draft the sections on supply and load characteristics. The section on circuit breaker characteristics will be drafted by an unsuspecting member of the C.B. Committee. Phil Hopkinson will draft the section on mitigation methods. Jerry Corkran, Jin Sim, Jeewan Puri, and Bob Veitch all agreed to provide summary data of specific transformer failures.

All drafts and data are to be submitted to the Chairman by september 1, 1998. Draft 1 of the guide will be assembled by October 1 and sent to members. It is anticipated that much of IEEE C37.015/1993 and IEC 1233/1994 will be used in this work. Two major limitations of these documents, however, are their lack of information on the vacuum

interrupter characteristics and the internal resonance characteristic of transformer windings.

It was agreed that the WG will try to secure a guest speaker for the next meeting to address the issue of breaker operation in this system context.

The meeting was adjourned at 5:25 PM.

7.10.5.8 Load Tap Changer Performance - Bill Henning, Chair

The Working Group on Load Tap Changer Performance met on Monday, April 27, 1998, at 10:55 a.m. There were 21 members and 10 guests in attendance. The first item of business was to approve the minutes of the last working group meeting in St. Louis. Those minutes were approved.

The time allotted to the working group meeting was devoted to a review of IEC Publication 542, "Application Guide for On-Load Tap-Changers." The discussion resulted in a decision to make this IEC document a starting point for an ANSI guide. The working group chair will conduct a working group survey of a Draft 1 of the guide, using most of the IEC text but taking internal references to other IEC documents and modifying those references to cite appropriate ANSI standards.

The Insulating Fluids Subcommittee has two projects related to LTC application. One project is C57.106-1991, *IEEE Guide for Acceptance and Maintenance of Insulating Oil in Equipment*, chaired by Joe Kelly. This document could include specific information on insulating oil for tap changers. The second project is C57.139, *Dissolved Gas Analysis in Load Tap Changers*, chaired by Rick Youngblood. A liaison between the "Fluids" working groups and this working group will be established.

The WG meeting was adjourned at approximately 12:00 noon.

7.10.6 Project Reports

7.10.6.1 Survey of GSU Transformer Failures - H. F. Light

No report given at the meeting

7.10.6.2 C37.91 Guide for Protective Relay Applications to Power Transformers - R. L. (Ron) Barker

The Transformers Committee's input to this document is complete. The Power System Relay committee has submitted the final draft to Mr. Tom Prevost for Standards approval.

7.10.6.3 Reaffirmation of C57.125, Failure Analysis Guide - Don Cash

No report at the meeting as Don Cash was traveling on business. Subsequently, Don indicated that a re-circulation after the first reaffirmation ballot was successful, and that the paperwork necessary for rescue from administrative withdrawal and completion of reaffirmation will be submitted shortly to the Standards Board.

Don also indicated that C57.117, Guide for Reporting Failure Data, has completed a successful reaffirmation ballot. A summary report will be given at the next meeting.

7.10.6.4 Single Phase Harmonics Limits

No report.

7.10.6.5 Other projects

There was no status report on the progress of reaffirmation of C57.105, Guide for Application of Transformer Connections in Three Phase Distribution Systems, and IEEE 638, Qualification of Class 1E Transformers for Nuclear Power Generating stations .

7.10.7 Old Business

There was no status report on the planned reaffirmation of C57.109, Guide for Through Fault Current Duration and C57.116, Guide for Transformers Directly Connected to Generators.

7.10.8 New Business

There were no items of new business brought up at the meeting.

7.10.9 Next Meeting

The next meeting will be held on November 10, 1998 in Guanajuato, Mexico.

The meeting adjourned at 9:05 a.m.

Respectfully submitted,

Donald J. Fallon

PCS Chair

7.11 Power Transformers Subcommittee - E.G. Hager, Jr., Chair

The Power Transformers Subcommittee convened for the first time at 13:20 hours on Monday, April 27, 1998. The Power Transformers Subcommittee replaces the West Coast Subcommittee. An invitation to join the new Power Transformers Subcommittee was announced.

At 13:25 hours the Working Group on Phase Shifting Transformers C57.135 chaired by Edgar Trummer met to discuss comments received in response to a survey letter to draft Revision 8a sent to W. G. members by Don Chu, W. G. Secretary. Less than one third responded with five affirmative, 13 negative and one abstaining. V.S. Sankar explained the reasons for his negative. Subsequently, the W.G. passed the following motion- "The user has the option to specify the minimum phase angle required at full load at a specified power factor and the impedance of the phase shifting transformer on its' various taps." V. Sankar also discussed clause 5.5.2. Bob Veitch will rewrite lines 11,12 and 13 of Page 21 and submit to Don Chu.

The W.G. further resolved that Page 23, Line 14, will now read: "Other ways to solve the above mentioned problems include:"

Following a 15 minute break, the W.G. reconvened. Chairman E. Trummer proposed the formation of subgroups to resolve other comments and negatives received to draft revision 8a. These groups will make recommendations and revisions to the latest draft based upon their best judgment. This is to be completed no later than July 15th and sent to Don Chu, Secretary.

The three groups are:

#1 Bob Stewart & Red Hager, Section 13

#2. Joe Watson, Jean Riboud, Dr. Preininger & Tom Lundquist,
Section 4,5 & 6

#3. Bipen Patel, Bob Veitch, Jim Fyvie & Jim Irvine, Sections 7, 8, 9, 10, 11 and 12.

It was also agreed the Chair would enclose a letter with the next draft, stating "non-participation in the balloting would result in removal from working group membership."

The W.G. Meeting adjourned at 15:55 hours. There were thirty attendees; 20 members and 11 guests.

The Power Transformers Subcommittee reconvened at 16:20 hours.

Bob Stewart, B. C. Hydro, discussed a draft paper dealing with Retro-fitting as an option to replacing generator step-up transformers.

Bob Grubb explained his original proposal for a Power Transformers Subcommittee, including scope and practice which has led to the new subcommittee.

At present, the following standards and/or guides fall under the Power Transformers Subcommittee:

From West Coast:

C57.93 Guide for Installation of Liquid-Immersed Power Transformers. (for revision/affirmation) Don Chu, Chair.

C57.120 Loss Evaluation Guide for Power Transformers and Reactors.

C57.135 Guide for Application, Testing and Installation of Phase Shifting Transformers. Edgar Trummer, Chair.

From Performance Characteristics:

C57.116 Guide for Transformers Directly Connected to Generators.

C57.117 Guide for Reporting Failure Data for Power Transformers and Reactors.

C57.125 Guide for Failure Investigation, Documentation and Analysis for Power Transformers and Shunt Reactors.

C57.131 Performance Requirements for LTC.

New WG - LTC Application Guide (Bill Henning, chair)

From Dielectric Tests:

WG - Diagnostic Field Testing and Monitoring (Rick Young, Chair)

From ANSI C57

C57.12.10 Power Transformers rated 230 kV and below, 100 MVA and below
(Jin Sim)

C57.17 Requirements for Arc Furnace Transformers

Note: New PARS for the above subjects will have to be obtained by the Working Group Chairmen.

Those present were asked for additional subjects related to Power Transformers Equipment. Roland James suggested Transformer life extension and Joe Watson volunteered control cabinet "standardization". They will prepare more details for the next meeting.

Following some lengthy discussion, the meeting was adjourned at 17:20 hours.

Minutes prepared by Tom Lundquist, Acting Secretary

7.12 Underground Transformers & Network Protectors - P. E. Orehek, Chair

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

7.12.1 Introduction/Attendance

The Underground Transformers and Network Protectors Subcommittee met at 9:30 a.m. on April 28, 1998, with 10 members and one guest present.

7.12.2 Approval of Minutes

The minutes of the November, 1997 meeting in St. Louis, Missouri were approved as submitted.

7.12.3 Membership

Three members (W. E. McCain of General Electric retired, C. E. Griffith of Potomac Electric Power and Bruce Nutt of TU Electric due to not attending any meetings for at least two years) were removed from the membership roster and John Sullivan of Tampa Electric became a member. Membership now is 14.

7.12.4 Chair's Remarks

Administrative Subcommittee Notes

- A. The next meeting will be held in Guanajuato, Mexico from November 8-11, 1998.
- B. The Working Group Award for 1997 was for C57.131 "Load Tap Changers."
- C. There is a new Working Group of the Administrative Subcommittee called Meetings - Planning chaired by G. Anderson.
- D. The IEEE delegation of the C57 Transformers Committee approved the following standards: C57.12.50, C57.12.51, C57.12.52, C57.12.55, C57.13.2, C57.19.01, C57.110 and C57.138.
- E. It was approved at the December, 1997 Standards Board meeting requiring individuals to be members in the IEEE Standards Association in order to ballot an IEEE Standard.
- F. Susan Tatiner of IEEE will give a presentation at the Main Committee meeting on Electronic Publishing for IEEE Standards Activities (balloting, paper review, standards publications, etc.)
- G. Any Subcommittee wishing to have a Panel Session at the IEEE T&D Exposition in New Orleans in 1999 needs to submit a request prior to June 1, 1998.

7.12.5 Working Group Reports

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

The working Group met on Monday, April 27, 1998 at 1:20 p.m. with nine members and five guests in attendance.

The minutes of the meeting on November 17, 1997 in St. Louis, Missouri were approved as submitted.

At the last meeting it was indicated that if voltage ratings, tap ratings, insulation levels and the tolerance on the impedance on a tap were part of C57.12.00, they could be removed from the Standard. A review of C57.12.00 indicated they were not part of this Standard and will therefore remain in C57.12.24.

A review of the first six sections of the Standard was previously completed. A review of the remaining sections was completed at this meeting with the following proposals:

- a. The General paragraphs for tank construction and finish will be reworded to read the same as in C57.12.40 "Secondary Network Transformers."
- b. The paragraph for "Other Requirements" will be removed.
- c. All Tables and Figures were reviewed and a few minor corrections are required. Dimensions will be converted to metric.

All changes will be incorporated into a new Draft and reviewed at the Fall meeting. It is expected the Standard will be ready for balloting in 1999.

There being no additional new or old business, the meeting was adjourned at 2:40 p.m.

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

The Working Group met on Monday, April 27, 1998 at 9:15 a.m. for two sessions with 10 members and six guests in attendance.

The minutes of the November 17, 1997 meeting in St. Louis, Missouri were approved as submitted.

Igbal Hussian of General Electric replaced Bill McCain of General Electric as a member of the WG.

The temperature rise was discussed again at length after which the WG agreed to the following changes to Section 3.1:

- a. reword to recognize the 55°C/65°C rating as the standard.
- b. add words to the section to recognize the 65°C rating only when specified.
- c. revise Table 1 to show the base 55°C kVA rating and the 112% 65° rating.

Other major revisions included the following:

In Paragraph 5.2.2, change the words “without impairing the continuous rating of the switch” to “without impairing the continuous rating or operation of the switch.”

In Paragraph 8.2, for the neutral termination, the full short circuit requirements will be added for the ground strap to agree with C57.12.24.

In part 2, the 1000 kVA rating with 4% impedance in Table 13 will be removed because of confusion with the 1000 kVA rating at 7.0% requirement in the same Table.

Dimensions will be converted to metric.

A final Draft of the revised standard will be ready for review at the Fall meeting. It is expected to ballot the standard in 1999.

There being no additional business, the meeting was adjourned at 12:10 p.m.

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

The Working Group met at 8:00 a.m. on Monday, April 27, 1998 with eight members and four guests present.

The minutes of the November 17, 1997 meeting in St. Louis, Missouri were approved as submitted.

A number of comments were received from the liaison to the Switchgear Committee and all were reviewed. The WG accepted the proposed revisions to the electrical tests but reworded some of the recommendations.

The Draft document was also sent to IEEE Staff for editorial comments and the proposed changes were reviewed.

It was agreed to include pictures of alloy fuses for non-submersible or ventilated network protectors with the fuse ratings for submersible protectors in Figure B-5. More manufacturer catalog information required for the fuses was requested of the members.

Concern was expressed that when converting dimensions to metric that other standards with the same component could have different values depending on which way the number is rounded.

A final Draft of the revised Standard will be ready for review at the Fall meeting. It is expected that the revision of the Standard will be ready for balloting after the next meeting.

There being no additional business, the meeting was adjourned at 9:15 a.m.

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

Mr. A. L. “Butch” Robinson was appointed as the new Chair of the WG to replace Bruce Nutt.

The Working Group met on Monday, April 27, 1998 at 2:50 p.m. with five members present.

There were no minutes available from the previous meetings since the Chair had been absent.

The PAR for the Standard has been extended until the Spring of 2000 to reaffirm or revise the Standard.

Previously, many revisions were made and a Draft document was developed for balloting. Since there wasn't any meetings for some time, the WG started a review of the changes previously incorporated. The Chairman will incorporate the comments and send out a revised Draft to previous members asking for comments and future participation.

The goal of the WG is to complete the review in 1999 and get ready for balloting in 2000.

There being no additional new or old business, the meeting adjourned at 4:05 p.m.

7.12.6 Future Meetings

The location and dates for future meetings are as follows:

November 8-11, 1998	Guanajuato, Mexico
April 11-16, 1999	New Orleans, Louisiana
Fall, 1999	Monterey, Mexico
March 12-15, 2000	Nashville, Tennessee
Fall, 2000	Niagara Falls, Ontario, Canada
Spring, 2001	Amsterdam, The Netherlands

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

8.0 Reports of Liaison Representatives

8.1 EPRI - S. R. Lindgren

EPRI

Electric Power

Research Institute _____ *Powering Progress through Innovative Solutions*

MEMORANDUM

April 17, 1998

TO: Mr. H. Jin Sim
Secretary, IEEE Transformers Committee
Waukesha Electric Systems
P. O. Box 268
Goldsboro, NC 27530

FROM: Stan Lindgren, Manager, Power Transformers

SUBJECT: **EPRI LIAISON REPORT**

The following report is for inclusion in your minutes for the April 29, 1998 meeting in St. Louis.

1. Static Electrification in Power Transformers:

- This is the suspected failure mechanism in over 24 core form and shell form FOA transformers worldwide. Recent failures involve 15 year or older transformers worldwide that had just been reprocessed following maintenance work. Failure typically occurs during the first startup or light loading period.
- Work has focused on the effects of temperature and moisture transients. Phase I of a comprehensive test program was completed on a 333 MVA single phase 500 kV autotransformer that was fully instrumented to monitor static electrification effects during a series of experiments. A broad range of partial discharge activity was produced. A Phase II second round of tests was completed in October, 1996. A broad range of static electrification activity was again produced. Tests and monitoring results are being evaluated. The transformer was disassembled and inspected. Evidence of static electrification discharges were found at both the bottom and at the top of the unit.
- Results of the field tests are being reflected in a quarter-scale flow-model experiment that will simulate the 500 kV transformer under laboratory conditions and controls. The model of the major insulation structure and simulated windings has been completed and experiments are underway.

2. Bubble Evolution in Overloaded Transformers:

- 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 recently 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. Phase II is in process 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 3.0% in paper and pressboard.

8.0 Reports of Liaison Representatives (cont'd)

3. High Voltage Instrument Transformers

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

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

4. Thermal Models for Real-Time Monitoring

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.

5. Microelectronic Fault Gas Analyzer

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. Metal-insulated-semiconductor (MIS) sensors are used to monitor multiple gases. A field demonstration program involving 40 prototypes, starting with the first in October 1993, was completed in 1996. The analyzer is designed to monitor individual ppm for hydrogen, acetylene, ethylene and carbon monoxide.

6. Power Transformer Remaining Life Prediction & Extension

- Furaldehydes in Transformer Oil

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

- Vibration & Frequency Response Analysis (FRA)

A project is in process to develop a correlation between existing winding conditions and vibration & FRA tests before and after internal inspection and re-clamping of the same transformers. The objective is to develop noninvasive field test methods and criteria that can be used to predict winding condition in the broad variety of existing power transformers without entering the transformer. Over 40 transformers have had the initial FRA and internal inspection, and over 20 have had the follow-up FRA test.

7. Transformer Expert System

Objective of this project is to capture the knowledge of transformer experts and make it usable in an off-line software tool for evaluation of transformer design questions, condition assessment, problem diagnosis, and identification of maintenance needs. Beta testing started October 1997.

8. Guidelines for Life Extension of Substations

8.0 Reports of Liaison Representatives (cont'd)

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

9. Maintenance-Free LTC

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

c: J.W. Matthews, Chair

Dr. Robert Schainker

8.2 SCC4 - P. A. Payne

February 4, 1998

**IEEE PES TRANSFORMER COMMITTEE
LIAISON REPORT
STANDARDS COORDINATING COMMITTEE NO. 4 – INSULATION SYSTEMS**

Standards Activities

1. IEEE 96 has been withdrawn, as there is no interest in maintaining this standard.
2. IEEE 1 has an approved PAR with completion of revision by May 1999. Assignments have been made for review of the document and harmonization with IEC 85.
3. Comparisons have been made for harmonization with IEC Standards:
 - IEEE 99 to IEC 611
 - IEEE 943 to IEC 610.
4. A similar comparison was made in 1995 for IEEE 1 to IEC 85.

Activity Report - USNC to IEC TC-98 – Insulation Systems

5. Guidance is being sought for transfer of responsibility of IEC 85 from SC 15 to TC 98.
6. WG3 draft document is being circulated as a CD including significant revisions from the previous draft circulated. Some of the changes were excluded from the latest draft; resolution is being pursued.
7. A draft document has been prepared for development of simplified procedures for modification or addition to an established EIS.
8. WG2 has resolved TAG comments and resubmitted to the USNC for the draft IEC 505-2 Evaluation and qualification of electrical insulation systems – Part 2: Electrical, thermal, mechanical, environmental and multi-factor.
9. William Simpson is being recommended by SCC4 for assuming the responsibility as Deputy Technical Director for TC98 due to the retirement of present director, Al Boulter.

Respectfully submitted,

Paulette A. Payne

8.3 CIGRE SC12 - W. N. Kennedy

No Report.

8.4 TC 14 TAG - P. J. Hopkinson

8.4.1 APPROVAL OF PREVIOUS MINUTES

The minutes for the meeting held November 17, 1997, were approved as submitted.

8.4.2 MEMBERSHIP

Members reviewed the TAG roster and made such changes and corrections as needed. The chairman noted that Tony Furfari would be serving as the liaison from IEEE.

8.4.3 OLD BUSINESS

Guided by the Technical Advisor, members of the TAG engaged in a review of the key documents (Pub 76-3, 76-3-3, 76-5, 214 and 551) that will be discussed during the October 1998 meeting of TC 14. It was noted that the compilation of national committee comments on each of the issues on the meeting agenda has yet to be distributed. Members were advised that as soon as the compilations are received they will be sent to them for review and recommendations for US positions.

8.4.3.1 Short Circuit Tests - IEC Pub 76-5

The TA noted that there is interest among some groups in Europe for all transformers to undergo a short circuit test before shipment while others seek verification through calculations. It was noted that a model will be proposed by the US expert to the WG.

It was noted that a TAG member expressed concern that the test tables in the current draft are not rigorous enough, though it was pointed out that the document also contains provisions for the customer to specify more rigorous requirements. It was also noted that the circuit impedance tables needed to have lower values or be deleted and that the method for determining the ability to withstand frequent fault was in need of improvement.

Following brief additional discussion, it was agreed that the US should vote affirmative with comment on the proposed revisions and seek additional changes in future actions.

8.4.3.2 Dielectric Tests - IEC Pub 60076-3

The TA noted that the relationship between low frequency test requirements and system voltage needs to be solidly established while continuing to provide for selected values for frequently used BIL levels.

8.4.3.3 On-Load Tap Changers - IEC Pub 60214

It was noted that the IEC document addresses only resistance aspects and that reactance tap changes should be addressed. It was also pointed out that a test method for contact ageing should be added to the standard.

8.4.3.4 Audible Sound Measurement - IEC Pub 551

The TA reported that progress continues to be made in defining the parameters relating to audible sound levels. We are continuing to press for the adoption of NEMA TR-1 tables in the IEC document.

8.4.3.5 Converter Transformers - HVDC applications - IEC 60378-2

It was noted that there is difficulty in affecting the changes on the RMS versus fundamental power issue. It was noted that there has been difficulty locating an US expert on the HV converter who is able to travel to IEC meetings. Solutions to this situation are being sought.

8.4.3.6 Electro-Magnetic Compatibility (EMC)

The TA noted that TC14 would undertake a new project on magnetic fields, noting that transformers neither contribute to or are affected by the phenomenon. The US position suggests that this is not true the case as close proximity of transformers to computers has been associated with screen distortion. It was reported that the project may include looking at mitigation levels. It was also noted that no US expert has been identified at this time to participate in the activity.

8.4.3.7 Converter Transformers - Industrial - IEC 60378-1

The standard has been issued but needs a new work proposal to address RMS vs fundamental frequency power ratings.

8.4.4 NEW BUSINESS

8.4.4.1 IEC TC 14 Meeting in Houston, TX - 19 -21 October 1998

The TA noted that TC 14 would meet in Houston from 19 to 21 October and expected that the principal and alternate experts to the various WG's to be invited to attend the meeting. He requested other TAG members to advise him of their interest and availability to attend the Houston meetings.

8.4.4.2 Category D Liaison with IEC Committees

The TA briefly reviewed the purpose and process of category D liaison activities and IEEE interest in such a liaison relationship in order to participate in certain IEC WG's.

8.4.4.3 Energy Efficiency Issues

Members briefly reviewed the status of energy efficiency standards under development in NEMA and Department of Energy activities relating to its development of a procedures/regulation relating to test methods for efficiency. It was reported that EPA now plans to allow energy standards on labeling for low voltage transformers based upon NEMA TP-1 criteria.

8.5 TIME AND PLACE OF NEXT MEETING

Members agreed to meet during the next IEEE Transformers Committee meeting at a time and date to be determined.

8.6 ADJOURNMENT

8.0 Reports of Liaison Representatives (cont'd)

There being no additional business, the meeting was adjourned at 14:45 PM.

Respectfully Submitted,

P.J. Hopkinson

9.0 Old Business

Transformers Committee's O&P manual did not make to the full Technical Council.

10.0 New Business

None

11.0 Adjournment

The meeting was adjourned at 11:18 AM.

Respectfully submitted,
H. Jin Sim, Secretary