

**IEEE TRANSFORMERS
COMMITTEE**

MINUTES OF MEETING

**APRIL 12, 1989
Chicago, IL**

MEMBERS PRESENT

1. D. Basel
2. J. Bonucchi
3. O.R. Compton
4. F.W. Cook, Sr.
5. D.W. Crofts
6. J.N. Davis
7. J.A. Abert
8. H.G. Fischer (represented by
T.A. Prevast)
9. F.W. Heinrichs
10. W. Henning
11. P.J. Hoefler
12. A.J. Jonnatti
13. W.N. Kennedy
14. R.E. Lee
15. L.A. Lowdermilk
16. C.K. Miller
17. M.I. Mitelman
18. W.E. Morehart
19. C.J. McMillen
20. J.M. Pollitt
21. H.A. Pearce
22. L.J. Savio
23. W.E. Saxon
24. L.R. Stensland
25. V. Thenappan
26. T.P. Traub
27. D.E. Truax
28. R.E. Uptegraff
29. G. Vaillancourt
30. E.J. Yasuda
31. D.A. Yannucci
32. E.H. Arjeski
33. D.A. Barnard
34. J.D. Borst
35. D.J. Cash
36. D.H. Douglas
37. S.L. Foster
38. S.M. Aslam Rizvi
39. J.H. Harlow
40. E. Howells
41. A.M. Iversen
42. C.P. Kappeler
43. E. Koenig
44. J.G. Lackey
45. M.L. Manning
46. J.W. Matthews
47. R.E. Minkwitz
48. H.R. Moore
49. J.W. McGill
50. R.J. Musil
51. B.K. Patel
52. W. Patterson
53. D. Perco
54. V. Shenoy
55. W.W. Stein
56. L.B. Wagenaar
57. A.C. Wurdack
58. R.A. Veitch
59. M.S. Altman
60. J.P. Kinney
61. D.N. Sharma
62. L.W. Pierce
63. D.S. Takach

MEMBERS ABSENT

1. E.J. Adolphson
2. L.C. Aicher
3. D.J. Allan
4. B.F. Allen
5. A. Allustiarti
6. S.J. Antalis
7. J.C. Arnold
8. J. Aubin
9. R. Bancroft
10. P.L. Bellaschi
11. S. Bennon
12. J.J. Bergeron
13. W.B. Binder
14. G.H. Bowers
15. C.V. Brown
16. J. Corkran
17. J.C. Dutton
18. J.K. Easley
19. C.G. Evans
20. P.P. Falkowski
21. D.J. Fallon
22. M. Frydman
23. H.E. Gabel
24. D.W. Gerlach
25. D.A. Gillies
26. R.L. Grubb
27. F.J. Gryszkiewicz
28. G. Hall
29. K.R. Highton
30. C.R. Hoesel
31. R.H. Hillister
32. C.C. Honey
33. F. Huber
34. C. Hurty
35. G.W. Iliff
36. R.G. Jacobsen
37. D.C. Johnson
38. D.L. Johnson
39. E.J. Kelly
40. J.J. Kelly
41. A.D. Kline
42. H.F. Light
43. T.G. Lipscomb
44. L.W. Long
45. R.I. Lowe
46. H.B. Margolis
47. T. Massouda
48. S.P. Mehta
49. C. Millian
50. W.H. Mutschler
51. W.J. McNutt
52. E.T. Norton
53. R.A. Olsson
54. C.T. Raymond
55. C.A. Robbins
56. E.G. Strangas
57. D.W. Sundin
58. L. Swenson
59. A.L. Tanton
60. R.C. Thomas
61. J.A. Thompson
62. R.J. Whearty
63. A. Wilks
64. W.E. Wrenn

GUESTS

1. J. Antweiler
2. B.L. Beaster
3. J.A. Fleeman
4. D.L. Hornak
5. R.L. Lane
6. S. Lindgren
7. J. Patton
8. P.A. Payne
9. V.Q. Pham
10. D.W. Platts
11. S.D. Smith
12. W.B. Uhl
13. J.L. Akers
14. W.J. Carter
15. V. Dahinden
16. J.M. Frank
17. R.H. Frazer
18. R. Garcia
19. R.E. Gearhart
20. P.J. Hopkinson
21. P. Krause
22. R. Marek
23. L.D. Miller
24. S.K. Oklu
25. T. Prevost
26. G.J. Reitter
27. J. Rossetti
28. A.M. Teplitzky
29. J.A. Tingen
30. H.J. Windisch

**IEEE PES TRANSFORMERS COMMITTEE
MEETING MINUTES
CHICAGO - APRIL 12, 1989**

Chairman Robert Veitch opened the meeting at 8:02 a.m. by welcoming attendees to the session. This was followed by self introduction by all attendees.

Chairman's Remarks and Announcements - Robert Veitch

1. The Chairman thanked Chicago hosts Len and Mary Stensland for the excellent meeting arrangements. 160 members and guests were registered with 37 spouses in attendance.
2. Future meetings of the Committee will be:

10/29 - 11/01, 1989	Charlotte (City Center Marriott)
03/25 - 03/28, 1990	Denver (Marriott)
10/21 - 10/24, 1990	Montreal (Hotel Bonaventure)
Spring , 1991	Phoenix
Fall , 1991	Baltimore

Hosts for the 1992 meetings are being sought.

3. The Chairman requested that Subcommittee Chairmen submit their minutes no later than June 30, 1989, so that the Main Committee minutes could be issued in a more timely fashion.
4. A written report was submitted to the Committee by the Chairman (Attachment ASC-B).

Approval Of Minutes - Robert Veitch

The Minutes of the November 2, 1988 meeting in Long Beach were approved as issued.

Reports of Subcommittees:

Administrative Subcommittee - Robert Veitch

The following individuals were announced to be new full members of the Transformers Committee:

Michael Altman	- Florida Power and Light
James Kinney, Jr.	- General Electric
Linden Pierce	- General Electric
Devki Sharma	- Nova Scotia Power
David Takach	- Union Electric

Several liaison positions are open including: C57.12.1, C57.12.2, C62 and C89. Representatives are being sought.

The Technical Council highlights were reviewed (see Chairman's Report - Attachment ASC-B).

The Status of the Transformers Committee scope and Operating Manual were reviewed (see Chairman's Report Attachment ASC-B).

The remainder of the Administrative Subcommittee activities are reported in the Subcommittee minutes (Attachment TC-A).

West Coast Subcommittee

No report was available at the meeting; minutes were provided after the meeting (Attachment TC-B).

Transformer Standards Subcommittee - Jim Harlow

Mr. Harlow's report is Attachment ASC-A. It was noted that several personnel changes had occurred at the IEEE Standards Office. Sue Vogel, PES Administrator, is now our primary contact (See TC-A for address/phone number).

Jim introduced Bill Kruesi, a former Chairman of the IEEE Standards Board, who has agreed to serve as a voluntary official representative from IEEE to the Transformers Committee. Bill commented as follows:

1. The publications backlog has been reduced.
2. The IEEE Standards Manual has been updated (4/88).
3. Typical causes of delays are failure to coordinate and failure to document resolution of negative ballots.

Recognition and Awards Subcommittee - Dean Yannucci

Mr. Yannucci's report (Attachment ASC-F) lists the awards presented at the meeting. Of special note is the "Distinguished Service Award" presented to Olin Compton.

Performance Characteristics Subcommittee - John Matthews

Mr. Matthew's report is Attachment TC-C.

Informal liaison will be established between the Working Group on Semi-Conductor Rectifier Transformers and the Dry Type Subcommittee.

C.J. McMillen noted that the Routine Resistance Test ballot issue had been lost from the 1980 version of C57.12.00 rather than the 1987 version.

Insulation Life Subcommittee - Dave Douglas

Mr. Douglas' report is Attachment TC-D.

The issue of oil-immersed vs. fluid-immersed was raised and discussed by several members.

Insulating Fluids Subcommittee - Henry Pearce

Mr. Pearce's report is Attachment TC-E.

Instrument Transformers Subcommittee - John Davis

Mr. Davis's report is Attachment TC-F.

Dry Type Transformers Subcommittee - Roy Uptegraff

Mr. Uptegraff's report is Attachment TC-G.

IEEE P745 (PC57.12.58, Guide for Conducting a Transient Voltage Analysis of a Dry Type Transformer Winding) had been approved and submitted over three years ago; however, all documentation was lost by IEEE. Mr. Uptegraff moved (seconded by Jim Harlow) that IEEE P745 be re-approved and re-submitted to the Standards Board. There was no discussion; the motion passed unanimously.

Dielectric Tests Subcommittee - Robert Lee

Mr. Lee's report is Attachment TC-H.

Anyone interested in providing liaison to revision of IEEE #4 was asked to contact Mr. Lee.

HVDC Converter Transformers and Reactors Subcommittee - Bill Kennedy

Mr. Kennedy's report is Attachment TC-I.

Busing Subcommittee - Loren Wagenaar

Mr. Wagenaar's report is Attachment TC-J.

Audible Sound and Vibration Subcommittee - Allan Teplitzky

Mr. Teplitzky's report is Attachment TC-K.

Mr. Teplitzky noted a need for a longer Subcommittee meeting time.

Liaison Reports

The EPRI Liaison report was presented by Stan Lindgren (Attachment TC-L).

A CIGRE SC-12 (Transformers) liaison report was provided after the meeting by Bill Kennedy (Attachment TC-M).

There were no other liaison reports.

Technical Papers for Future IEEE/PES Meetings - Robert Veitch Reported for John Bergeron

Mr. Bergeron's report is Attachment ASC-E.

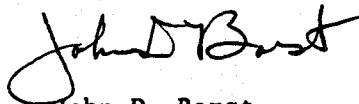
New Business

Bill Kruesi reminded members that all drafts must include the IEEE copyright statement to protect IEEE publication interests.

Ed Yasuda requested that all ballots to the Main committee identify changes represented in the draft being balloted to facilitate evaluation.

There being no further new business, the meeting was adjourned at 11:03 a.m.

Respectively submitted,



John D. Borst
Secretary

NOTE: The text of the luncheon address by Wallace B. Behnke, Jr. (Vice Chairman of Commonwealth Edison and PES President) is attached (TC-N).

ATTACHMENTS LIST

TC-A Administrative Subcommittee Minutes - Borst
ASC-A Standards Subcommittee Report - Harlow
ASC-B Committee Chairman's Report - Veitch
ASC-C PCS Activities - Matthews
ASC-D Dielectric Tests Activities - Lee
ASC-E Technical Paper Activities - Bergeron
ASC-F Awards Subcommittee Activities - Yannucci
TC-B West Coast Subcommittee Minutes
TC-C Performance Characteristics Subcommittee Minutes - Matthews
TC-D Insulation Life Subcommittee Minutes - Douglas
TC-E Insulating Fluids Subcommittee Minutes - Pearce
TC-F Instrument Transformers Subcommittee Minutes - Davis
TC-G Dry Type Transformers Subcommittee Minutes - Uptegraff
TC-H Dielectric Tests Subcommittee Minutes - Lee
TC-I HVDC Converter Transformers and Reactors Subcommittee Minutes
- Kennedy
TC-J Bushing Subcommittee Minutes - Wagenaar
TC-K Audible Sound and Vibration Subcommittee Minutes - Teplitzky
TC-L EPRI Liaison Report - Lindgren
TC-M CIGRE SC-12 (Transformers) Liaison Report - Kennedy
TC-N Wallace B. Behnke, Jr. luncheon address

TC-A Pg 1 of 5

IEEE TRANSFORMERS COMMITTEE
ADMINISTRATIVE SUBCOMMITTEE
APRIL 10, 1989
CHICAGO, ILLINOIS

GENERAL

Chairman Robert Veitch opened the meeting at 7:00 p.m. with 14 members and 5 guests present:

Members:	John Bergeron	John Matthews
	John Borst	Henry Pearce
	John Davis	Allan Teplitzky
	Dave Douglas	Roy Uptegraff
	Jim Harlow	Robert Veitch
	Bill Kennedy	Loren Wagenaar
	Robert Lee	Dean Yannucci
Guests:	Olin Compton	Len Stensland
	William Kruesi	Georges Vaillancourt
	Bill Saxon	

It was decided that future Administrative Subcommittee meetings would start at 6:00 p.m.

The Minutes of the Long Beach meeting were approved as distributed. The proposed agenda was accepted.

As of Monday night, 159 people (plus 37 spouses) were registered at the Chicago meeting. Ninety plan to attend the Tuesday luncheon which will feature as speaker, Wallace B. Behnke, Jr., Vice Chairman of Commonwealth Edison and present PES President. The Subcommittee expressed its appreciation to host Len Stensland for the excellent meeting arrangements.

FUTURE MEETINGS

Fall, 1989	Charlotte	October 29 - November 1	City Center Marriott
Spring, 1990	Denver	March 25-28	Marriott
Fall, 1990	Montreal	October 21-24	
Spring, 1991	Phoenix		
Fall, 1991	Baltimore		

Meeting hosts/sites are being sought for 1992 meetings. It was noted that conflicts with the Doble Conference should be avoided.

Subcommittee Chairmen are requested to review the invitation list for changes.

TRANSFORMER COMMITTEE OPERATING MANUAL

Leo Savio has advised the Chairman that the final draft of the revised Operating Manual is complete except for approval of the scope changes for the Transformers Committee and the new scope for the HVDC Subcommittee. Pending approval, the Chairman will request that Leo provide draft copies to Administrative Subcommittee members.

STANDARDS SUBCOMMITTEE - Jim Harlow

Jim Harlow submitted a detailed report on Standards activities (Attachment - ASC-A). Subcommittee Chairmen are requested to review the project status list for changes.

Jim introduced Bill Kruesi, a volunteer who is an official representative of IEEE to the Transformers Committee. Bill is a past Chairman of the IEEE Standards Board and should prove very helpful in the approval process.

Our official contact at the IEEE Standards Office is:

Sue Vogel, Administrator, PES
IEEE Standards Office
445 Hoes Lane
P.O. Box 1331
Piscataway, NJ 08855-1331
(201) 562-3817

She plans to attend future meetings; all Working Groups, Subcommittees, etc. should send copies of minutes, drafts and ballots to her.

Jim reminded members of the importance of maintaining ballot results, particularly negative ballots and their resolution. He also noted the importance of coordinating changes for the 1992 revisions of C57.12.00 and C57.12.90; please keep him posted as to status and progress.

A new IEEE Style Manual (2/89) and new IEEE manual on Standards Development are available; copies will be obtained and distributed to the Administrative Subcommittee. The Submittal guide and Form have also been revised. Also, Judy Gorman, IEEE Standards Publications, would like some advance notice of Standards completion; IEEE approval should provide sufficient notice.

Olin Compton raised a concern regarding clarification of IEEE representation to ANSI C57. Vietch and Harlow feel that Mr. Whittemore has the correct information.

REVIEW OF TECHNICAL COUNCIL ACTIVITIES - Robert Veitch

A detailed review is included in the Chairman's Report (Attachment ASC-B). Highlights include: (a) Corresponding Membership, (b) Technical Papers at Off-Site Committee meetings and (c) General Meeting scheduling. With regard to (b), the Vice Chairman will screen for papers having the potential for presentation at the Transformers Committee Meeting.

TECHNICAL SUBCOMMITTEE ACTIVITIES

NOTE: Written submittals are encouraged and would be appreciated.

DRY TYPE TRANSFORMERS - Roy Uptegraff

The Subcommittee Scope has been proposed as follows: "Preparation of standards, guides and test codes or revisions thereof, for dry-type transformers and reactors, including liaison with ANSI on matters pertaining to dry-type transformers and reactors. Dry-type transformers and reactors are considered to include those in which a significant component of the transformer or reactor internal insulation is an insulating gas (including air)."

Previous submittal of Project P745 (Guide for LV Transient Analysis) was lost after Transformer Committee approval. Re-approval will be sought by the Subcommittee and the Main Committee.

HVDC CONVERTER TRANSFORMERS AND REACTORS - Bill Kennedy

The initial draft of the General Requirements and Test Code for Converter Transformers and Smoothing Reactors is under development. A future seminar will be proposed to educate the Main Committee concerning this specialized activity.

INSULATING FLUIDS - Henry Pearce

1. Gas Guide (C57.104) - Draft to be balloted at the Main Committee.
2. Oil Guide (C57.106) - Draft 2 being reviewed.
3. Guide for Detection and Determination of Gases in Oil-Immersed Transformers during factory test - PAR requested and Working Group being formed.
4. C57.111 and C57.121 are being balloted by NEMA.

BUSHINGS - Loren Wagenaar

1. A future seminar on bushings for DC application may be desirable, perhaps in conjunction with the seminar suggested earlier by Bill Kennedy.
2. General Requirements and Test Procedures for Outdoor Apparatus Bushings (IEEE 21) is being prepared for Main Committee ballot.
3. Concern was expressed for Loading Guide (C57.19.101) progress; Bill Kruesi agreed to follow up on its status.

INSULATION LIFE - Dave Douglas

The Overload Test guide will be submitted for Main Committee ballot prior to the next meeting.

AUDIBLE SOUND AND VIBRATION - Allan Teplitzky

The Audible Sound Test code should be ready for Main committee ballot prior to the next meeting.

INSTRUMENT TRANSFORMERS - John Davis

The liaison process with other technical committees (particularly PSIM) was raised as a concern; Jim Harlow discussed the liaison process.

PERFORMANCE CHARACTERISTICS - John Matthews

Activities report submitted (Attachment ASC-C).

The LTC Performance Requirements Task Force was elevated to a Working Group by Administrative Subcommittee action.

DIELECTRIC TESTS - Robert Lee

Activities report submitted (Attachment ASC-D).

John Rossetti was approved by Chairman Veitch to serve as Chairman of the Working Group for Revision of Dielectric Tests of Distribution Transformers.

The administrative Subcommittee approved a request by Harold Moore to sponsor a seminar on Impulse Test Digital Techniques at the Fall meeting.

WEST COAST - no report

LIAISON ACTIVITIES/APPOINTMENTS

Chairman Veitch reviewed the present list of liaison representatives. Several positions are open; replacements will be pursued by Chairman Veitch.

PAPERS FOR FUTURE MEETINGS

Vice Chairman Bergeron submitted and reviewed his report on Technical Paper Activities (Attachment ASC-E)

COMMITTEE MEMBERSHIP REVIEW

New members of the Main Committee were approved as follows:

- Michael S. Altman - Florida Power and Light
- James P. Kinney, Jr. - General Electric
- Linden W. Pierce - General Electric
- Devki N. Sharma - Nova Scotia Power
- David S. Takach - Union Electric

Other membership actions include:

- Remove:
- S. J. Antalis
 - G. H. Bowers
 - C. G. Evans
 - P. P. Falowski (retain on invitation list)
 - G. Gunnels
 - F. Huber
 - T. G. Lipscomb
 - E. J. Kelly

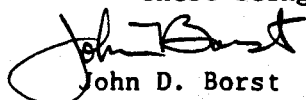
- Letters:
- H. F. Light
 - E. G. Strangas
 - J. A. Thompson
 - H. E. Gabel

RECOGNITION AND AWARDS

Dean Yannucci submitted a detailed report (Attachment ASC-F). Mel Manning will be nominated for a Power Engineering Educator Award.

NEW BUSINESS

There being no new business, the meeting adjourned at 11:05 p.m.


 John D. Borst
 Secretary

TO: Members of IEEE PES Transformers Committee, Administrative Subcommittee
April 10, 1989

SUBJECT: Status Report - Transformer Standards

Following are topics of interest for period October 31, 1988 to April 10, 1989:

1. Active Transformers Committee Projects. A listing of project activity, by subcommittee, is included as attachment.
 2. A note has been distributed to Working Group and Task Force Chairmen who are involved with changes to particular sections of C57.12.00-1987 or C57.12.90-1987. It is essential that each of the independent activities be properly administered regarding PAR's, liaison and ballots so that the future formal submission of the consolidated changes will flow smoothly.
 3. The PES Standards Coordinating Committee met January 30, 1989. Following are points for note:
 - a. IEEE Standards Department is initiating a regular spring and fall "Standards Week" to which all standards writing bodies are invited. The purpose is to provide coordination of facilities for those groups which may find this beneficial. Within the Transformers Committee, the West Coast Subcommittee may find the meeting useful. The first of these meetings will be September 25-29, 1989 in San Francisco.
 - b. The IEEE Standards Office has relocated and has had many changes in personnel in recent months. New address:
IEEE Standards Office
445 Hoes Lane
P.O. Box 1331
Piscataway, NJ 08855-1331
- Ms. Sue Vogel, Administrator, PES, at 201/562-3817 is our contact for matters of general concern.
Note: All working groups should be sending copies of minutes and drafts of standards to Sue Vogel.
- c. The point is reiterated that the 5-year rule for review of standards is based on the date of publication, which is not necessarily the date shown in the title of the standard. This point of potential confusion applies to five ANSI/IEEE C57. series standards, as follows:

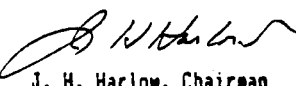
<u>Standard</u>	<u>copyright</u>	<u>5-yr review date</u>
ANSI/IEEE C57.13.3-1983	1988	1993
ANSI/IEEE C57.15-1986	1988	1993
ANSI/IEEE C57.95-1984	1988	1993
ANSI/IEEE C57.110-1986	1988	1993
ANSI/IEEE C57.117-1986	1988	1993

This situation occurred because of the bad backlog in printing which existed 1 to 3 years ago. It is claimed that the backlog is now eliminated and approval and publication year will closely match in the future.

4. Liaison with other PES Technical Committees established in period:

<u>TC</u>	<u>Project</u>	<u>Liaison Representative</u>
T & D	Separable Connectors Guide	A. Wilks

5. Mr. Bill Kruesi, a past Chairman of the IEEE Standards Board, is attending our Chicago meetings as an official representative of the IEEE Standards Office.


J. H. Harlow, Chairman
Standards Subcommittee

Subcommittee: Audible Sound and Vibration				PAR		
Subcommittee Chairman: Allan M. Teplitsky (212/460-4959)				ON FILE		
IEEE	ANSI	WG/TF		TRANS		PES
<u>NO.</u>	<u>NO.</u>	<u>CHAIRMAN</u>	<u>IDENTIFICATION</u>	<u>COMM.</u>	<u>AS OF/STATUS</u>	<u>COORD.</u>
P523	PC57.112	A. Teplitsky	Guide for the Control of Transformer Sound	Yes (8/73)	11/1/88 - No Report	
	PC57.12.90b	A. Teplitsky	Transformer Sound Power Measurement	Yes (3/86)	11/1/88 - Resolution of ballots on 05	RM
Subcommittee: Bushing				PAR		
Subcommittee Chairman: Loren B. Wagenaar (614/223-2259)				ON FILE		
IEEE	ANSI	WG/TF		TRANS		PES
<u>NO.</u>	<u>NO.</u>	<u>CHAIRMAN</u>	<u>IDENTIFICATION</u>	<u>COMM.</u>	<u>AS OF/STATUS</u>	<u>COORD.</u>
P21	PC57.19.00	L. B. Wagenaar	General Requirements and Test Procedures for Outdoor Apparatus Bushings (Rev. of ANSI C76.1)	Yes (4/79)	11/1/88 - 08 comments being resolved.	SWGR T & D PSR IC
P757	PC57.19.101	F. E. Elliott	Guide for Loading Apparatus Bushings	Yes (5/78)	11/3/88 - Guide reaffirmed by Standards Board. Referred to ANSI C57.	PSR SWGR SUB
P800	PC57.19.100	F. E. Elliott	Bushing Application Guide	Yes (4/79)	11/1/88 - 02 comments being resolved.	SWGR SUB PSR
		L. B. Wagenaar (Acting)	WG Bushings for HVDC Applications	None	11/1/88 - Initial Meeting Required	
		L. D. Miller	TF Bushings for Distribution Transformers	None	11/1/88 - No activity Required	
24			Standard Performance Characteristics and Dimensions for Outdoor Apparatus Bushings	?	11/1/88 - Comments from subcommittee ballot being resolved. (Tables 9 and 10).	
Subcommittee: West Coast				PAR		
Subcommittee Chairman: Dennis Gerlach (602/236-5483)				ON FILE		
IEEE	ANSI	WG/TF		TRANS		PES
<u>NO.</u>	<u>NO.</u>	<u>CHAIRMAN</u>	<u>IDENTIFICATION</u>	<u>COMM.</u>	<u>AS OF/STATUS</u>	<u>COORD.</u>
P513	PC57.114	S. Oklu	Seismic Guide for Power Transformers and Reactors	Yes (7/73)	11/1/88 - Discussion re negative comments on D/7 from main committee.	NPE Sub
P842	PC57.120	R. Jacobsen	Loss Evaluation Guide for Power Transformers and Reactors	Yes (5/80)	11/1/88 - D14 balloted. Will be submitted to Std Bd.	Sub RM PS
	PC57.93	D. Johnson J. Gillies, VC	Guide for Installation of Liquid Immersed Power Transformers (Including C57.12.11 and C57.12.12 Consolidation)	Yes (6/82)	11/1/88 - Consolidation work on 3 standards started	None
	PC57.128	H. Johnson	Fire Protection of Outdoor Liquid Immersed Power Transformers	No (Pending)	11/1/88 - Outlines made 3/27/89- Response to IEEE re questions on PAR request.	NPE Sub PSR

ASC - A
3 of 6

Subcommittee: Dielectric Tests

Subcommittee Chairman: Robert E. Lee (215/398-5150)

<u>IEEE NO.</u>	<u>ANSI NO.</u>	<u>WG/TF CHAIRMAN</u>	<u>IDENTIFICATION</u>	<u>PAR ON FILE TRANS COMM.</u>	<u>AS OF/STATUS</u>	<u>PES COORD.</u>
		H. R. Moore	WG on Revision of Dielectric Tests			
	PC57.21a	W. N. Kennedy	TF on Revision of Dielectric Tests of Shunt Reactors	Yes (2/86)	4/11/88 - Discussion on D7 re dielectric tests	None
	PC57.12.00j	R. A. Veitch	TF on External Phase to Phase Clearances for Power Transformers	Yes (2/86)	11/18/88 - Complete. Held pending C57.12.00 revision	None
	PC57.98	R. E. Minkwitz	TF Revision for Guide for Transformer Impulse Tests	Yes (2/86)	11/1/88 - Review of scope of TF	None
		C. V. Brown (J. Rossetti)	WG for Revision of Dielectric Testing of Distribution Transformers			
	PC 57.12.90c	W. R. Henning	TF on Routine Impulse Test for Distribution Transformers	Yes (9/87)	11/1/88 - Working on D6 of proposed addition to Section 10.4	RM PSC
		R. E. Lee	TF on Low Side Surge Requirements for Distribution Transformers	None	11/1/88 - Defining scope Required	
		G. H. Vaillancourt	WG on Partial Discharge Tests for Transformers			
		W. J. Carter	TF for Measurement of Apparent Charge	None	11/1/88 - Considering changes Required to C57.113 Section 5	
	PC57.127	E. Howells	TF on Guide for the Detection of Acoustic Emissions From Partial Discharges in Oil-Immersed Power Transformers	Yes (3/88)	11/1/88 - Discussion of D10 ballot returns	T & D PG

Subcommittee: Instrument Transformers

Subcommittee Chairman: John N. Davis (404/447-7386)

<u>IEEE NO.</u>	<u>ANSI NO.</u>	<u>WG/TF CHAIRMAN</u>	<u>IDENTIFICATION</u>	<u>PAR ON FILE TRANS COMM.</u>	<u>AS OF/STATUS</u>	<u>PES COORD.</u>
P546	PC57.13		Standard Requirement for Instrument Transformers	Yes (5/80)	11/1/88 - Tables 2 & 3 format change.	PSIM PSR SPD
P670	C37.077	J. G. Reckleff (Joint w/Swgr)	Requirement for Current Transformers for use with AC-High-Voltage Circuit Breakers	No	4/11/88 - Procedure to be submitted to subcommittee for ballot. 11/1/88 - No Report	?
P832	PC57.13.4	A. J. Jonnatti	Detection of Partial Discharge and Measurement of Apparent Charge Within Instrument Transformers	Yes (10/79)	4/11/88 - Draft to be ready at next meeting. 11/1/88 - No Report	T & D

Subcommittee: Dry Type Transformers				PAR		
Subcommittee Chairman: Roy E. Uptegraff, Jr. (412/887-7700)				ON FILE		
IEEE	ANSI	WG/TF		TRANS		PES
<u>NO.</u>	<u>NO.</u>	<u>CHAIRMAN</u>	<u>IDENTIFICATION</u>	<u>COMM.</u>	<u>AS OF/STATUS</u>	<u>COORD.</u>
	C57.21 (contribution)	R. Dudley	Loading Dry Type Reactors	None Required	11/1/88 - Discussion re C57.21 draft. Dry-type info to be included in C57.21	None
P259	None	A. M. Iverson	Standard Test Procedure for Evaluation of Systems of Insulation for Specialty Transformers	No	11/1/88 - D/3 Discussion	?
	PC57.12.01	E. Koenig	General Requirements for Dry Type Distribution and Power Transformers	Yes (7/82) StB	9/22/88 - Submission ready for	None
	PC57.96	W. H. Mutschler	Guide for Loading Dry Type Distribution and Power Transformers	Yes (2/81)	6/15/88 - Submission approved pending condition	PSR PSIM
	PC57.124	A. D. Kline	Recommended Practice for Measuring Partial Discharge and Measurement of Apparent Charge in Dry-Type Transformers	Yes (1/86)	11/1/88 - Discussion regarding sensitivity requirements	None
	PC57.12.60	R. L. Provost	Trial Use Standard Test Procedure for Thermal Evaluation of Insulation Systems for Solid Cast and Resin Encapsulated Power and Distribution Transformers	Yes (11/85)	11/1/88 - Added "Trial Use" in title. Work nearing completion with DB	Un- clear
P1052	PC57.12.59	R. E. Uptegraff	Dry-Type Transformer Through Fault Current Duration Guide	Yes (84)	4/11/88 - Has been approved by StB. Held pending PC57.96 revision	PSR SWGR
		R. L. Provost	Thermal Evaluation of Insulation Systems of Dry-Type Transformers above 600V	No	11/1/88 - Name Change	
	PC57.12.58	A. D. Kline	Guide for Conducting Transient Voltage Analysis of a Dry-Type Transformer Coil	No	11/1/88 - IAS endorsement received	
	PC57.16			No	11/1/88 - Discussion initiated re scope	
	C57.12.91	E. Koenig	Test Code for Dry-Type Distribution and Power Transformers	No (pending)	11/1/88 - Organizational Meeting 3/15/88 - PAR request to IEEE	SPD RM

Subcommittee: HVDC Converter Transformers and Smoothing Reactors
 Subcommittee Chairman: William N. Kennedy (413/494-2322)

IEEE NO.	ANSI NO.	WG/TF CHAIRMAN	IDENTIFICATION	PAR ON FILE TRANS COMM.	AS OF/STATUS	PES COORD. RM T & D
	PC57.129	W. Kennedy	Dielectric Tests for HVDC Transformers and Reactors	No (Pending)	11/1/88 - Outline defined. 3/6/89 - IEEE Questions answered	

Subcommittee: Insulating Fluids
 Subcommittee Chairman: Henry A. Pearce (412/983-4335)

IEEE NO.	ANSI NO.	WG/TF CHAIRMAN	IDENTIFICATION	PAR ON FILE TRANS COMM.	AS OF/STATUS	PES COORD. RM T & D
	PC57.106	F. W. Heinrichs	Guides for Acceptance and Maintenance of Insulating Oil in Equipment	Yes (4/86)	11/1/88 - D2 being prepared	None
	PC57.104	H. A. Pearce	Guide for the Detection and Determination of Generated Gases in Oil-Immersed Transformers and Their Relation to the Serviceability of the Equipment	Yes (12/81)	11/1/88 - Results of D6 ballot reviewed	PSR T & D
P954	PC57.121	H. A. Pearce	Guide for Acceptance and Maintenance of Less Flammable Hydrocarbon Fluid in Transformers	Yes (12/81)	2/22/88 - Submission approved by RevCom.	T & D PSR
	PC57.111	H. A. Pearce	Guide for Acceptance and Maintenance of Silicone Fluid in Transformers	Yes (12/87)	12/88 - Revision submitted to Standards Office	T & D PG
		H. A. Pearce	Guide for the Detection and Determination of Gases in Oil-Immersed Transformers During Factory Tests	No (Pending)	3/15/89 - PAR request submitted to IEEE	None

Subcommittee: Insulation Life
 Subcommittee Chairman: David H. Douglas (216/447-3370)

IEEE NO.	ANSI NO.	WG/TF CHAIRMAN	IDENTIFICATION	PAR ON FILE TRANS COMM.	AS OF/STATUS	PES COORD. RM T & D
	PC57.91	W. E. Wrenn	Guide for Loading Mineral Oil-Immersed Transformers	Yes (3/85)	11/1/88 - Inputs of 4 TF being reviewed.	Sub T & D PSE
	PC57.100	L. A. Loudermilk	Standard Test Procedure for Thermal Evaluation of Oil-Immersed Distribution and Power Transformers	Yes (10/88)	11/1/88 - Various inputs being assembled.	NPE RM T & D SPD
P838	PC57.119	R. L. Grubb	Recommended Procedures for Performing Temperature Rise Tests on Oil-Immersed Power Transformers at Loads Beyond Nameplate Rating	Yes (9/80)	11/1/88 - D10 ready for ballot.	SWG SUB PSR

Subcommittee: Performance Characteristics		PAR				
Subcommittee Chairman: John W. Matthews (301/281-3775)		ON FILE				
IEEE	ANSI	WG/TF		TRANS		PES
NO.	NO.	CHAIRMAN	IDENTIFICATION	COMM.	AS OF/STATUS	COORD.
P638	None	L. R. Stensland	Qualification of Class 1E Transformers for Nuclear Power Generating Stations	Yes	11/1/88 - Reviewed results of D16 ballot of main committee	NPE SUB
	PC57.18.10	C. G. Pounds	Practices and Requirements for Semiconductor Power Rectifier Transformers	Yes	11/1/88 D6 reworked by (6/81) working group	None
	PC57.21	J. W. McGill	Requirements, Terminology, and Test Code for Shunt Reactors over 500 KVA	Yes	11/1/88 - Discussion re results (6/88) of ballot on D7	RM T & D PSR
P785	PC57.116	B. K. Patel	Guide for Transformers Directly Connected to Generators	Yes	11/88 - Coordination document sent to Std Bd. (2/79)	PG PSR RM NPE
P262 E3	PC57.12.90 e3	W. R. Henning	C57.12.90e3 - Revision of C57.12.90 Section 8 - "No Load Losses and Exciting Current"	No	11/1/88 - Complete - Awaiting Section 9 rework.	?
P262 E2	PC57.12.90 e2	W. R. Henning	Revision of C57.12.90 Section 8.3.3	No	11/1/88 - D/8 approved by TC 1985. Text held pending C57.12.90e3 project.	?
P262 E1	PC57.12.90 e1	W. R. Henning	Addition to C57.12.90 Section 8	No	11/1/88 - D4 text being held pending C57.12.90e3 project.	?
P262 E	PC57.12.90e	W. R. Henning	Revision of C57.12.90 Section 9 - Load Loss and Impedance Tests	No	11/1/88 - Ideas being discussed by WG	?
P1098	PC57.123	W. R. Henning R. Girgis	Guide for Transformer Loss Measurement	Yes	11/1/88 - Work awaiting (3/85) conclusion of C57.12.90e	PSIM
P462C	PC57.12.00	W. R. Henning	Supplement for Allowable Loss Tolerances and Methods of Loss Measurements	No	11/3/87 - Proposal pending round-robin test. 11/1/88 - Proposal circulated re accuracy requirements	?
	PC57.125	D. J. Cash W. B. Binder	Guide for Failure Investigation, Documentation and Analysis for Power Transformers and Shunt Reactors	Yes	11/1/88 - Discussion re (2/87) resolution of D6 ballot	T & D P6S PSE SWGR
		R. H. Frazer	TF - LTC Position Indication	No	11/1/88 - Review of 1985 Survey	
	PC57.12.00i	J. W. Matthews	TF-Nameplate Information "Directed Flow"	Yes	4/11/88 - Awaiting input from (12/86) Loading Guide WG	
	PC57.12.00k	C. J. McMillen	TF-Routine Resistance Test Table 14	No	4/11/88 - To be considered by Herring WG.	
		T. P. Traub	TF-LTC Performance Requirements	No	11/1/88 - First meeting held. Will become WG	

IEEE/PES TRANSFORMERS COMMITTEE

Chairmans' Report

April 10 - 12, 1989 Chicago, Illinois

REPORT FROM THE TECHNICAL COUNCIL

The last meeting of the Technical Council was held on January 31, 1989 in New York during the Winter Power Meeting. I would like to pass on the following points of interest to the membership:

(a) Corresponding Membership:

The initial proposal for "Corresponding Membership" has been modified to restrict such membership to the Working Group Level and not restrict this status to persons outside the U.S. and Canada. The Technical Council unanimously approved the following guidelines for "Corresponding Working Group Members":

- 1) Will be appointed by the Working Group Chairman with the approval of the Subcommittee Chairman. The Working Group Chairman should identify the reason(s) why the Working Group Member is requesting corresponding status (corresponding status is limited to the Working Group Level);
- 2) Must express and demonstrate their willingness to comment on and contribute to those documents developed by Working Groups to which they are assigned within established deadlines;
- 3) Are accorded the full responsibility of Working Group Membership and will receive Working Group Meeting minutes;
- 4) Will conduct all business and correspondence in English.

(b) Presentation of Technical Papers at Off-Site Committee Meetings:

We were authorized at the Executive Board meeting in July 1988, to proceed with the presentation of as many as three papers per year per Committee at off-site Committee meetings. Even though this is not yet detailed in the PES Publication Guide and the Declaration of Intent does not yet give the author a choice of General or Committee meeting sites for the presentation, each Technical Publications Coordinator should evaluate the possibility of proceeding with this option now. The Author must approve the assignment of his paper to a Committee meeting. The presentation should be scheduled after a general meeting so the pre-prints will be available, and a maximum of discussion can be generated.

(c) General Meeting Scheduling:

The Winter and Summer Power Meetings have encountered many problems for those trying to come up with an acceptable schedule for the technical sessions, panel discussions and meetings of Technical Committees. Fortunately, the Transformers Committee meets separately and is not part of the scheduling problem. The following items are being considered to not only relieve this problem, but to improve the overall meeting:

- (i) We will try to gain approval from the Executive Board to schedule a limited number of technical committee working group meetings in parallel with the Monday morning Plenary Session.
- (ii) Because Friday attendance has been poor, and most people do not like to have their sessions scheduled for a Friday, we will consider reducing the meeting to four days.
- (iii) A suggestion was made to have four technical sessions per day per meeting room but this was defeated. Technical sessions will continue to have a full half day.
- (iv) To reduce the number of technical sessions, we will try to have not less than four papers but not more than six papers per session.
- (v) A master plan will be developed for all technical sessions. This plan will not change from meeting to meeting. The first cut at the master plan allotted only one session for Transformers on Wednesday afternoon. This was based on our "allotted" number of papers, i.e. 7. I have discussed this with Don Volzka, Secretary of the Technical Council, and expressed my dissatisfaction and requested an allocation of two sessions. Basically, if we require two sessions we will get them. One session would be in the "master plan" and the second would be allocated to a spare slot. It was also proposed that there would be joint technical sessions sponsored by two committees to ensure that each session had the required minimum number of papers. For example, if we had seven papers to present at the next Summer Power Meeting, we would likely have one five paper session, sponsored by the Transformer Committee, and the remaining two papers would be given in a combined session with papers from another Technical Committee.

CHAIRMAN'S REPORT CONTINUED ...

(d) Technical Council (TC) Liaison with the Power Engineering Education Committee (PEEC):

The activities of the PEEC are of necessity closely inter-related with those of the various Technical Committees of the Technical Council. As long as PEEC was a Committee of the Technical Council, the relationship was clear, but with the change in PEEC reporting from TC to the Executive Board, the exact nature of the relationship has been obscured. A formal liaison has now been established between PEEC and TC with Carl Flick, Chairman of PEEC, as the designated Liaison Representative.

SCOPE CHANGES IN THE TRANSFORMERS COMMITTEE:

Scope changes for the Transformers Committee and the new scope for the HVDC Converter Transformer and Smoothing Reactor Subcommittee were sent to the IEEE/PES Organization and Procedures Committee for review in January. This information was forwarded to the members of the Organization and Procedures Committee for comment and at this time, we are still waiting for a reply from this Committee.

TRANSFORMERS COMMITTEE OPERATING MANUAL:

I have been advised by Leo Savio that the final draft of the revised Operating Manual is complete except for approval of the scope changes for the Transformers Committee and the new scope for the HVDC Subcommittee. Unfortunately, the approval is slow in coming thus the revised procedures manual will not be ready for the Chicago meeting.

FUTURE TRANSFORMER COMMITTEE MEETINGS:

The future meeting dates and locations are given in the minutes of the Long Beach Meeting. Please note that the Fall 1989 meeting in Charlotte, N.C. has been changed. The meeting will now be held October 29 through November 1, 1989.



ROBERT A. VEITCH
CHAIRMAN

RAV:SH

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Administrative Subcommittee Meeting - 4/10/89

Performance Characteristics Subcommittee Activities

Membership - Committee

Nomination of Michael S. Altman to membership of the Transformers Committee.

Working Groups - LTC Performance Requirements

Request elevation from Task Force to Working Group status.

Projects - LTC Position Indication

Jim Harlow has verified and obtained copy of approved PAR from Standards Board. Assigned Project Number is PC57.12.00h.

Liason - IEEE Switchgear Committee

Received Draft #7 - Proposed ANSI/IEEE C37.36B - Guide to Current Interruption with Horn Gap Air Switches.

Reviewed sections pertaining to transformers and returned approved ballot on 11/29/88.

Misc. - ANSI/IEEE C57.12.90-1987

A printing error was reported by Allen Bartek. The schematics shown in Figures 9 and 10 are reversed. The captions are correct and the prose in Section 7.3.2, which refers to these figures, is correct.

This information was forwarded to Jim Harlow for retention pending next revision of the standard.


PCS Chairman

**DIELECTRIC TESTS SUBCOMMITTEE
ACTIVITIES
ADMINISTRATIVE SUBCOMMITTEE - 4/10/89**

1. Membership - 55
2. Invitation List - Please add to the Committee List:

Mahash P. Sampat General Electric Co. P.O. Box 2188 Hickory, NC 28601 (704) 462-3226	David R. Smith PTI Castle Main Wilmerding, PA 15148 (412) 824-2488
--	--
4. John Rossetti of Memphis Light, Gas & Water has accepted chairmanship of the Working Group on Revision of Dielectric Tests on Distribution Transformers to replace Charles V. Brown who accepted early retirement from Florida Power & Light. Charles is now a consultant.
3. Standards Activities
 - a. Bill Kennedy - PC57.21/D8 - Requirements, Terminology and Test Code for Shunt Reactors over 500 kVA (Sections 6, 9, and 10).

Balloted the Task Force and Dielectric Tests Subcommittee. Insufficient ballot returns and one negative that can't be resolved. Revisions to be made and the Committee balloted.
 - b. Bill Henning - PC57.12.90c/D6 - Routine Impulse Test for Distribution Transformers.

Successfully balloted the Working Group on Revision of Dielectric Tests on Distribution transformers and the Subcommittee. 69 sent, 47 approved, 3 approved with comment, 77% approved - a good ballot. Minor revision will be made and the Committee balloted.
 - c. Ed Howells - PC57.127 - Trial Use Guide for the Detection of Acoustic Emissions from Partial Discharges in Oil-Immersed Power Transformers.

Based on discussion and resolution of Dielectric Tests Subcommittee negatives at Long Beach, the Transformers Committee was to be balloted. The last negative was resolved on 4/10/89. Minor editorial changes will be made and the Committee balloted.

4. IEEE High Voltage Testing Technique Subcommittee Meeting.

Russ Minkwitz attended the November 15-16, 1988 meeting held in Lenox, MA. The subcommittee began the process of review for revision and updating ANSI/IEEE STD #4-1978-IEEE Standard Techniques for High Voltage Testing.

5. Harold Moore, Chairman of the Working Group on Revision of Dielectric Tests has expressed the need to learn more about digital recording of data during dielectric testing. He requests permission to organize and chair a seminar during the Charlotte meeting. The seminar will provide a forum for those knowledgeable and experienced in digital data recording to present their knowledge to the Committee.

Robert E. Lee

Robert E. Lee
April 14, 1989

REPORT ON TECHNICAL PAPER ACTIVITIES

A. 1989 T&D Conference

The T&D conference was held on April 2-7, 1989 in New Orleans, Louisiana. The Transformers Committee conducted two sessions with four papers in each. Attendance at these sessions range from 40 to 80 people. The papers were well received and several excellent discussions were presented. Robert Veitch chaired the first session and John Bergeron chaired the second session. There was also a panel session with four panelists; attendance was approximately 200 people.

B. 1989 Summer Power Meeting

A total of thirteen papers were received for review for this conference. However, one paper was received late because it had been sent to another committee and a second is a re-review and there have been problems obtaining second reviews from the original reviewers. Therefore, of the thirteen papers, eleven have been fully reviewed.

Of these eleven papers, three were accepted with suggested changes, two were accepted with mandatory changes, four were rejected for revision (RJR) and two were rejected outright (RJO). We are presently scheduled for two sessions on Tuesday, July 11.

C. Technical Council Publications Committee

I attended this meeting in New York on January 30, 1989. The following constitute the major items covered.

- 1) The Transformers Committee received an allocation of seven papers for the 1990 Winter Power Meeting. This is based on a historical ratio of approximately 240 papers which will be presented at the conference. A five year average was used in the computation.
- 2) The techniques for nominating members of technical committees are being questioned and will probably be addressed in a new organizational manual. The favored approach seems to be very near to that which we use.
- 3) It was noted that trading of paper allocation space between committees would be condoned within limits.
- 4) A modification was approved for adding a statement to the review forms pointing out the confidentiality of the information disclosed in reviewing a paper. This item will now be sent on to IEEE Headquarters.

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Report on Technical Paper Activities
Page 2

- 5) Considerable time was spend in reviewing the Publication Guide and Author's Declaration of Interest for the inclusion of Conference Record papers at Special Technical Conferences. Comments received at the meeting will be incorporated into a second draft and mailed to all Publication Committee members for a second review. The final version is to be sent out as an action item for the SPM in July. Conference records will not contain discussions. Designations made by authors requesting transactions or conference grading may not be changed.
- 6) A proposed "Guidelines for Reviewers" was discussed. Following the discussion, it was agreed to update the guideline to remind reviewers that they can and should accept practical papers. After the rewrite and second review by the Publications Committee, the document will be forwarded to IEEE Headquarters for printing and enclosing with the review forms. The guideline will be reviewed again in two years to see if it has been of any assistance and should be continued.
- 7) The Executive Board's Strategic Planning Ad Hoc Publications Committee is studying many issued involving publications. Recommendations from this study will be sent to all Technical Committee Chairman and Vice Chairman prior to the 1989 SPM. The issues will be open for discussion at the Publications Committee Meeting and forwarded to the Technical Council for their concurrence during the SPM.


John J. Bergeron
Vice Chairman
Publications Coordinator

4/10/89



IEEE

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**POWER ENGINEERING SOCIETY
TRANSFORMERS COMMITTEE**

CHAIRMAN
Olin R. Compton
Virginia Power
Grayland
P.O. Box 2668
Richmond, VA 23261

PLEASE REPLY TO:

VICE CHAIRMAN
Robert A. Veitch
Ferranti - Packard Transformer
121 Industry St.
Toronto, Ont. Can. M6M 4M3

April 5, 1989

SECRETARY
John J. Bergeron
Louisiana Power and Light
P.O. Box 60340
New Orleans, LA 70160

To: IEEE Transformer Committee and Administrative Subcommittee

SUBCOMMITTEE CHAIRMEN:

Subject: Awards Subcommittee Activities
October 1988 - April 1989

AUDIBLE SOUND and VIBRATION
Allan M. Tepitsky
Consolidated Edison
4 Irving Place RM. 306 S
New York, N.Y. 10003

BUSHINGS
Loren B. Wagenaar
American Electric Power
One Riverside Drive
Columbus, OH 43215

The following awards were received and presented at the
April 1989 Transformer Committee meeting:

**HVDC CONVERTER
TRANSFORMERS and REACTORS**
William N. Kennedy
Westinghouse Electric Corp.
651 Holiday Drive
Pittsburgh, PA 15802

Certificate of Appreciation:

- Bob Veitch - Chairman - Working Group on Thermal Tests
- Olin Compton - Chairman - IEEE Transformer Committee
- Dean Yannucci - Chairman (1985-1986) - IEEE Transformer Committee

DIELECTRIC TESTS
Robert E. Lee
Pennsylvania Power & Light
P.O. Box 3328
Allentown, PA 18106-3328

Certificate of Appreciation:

- J. H. Harlow - Chairman - Working Group on Step Voltage Regulators
- B. K. Patel - Chairman - Working Group on the Guide for Transformers Directly Connected to Generators
- H. F. Light - Chairman - Working Group on the Guide for Transformer Reliability
- A. C. Wurdak - Chairman - Working Group on Thermal Evaluation of Distribution and Power Transformers
- S. P. Mehta - Chairman - Taskforce on Loss Measurements
- J. D. Borst - Chairman - Performance Characteristics Subcommittee

DRY TYPE TRANSFORMERS
Roy E. Uptegraff, Jr.
R. E. Uptegraff Mfg. Co.
P.O. Box 182
Scottdale, PA 15883

INSTRUMENT TRANSFORMERS
Ralph B. Sletson
General Electric Co.
30 Main St.
Somersworth, NH 03878

INSULATION LIFE
Dave H. Douglas
Centerior Energy Corp.
P.O. Box 5000
Cleveland, OH 44101

INSULATING FLUIDS
Henry A. Pearce
Westinghouse Electric Corp.
469 Sharpsville Ave.
Sharon, PA 18146

**PERFORMANCE
CHARACTERISTICS**
John D. Borst
Westinghouse Electric Corp.
P.O. Box 883
Jefferson City, MO 65102

RECOGNITION and AWARDS
Dean A. Yannucci
Westinghouse Electric Corp.
651 Holiday Drive
Pittsburgh, PA 15802

TRANSFORMER STANDARDS
James H. Harlow
Siemens Energy and Automation
P.O. Box 6289
Jackson, MS 39208

WEST COAST
Dennis W. Gerlach
Salt River Project
P.O. Box 52025
Phoenix, AZ 85072-2025

THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.

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IEEE Transformer Committee and Administrative Subcommittee
April 5, 1989
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Working Group Recognition Award: W. J. McNUTT CHAIRMAN

D. Takach	E. H. Gabel, Jr.	S. L. Foster
G. C. Bryant	C. G. Evans	O. R. Compton
R. E. Uptegraph	W. H. Mutschler	L. W. Long
R. S. Girgis	W. P. Gibbons	E. W. Kalkstein
S. Northrop	R. A. Veitch	D. E. Shefka
V. Chenappan	C. J. McMillen	D. A. Duckett
B. F. Allen	A. Bimbris	

Transformer Technical Committee Prize Paper

"A Refined Mathematical Model for Prediction of Bubble Evolution in Transformers:

W. Fessler
T. Rouse
W. McNutt
O. Compton

Distinguished Service Award:

Olin R. Compton

In addition to the above, nominees for the following were submitted:

PES Prize Paper Award:

"Calibration of Test Systems for Measuring Power Losses of Power Transformers" by S. P. Mehta and Oskars Petersons.

Note that originally the paper "A Refined Mathematical Model for Prediction of Bubble Evolution in Transformers" by McNutt, et. al, was submitted, but was rejected in that it had not yet been published. Thus, the Mehta & Petersons paper was submitted.

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The Winning Papers Report were:

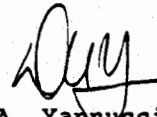
"Application of an On-Line Air Gap Monitor for
Hydroelectric Generator Protection and Problem
Diagnosis" by Talas et. al.

PGC

and

"Influence of Harmonics on Power Distribution System
Protection" by Fuller et. al.

PSRC



D. A. Yannucci, Chairman
IEEE Transformer
Awards Subcommittee

WEST COAST TRANSFORMER SUBCOMMITTEE
FEBRUARY 16, 1989 MEETING MINUTES
TEMPE, ARIZONA

The meeting was called to order by the Chairman, Dennis Gerlach, shortly after 1 pm. Attendees of the meeting were introduced, and were as follows:

<u>NAME</u>	<u>COMPANY</u>	<u>Member/ Guest</u>
Ray Allustiarti	SAI Engineers Inc.	M
John Barry	Maydwell & Hartzell	G
Dave Billings	Qualitrol Corp.	G
George Forrest	Sypotec Corp.	
John Galbraith	Bonneville Power Admin.	G
Dennis Gerlach (Chairman)	Salt River Project	M
D.A. Gillies	Consultant	M
Bill Isberg	Isberg Associates, Inc.	M
Roger Jacobsen		M
Herb Johnson	Seattle City Light	M
Luther Kurtz	Engineer & Design Assoc.	G
Gary McCulla	Salt River Project	G
Bob Norton	McGraw Edison Power Sys.	M
Samuel Oklu (Vice Chairman)	L.A. Dept of Water & Power	M
Denise Roth	ASEA Brown Boveri / Westinghouse	M
Don Schafer	Puget Sound Power & Light	M
Dick Sullivan	Qualitrol Corp.	G
David Sundin	RTE - Cooper Power Systems	M
Lou Tauber (Secretary)	Corps of Engineers	
Chuck Todd	Tacoma City Light	M

-Approval of Previous Meeting Minutes-

Minutes of the Long Beach California Meeting dated November 1, 1989 were approved without changes.

-New Membership-

There were no requests for membership in the subcommittee. Bill Isberg has been making an effort to recruit new members. Dennis introduced a brochure which will be distributed by the Substations Committee for new member recruitment. There were blanks put in for Substation Officers, which could be removed or kept. The West Coast Transformer Subcommittee could possibly use this format to recruit new members.

West Coast Transformer Subcommittee
February 16, 1989 Meeting Minutes
Page 2

-Old Business-

Denise introduced information on transformer storage from different users.

-New Business-

None

-Future Meetings-

The next full transformer meeting will be in Chicago April 9-12. The fall meeting will be in Charlotte, October 22-25. The spring meeting will be in Denver March 25-28. There will be a meeting in Montreal, October 21-24, and in Phoenix, the Spring of 1991.

We do have the option of having the meeting in Long Beach, during the Summer Power Meeting, July 9-14. During the Long Beach meeting, there will be a Substation meeting. Gillies said that the Installation Group needs to meet both in the Summer and the Fall. The consensus of the group was that the next meeting should in Long Beach during the Summer Power Meeting with the Substation group.

-Gas-In-Oil Demonstration-

Alberto Marquez and Albert Redlinger from the Salt River Project gave a demonstration on portable gas-in-oil analyzers. Two models were on display, both built by Hydran. The units measure primarily Hydrogen, with some CO readings.

Oil samples were brought from two different concentrations of Hydrogen. One was relatively low, and the other high. Only 2 mL samples are needed.

The first Hydran unit is a plug in unit. The second unit is a simplified battery operated unit.

If a sample which is high in Hydrogen is tested, the tester must be well flushed before another sample is tested. Flushing consists of running a known low hydrogen through the tester.

Approximately 15% CO will be read. Dennis said that SRP is leaning towards abandoning the gas blanket analysis for this type of testing because of its improved accuracy.

West Coast Transformer Subcommittee
February 16, 1989 Meeting Minutes
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There was a question on the frequency of sampling. Al said that on large power transformers, SRP does yearly sampling. On a unit which is expected to do more gassing, then they test more often, and they may do a dissolved gas analysis every three months. They use the portable device for trending.

While the discussion was taking place, a sample was being tested on both units. The AC unit read 180, whereas the battery powered unit read 175.

It was again stressed that SRP uses these tests for thumb nail figures, and they do a gas in oil analysis.

Sam said that their group uses the Hydran system on large power transformers.

Al said that with a sample which is high in Hydrogen, some Hydrogen will be lost through the syringe, introducing the sample into the unit.

Herb asked if this test could replace other types of testing. Answer: Not likely. SRP uses power factor tests as a base for future comparisons. On large units, they do annual screening tests.

Sam mentioned that Nissan provided a display of a unit in Long Beach which detected five or six gasses, although he could not remember many details.

The cost of the Hydran portable unit is approximately \$6000.

David Sundin asked if the gas analysis could be done in conjunction with a hand held or portable computer. Answer: Thus far, Hydran does not have this available.

Calibration of the units are done through a sample with a known Hydrogen content.

-Working Group reports-

Transformer Loss Evaluation. Roger reported that the Main Committee had been balloted and the ballots were affirmative. Roger plans on sending a letter with documentation to the Standards Committee. 120 total ballots were sent. Names of the working group members were read by Roger. Roger said that those whose names were read, but did not want their names included see him after the meeting. Additionally, Roger described how the only negative ballot was resolved.

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Gillies said that the letter which Roger will send to the Standards Committee should particularly address liaison. The letter should identify who was sent a ballot, and who did and did not send a response. Roger asked who should author the letter forwarding the standard to the Standards Committee. Gillies said the Chairman of the Working Group should send the letter in directly.

Consolidation Guide. Gillies said that Draft two was worked on extensively, and draft three will be forwarded and worked on in Long Beach.

Fire Protection. Herb reported that seven members and six guests worked on the letter explaining the guide. No change in the PAR was made.

Seismic Guide. Sam reported that there are three negative votes which he is still working on. He is hoping to submit the guide to the Standards Board in September. Additionally, he said that he is having trouble getting liaison response.

-Qualitrol Demonstration-

Dick Sullivan and Dave Billings gave a demonstration on the new Qualitrol Electronic Temperature Monitor for Oil-Filled Transformers. The system monitors contact closures and fan motor operation. This system is the beginnings of a smart type control system for the entire transformer. The unit is available in either a two or three winding configuration. Devices are customer selectable fail safe or not fail safe. The unit provides remote output capability, with outputs at 0-1 mA or 4-20 mA selectable for Scada incorporation. The device could be mounted in the transformer terminal cabinet. The temperature operation range is -20°C to 80°C, with a 2% accuracy, and 100°C with a 5% accuracy. A relay is provided to indicate that the power supply has been lost, with an alarm contact. Relay outputs are 10 amps. The memory is supported with a lithium battery back-up with a ten year life.

After the Qualitrol demonstration, the representatives from Hydran and Qualitrol were asked to step outside in order that the subcommittee could discuss the subject of bringing in manufacturers to display new products.

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Dennis asked for input on this type of program, with reps giving demonstrations.

Herb said that this demo was very informative. Chuck said that the demo should be timely, with new products displayed.

Dennis said that Hydran was used since SRP uses them in their maintenance program. Since time and scheduling are tight at the Summer Power Meeting, topic presentation may not be possible. T&D normally holds committee meetings the first three days, so there is no way to tell how the schedule looks for this group.

Gillies asked that the Consolidation group meet towards the end of the week, for four hours. Herb thought that all working groups should meet towards the end of the week.

Both Sam and Roger have no plans for future working group meetings, but will report on the progress in publishing their guides during future West Coast Transformer Subcommittee Meetings.

The meeting was then adjourned.

Next meeting, Long Beach, California.

Respectfully submitted,

Louis A. Tauber
Secretary
West Coast Transformer Subcommittee

April 21, 1989

Performance Characteristics Subcommittee

Meeting Minutes - Chicago, IL - April 11, 1989

I. Introduction/Attendance

The Performance Characteristics Subcommittee (PCS) met at 2:00 p.m. on Thursday, April 11, 1989, with 29 members and 38 guests in attendance.

II. Approval of Minutes

The minutes of the November 1, 1988, PCS Meeting were approved as written.

III. Chairman's Remarks

A. The Chairman recognized John Borst, PCS Past Chairman, and the Subcommittee offered an applause of thanks for his superb performance as PCS Chairman during the last six years.

B. Administrative Subcommittee Notes

The following information, obtained at the April 10, 1989, meeting of the Administrative Subcommittee was presented:

1. The next Committee meeting will be held at City Center Marriott in Charlotte, NC, during October 29, 1989 through November, 1989.
2. The revised Committee Operating Manual is pending final approval and should be available by the next meeting.
3. The new address for the IEEE Standards Office is:

IEEE Standards Office
445 Hoes Lane
P.O. Box 1331
Piscataway, N.J. 08855-1331
4. Sue Vogel has replaced Fred Huber as PES Administrator. Her phone number is 201-562-3817. Working Groups are requested to send copies of all formal correspondence, such as minutes and draft standards, to Sue Vogel at the address shown above.
5. A new IEEE Standards Style Manual has been recently published. A copy will be sent to every Working Group Chairman.
6. We received approval to elevate the status of the LTC Performance Requirements group from Task Force to Working Group.

7. The portion of the Standards Subcommittee Report pertaining to PCS projects is attached for review (Attachment PCS-A).

C. Liaison Reports

1. IEEE Power Systems Relaying Committee,
Network Transformer Protection Working Group

The Chairman presented the attached liaison report (Attachment PCS-B) which was submitted by Dave Smith (PTI).

2. IEEE Switchgear Committee

A liaison ballot was received on Draft #7 - Proposed ANSI/IEEE C37.36B - Guide to Current Interruption with Horn Gap Air Switches. The Chairman reviewed sections pertaining to switching of transformers and returned an approved ballot on November 29, 1988.

D. Membership

Mike Altman (Florida Power and Light), Ramsis Girgis (Westinghouse ABB Power T&D), and Eddy So (National Research Council Canada) were added to the PCS roster.

IV. Agenda Changes

- A. The date shown for Next Meeting was changed to October 31, 1989.

V. Working Group Reports

- A. Test Code for Shunt Reactors (C57.21) - J. W. (Jack) McGill

This working group met at 3:05 p.m. on April 10, 1989, at the Drake Hotel in Chicago, Illinois. There were eleven (11) persons present; nine (9) members and two (2) guests.

Minutes of the last meeting in Long Beach, California were approved as written.

The results of the balloting on the dielectric portion of this standard were not completed as of this meeting, however, all the many comments and changes resulting from this ballot will be incorporated into the next draft. (Draft #9)

The following are some of the minor modifications made to draft #8:

1. The procedure for determining the reference temperature for guaranteed losses was made the same for both dry-type and oil-immersed shunt reactors with a note to consider using the average winding rise, as determined by temperature tests, plus 20 degrees C, as the reference temperature in the case of loss evaluated shunt reactors.
2. The paragraph referring to a Gas-Oil System as a type of an Oil Preservation System for shunt reactors was deleted, because this manometer system is no longer used in the industry.

It was decided that the total losses of a dry-type shunt reactor will not include the stray losses in the reactor support structures, surrounding structures or the mounting pad, because each user has a different method of support.

There were some minor editorial changes noted at this W.G. meeting, however further editorial changes will be forthcoming from both the dielectric and dry-type T.F.'s. All of these changes will be made in the next draft.

At present, this working group is waiting for a successful ballot from the dielectric T.F. so that the entire revision of C57.21 can be balloted at the main Transformer Committee level.

The meeting was adjourned at 4:25 p.m.

B. Failure Analysis - D. J. (Don) Cash

The Working Group met at 1:00 p.m. on April 10, 1989. There were 25 members and 25 guests present.

The results of balloting Draft #7 were reported as follows:

54 ballots mailed to Subcommittee
42 ballots returned (78%)
28 ballots returned approved
12 ballots returned approved w/comments
2 ballots returned not approved

As a result of our Task Force meeting in Detroit last February, Wally Binder, Task Force Chairman, led a discussion on focused tests in Tables 6 and 7 where several changes were proposed. He also walked through the development of the equation for single phase impedance testing of three phase transformers in Appendix A1.9. A discrepancy seems to exist between this formula as printed in the Guide and the one used for factory tests. Several volunteers agreed to assist in resolving this problem.

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The two negative ballots were also discussed in an attempt to reach resolution. One of these negative ballots involved the presentation of case histories. The question of keeping case histories in the Guide was raised. The Working Group, by a show of hands, voted in favor of keeping them in the Guide and suggested including additional comments to resolve the negative ballot. The other negative ballot was discussed and appeared to be resolved.

All of the above comments and suggestions were referred back to the Task Force for incorporation in Draft #8.

The Working Group voted to keep the balloting of Draft #8 at the Subcommittee level instead of going to the full committee at this time.

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

C. Loss Tolerance and Measurement - W. R. (Bill) Henning

The WG on Loss Tolerances and Measurements met on Monday, April 10 at 3:05 p.m. with 19 members and 12 guests attending. Ramsis Girgis presented a report of the task force which is writing a loss measurement guide. The task force first discussed the scope and structure of the guide as proposed earlier by Sam Mehta. It was agreed that the guide will follow the proposed new test code sections on loss measurement, with emphasis on the methods adopted in the standards, along with tutorial information on why alternative methods were not adopted. A survey of prospective contributors to the guide was made using a form designed for the purpose. In the meantime, the task force chairman will put together a list of references to the chairman within the next weeks.

By June 1, contributors to the guide will be identified along with assignments. The plan is to work first on the no-load losses portion of the guide. The contributors will be requested to turn in their text to the task force chairman by August 1. He will then put the various parts of the document together for a preliminary draft to be prepared for the next task force meeting at the end of October. The task force meeting adjourned at 11:35 a.m.

After the task force report, the working group reviewed a ballot package it has prepared for a subcommittee ballot. This package consists of:

1. Section 8 of the test code C57.12.90 on "No-Load Losses and Excitation Current".
2. Section 9 of the test code C57.12.90 on "Load Losses and Impedance Voltage".

3. Section 9.3.1 of C57.12.00 on "Accuracy Requirements for Measured Losses".
4. Section 5.9 of C57.12.00 on "Specification of Reference Temperature for No-Load Losses".

The working group reviewed the changes that had been made in Section 8, and changed the wording in places. At the end of the meeting it was decided to conduct a simultaneous working group and subcommittee ballot of the entire package.

The meeting adjourned at 4:50 p.m.

Following this Working Group report, the PCS Chairman presented the attached report (Attachment PCS-C) on Project PC57.12.00K - Revision of ANSI/IEEE C57.12.00, Table 16, which was submitted by Chuck McMillen.

D. Semi-Conductor Rectifier Transformers -
G. C. (Charlie) Pounds

The PCS Chairman presented the following report which was submitted by Charlie Pounds (not present):

The working group met on Monday, April 10, 1989, at 8:00 a.m. There were 8 members and 11 guests present.

Minutes of the last meeting (10/31/88) as written by S. P. Kennedy were presented and approved as written.

Various technical papers on the subject of harmonic losses in rectifier transformers were presented by Charlie Pounds, followed by considerable discussion as to how the group should realistically approach this subject in the new standard.

A general consensus seemed to be as follows:

- a. Manufacturers must measure 60 Hz losses during testing of all primary to secondary impedance relationships.
- b. Determine individual primary and secondary circuit losses by computational means. (2 winding designs by manufacturer & user agreement), (3 or more windings per ANSI methods.)
- c. Determine individual primary and secondary stray losses by subtracting off individually calculated I²R loss. (Note: Special consideration must be given to the case of CCT #31 with two paralleled primary (AC) circuits due to fact that effective dc resistance will be much higher than tested by normal methods.)

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- d. For split of strays in each circuit into winding strays (including eddy loss) and "other" strays (tank, etc.), it was suggested that the following arbitrary factors be used, when agreement between user and manufacturer has not occurred:

	<u>Winding Strays</u>	<u>Other</u>
Dry Type	90%	10%
Liquid Filled	60%	40%

- e. Escalate stray losses by appropriate means as discussed in previous meetings. Consideration will also be given for direct measurement of harmonic loss when the required equipment is available.

The discussion then moved to the topic of short circuit testing with general conclusions as follows:

- a. A note should appear in the standard that it is assumed that all diode or thyristor circuits are fused, and that if this is not the case, that manufacturer should be warned, as a special transformer design may be required.
- b. All transformers must be designed in full accordance with the short circuit requirements of ANSI C57.12.00 and C57.12.01 (same as a non-simultaneous LV fault in a three winding transformer).
- c. Alternatively test (if calculated higher forces) for a case of simultaneous secondary winding fault (DC terminals faulted).

It was agreed that low frequency and impulse test levels be added for 1.2 kV class windings as follows:

Dry	4/10 kV
Liquid	10/30 kV

The final topic for discussion was overloads with general agreement as follows:

- a. All overload cycles, unless otherwise specified will be assumed to occur once every 24 hours. The calculated RMS equivalent should be used for further calculation and testing purposes.
- b. The appropriate ANSI Loading Guides should be used for calculation techniques to be used in determining loss of life.
- c. The term "without injury" should be changed to "without loss of life beyond the normal expected for the examined elapsed time".

Now that general agreement on the proposed method for escalating stray losses and estimating winding temperature rises during normal rectifier operation (harmonic loading) is at hand, Draft 6 can finally be revised before the next meeting.

Following presentation of this report, Dean Yannucci asked if this Working Group had established liaison with the Dry-Type Transformers Subcommittee. The PCS Chairman agreed to contact the WG Chairman for designation of a WG member (or members) to perform this liaison function.

E. Qualification of Transformers for Class 1E Application in Nuclear Power Stations - L. R. (Len) Stensland

Len Stensland presented the attached WG report (Attachment PCS-D).

F. Transformers Directly Connected to Generators - B. K. (Bipin) Patel

This WG did not meet during this Committee session. Bipin Patel reported that the approved Guide (C57.116) is being reviewed by ANSI and is expected to be returned to the Standards Board shortly.

VI. Project Reports

A. LTC Position Indication - R. H. (Bob) Frazer

Bob reported that this project has an approved PAR. The project number is PC57.12.00h and the title is "Nameplate Voltage Note Changes for LTC".

A proposal will be balloted in the Subcommittee by the end of April, 1989.

B. Nameplate Information Change Request - J. W. (John) Matthews

This project (PC57.12.00i) concerns the addition of terms "Directed Flow" or "Non-Directed Flow" to the nameplate to indicate the method of cooling.

Following two unsuccessful ballots in PCS, it was put on hold until further definition of the terms could be furnished by the WG Guides for Loading. Definitions for these terms will be balloted in this WG prior to the next meeting.

C. Task Force - LTC Performance Requirements - T. P. (Tom) Traub

The LTC Performance Requirements Task Force met at 3:05 p.m. on Monday, April 10, 1989 with 15 members and 20 guests in attendance.

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After introductions were made and the minutes approved, the proposed scope of the Task Force's activities was discussed. It was agreed that LTC's for furnace transformers would be included and, therefore, the scope will read "Electrical and mechanical performance and test requirements for load tap changers installed on transformers and voltage regulating transformers of all voltage and kVA ratings". A PAR which contains this scope is in the process of being submitted.

Since the last meeting, a copy of IEC-214, the IEC Standard on LTC's, was sent to each Task Force member as the first ballot on the development of a new IEEE standard. Fifteen ballots were sent out and 11 were returned. One was returned as approved, 9 as not approved and 1 as not voting. Not surprisingly, the first ballot tells us that the IEC document cannot be used "as-is". Therefore, it will be used as the basis for a new IEEE standard after considerable additions, deletions and modifications. Many good comments were received with the first ballot and will be incorporated into the new standard. Some major points concerning the organization and content of the new standard are as follows:

1. The IEC document contains certain physical or hardware requirements for LTCs. Such requirements will not be included in the IEEE standard since they more properly belong in ANSI C57.12.10 which has recently been revised and published. Section 6 of the ANSI standard covers basic construction features of load tap changing equipment. This includes construction features of the arcing-tap switch, motor-drive mechanism, position indicator, control equipment and accessories, and automatic control equipment operating requirements.
2. The IEC document also includes requirements for the LTC motor-drive mechanism. The Task Force decided that design and construction requirements for LTC motor-drive mechanisms should not be included in the IEEE standard, but that design and routine tests, as well as nameplate requirements for motor-drive mechanisms should be included.
3. The IEC standard contains an Appendix which covers information on switching duty relating to tap changers with resistor switching. The IEEE standard will have, in addition, a similar Appendix for LTC's with reactive switching.
4. The subject of overload capability for LTC's was discussed at some length. Further discussion will be required; however, the initial approach will be that the LTC should not impose a limitation to loading if the transformer is loaded in accordance with the applicable loading guide.

5. The need for an application guide for LTC's was also discussed. It was agreed that this would be a future activity after a standard has been developed.
6. The IEC standard contains minimum and maximum temperatures of the LTC environment under the category of Service Conditions. The Task Force feels that these values are not completely applicable to LTC's of North American design and will require review and probable modification.
7. The possibility of including requirements and tests for preventive auto and series transformers in the IEEE standard was discussed. It was agreed not to do this since such equipment is not actually a part of the LTC and may very likely not even be manufactured by the LTC manufacturer. Therefore, it was felt that requirements and tests for preventive auto and series transformers should be part of the applicable transformer standard.

The organization of the new standard has now been reviewed by the Task Force, and we now have a basic outline that will be used to prepare a second draft. The Chairman agreed to take on the task of preparing a second draft which will be accomplished by Labor Day or sooner and sent to the Task Force members for approval as ballot #2. The results of the second draft will be summarized and discussed at the next meeting.

There was no new business and the meeting was adjourned at 4:30 p.m.

VII. Old Business

There was no old business.

VIII. New Business

- A. A printing error in ANSI/IEEE C57.12.90, Section 7.3 - Ratio Test Methods, was reported by Allen Bartek. The schematics shown in Figures 9 and 10 are reversed. Note that the captions to these figures are correct, and the prose in Section 7.3.2, which refers to these Figures also is correct. This information was forwarded to Jim Harlow for retention pending the next revision of the Standard.

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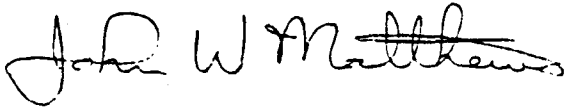
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IX. Next Meeting

The next meeting will be held on Tuesday, October 31, 1989, in Charlotte, North Carolina.

The meeting was adjourned at 2:50 p.m.

Respectfully submitted,

A handwritten signature in cursive script that reads "John W. Matthews". The signature is written in dark ink and is positioned above the typed name.

John W. Matthews
PCS Chairman

4/11/89

Subcommittee: Performance Characteristics
 Subcommittee Chairman: John W. Matthews (301/281-3775)

IEEE NO.	ANSI NO.	WG/TF CHAIRMAN	IDENTIFICATION	PAR ON FILE TRANS COMM.	AS OF/STATUS	PES COORD. NPE SUB RM T & D PSR PG RM NPE ? PSIM ?
P638	None	L. R. Stensland	Qualification of Class 1E Transformers for Nuclear Power Generating Stations	Yes	11/1/88 - Reviewed results of D16 ballot of main committee	
	PC57.18.10	C. G. Pounds	Practices and Requirements for Semiconductor Power Rectifier Transformers	Yes (6/81)	11/1/88 D6 reworked by working group	None
	PC57.21	J. W. McGill	Requirements, Terminology, and Test Code for Shunt Reactors over 500 KVA	Yes (6/88)	11/1/88 - Discussion re results of ballot on D7	RM PSR
P785	PC57.116	B. K. Patel	Guide for Transformers Directly Connected to Generators	Yes (2/79)	11/88 - Coordination documentation sent to Std Bd.	PG PSR RM NPE
P262 E3	PC57.12.90 e3	W. R. Henning	C57.12.90e3 - Revision of C57.12.90 Section 8 - "No Load Losses and Exciting Current"	No	11/1/88 - Complete - Awaiting Section 9 rework.	?
P262 E2	PC57.12.90 e2	W. R. Henning	Revision of C57.12.90 Section 8.3.3	No	11/1/88 - D/B approved by TC 1985. Text held pending C57.12.90e3 project.	?
P262 E1	PC57.12.90 e1	W. R. Henning	Addition to C57.12.90 Section 8	No	11/1/88 - D4 text being held pending C57.12.90e3 project.	?
P262 E	PC57.12.90e	W. R. Henning	Revision of C57.12.90 Section 9 - Load Loss and Impedance Tests	No	11/1/88 - Ideas being discussed by WG	?
P1098	PC57.123	W. R. Henning R. Girgis	Guide for Transformer Loss Measurement	Yes (3/85)	11/1/88 - Work awaiting conclusion of C57.12.90e	PSIM
P462C	PC57.12.00	W. R. Henning	Supplement for Allowable Loss Tolerances and Methods of Loss Measurements	No	11/3/87 - Proposal pending round-robin test. 11/1/88 - Proposal circulated re accuracy requirements	?
	PC57.125	D. J. Cash W. B. Binder	Guide for Failure Investigation, Documentation and Analysis for Power Transformers and Shunt Reactors	Yes (2/87)	11/1/88 - Discussion re resolution of D6 ballot	T & D PGS PSE SWGR
		R. H. Frazer	TF - LTC Position Indication	No	11/1/88 - Review of 1985 Survey	
	PC57.12.00i	J. W. Matthews	TF-Nameplate Information "Directed Flow"	Yes (12/86)	4/11/88 - Awaiting input from Loading Guide WG	
	PC57.12.00k	C. J. McMillen	TF-Routine Resistance Test Table 14	No	4/11/88 - To be considered by Herring WG.	
		T. P. Traub	TF-LTC Performance Requirements	No	11/1/88 - First meeting held. Will become WG	

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ATTACHMENT PCS-E
4/11/89

LIAISON REPORT

**Network Transformer Protection Working Group
Substation Protection Subcommittee**

IEEE Power Systems Relaying Committee

Draft 10 of the "IEEE Guide for the Protection of Network Transformers" was prepared to resolve the negative ballot that I submitted on draft 9 as discussed in my 10/04/88 liaison report. The Network Transformer Protection Working Group, chaired by Tom Wiedman at Commonwealth Edison, was in agreement with my reasons for the negative ballot on draft 9, and corrected the errors that I identified and incorporated my suggested changes into drafts 10 and 11.

Draft 11 of the Guide is now being reviewed by the Standards Board Review Committee.

The Guide is intended to aid in the effective application of relays and other protective devices for the protection of network transformers and other equipments in the 480-volt spot network system. It is still my opinion that the Guide will not impact the standards for network transformers.

D. R. Smith
Power Technologies, Inc.
Castle Main, Suite 219
Wilmerding, PA 15148
4/08/89

Report to the Performance Subcommittee

Balloting on Project PC 57.12.00K Table 14 (16)*

Revision of ANSI C57.12.00- 1987, Table 14 (16)* to Make Resistance Measurements a Design Test for Three- Phase Distribution Transformers Rated 501 to 2500 KVA

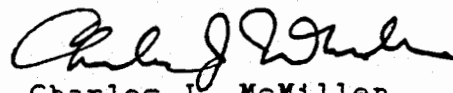
As of April 6, 1989 the results of this re-ballot of the Transformers Committee have not yet reached the required 75% return of active Committee members.

I urge the remaining 44 members who have not as yet returned their ballots to perform their duty.

	<u>Number</u>	<u>Percentage</u>
Approve	58	54
Not Approved	3	3
Abstain	3	3
No Return	44	41
	---	---
Total	108	100

* Note:

Table No. 14 was changed to No. 16 in the 1987 Revision of C57.12.00.



Charles J. McMillen
April 7, 1989

PCS CHAIRMAN NOTE: THIS PROJECT WAS STARTED PRIOR TO 1980 EDITION OF C57.12.00. IT WAS SUBSEQUENTLY COMPLETED, APPROVED BY STANDARDS BOARD, AND THEN LOST. ALL COMMITTEE MEMBERS ARE REQUESTED TO PROMPTLY RETURN BALLOTS TO AVOID ANY FURTHER DELAYS.

John Matthews 4/12/89

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ATTACHMENT PCS-D
4/11/89

April 13, 1989
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Minutes of Meeting - April 10, 1989

Working Group on Qualification of Class 1E
Transformers for Nuclear Generating Stations

MEMBERS PRESENT:

J. W. Grimes
L. W. Pierce
D. S. Takach
L. R. Stensland

GUESTS PRESENT:

W. R. Kruesi

MEMBERS ABSENT:

C. Hurty
W. H. Mutschler, Jr.

The Working Group met in Chicago, Illinois at the Drake Hotel on Monday April 10, 1989, with four members and one guest present.

The minutes of the October 31 and November 1, 1988 meetings were approved as written.

We welcomed our newest member, Mr. D. S. Takach.

At the meeting it was agreed that the following sentence will be included in the standard as the new Subsection 5.6:

5.6 "It is suggested that the specification include a requirement for measurement and recording the impedance value on each tap position. This information may be use for detailed load flow studies."

During our discussion at the meeting it was agreed that the second paragraph under Subsection 6.3 will be moved and become the first paragraph under Subsection 6.2. The second paragraph under Subsection 6.2 will be as follows:

"When thermal aging effects based on qualified life cannot be demonstrated to be negligible, then the following approach can be used to evaluate thermal life of the transformer. This should be performed prior to seismic testing."

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April 13, 1989
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Minutes of Meeting - April 10, 1989

The first paragraph now under Subsection 6.2 will become the third paragraph.

The Chairman advised that the absent members had not reviewed (nor had a chance to discuss the resolution of the comments with some commentors) D 16.1 of P638 sent with his letter of December 30, 1988. Every effort should be made to complete this task in the next six weeks.

After the working group members are in agreement with the proposed resolutions, including the comments suggested at this meeting, we will issue D17 for ballot to members of NPEC/SC-2 and IEEE Transformers Committee by June 15, 1989. Let's try and see if we can make this the final draft.


L. R. Stensland
Chairman

LRS:cmt
Copies:
All Members
J. W. Matthews
S. Vogel

TC-1
Pg 1 of 6

Meeting Minutes
Insulation Life Subcommittee
of the
IEEE Transformer Committee
at the
Drake Hotel
Chicago, Illinois

April 11, 1989

The Insulation Life Subcommittee met on Tuesday, April 11, 1989 at 10:05 AM. A total attendance of 64 consisted of 25 members and 39 guests.

After the introductions were made the minutes of the previous meeting, in Long Beach, California, were approved as written.

The Chairman announced that three new members were added to the Subcommittee after our last meeting:

Lin Pierce - GE, Rome, GA
Bipin Patel - Southern Services, Birmingham, AL
Jim Sim - NEI Ferranti Packard, Dunkirk, NY

Before the working reports were given the chairman indicated his need for help in guiding the work of this subcommittee. He especially asked the younger members to get involved and provide much needed leadership in the activities of the W/G's and in other areas of work that should be undertaken by the subcommittee.

The first W/G report was then given by Bill Wrenn, chairman of the Working Group on Guides for Loading.

Bill reported that the working group met on Monday, April 10 at 8:00 A.M. in the Astor Room with 27 members and 11 guests present.

The Minutes of the Long Beach, California Meeting were approved.

Two new members were added to the Working Group: Michael Altman and Felipe Weffer.

No IEC report was given, as Jacques Aubin was not present. It was noted that Jacques Aubin was the principle author of a report issued by the Canadian Electrical Association on a Cold Load Pickup Loading Guide for Oil-Immersed Distribution Transformers. A separate report from the same association dealt with Substation Power Transformers.

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C57.91, C57.92 & C57.115 Revisions

General Section

John Mathews, Task Force Chairman, reported that Draft 4 of Sections 1-3; Scope, References and General is being Balloted in the Working Group. The ballots are due May 5th. This draft includes the alternate calculation method presented at the last Working Group meeting.

Values for the exponents are being solicited from manufacturers.

It was noted that the equations could be applied to each winding of a 2 or 3 winding transformer. This would be necessary if one winding had a directed flow and another was non-directed flow. A statement addressing this situation will be developed.

A question was raised about the accuracy of including Lead Resistance in the I^2R loss, which would affect the hot spot temperature. It was agreed that since the Lead Resistance is not available on the test report, the equations would not be changed. In this respect, the accuracy is somewhat better than the present equation, which only deals with the change in $(load)^2$.

Much discussion occurred on the Alternate Calculation Method. The need for such a complex calculation method was questioned as well as if the Alternate Calculation Method was indeed more accurate.

Linden Pierce reviewed for the Working Group that in some cases, the Loading Guide is being used as a contractual document, thus requiring higher accuracy.

Many utilities modify the present calculation method, by adding resistance and viscosity corrections, thus making the result even more conservative.

Linden reported that based on his tests of 8-10 transformers over the last several years, he found the Alternate Calculation Method results in a more consistent calculation of the exponents.

He felt that he would be able to propose values for the exponents in the next 3 months.

It was noted that some test data seemed to indicate that there was little increase in accuracy by using the Alternate Calculation Method.

Many other questions were raised:

Which Calculation Method would utilities routinely use?

Does it depend on the type of transformer?

Does it depend on the type of oil?

Is it premature to change the Loading Guide Calculations without first changing the overload test guide?

Will the Working Group be able to complete a document which includes the Alternate Calculation Method in 2 years to meet our 10 year deadline?

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It was agreed to review the results on the ballot and proceed as indicated.

Distribution Section

David Takach, Task Force Chairman, stated that Draft 4 of Section 4; Distribution Transformers, was complete and ready for Ballot.

Equation numbers need resolution, but that will be done after the whole document is put together.

Power Section

Jerry Grimes, Task Force Chairman, reported that the first draft of Section 5; Power Transformers has been started. A task force meeting was held Tuesday, April 11 to continue the work on this Section.

Unresolved issues include: Loss of life criteria changes, the 140°C Rise Limit due to bubbling, Directed & Non-Directed Flow, and Conductor types.

Appendices

Dan Perco, Task Force Chairman, presented the results of the Working Group Ballot of Draft 4 of the Appendices.

13 members voted to approved and 9 approved with comments. Most of the comments were editorial in nature.

Additional information will be added to the "Other Considerations" section on Cold Load Pick-Up.

Additional wording will be added to Figures 5 & 6 in Appendix A, dealing with membrane conservator systems, which will note that the issue is still in the development stage.

References to Nomex insulation were proposed, but it was felt that it didn't fit the 65°C Rise Scope of this document.

The next W/G Ballot will include all Sections of the proposed Guide.

Old Business

The proposed definition of Directed and Non-Directed winding cooling will be ballotted in the Working Group, by John Mathews. It is hoped that with a successful ballot this information will be placed on all transformer nameplates.

New Business

Olin Compton volunteered to program both sets proposed sets of calculations in the new guide and make them available on floppy disc.

The second report was given by Bob Grubb, Chairman of the W/G on Thermal Tests. He reported that their group met at 3:05 P.M. April 10th with 5 members and 9 guests in attendance. One new member, Stan Lindgren, EPRI, was added to the Working Group.

Following the usual introductions, the minutes of the previous meeting were discussed. Frank Heinrich requested that the paragraph of the minutes stating that the Fluids Subcommittee may have to exclude the tables of limits of quantities of gasses generated during factory heat runs, be revised to state that the committee had decided to eliminate these limit tables. The minutes were approved as amended.

Secretary Don Fallon's apology for having to miss this meeting because of a business emergency was relayed to the Working Group.

A joint ballot of the W/G and the Insulation Life Subcommittee was completed on Draft 10 of P838. "Recommended Procedures for Performing Temperature Rise Tests on Oil Immersed Power Transformers at Loads Beyond Nameplate" with the following results.

	<u>W/G</u>	<u>Subcom.</u>
Ballots Sent	28	42
Ballots Returned	25	34
Percent Return	89%	81%
Approved W/Comments	20	28
Not Voting	1	3
Not Approved	4	3

Copies of Draft 10, which was marked to include all editorial comments, was distributed and discussed. In addition, five more significant requested changes were discussed.

#1 A more accurate method of determining average winding rise was proposed.

#2 It was suggested that the average oil temperature in the winding be determined and used instead of the average oil temperature in the tank.

It was agreed that the above two items should be addressed after this guide is completed as the work will be extensive and require changes in a future revision of ANSI C57.12.90.

A 3rd item consisted of a requirement that an 8 hour period elapsed before a dissolved gas in oil sample be taken in order to allow any combustible gases to diffuse through the oil. Since there was not technical support for the 8 hour period it was decided to recommend that multiple samples be taken.

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The remaining two items dealt with use of 15°C as the hottest spot allowance. After some discussion it was decided that this wording be replaced with a recommendation that the hottest spot temperature be determined by direct measurement if possible. If this is not possible it was recommended that the manufacturer's calculated allowance be used and if these first two methods are not possible, that the 15°C allowance be used.

With the resolution of the above 5 items all but one of the negative ballots were resolved.

It was decided that Draft 11 of the document would be prepared and issued to the W/G and Subcommittee. If no serious objections were reviewed within two weeks, Draft 11 will be sent to the Transformer Committee for balloting before the Fall meeting.

Progress on establishing a definition for the term "Thermal Duplicate" has been slow. At the last meeting six W/G members volunteered to form a Task Force to develop this definition. It was determined that this term exists only in C57.12.00, and therefore this would be the only document that would need to be revised.

A description of the problems involved with arriving at a definition was sent to the T.F. by the W/G Chairman asking for their comments. Only one of the six on the T.F. responded.

At this point in the Subcommittee meeting a very lively discussion was held on this subject. This discussion generated three additional manufacture volunteers for the T.F. Each has promised to submit his recommendation for a definition to the Chairman in the near future.

The final report was given by Larry Lowdermilk, Chairman of the W/G on Thermal Evaluation of Oil Immersed Power and Distribution Transformers. He reported that his group met at 8:00 AM on Tuesday, April 11.

The minutes of the November 1, 1988 meeting in Long Beach, California were read and approved.

A draft of the proposed Standard Test Procedure C57.100 combining the thermal evaluation of both power and distribution transformers was discussed. This draft had been prepared and distributed at a previous meeting by Dave Truax. The main topic of discussion centered around Draft 3 of a proposed appendix to the Test Procedure which was prepared and presented by Dean Yannucci.

The proposed appendix covers guidelines on the design and construction of annular disc subassembly models that represents both shell and core form designs for large power transformers. Mr. Yannucci distributed the third draft of the proposed appendix at the meeting and commented that it had been modified from the original draft to include comments which address the testing of advanced

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transformer designs requested by Lin Pierce and to emphasize turn to turn dielectric strength as the evaluation criteria rather than section to section as was included in the second draft.

In response to a question, it was stated that the proposed test procedure does not include oil compatibility testing and it was agreed that material compatibility testing should not be included in this test procedure. It was also agreed that gas in oil analysis should not be included as part of the test procedure.

A motion was made and carried to have the title of the test procedure remain as it presently exists, specifying the words "Oil Immersed" and to include a comment in the procedure to indicate that it may also be applicable to evaluation of other fluids such as silicon and high fire point liquid.

It was proposed that the Subcommittee Chairman submit this question at the next meeting of the Administrative Subcommittee for resolution.

At this point in the Insulation Life Subcommittee meeting another lively discussion was held on this subject.

It was noted that there is a need to expand the scope of many documents to include such fluids as silicone and high-fire point liquids and that this document is a key document in doing this. It was noted that IEEE and ANSI has resisted this change in the past.

It was also pointed out that the term liquids is more appropriate than fluids because gas can be included as a fluid and we don't want to infringe in the dry type or gas filled transformer area of responsibility.

As a result of this discussion there were several volunteers to form a Task Force to study which way to go as guidance for the Administrative Subcommittee.

Mr. Yannucci agreed to make an attempt to have a combined procedure including Lin Pierce's forward, Dave Truax's procedure and his own appendix material ready for mailing with a working group ballot on this test procedure by August, 1989.

There being no new business for the W/G, the meeting was adjourned at 9:10 AM.

After this final Working Group report, and their being no new business brought up, the Subcommittee Meeting was adjourned at 11:15 AM.

Respectfully Submitted



D. H. Douglas
Chairman,
Insulation Life Subcommittee

INSULATING FLUIDS SUBCOMMITTEE

The Insulating Fluids Subcommittee met on Monday and Tuesday morning April 10th and 11th, 1989 with fourteen (14) members and eight (8) guests present. Much of the time was spent reviewing comments on the Subcommittee ballot on Draft 7 of the revision C57.104 Gas Guide. With all negatives and comments resolved it was voted to prepare Draft 8 and to recommend for Transformers Committee Ballot.

A PAR has been requested for approval to prepare a new guide for Gas-in-Oil Analysis during factory test. A Working Group is being formed and work will be started.

The remainder of the time was spent reviewing Draft 2 of C57.106 Oil Guide and Draft 3 will be prepared for Subcommittee Ballot prior to the next meeting.

to be printed 1st Q '90

Guides C57.111 on Silicone and C57.121 on High Temperature Hydrocarbon have been approved by the Standards Board and are currently being balloted by NEMA.

Henry Pearce
Chairman

TC-F

PES TRANSFORMER COMMITTEE
INSTRUMENT TRANSFORMER SUBCOMMITTEE
Minutes for meeting April 11, 1989
Chicago, Ill.

1. The meeting was opened at 8:00 AM, April 11, 1989.
2. The following announcements were made.
 - 2.1 The future meeting schedules for the IEEE Transformer Committee are:

Location	Hotel	Date
Charlotte, N.C.	Adamhost	Oct. 22-25, 1989
Denver, Co.	Marriott	Mar. 25-28, 1990
Montreal, Quebec		Oct. 21-24, 1990
Phoenix, Az.		Spring 1991

3. Nine members and eight guests attended the meeting.
4. PAR 546/Draft 6 (P546/D6) for C57.13 was reviewed with emphasis on tables 2 and 3 for insulation levels and dielectric tests. The tables require minor format changes for improved clarity and similarity to reference tables.
5. The new wording and test requirements for the short time mechanical rating test was approved with a minor editorial change.
6. Draft 7 will be issued after committee member review of draft 6 is completed. P546/D7 is expected to be ready for sub-committee balloting in the third quarter, 1989. Individual members are reviewing specific sections of draft 6 and are to send their comments to the chairman.
7. A quick review was made of the information pertinent to instrument transformers which will apply in defining the scope and requirements for test guides for RIV and partial discharge tests.
8. The meeting was adjourned at 12:20 PM.

Respectively submitted,


John N. Davis

Members Present:

V. Raff	E. So
W. Morehart	J. Ramboz
K. Massouda	C. TenHaagen
R. Magill	J. Davis
A. Jonnatti	

MEETING MINUTES

DRY-TYPE TRANSFORMER SUBCOMMITTEE
Chicago, IL
April 11, 1989

Chairman: R. E. Uptegraff, Jr.

1. Introductions/Attendance/Approval of Minutes

The Dry-Type Transformer Subcommittee met at 1:50 PM on 04/11/89. There were 16 members and 10 guests present (see Sec.8). Following the introductions of those present a motion was made to approve the minutes of the 11/01/88 meeting (Long Beach, CA). Subject to the following corrections, the minutes were approved:

A. Sec.1.11

Delete word 'in' in "...possibilities of in...".

- 1.1 Following the approval of the minutes, the chairman introduced Mr. Jim Harlow, Chairman of the Standards Subcommittee, and discussed the current status of P745 (PC57.12.58), "Guide for Conducting a Transient Voltage Analysis of a Dry-Type Transformer Coil". It was noted that the files on this project were lost by the Standards Review Subcommittee of the Standards Board during a relocation from New York to New Jersey. In order to complete all the protocols required by the Standards Subcommittee, it was recommended that this committee review the final draft (Draft #7, 10-1-84) and take a voice vote to reapprove this draft. It was also recommended that, should this draft be approved by the Subcommittee, a similar action be taken at the Transformer Committee meeting. Following a motion to reapprove Draft #7 of P745, the Subcommittee voted in the affirmative with no negative votes. Following a motion for the Chairman to present a similar vote request before the Transformer Committee, the Subcommittee again voted in the affirmative with no negative votes.
- 1.2 The Chairman then informed the Subcommittee that a similar problem had arisen with PC57.12.59, "Through Fault Current Duration Guide for Dry-Type Transformers". This document was submitted to the Standards Board in January, 1986; but action was held pending completion and approval of C57.96, "Guide for Loading Dry-Type Transformers". It was noted that C57.96 was an integral part of PC.57.12.59. The Loading Guide is now in the process of balloting by the ANSI C57 Committee. Unfortunately, all of the documentation sent to the Standards Board on PC57.12.59 was lost in the previously mentioned move. Fortunately a complete copy of all the submittal data was available and has been sent to the Standards Board.

It was noted by Mr. Olin Compton the importance of the working group chairmen maintaining complete copies of all data until the standards are printed.

- 1.3 Following the above topics, the status reports from the various working groups and task forces were presented by their respective chairman or their chairman's alternate. See the following sections for details:

Sec.2	Dry-Task Reactors	Mr. R. Dudley
Sec.3	Specialty Transformers	Mr. A. Iverson
Sec.4	Cast Coils	Mr. E. Koenig
Sec.5	Thermal Problems	Mr. R. Uptegraff
Sec.6	Dielectric Problems	Mr. D. Kline
Sec.7	Thermal Evaluation	Mr. R. Provost
Sec.7	Flammability	Mr. R. Provost

- 1.4 Following Mr. Dudley's presentation on Dry-Type Reactors, discussions ensued on the unique, and rather large, differences between dry-type and liquid reactors. The task of combining standards for both in a single document continues to be a very difficult problem. A suggestion was made that it may be best to have separate documents for the dry's and liquids.
- 1.5 The Chairman discussed the potential overlap of scopes between the W.G. on Specialty Transformers and the W.G. on Thermal Evaluation following the report by Mr. Iverson. He indicated that he did not feel there would be any serious problem in the near future.
- Mr. Uptegraff again reiterated that a possible structure of only Working Groups reporting to the Dry-Type Subcommittee, with Task Forces reporting to the Working Groups, would help avoid such conflicts. The Working Groups would be somewhat 'permanent' and the Task Forces would need to get their PAR's under them. He will pursue considerations along this concept.
- 1.6 Following Mr. Koenig's report, the Chairman discussed the recent concerns about division between Power and Dry-Type Transformers. After discussing the historical development of the dry-type standards, Mr. Uptegraff noted that general purpose dry-type standards, 600 volts and under, are still essentially NEMA standards.
- 1.7 As Mr. Mutschler was unable to attend, the Chairman presented the minutes for the Working Group on Dry-Type Thermal Problems.
- 1.8 Following the report of the W.G. on Dielectric Problems, Mr. Kline noted that the liquid-filled Partial Discharge Guide, a parallel effort to his W.G., was going to press.
- 1.9 Following Mr. Provost's report, the Chairman discussed with Mr. Olin Compton if there would be a more general interest, at the Transformer Committee level, in the topic of flammability and toxicity if some authorities of broad knowledge could come and give a presentation. Mr. Provost was requested to see if he could find someone who would be will to address our group.

1.10 The Chairman questioned Mr. Compton if the scope of the Subcommittee's working groups required any approval outside of the Subcommittee. Mr. Compton thought the scope would require approval of the Transformer Committee Chairman.

Another topic discussed was if a Task Force required a PAR. It was stated by the Chairman that a PAR was not required unless a document was going to be produced.

The Chairman requested the following W.G. Chairmen to forward a copy of their PAR's to Mr. Jim Harlow: Mr. Iverson, Mr. Kline, and Mr. Provost.

1.11 The meeting was adjourned at 3:30 PM.

REPORTS FROM WORKING GROUPS

2. Working Group on Dry-Type Reactors

Chairman: Mr. Richard Dudley

Ref: C57.21 - "Requirements for Shunt Reactors"
C57.16 - "Requirements for Current-Limiting Reactors"

This W.G. participates as a task force in the activities of the W.G. on Shunt Reactors chaired by Mr. Jack McGill. The W.G. provides recommendations relating to dry-type reactors as distinguished from liquid-filled reactors. Work on revision of C57.21 is essentially completed except for last minute change proposals; and the W.G. is now undertaking the revision of C57.16.

2.1 The task force met 8:00 AM on 04/10/89 with 6 members and 2 guests present. Following the introductions of those present, the minutes of the 10/31/88 meeting were approved as written.

2.2 Discussions then took place on the 02/89 draft of C57.21 and focussed on issues arising from the inputs of the Dry-Type Reactor Task Force to the revision. The following are the key points that were discussed.

2.2.1 It was reaffirmed to keep Tables 4A and 4B for oil-immersed and dry-type shunt reactors respectively.

The temperature rise test should be designated a 'design' test. This would be the case for oil-immersed shunt reactors as well as dry-types.

2.2.2 Section 10.3.3.2 was discussed at length and several changes were recommended.

2.2.2.1 The title should be:

"Turn-to-Turn Overvoltage Test for Dry-Type Shunt Reactors"

The word 'overvoltage' more accurately describes this test than 'potential'.

2.2.2.2 The third sentence of the first paragraph should be:

"The test duration is for 1 minute and the initial crest value for each discharge is to be at least $\sqrt{2}$ times the R.M.S. value as specified in Table 5B."

2.2.2.3 A final sentence should be added to the first paragraph to wit:

"... on the order of 100 kHz. The test shall consist of not less than 7200 overvoltages of the required magnitude."

2.2.2.4 The final sentence in the second paragraph should be:

"The crest test voltage level is based on the R.M.S. voltages listed in column 3 or 4 of Table 5B."

2.2.3 The title of columns 3 and 4 of Table 5B should be:

"Turn-to-Turn Overvoltages"

2.2.4 In Section 10.3.5 the following sentence should be added to the end of the first paragraph:

"...only when specified. Dry-type shunt reactors rated 34.5 kV and lower shall be tested with the Turn-to-Turn Overvoltage Test."

2.2.5 Section 9.1.3.2 should be modified as follows:

"The turn-to-turn with a first peak voltage at least equal to $\sqrt{2}$ times the R.M.S. values specified in Tables 5B, columns 3 or 4."

2.2.6 The first sentence of Section 10.5 should be:

"The measurement of sound level is a test sometimes performed in the laboratory on dry-type shunt reactors as it is with oil-immersed equipment."

This change is needed to be consistent with Table 4B where sound level testing is classified as 'OTHER'.

2.2.7 Should Section 6 be retitled "Types of Tests"? This will be discussed in Mr. McGill's W.G.

2.2.8 Sections 7,8, and 9 deal with tests presented in Tables 4A and 4B. There are no descriptive sections for resistance, vibration, audible sound and seismic. They are however dealt with in Section 10, "Test Code".

The consensus was to leave things as is but the Chairman said he would discuss the issue in Mr. McGill's W.G.

2.2.9 The issue of partial discharge testing for dry-type shunt reactors was discussed. The consensus was that it is not applicable. Further discussions will take place in the W.G. chaired by Messrs. McGill and Kennedy.

A position statement will have to be prepared. In addition to the technical arguments regarding low stress levels, test methods and procedures are not defined.

2.2.10 Section 7.1.2 and the plus 6% bound on single coil losses was discussed. Where does this come from? What happens if a unit exceeds specified losses by more than 6% but meets all other criteria including temperature rise? This will be discussed in Mr. McGill's W.G.

- 2.2.11 The subject of losses and reference temperature was discussed. The rise of the average winding rise limits specified in Table 3 plus 20°C is done to be consistent with the transformer standard. However the resulting value will not accurately reflect actual losses in the case of a low temperature rise loss evaluated unit.

Section 10.4.1 will be discussed in Mr. McGill's W.G.

- 2.2.12 The subject of losses in structures associated with dry-type shunt reactors was discussed. Section 7.1.3 discusses this. Should the second paragraph in 2.4 be modified to wit:

"For dry-type shunt reactors the total losses should be taken as the sum of conductor DC loss, the conductor eddy loss, and the stray loss in the windings and supplied reactor framework".

This change reflects the fact that dry-type manufacturers may not supply some or all of the supports or peripherals.

- 2.2.13 Some editorial comments were:

Section 10.3.5.5

Use the word 'is' in "The wave to be used is....."

Section 10.3.9.1

Refer to Tables 5A and 5B.

Section 10.3.10.3

Correct the spelling of 'insulation'.

Section 10.6.4.1

Correct the spelling of 'reactor'.

- 2.3 The revision of C57.16 was discussed. The need for a scope statement as well as a statement of what is not covered was noted.

The consensus seemed to be that the revision should cover more than current limiting reactors (distribution voltage and transmission voltage classes) but there was discussion as to how broad the scope should be. In addition to current limiting reactors it was proposed to include bus tie reactors, load balancing reactors, and capacitor discharge reactors. A great deal of discussion took place as to whether it should cover filter reactors (A.C. and D.C.). Also discussed were smoothing reactors. It was noted that neutral grounding reactors are covered in IEEE-32 (Neutral Grounding Devices).

The chairman agreed to canvas a number of end users to solicit their opinions with respect to the scope of the revision of C57.16.

Discussion on whether the Task Force needs a PAR to proceed with this work followed. Also discussed was whether the main working group would be under the Performance Characteristics Subcommittee as is the case for the revision of C57.21 (Shunt Reactors). Additionally, discussion on whether the revision of C57.16 should be for both oil-immersed and dry-type reactors ensued. It was hoped that these basic issues would be resolved before the next meeting.

2.4 The meeting was adjourned at 9:45 AM.

3. Working Group on Specialty Transformers - P259

Chairman: Mr. Al Iverson

Ref: IEEE Std 259 - Standard Test Procedure for Evaluation of Systems of Insulation for Specialty Transformers

This W.G. is charged with the revision of the 1974 edition of IEEE 259. This standard relates to evaluating the thermal and environmental degradation of small low voltage dry-type transformers.

- 3.1 The working group met at 1:00 PM on 04/10/89 with 7 members and 6 guests present. Following the introductions of those present, the minutes of the 10/31/88 meeting were approved as written.
- 3.2 Draft 4 of P259 was distributed and the working group discussed the draft for the remainder of the meeting.
- 3.3 The working group considered adding lower suggested aging temperatures to correspond with the required 5000 hour life at the lowest temperature. Absent a sound empirical basis for suggesting lower aging temperatures, it was agreed a footnote would be added pointing out that the lowest aging temperature result in a 5000 hour average life.
- 3.4 Several suggested editorial changes improved and clarified the text of the document.
- 3.5 The Chairman requested final comments on Draft 4 by 06/01/89.
- 3.6 The meeting was adjourned at 2:30 PM.

4. Working Group on Cast Coils

Chairman: Mr. Egon Koenig

Ref: C57.12.01 - General Requirements for Dry-Type Transformers
Including Those With Solid Cast and/or Resin
Encapsulated Windings

C57.12.91 - Test Code for Dry-Type Transformers

This W.G. has the mission of revising C57.12.01 and C57.12.91, in that order, to incorporate changes and additions appropriate to Solid Cast or Resin Encapsulated Windings. At present, C57.12.01 is in the ANSI consensus process and should be published later this year. Work on the Test Code (C57.12.91) is just beginning.

- 4.1 The working group met at 10:05 AM on 04/10/89 with 13 members and 8 guests present. Mr. Len Pierce, Mr. Guy Pregent, Mr. Roger Hayes, and Mr. Charles Kirschal Jr. requested to become members and were accepted. Following the introductions of those present, the minutes of the 10/31/88 meeting were approved as written.
- 4.2 The Chairman reported on the status of the approval process for C57.12.01 and noted that it was approved by RevCom and passed on to the standards group.
- 4.3 The Chairman reported that a PAR for C57.12.91 had been submitted.
- 4.4 The Task Forces appointed at the 10/31/88 meeting to review specific paragraphs reported on their progress since the last meeting. Each Task Force met on Sunday, 04/09/89. Copies of the minutes of these meetings are on file with the Chairman. Initial drafts of proposed changes will be submitted by each Task Force to the Chairman with copies to the Secretary, Mr. Dave Barnard, prior to 06/01/89.
- 4.5 It was agreed that the Chairman will request 3 rooms in Charlotte, NC (the location of the Fall, 1989 meeting) on Sunday prior to the main meeting between 3:00 and 5:00 PM for Task Force Meetings.
- 4.6 Mr. Dave Barnard asked Mr. Roy Uptegraff if he knew any reason why specialty transformers are excluded from C57.12.91 in the scope. Mr. Uptegraff stated that it is his understanding that since these transformers are covered by ANSI C89.1 and C89.2 and not C57.12.01 they are beyond the charter of the IEEE Transformer Committee. Mr. Barnard was appointed to investigate the issue further specifically to determine if C89 refers to C57.12.91 for testing or some other document.

Mr. Barnard will also investigate general purpose transformers, below 600 volts, which are not specifically excluded from C57.12.91 in scope. These transformers are defined by NEMA and could be tested by C57.12.91 if there is not another standard which describes the methods and procedures.
- 4.7 The meeting was adjourned at approximately 11:15 AM.

5. Working Group on Dry-Type Thermal Problems

Chairman: Mr. Bill Mutschler

Ref: C57.96 - Guide for Loading Dry-Type Transformers

This W.G. is undertaking the review of various temperature related parameters involved in loading, overloading, and aging of dry-type transformers. This review is prompted by changes in the state of the art including new temperature ratings and insulating materials. A secondary mission is the monitoring of the consensus process now under way with C57.96.

- 5.1 As Mr. Mutschler was unable to attend the meeting, Mr. Uptegraff and Mr. Patterson conducted the meeting.
- 5.2 The W.G. met at 3:05 PM on 04/10/89 with 7 members and 9 guests present.
- 5.3 Following the introductions of those present, Mr. Uptegraff discussed the dilemma of having a fixed hot spot allowance of 30°C regardless of the rated temperature rise of the transformer. He stated that not only does this not make good sense but it differs from the practice of the IEC (International Electrotechnical Commission). It was generally accepted that the hot spot allowance should relate to the temperature rise and it is planned to send a questionnaire to the W.G. members to see if some kind of a consensus can be found to resolve this problem.
- 5.4 Mr. Uptegraff then discussed the fact that present formulas to determine the rate of transient heating - important to temporary overloading - are based on unrealistic assumptions as to the energy generated in the form of heat and as to the presumption that the various conductor elements experience only the presence of ambient air. Actually the resistance of the winding increases during heating, increasing in turn the heating effect of the winding. Upper portions of the winding experience hotter than ambient air due to this heating. Because of such effects as these, thermal time constants are usually greater than the present loading guides predict. The W.G. plans to continue to collect heat run data for submission to Mr. Egon Koenig who will maintain the anonymity of the contributor and to arrange the data as best he can to throw more light on this problem.
- 5.5 The meeting was adjourned at 4:30 PM.

6. Working Group Dry-Type Dielectric Problems

Chairman: Mr. Don Kline

Ref: PC57.124 - Recommended Practice for the Detection of Partial Discharges and the Measurement of Apparent Charge in Dry-Type Transformers

This mission of this W.G. is the development of C57.124 which is presently in Draft #5.

- 6.1 The working group met at 8:00 AM on 04/11/89 with 10 members and 6 guests present. Following the introductions of those present, the minutes of the 11/01/88 meeting were approved as written.
- 6.2 The Chairman reported that the Transient Analysis Guide - P745 is to be revived for a vote for reconfirmation in the Dry-Type Subcommittee.
- 6.2 The Chairman reviewed Draft #5 of the Partial Discharge Guide - PC57.124. Changes in the detector circuit were suggested and additional comments reviewed.

The Chairman indicated that he expected to issue Draft #6 within 3 months for voting.

- 6.3 The meeting was adjourned at 9:30 AM.

7. Working Group on Thermal Evaluation of Dry-Type Transformers
Working Group on Flammability and Toxicity of Dry-Type Transformers

Chairman: Mr. Dick Provost

Ref: C57.12.60 - Standard Test Procedures for Thermal Evaluation of
Systems for Solid Cast and Resin Encapsulated Power
and Distribution Transformers

This W.G. has been charged with developing C57.12.60. The work on this standard has been pretty well completed and the standard will be submitted for trial use. Trial use was employed due to the W.G. being unable to define an existing insulation system to use as a control for comparison with an insulation system under test.

Subordinate to this W.G. is a W.G. charged with monitoring developments in flammability and toxicity of dry-type transformers.

- 7.1 The working group met at 11:15 AM on 04/11/89 with 12 members and 6 guests present. Following the introductions of those present, the minutes of the 11/01/88 meeting were approved as written.
- 7.2 The Chairman circulated copies of a draft for the title and scope of this W.G. After considerable discussion, a motion to strike the words "above 600 volts" from the W.G. title was voted on and passed by a margin of 11 affirmative, 1 negative, and 5 abstentions.
- 7.3 Next the proposed scope was modified and a final version was voted on and approved by a vote of 10 affirmative, 1 negative, and 7 abstentions. The final scope will read as follows:

"Monitor and Review issues related to the Thermal Characteristics of Insulating Systems of Dry-Type Transformers, including thermal evaluation of insulation systems, flammability and fire hazard analysis, and to Develop and/or Review the Guides and Standards related to these issues as required."

It was noted that currently this includes final review by the Liaison Committee and the Standards Board for PC57.12.60. Later, this will include revision and/or reaffirmation of C57.12.56 in 1991 and further revision of PC57.12.60 two years after its publication.

- 7.4 Considerable discussion around the scope of this W.G. centered on the distinction between this group and Mr. Al Iverson's group (Insulation Requirements for Specialty Transformers - P259). It was agreed that this group would state clearly that it was not the intent of this group to incorporate the work of Mr. Iverson's group and would be treated separate from their activities, which is currently revising P259.

- 7.5 The Chairman circulated copies of a diagram summarizing various groups and committees within IEEE which are either monitoring or actively working in the areas of flammability and toxicity of insulating materials for electrical applications. A proposal was made and agreed to have a member of the Standards Coordinating Committee #18 (SCC #18) on the Fire Hazard Assessment & Toxicity Subcommittee (FHAT) address the group at a future meeting. The format, topics, and time for such a presentation will be explained by the Chairman and a proposal will be made to the Subcommittee for a show of interest.
- 7.6 Several other activities on the fire hazard subject were noted by the Chairmen, specifically seminars by the ASTM in July and at the EEIC meeting in September. The Chairman also agreed to develop a bibliography of current literature on file related to flammability to be submitted to members at the next meeting.
- 7.7 The meeting was adjourned at 12:25 PM.

8. Attendance Roster

MEMBERS PRESENT

 Bancroft, Roy
 Barnard, David A.
 Dudley, Richard F.
 Frank, Jerry M.
 Gearhart, R. E.
 Iverson, A. M.
 Kline, Don A.
 Koenig, Egon
 Manning, Mel L.
 Marek, Rick P.
 Patterson, Wesley F.
 Payne, Paulette
 Provost, Richard L.
 Thenappan, Vis
 Uptegraff, R. E.
 Windisch, Henry J.

MEMBERS ABSENT

 Allen, Ben F.
 Bimbiris, Alfons
 Bowers, George H.
 + Darr, Timothy
 Dutton, John C.
 Gabel, Herman E.
 ++ Gaibrois, G. L.
 Hupp, Joe W.
 Jonnatti, Anthony J.
 Kennedy, Sheldon P.
 Mutschler, William H.
 Nay, John J.
 Rodden, Jack
 Smith, Bynam E.
 Weincek, S. A.
 + Liaison - NEMA Insulating Materials
 Division
 ++ Liaison - Surge Protective Devices
 Committee

GUESTS PRESENT

 Cambre, Max
 General Electric
 P.O. Box 1701
 Ft. Wayne, IN 46801

 Compton, Olin
 Virginia Power
 P.O. Box 26666
 Richmond, VA 23261

 Haas, Michael
 National Indusrti
 2520 58th Street
 Hampton, VA 23661

 Harlow, Jim
 Beckwith Electric Co.
 P.O. Box 2999
 Largo, FL 34649

 Hayes, Roger
 56 Bramsteele Road
 Brampton
 Ontario, Canada L6W 3M7

 Mitelman, Michael
 General Electric
 P.O. Box 2188
 Hickory, NC 28603

 Papp, Klaus
 Spezielentra
 Zerzer Str. 8
 A-4040 Linz, Austria

 Pierce, Linden
 General Electric
 1935 Redmond Circle
 Rome, GA 30161

 Pregent, Guy
 P.O. Box 1009
 St. Jean Sur Richelieu
 Quebec, Canada J3B 7A4

 Simpson Jr., R. W.
 Quin-T Corp.
 P.O.Box 309
 Tilton, NH 03276

Submitted by: Wesley F. Patterson Jr.
 Secretary
 Dry-Type Transformer Subcommittee
 July 24, 1989

MEETING MINUTES

DIELECTRIC TESTS SUBCOMMITTEE

April 11, 1989

The Drake - Chicago, IL

1. INTRODUCTION/ATTENDANCE

The Dielectric Tests Subcommittee met at 11:20 A.M. with 26 members and 41 guests in attendance. Ed Howells and Larry Lowdermilk have been accepted as new members of the Dielectric Tests Subcommittee.

2. APPROVAL OF MINUTES

The minutes of the November 1, 1988 meeting in Long Beach, CA were approved as submitted.

3. CHAIRMAN'S COMMENTS from ADMINISTRATIVE SUBCOMMITTEE

- A. The Charlotte meeting will be held at the City Center Marriott, October 29 to November 1, 1989.
- B. Corresponding Membership has been approved, by IEEE, at the working group level with subcommittee chairman approval. Any Corresponding Member must be a working member contributing to the working group effort and honoring his balloting responsibilities.
- C. John Rossetti has been confirmed as chairman of the Working Group for Revision of Dielectric Tests of Distribution Transformers replacing Charles Brown who has retired from Florida Power & Light and has become a consultant.
- D. Harold Moore has been authorized to organize and chair a seminar, in Charlotte, dealing with digital test recording of transformer impulse testing.

4. WORKING GROUP REPORTS

A. Working Group on Revision of Dielectric Tests

H. R. Moore

The Working Group met on April 10, 1989 with 20 members and 7 guests present.

The minutes of the October 31, 1989 meeting were approved as written.

T-
Pg 2 of 8

Task Force on Revision of Dielectric Tests
of Shunt Reactors
W. N. Kennedy

The Task Force met on April 10 with 8 members and 10 guests present.

The results of the ballot of the Task Force and Subcommittee on C57.21/D8 "Requirements, Technology, and Test Codes for Shunt Reactors over 500 kVA" were discussed. The balloting was as follows:

Ballots mailed	69
Ballots returned	46
Ballots - Approved	40
Abstained	4
Ballots - Not approved	2
Ballots not returned	6

One negative vote on the wording of the reference to partial discharge measurements has been resolved. The wording will now emphasize the more recent C57.113 "Trial Use Guide for Partial Discharge Measurements in Liquid Filled Power Transformers and Shunt Reactors".

The other negative vote involved differences in tests for air and liquid insulated reactors. Specifically, the lack of partial discharge measurements in air insulated reactors was the reason for this negative vote. This is actually only one of several differences that exist. This Task Force was formed to revise C57.21. It has concentrated on oil immersed equipment and a separate Task Force chaired by Richard Dudley which reports through the Performance Characteristics Subcommittee has concentrated on dry type reactor tests.

This has resulted in these differences. For example, this Task Force is recommending a one hour AC test at 1.5 times normal operating voltage. The dry type Task Force is recommending a 7200 cycle turn-turn test using repeated impulse waves. This represents state of the art for dry type reactors. Measurement of partial discharges is not practical due to high magnitude signals from the impulse testing.

Unfortunately, the remaining negative ballot could not be resolved. It was decided that Draft 9 of the test code will be balloted in the Transformers Committee when the required number of ballots has been achieved. A cover letter will accompany the draft which will explain that the one negative ballot could not be resolved. It does not appear possible to prepare two separate documents - one for oil immersed and one for dry type - and not meet the 10 year rule.

293048

Task Force on Revision of Impulse Test Guide

R. E. Minkwitz

The Task Force met at 10:05 A.M. on April 10, 1989 with 8 members and 14 guests present. The minutes of the previous meeting were approved as presented.

The following items were discussed:

1) Review of Digital Recording Equipment

B. Paulin reviewed the draft document prepared by Mr. Freyhault and Mr. Mehta on this subject. Experiences with digital recording equipment during impulse tests were also noted.

There was discussion on the use of ANSI Standard 1122 "Digital Recording Equipment for Impulse Testing". This document was prepared without liaison with the Dielectric Tests Subcommittee. However, it appears that this standard does contain the proper requirements for digital recording equipment for use during transformer impulse testing.

There is an apparent need for the Task Force to learn more about digital recording techniques before taking further actions on this matter. The Chairman was asked to request permission for a seminar on experiences with digital recording during production impulse tests. This matter was discussed at the Administrative Subcommittee on April 10, 1989. Approval was granted for a seminar at the Charlotte meeting. H. R. Moore will make arrangements for the seminar and will chair the seminar session. Participants from different companies having experience with digital recording during production tests will be invited. Emphasis will be placed on practical aspects of digital recording during production impulse tests.

The Task Force will consider approval of the 1122 document and drafting a guide after the seminar.

2) Draft of Switching Surge Test Guide

Mr. B. K. Patel presented the draft of a guide for switching surge tests. This draft was only a starting point for a complete guide and many parts were incomplete. Various aspects of the draft were reviewed and the following actions will be taken.

- a. The guide must be specific on the point that switching surge voltages are transferred by turns ratio and that voltages induced into each winding must be considered. That is, the switching surge voltage induced may be greater than the switching surge level for the winding.

- b. The section on typical test circuits will be revised such that the general approach for connections to obtain different induced voltages will be outlined. For example, different core geometries sometimes require different test connections.
- c. Assignments were made for completion of various parts of the draft.

It is planned that a complete draft will be available for the October, 1989 meeting.

3) Impulse Testing of Low Impedance Windings

H. R. Moore reported that he had researched the minutes of the Working Group on Revision of Dielectric Tests and could find no reference to changing the test parameters for impulse tests on low impedance windings. Some additional contacts will be made to determine if the change was an error or an approved change. Copies of the page from the old guide will be sent to the Task Force members by H. R. Moore.

Enhancement Voltage Time Duration During Power Transformer Induced Tests

The Working Group had been asked to investigate the reduction of the enhancement time from 7200 cycles to 5 seconds. The original proposal for an enhancement test contained the 5 second time duration. It was changed to 7200 cycles prior to final balloting because some persons believed that the enhancement time should be related to the previous 7200 cycle high magnitude induced test. After experience with the enhancement which precedes the one hour test at 1.5 times maximum voltage, it appears that most persons now favor reducing the enhancement time to the original 5 second proposal.

The Working Group established a Task Force to draft a revision for this part of the test code. The Chairman will obtain a project number for this task. It is planned to ballot the draft in the Working Group prior to the next meeting.

The meeting was adjourned at 4:15 P.M.

B. Working Group for Revision of Dielectric Testing of Distribution Transformers

John Rossetti

The Working Group met at 1:05 P.M. on April 10, 1989 in Chicago, Illinois with 15 members and 14 guests present.

The minutes of the October 31, 1988 meeting in Long Beach, California were approved as written.

Bill Henning stated that 77% of the ballots on PC57.12.90c/D6 "Routine Impulse Test for Distribution Transformers" had been returned. Bill will ballot the Transformers Committee. Some ballots were approved with comments. These comments were:

- 1) That the Working Group look into preparing a Guide for Routine Impulse Tests. Jeewan Puri agreed to help gather information for the Guide.
- 2) A comment was made concerning the second method of impulse testing using two full waves. The Working Group had approved this earlier. This allows for the two full waves to be compared against the full wave oscillogram of a like transformer.
- 3) Minor revisions will be made in grammar and English.

Task Force on Low Side Surge Requirements for Distribution Transformers

R. E. Lee

The Task Force met at 8:00 A.M. on April 10, 1989 with 13 members and 10 guests present and at 2:05 P.M. on April 11, 1989 with 10 members and 4 guests present in Chicago, IL.

The minutes of the October 31, 1988 and November 1, 1988 meetings in Long Beach, CA were approved as submitted.

The chairman announced that the published agenda had been revised to accommodate a Cooper Power Systems presentation.

The presentation described a laboratory circuit used to analyze surge response of a typical single phase distribution transformer and its service drop. This and other information which has been gathered will be published at a later date. The Tuesday meeting provided time to discuss the Working Group Report outline submitted by Jeewan Puri and the written comments of Charlie Williams and Chuck McMillen.

There being no other business the meeting was adjourned at 1:35 P.M.

C. Working Group on Partial Discharge Tests for Transformers

G. H. Vaillancourt

The Working Group met on April 11, 1989 at 8:00 A.M. with 18 members and 23 guests present.

Membership remains at 36.

The minutes of the Long Beach meeting were then approved as written for the part pertaining to the Working Group.

Task Force for Measurement of Apparent Charge
W. J. Carter

The Task Force met in Chicago, IL on April 10, 1989 with 8 members and 13 guests present.

Mr. D. Ballard requested membership in the Task Force.

The minutes of the Long Beach meeting were approved as corrected to add a promised attachment on Partial Discharge acceptance levels in use by several North American utilities and in some other countries.

Copies of the most recent test data sheet were distributed. No discussion of test results occurred since only one set of data had been received. It was suggested by Mr. Moore that both manufacturers and users should be encouraged to submit data. Users should include the test in their specification and submit the data. We need to have data from charge responding instruments to set acceptance levels in picocoulombs.

A discussion of a future revision of C57.113 "IEEE Trial Use Guide for Partial Discharge Measurement in Liquid Filled Power Transformers and Shunt Reactors" followed. Mr. George Vaillancourt presented draft revisions to both Sections 5 and 9 of the Guide.

Information in Section 5 was expanded to clarify the test instrumentation and to add a new subsection on Partial Discharge Pulse Counters. Discussion indicated the Pulse Counter could be an optional part of the instrumentation.

The revision of Section 9 included changes in the test procedure to include the Pulse Counter information as part of the acceptance criteria to replace the statement: "Occasional high discharges should be disregarded".

The interpretation of the pulse count data received a lot of discussion. Several people expressed that it may be a bit early to include pulse count information as part of the acceptance test data. These paragraphs may better belong in an appendix. Further discussion of this change will be conducted at the Working Group level where a larger audience should be available for discussion.

Mr. Fleeman of AEP suggested that a change be made in the test procedure to energize the transformer at the 150% level for at least five minutes before the enhancement part and then take an apparent charge reading immediately before going into the enhancement period. This reading would be used as a reference to determine if changes occurred during the spike. Mr. Vaillancourt said, he will look into this matter to see if a change can be made.

There being no new business, the meeting was adjourned at 9:42 A.M.

Task Force for Acoustic Detection of Partial Discharge
E. Howells

The Task Force met at 10:05 A.M. on April 10, 1989 with 6 members and 13 guests present.

The chairman reported the progress of the two projects currently active in the Task Force.

The first project, PC57.127 is a guide on field acoustic detection of partial discharges in transformers. Before the Long Beach meeting, the Working Group and the Subcommittee balloting resulted in 3 negative ballots, all relating to safety issues. Acceptable editorial changes have eliminated the negative ballots. Permission has been granted to ballot the main committee.

A PAR has been requested for the second project to prepare guide for acoustic location of partial discharge in oil-filled power transformers. Information requested from Task Force and Working Group members has not been received by the Chairman. However, the draft has been started, based on EPRI work, and presented to the Task Force. A discussion then followed on the purpose of the location document whether it is for field use or factory use or both. Since no agreement on this could be reached at the Task Force level, it was resolved to put this question before the Working Group.

Richard Lowe indicated that work pressures will not allow him to continue as Secretary of the Task Force. He was thanked for his excellent work. The plea for a volunteer replacement was unsuccessful.

There being no other new business, the meeting was adjourned at 11:00 A.M.

Later, the Working Group unanimously decided to include both field and factory acoustic location of partial discharge in transformers in the guide.

This concluded Task Force reports.

The Working Group discussed the proposal to include Partial Discharge Pulse Counters in ANSI C57.113 as part of the instrumentation required for the Partial Discharge testing of oil-filled power transformers. After much lively and interesting discussion, the proposal was rejected on the basis that it is too early to consider such an important change. We are presently working on trying to establish an acceptance level. It was suggested that results of the work on the use of Pulse Counters in transformers be first published before this matter is given further consideration by the Working Group.

Mr. Fleeman's proposal to take a partial discharge reading before the enhancement period of the test was again discussed. Mr. Vaillancourt remarked that this had also been discussed at the Working Group for the Revision of

Dielectric Tests yesterday and the Chairman, Mr. Moore, had said he would look into it along with shortening the time of the enhancement period. This was confirmed by Mr. Moore.

There being no other new business the meeting was adjourned at 9:30 A.M.

5. OLD BUSINESS

IEEE High Voltage Testing Techniques.

Russ Minkwitz attended the November 15, 16, 1988 meeting in Lenox, MA. The subcommittee began review for revision and updating ANSI/IEEE STD #4-1978 "IEEE Standard Techniques for High Voltage Testing".

Comparison of STD #4 will be made with IEC #60-1, 60-2, 60-3, and 60-4. Two new sections will be developed. Section 6 "Partial Discharge and Corona" and Section 7 "Capacitance and Dielectric Loss Measurement".

Russ cannot act as liaison to this subcommittee. Therefore the Transformers Committee needs an active liaison.


Their next meeting is in St. Petersburg, FL on May 3, 4, and 5, 1989.

6. NEW BUSINESS

None

7. ADJOURNMENT

The meeting adjourned at 12:05 P.M.


Robert E. Lee
Chairman

REL/rel



**Westinghouse ABB
Power T&D Company**

651 Holiday Drive
Pittsburgh, Pennsylvania 15220

Minutes of the April 10, 1989 Meeting of the
HVDC Converter Transformer and Smoothing Reactor Subcommittee
Chicago, IL

The meeting was called to order at 8:00 AM with four members and five guests present. A new member was added, Mr. Pierre Riffon from Hydro-Quebec. He is presently involved with testing converter transformers and his membership is welcomed by the Subcommittee. After the usual introductions and discussions of the minutes of the previous meeting in Long Beach, Mr. Ed Yasuda gave a review of the meeting of the CIGRE joint working group 12/14-10 on March 15 in London. The CIGRE group has several projects under current development:

- o Task Force on Transformer Reliability - This task force has been recently formed and will investigate problems associated with failures of converter transformers in service.
- o Converter Transformer Specifications - Mr. T. H. Harrison has prepared an extensive list of specifications which will be modified as a result of comments received from other members. This list will be very valuable in preparing the IEEE and IEC standards.
- o Dielectric Testing of Converter Transformers - The CIGRE working group discussed a draft of a paper comparing the operating and test stresses in converter equipment. This paper suggests that although present tests demonstrate adequate margin over test stresses for the operating stresses in the solid insulation, under certain extreme conditions the service stresses in the oil may not have the desired margin over the test stresses. At present the working group is considering recommending a dc design test to be performed at elevated temperature in addition to the routine dc and polarity reversal tests done at ambient temperature.
- o Other items being examined in the CIGRE working group include harmonic currents, losses, acoustic noise, and unbalance and variations in transformer reactances. We have a close liaison with the CIGRE working group and expect that the final IEEE and IEC standards will share similar test procedures wherever possible.

Draft #1 of the Subcommittee's new document, "General Requirements and Test Code for Converter Transformers and Smoothing Reactors for DC Power Transmission" was distributed and discussed at the meeting. It was noted that several

sections including the test code remain to be written and will be included in draft #2 for the meeting in Charlotte. Members are encouraged to review draft #1 and return their comments, criticisms and suggestions by Sept. 1, 1989 so that they may be included in Draft #2.

The meeting was adjourned at 9:35.

Respectfully Submitted,

Bill Kennedy

William N. Kennedy
Chairman, HVDC Converter Transformers and Smoothing Reactors
Subcommittee

BUSHING SUBCOMMITTEE

Report to Transformers Committee
April 12, 1989

The Bushing Subcommittee met on Tuesday, April 11, 1989 with 11 members and 10 guests present.

After introductions, approval of last meeting's minutes and announcements, the meeting began with the reports of the Working Groups and Task Force. The Working Group on Bushing Application Guide did not meet because Chairman Fred Elliott was unable to attend the meeting. It was reported that Mr. Elliott is continuing to resolve the various comments generated from the first draft of P800 (PC57.12.100). It was also reported that P757, (PC57.12.101) Bushing Loading Guide, has been approved by the IEEE Standards Board and has been referred on to C57 for its approval. IEEE Publications has this document as one of its highest priorities.

The activities of the Working Group on Bushings for DC Applications was reported by Acting Chairman Wagenaar. The Working Group met on April 10 with eight members and eight guests present. Prit Singh and Devki Sharma wrote the first draft of several sections of the new document and these were reviewed at the meeting. Most of the discussion concentrated around the testing of these bushings. After considerable discussion, it was decided that:

- 1) The routine test sequence on bushings rated 300kV or below will be an ac test followed by a dc test and a dc polarity reversal test.

- 2) The routine test sequence on bushings rated over 300kV will be given a test sequence of ac test, dc test, dc polarity reversal test and a final ac test. The reason for the final ac test is to detect any damage which may have been caused by the dc tests. The dc tests will be done with the external insulation and ground planes which surround the lower end of the bushing while mounted in the transformer in place.
- 3) The design test procedure for all dc bushings will be the same as that for bushings rated over 300kV.
- 4) The magnitude of the dc test voltages will be 115% of the test voltages used for the converter transformer or smoothing reactor in which the bushing is applied.

Mr. Lloyd Miller, Chairman of the Task Force on Bushings for Distribution Transformers, reported no progress on his subject.

The Subcommittee spent the rest of the meeting time reviewing the comments to the latest ballots of the subcommittee on draft 8 of PC57.19.00, General Requirements and Test Procedures for Outdoor Apparatus Bushings and revisions of Tables 9 and 10 of IEEE 24-1984. The final results of these ballots are as tabulated below:

	<u>C57.19.00</u>	<u>Table 9</u>	<u>Table 10</u>
Ballots sent out	24	24	24
Ballots returned	16	16	16
Affirmative	9	11	13
Affirmative w/comment	4	2	3
Negative	3	3	0

All negative ballots except one on PC57.19.00 have been resolved and we are attempting to resolve the remaining negative ballot by investigating the facts of matter further. One negative ballot on PC57.19.00 was resolved by creating a third category of tests to supplement the existing design and routine tests. The new category, special tests, has precedent in the transformer standards, and will include the thermal stability test. The test will be made upon agreement between the manufacturer and the user.

The third negative ballot on PC57.¹⁹12.90 has been resolved by adding the altitude correction tabulation which appears as Table 1 in C57.12.00 in the Bushing Standard. All of the Table 9 negative ballots were resolved by reducing the partial discharge limits for resin impregnated bushings from 25 to 10 uv/pc.

If the remaining negative ballot can be resolved, then all three documents will be balloted by bushing subcommittee and the transformers committee.

10-K

IEEE TRANSFORMERS COMMITTEE
AUDIBLE SOUND AND VIBRATION SUBCOMMITTEE

CHICAGO, ILLINOIS

APRIL 11, 1989

Minutes

Chairman Allan Teplitzky opened the meeting at 10:05 a.m. with 12 members and 15 guests present.

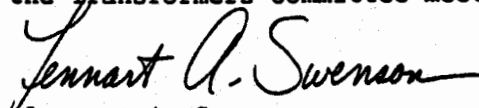
Members:	Roy Bancroft	Jack McGill
	John Ebert	Linden Pierce
	Ramsis Girgis	J. M. Pollitt
	Jerry Grimes	H. J. Sim
	Roger Hayes	Lennart Swenson
	John Lackey	Allen Teplitzky
Guests:	Barry Beaster	Alan Iversen
	Jerry Corcoran	William Kruesi
	Max Cumbre	Klaus Papp
	Alfonso Delgado	Van Quan Pham
	Richard Dudley	Pierre Riffon
	Ramon Garcia	W. W. Stein
	Donald Hornak	Gordon Tanaka
		James Tingen

Minutes of the November 1, 1988, meeting in Los Angeles were approved.

The remainder of the meeting was devoted to discussion of Draft 7 of the proposed revision of the audible sound measurement portion of C57.12.90. Several comments were made by Ramsis Girgis who indicated he had more comments when the allotted meeting time expired. He was requested to submit all his comments to the chairman or the secretary in time for a new revision ballot to be issued on June 1, 1989. He indicated he would comply with that request. It will then be possible to receive ballots and present results at the next meeting.

There was no action on the Transformer Siting Guide at this meeting.

The next meeting will be at the Transformers Committee meeting in Montreal in the fall of 1989.


Lennart A. Swenson
Secretary, Audible Sound
& Vibration Subcommittee

March 31, 1989

TO: Mr. John D. Borst
Secretary, IEEE Transformers Committee
Westinghouse ABB Power T&D Company
P.O. Box 883
Jefferson City, MO 65102

FROM: Stan Lindgren, Project Manager 

SUBJECT: EPRI LIAISON REPORT

The following report is for inclusion in your minutes for the April 12, 1989 meeting.

1. EHV Converter Transformer:

- Test results confirmed 25% or greater major insulation size reduction can be attained with some further work.
- Final report is being drafted.

2. Amorphous Steel For Distribution Transformers:

- GE reports they have shipped "many thousands" of commercial amorphous core transformers.
- A joint CRIEPI/EPRI sponsored symposium on amorphous transformers was held in Tokyo March, 1989.

3. Amorphous Steel For Power Transformers:

- Improved through-put in the lamination consolidation process has been accomplished.
- A pilot facility automated cutting line is being fabricated.
- No problems have been reported with 500 kVA unit installed and placed in service June 1987.

4. Advanced Power Transformer:

- Reduced load loss feasibility has been demonstrated.
- Detailed analytical studies exploring individual design aspects has been completed.
- Phase II is starting which involves building a number of physical models to verify the design studies.

5. Static Electrification in Power Transformers:

- Suspected failure mechanism in over 12 core form and shell form FOA transformers worldwide.
- Four basic physical mechanisms and more than ten variable parameters have been identified.
- Work is now focused on monitoring instruments and quantification of parameters for mathematical models.
- A project has been initiated to monitor a large FOA transformer in the field.

6. Bubble Evolution in Overloaded Transformers:

- Very rapid load changes can cause bubble formulation under some conditions and reduce 60 Hz and impulse dielectric strength. This has been demonstrated in models with rapid/high O.L.
- Supplemental project is underway with Westinghouse to better identify moisture conditions associated with bubbles and verify GE mathematical model.

7. Power Transformer With Two-Phase Cooling:

- 75% perchlorethylene, 25% oil.
- 65 MVA unit went into full service October 31, 1986.
- Unit is carrying normal load without incident including temporary 15% above nameplate.
- Final Report is being published.

8. Active Transformer Noise Cancellation System:

- Two-year project started March 1987.
- Noise reduction in one direction is being pursued first.
- An initial evaluation on a substation transformer was completed that demonstrated over 10 decibel reduction with a small trial system.

9. Feasibility For Improved LTC:

- One project focused on conventional electromechanical and ways to minimize maintenance and transformer failure. Vibration signature analysis to identify maintenance has been explored. Final report will be published.
- One project focused on feasibility of total solid state LTC and static phase shifters. An inertie simulation with fast response phase shifter was included. Final report EL-6079 is published.

SRL:sf:BORST

cc: Stig Nilsson
Bob Veitch

TC-M



ABB

**Westinghouse ABB
Power T&D Company**

651 Holiday Drive
Pittsburgh, Pennsylvania 15220

**LIAISON REPORT
CIGRE SC-12 (TRANSFORMERS)**

There have been no meetings of CIGRE SC-12 since the General Session in Paris in August, 1988 and reported by Mr. W. J. McNutt in his liaison report at our last meeting in November.

The next meeting of SC-12 will be held October 2-7, 1989 in Rio de Janeiro, Brazil. There are two preferential subjects that will be discussed - thermal aspects of transformers and problems related to generator step-up transformers. In addition, there will be a one-day meeting with SC-15 (Insulation) covering application of chromatography to transformer analysis, static electrification, and ageing of insulating materials.

Topics to be discussed with respect to thermal aspects of transformers include:

- o direct measurement of hot-spot temperature
- o heat-run test procedure at rated load and under overload
- o maximum tolerable hot-spot temperature under emergency conditions
- o equations for the prediction of hot-spot temperatures under overload conditions
- o current overloading practices

Subjects included in the generator step-up transformer session are:

- o specific service conditions affected by the design
- o overvoltages caused by load shedding or back-feeding
- o transport, application and installation conditions
- o testing
- o reliability, availability, maintainability

Individuals who wish to share their observations on any (or all) of these topics are strongly urged to contact me with their comments. These topics are quite timely and this colloquium represents an opportunity to share the considerable experience that is represented within the IEEE Transformers Committee with CIGRE.

Sincerely,

Bill Kennedy
William N. Kennedy

U.S. Representative to CIGRE SC-12 (Transformers)

TC-N
P: 1-1-1

IEEE/PES TRANSFORMERS COMMITTEE
April 11, 1989

Remarks by
Wallace B. Behnke, Jr.
Vice Chairman, Commonwealth Edison Company
President, Power Engineering Society

Introduction

I have been looking forward to today's luncheon, first to salute the Transformers Committee for its many contributions to power engineering technology, and second to share with you some thoughts concerning the changes taking place in our industry along with some challenges and opportunities I see for the Society in the coming decade.

It seems virtually certain that for at least the next several decades, electric power will play an increasingly critical role in the nation's energy economy. This is a period when the deliverable supply of energy, including that supplied by the electric utility industry, will be constrained by the interplay of public policy, technological innovation, environmental concerns and economic forces.

Let us begin by looking at several of the more significant forces reshaping the industry beginning with the demand for electric power.

Demand

The importance of energy to the nation's economic and strategic well being has been recognized for a long time. As things stand now, energy consumption has been decoupled from Gross National Product and has leveled off in recent years while kilowatthour consumption continues to grow in step with the nation's economy. The main reason why electricity use remains wedded to GNP has been the continued electrification of U.S. industry as it seeks to remain competitive in the global markets for goods and services.

The most recent forecast of the growth in summer peak demand for electricity by the North American Electric Reliability Council is for increases averaging approximately 1.9 percent annually over the next ten years. According to the Council, there is an 80 percent chance that demand growth over the next decade will be in the range of 1.0 to 2.6 percent per year with a 10 percent chance that demand will exceed the higher estimate.

Planned capacity additions of 73,400 megawatts are considered adequate to meet this base case projection. Non-utility generators are expected to account for about 27 percent of these planned capacity additions. However, delays in new capacity and loss of existing capacity could reduce the planned capacity resources for 1997 by as much as three percent.

As a sign of things to come, last year's hot summer and a vigorous economy in the U.S. pushed system loads to record levels in many areas. Over two-thirds of the country's 75 largest electric utilities exceeded their own 1990 peak load estimates and at least ten percent of the group exceeded their own peak estimates for the year 2000.

Public Utility Regulation

There is ample reason for concern about the adequacy of the nation's electric power supply over the next decade. Between 1970 and 1985 the utilities were subjected to periods of rapid inflation, higher real interest rates, unexpectedly low demand growth, unanticipated fuel cost volatility and construction delays caused by escalating environmental and safety regulations. These developments were followed by adverse regulatory treatment regarding the recovery of costs for many newly completed electric generating projects.

As a result few utilities feel they can undertake the financial risks inherent in commitment to a large generating unit project without some better assurances from regulators that they will afford them a reasonable opportunity to recover their costs. It should not be surprising that many utility managers indicate they plan on meeting future electricity demand by extending the life of existing generating facilities, purchasing power from other utilities and independent power producers (IPP's), promoting conservation and initiating a variety of load management measures.

Environmental issues will also be pervasive in the 1990's. There is a good chance of acid rain legislation coming out of the Congress this year. According to the Reliability Council, environmental regulations that reduce capacity, delay new facilities, or reduce the availability of existing facilities would pose a serious threat to electric power system reliability as well as to the cost of electric service.

The "greenhouse effect" has also lent a new respectability to nuclear power. Many environmentalists have even joined with Congress in a call for a new generation of simpler, smaller reactors with a speeded up licensing process. More than ever, nuclear power seems to be the keystone of any strategy to combat both foreign oil and global warming while still producing power for economic growth.

At least 20 states now impose requirements for least cost planning, which include both supply side and demand side strategies. Most utilities are experimenting with demand management programs aimed at reducing system peak loads and deferring the need for generating capacity additions. But government intervention in the form of least cost planning also translates into higher risk. The Reliability Council cautions that more experience will be required to establish the long-term availability, cost effectiveness, and customer acceptance of many of these programs.

Deregulation

A second major force shaping the electric utility business in the U.S. is deregulation.

Following deregulation in transportation, natural gas pipelines and telecommunications, interest in greater competition among electric power producers has grown. The trend toward increased competition in both the bulk power and retail markets is expected to continue through the next decade.

The Public Utility Regulatory Policy Act of 1978 opened the door for competition in the bulk power markets from qualified generating facilities such as industrial cogenerators and certain classes of small power producers. Hardened competition between utilities with surplus generating capacity is developing, now that the Federal Energy Regulatory Commission is allowing more flexibility in the pricing of wholesale transactions. In addition, a growing number of independent power producers are entering the market and contracting to sell power to the franchised utilities.

The Federal Energy Regulatory Commission is considering proposals to further relax the regulation of independent power producers and promote competitive bidding for future capacity requirements.

In theory, increased competition will produce lower prices, weed out inefficient producers, and lead to a more efficient industry. But there is a fundamental inconsistency between treatment of electricity as a commodity in a competitive market economy and preservation of the utilities obligation to service. However, continuing interest in competition and deregulation notwithstanding, utilities are not likely to be relieved of their obligation to serve as the supplier of last resort.

Serious concern has been voiced about the federal regulatory proposals. Some say these proposals ignore many of the political, technical and economic realities of the nation's power supply system. They warn that if this national experiment in deregulation does not work, then the nation's supply of electricity could be in jeopardy.

Whatever the outcome of the debate, one thing seems clear: we are going to need more electric generating capacity in the 1990's with a significant amount coming from non-utility sources. This will require some new understanding with regulators on the matter of cost recovery and return on investments made in response to the utilities' obligation to serve.

Transmission Access

The key issue for those who are expounding the need to increase competition in the electric power markets is access to the transmission system.

Transmission systems are critical for providing pathways for emergency power transfers. Utilities, and now non-utilities, also use these systems for capacity and economy energy transfers.

The nation's bulk power systems are also complex. They were not designed for unlimited access by competitive suppliers and users. Individual utility property rights, pricing issues and technical limitations raise serious questions as to how and to what extent wheeling should be mandated. The question of federal versus state jurisdiction must also be clarified.

Analogous from the pipeline and transportation systems offer little guidance in addressing the technical issues. Kirchoff's laws, loop flows, non-linear losses and non-linear interactions complicate the analysis. Voltage and frequency control, as well as system stability considerations, demand continuous on-line control, and coordination of multiple sources and loads is required.

The bad news is that transmission access and deregulation are issues which potentially threaten future electric system reliability by increasing transmission system loadings, compounding coordination problems and reducing transmission capability margins.

According to a recently issued report to Congress by the Office of Technology Assessment, entitled "Electric Power Wheeling and Dealing: Technological Considerations for Increasing Competition," a key issue is how to maintain the coordination that is required for reliable operation and economic dispatch when responsibility for generating and transmission facilities is divided among competitive entities.

The good news is that new technology is offering ways to mitigate the risk by allowing for better monitoring and control. Indeed we are also heading toward power systems which are electronically, rather than mechanically, controlled and, thus will be far more flexible than today's utility networks. Computer technology, already widely applied to electric power

systems, offers still further potential for both supply and demand side load management. Moreover, power semiconductor technology, including the thyristor and its variations, is now being used in AC/DC convertors for high voltage d-c transmission, and static var (reactive power) compensators. In the future, there is the prospect of all-thyristor-based devices that can rapidly control both active and reactive power flows.

Globalization

A third major force is the globalization of the power equipment supply industry.

Manufacturing Sector

When the historical seven percent long-term average annual growth in electricity in the U.S. demand dropped to less than half this level after the 1973 Arab embargo, the manufacturing sector suffered severely because its sales are proportional to the growth of the output of its utility customers.

Responding to the financial pressures of the past decade, the manufacturers reduced forces, cut back R&D and curtailed the hiring of young graduates. Consolidation inevitably occurred. An early manifestation of the trend toward consolidation was GE's exit from the high voltage switchgear manufacturing business in the late seventies. In essence, G.E. became the sales agent for Hitachi breakers, manufactured in Japan. This was followed in the 1980's with G.E. dropping out of the HVDC business and selling their power transformer business to Westinghouse. A more recent development is the joint venture between Westinghouse and ASEA-Brown Boveri involving a significant fraction of Westinghouse's power equipment business and a similar joint venture of Alstom of France and GEC of the United Kingdom. While some segments of the U.S. based apparatus industry remains strong, there is no reason to believe the shift to offshore ownership or control has run its course.

In assessing the consequences of this trend for the U.S. electric utilities, it is important to keep in mind their historical relationship with manufacturers. The manufacturers were not just the manufacturing arm of the industry; they were also the R&D arm, as well, R&D not only for advanced equipment, but also for system design, analysis and operation.

In the late 1960's competence in bulk power system analysis and operating theory began migrating to the consulting industry, to system control suppliers and increasingly to utilities themselves. While U.S. analytical consultants and control system suppliers remain among the most competent in the

world, the weakening of technical emphasis within the U.S. apparatus industry has paralleled the decline in the industry's market position.

Globalization is also impacting research and development and power engineering education in the U.S.

Before the Electric Power Research Institute (EPRI) was formed in 1973, about two-thirds of the R&D in the electric power industry was conducted and paid for by manufacturers. EPRI's original role as manager for utility supported R&D was to bridge the gap between the longer range, high risk research performed by the government and the shorter term, product development work done by manufacturers and system specific application research done by individual utilities. With the cutback in R&D expenditures by the manufacturing sector, EPRI shifted its emphasis to nearer term needs as defined by the utilities. But EPRI's funds are not sufficient to sustain the domestic manufacturing industry's R&D during long periods of down markets. Moreover, the long-range research performed and/or supported in the past by the U.S. Department of Energy has dwindled from the high levels in the mid-70s - early 80s.

At the same time, there has been a decline of interest in university teaching and training among U.S. manufacturers and utilities. Power is no longer a fashionable area of engineering education or research in U.S. universities. Fewer students enroll and consequently graduate from the decreasing number of U.S. institutions of higher learning. The problem is compounded by the trend toward globalization of the manufacturing sector in certain product lines with a further shift of research and development to Europe and Japan.

International standards, particularly IEC standards, will become much more important in the future as the locus of high voltage equipment manufacturing shifts toward overseas suppliers. The key point is that as manufacturing moves offshore, the U.S. must be in a position to reflect its requirements on the development of international standards. In the past, U.S. manufacturers have participated heavily in international standards development and committee management. However, utility involvement in the international standards process will have to increase if U.S. requirements are to be accommodated, particularly where these requirements diverge from those of the industry overseas.

Conclusion

Those of us in the electric power engineering community have good reason to be concerned.

Unfortunately, the power surpluses in most parts of the country, together with preoccupation with financial and regulatory issues, are masking underlying trends which

unchecked could spell trouble in the mid-1990s when the electric power industry is expected to face the triple engineering challenges of the next construction cycle, restructuring and technical obsolescence, with significantly fewer new technical graduates entering the job market. Moreover, the impacts on the nation's economic well-being and national security from the globalization of equipment manufacturing have yet to be fully assessed.

It is also evident that we are already in the midst of a technical revolution in telecommunications and control arising from semiconductor developments. These information technologies are combining with other new electrotechnologies to provide us with new frontiers for economic growth and progress.

The key to adapting to the increasing pace of technology development is the interaction between engineers and society according to the National Research Council. Thus, professional societies, which have long grappled with the ethical questions, will also continue to play a primary role in addressing large public policy issues on behalf of the profession.

All this underscores the importance of Power Engineering Society membership and participation at meetings such as this. Sharing information in such a format is the most cost-effective way, if not the only way, for individual engineers to keep abreast of these fast-moving developments as well as to exchange ideas and share experience with other professionals in the field. As a Society, our purpose is the advancement of the theory and practice of electrical engineering. As a Society, we are committed to improvement in the quality of life through constructive application of technology, better public understanding of the influence of technology on the public well-being and maintenance of the credibility of our profession. The strength of the Society is measured in terms of the commitment of its members to these principles and the willingness of individuals to give of their time and talents to these ends.

With this in mind, we have established the following goals for the Society for 1989:

- First is to continue the emphasis on improving membership services including the quality and relevance of conferences and publications, broadening the support of our chapters, both here and overseas through the distinguished lecturer programs, and finding new ways to encourage and recognize professional achievement.
- Second, to continue efforts to expand membership with particular emphasis on building up our student chapters and enrolling younger engineers in the Society.

- Third, to continue with our joint initiative with the Edison Electric Institute to address the troubled state of power engineering education and to expand and enhance our continuing education services, especially in underserved areas identified in last year's survey of member needs and expectations.
- Fourth, to continue our participation as experts in discussions of public policy where we can contribute to a better public understanding.
- Fifth, to reassess the role of the Society in light of the trend toward globalization of the electric power equipment manufacturing sector of our industry.

Thank you for your attention. At this point, I would be glad to answer your questions.