

**SWITCHGEAR ASSEMBLIES SUBCOMMITTEE
MINUTES OF THE SPRING 2016 MEETING**

**Sonesta Resort, Hilton Head, SC USA
April 27, 2016**

The meeting was called to order by SA S/C Chair, D. Edwards, at 1:30 PM on April 27, 2016 with the introduction of the following members and guests:

Attendance

Members: 27 present, 48 absent – Quorum was met.

Guests: 34

Total: 61

Attendance is recorded at the end of the meeting minutes. Membership and attendance is recorded in the AMS system.

1. Introduction of Members and Guests

Members and guests introduced as recorded above.

2. Approval of Meeting Agenda

Spring 2016 agenda presented.

Agenda accepted without changes by the SA S/C.

3. Approval of SA Meeting Minutes

Link: <http://www.ewh.ieee.org/soc/pes/switchgear/minutes/2015-1/F15index.htm>

Minutes (link above) from the fall 2015 meeting in San Diego, CA were posted on-line.

Minutes accepted without changes by the SA S/C.

SA S/C Secretary Email address: mike.lafond@ieee.org

4. Working Group Status Reports

a. C37.20.7 – Guide for Testing Medium-Voltage Metal-Enclosed Switchgear for Internal Arcing Faults

M. Wactor: Minutes are provided.

M. Wactor: WG met Tuesday, April 26, with 67 attendees. Quorum was met.

M. Wactor: WG received 683 comments from the first ballot. Ballot achieved 75% participation but did not achieve a 75% affirmative vote. Several task groups were assigned to evaluate the comments for their respective annex for appropriate modifications to maintain their annex within the document. Task groups are required to complete their actions by May 20, 2016. Resolution committee was formed and targeting weekly teleconferences to resolve ballot comments. WG Chair will pursue a PAR amendment to address scope items and extension. WG is targeting a re-circulation ballot in July 2016 to support the fall meeting schedule.

Actions for SA S/C: No further action required.

b. C37.20.9 – Metal Enclosed Switchgear Rated 1 kV to 52 kV Incorporating Gas Insulation Systems

Comment Resolution Team met:

- November 5 and November 6, 2015: At UL office in Research Triangle Park, NC
- January 28, 2016: At UL office in Research Triangle Park, NC
- February 4, 2016: On-line meeting
- February 12, 2016: On-line meeting

E. Byron: WG met Wednesday, April 27, with 59 attendees. Quorum was met.

E. Byron: Several topics reviewed with excess of 600 comments from a straw-man ballot. WG discussed and voted to maintain the fuse requirements for VT's. WG voted to move forward with a formal ballot. Two open topics are to be resolved.

i. Tracking resistance

Track resistance and testing of materials not in open air is not fully resolved.

ii. Ground Switch

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Current draft includes a grounding switch with a single operation for closing onto a fault. If there is an issue with the grounding switch, it is not in a serviceable location. WG requests some assistance from experts in C37.20.4 for guidance and recommendations.

C. Taylor: C37.20.4 contains table 1 and table 7 but these tables do not address all the grounding switch requirements.

P. Barnhart: Motion to create a C37.20.4 Amendment WG to address grounding switch issues.
2nd: D. Sigmon. Motion approved by SA S/C.

E. Byron: RODE documents have a requirement to operate switch 5 times.

T. Burse: There are no requirements for more than one operation for a ground and test device in air insulated switchgear assemblies. It has historically not been an issue since the device is serviceable.

iii. Snubber Circuit Protection

A. Livshitz: The current draft does not address protection requirements of snubber circuits. Some manufacturers provide them and some do not. Is this requirement addressed somewhere in a document or standard?

J. Shullaw: I believe there is a standard on transients for transformers close coupled to equipment.

T. Olsen: IEEE 57.142 Guide to Describe the Occurrence and Mitigation of Switching Transients Induced by Transformers, Switching Device, and System Interaction. This guide does not provide any details on how to provide protection of snubber circuits. In the industry there is a wide variety of theories and consultant recommendations. It appears this subject may not be ready to standardize.

A. Livshitz: Volunteers to lead ad-hoc team to research and solicit information to proper means of protection of snubber circuits as they apply to switchgear assemblies.

D. Edwards: Ad-hoc team approved by SA S/C with T. Olsen, J. Shullaw, E. Dullni, and R. Hartzel as volunteer members.

Actions for SA S/C: No further action required.

c. C37.20.10 – Standard for Definitions for AC (52kV and below) and DC (3,2kV and below) Switchgear Assemblies

K. Flowers: Minutes are provided.

K. Flowers: WG met Monday, April 25, with 34 attendees.

K. Flowers: WG had 28 open ballot comments and resolution achieved. WG chair will target a 10 day re-circulation ballot very shortly. WG should complete efforts this summer.

Actions for SA S/C: No further action required.

d. C37.21 – Control Switchboards

D. Hrcir: Minutes are provided.

D. Hrcir: WG met Monday, April 25, with 18 attendees.

D. Hrcir: WG continued the work from previous meetings. WG voted to circulate D2 after work is complete and move to ballot with a PAR revision.

Actions for SA S/C: No further action required.

e. C37.23 – Standard for Metal-Enclosed Bus

A. Jur: No meeting held. Document was approved April 2016.

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A. Jur: No meeting this time. Editorial edits were completed and returned. No more work required or expected at this time. WG Chair recommends a disbanding of the WG.

D. Edwards: Commends the WG for the strong work between meetings. SA S/C Chair disbands the WG.

Actions for SA S/C: Will report the WG disbandment to ADSCOM and Main Committees

f. C37.24 – Guide for Evaluating the Effect of Solar Radiation on Outdoor Metal-Enclosed Switchgear

J. McClelland: Minutes are provided.

J. McClelland: WG met Monday, April 25, with 21 attendees.

J. McClelland: Several web conferences held and comment resolution was achieved. No additional comments with D6. Current draft is under a re-circulation ballot.

D. Edwards: Commends the WG for great work in between meetings.

Actions for SA S/C: No further action required.

g. C37.81 – Seismic Qualification of Class 1E Metal-Enclosed Power Switchgear Assemblies

D. Riffe: Minutes provided.

D. Riffe: WG met Tuesday, April 26, with 21 attendees.

D. Riffe: WG has received just over 300 comments from ballot which were mostly editorial in nature. WG has resolved approximately 75 percent of the comments. WG expects to complete comment resolution shortly and target a re-circulation ballot prior to fall meeting.

Note that a combined WG is focused on both C37.81 and C37.82 documents.

Actions for SA S/C: No further action required.

h. C37.82 – Qualifications of Switchgear Assemblies for Class 1E Applications in Nuclear Power Generating Stations

D. Riffe: Minutes Provided

D. Riffe: WG met Tuesday, April 26, with 21 attendees.

D. Riffe: WG has received just over 300 comments from ballot which were mostly editorial in nature. WG has resolved approximately 75 percent of the comments. WG expects to complete comment resolution shortly and target a re-circulation ballot prior to fall meeting.

Note that a combined WG is focused on both C37.81 and C37.82 documents.

Actions for SA S/C: No further action required.

5. Old Business

a. IEC Activities

T. Burse: No meeting minutes provided.

T. Burse: IEC 62271-200 draft work will start next year. IEC 62271-214 is now underway for internal arc ratings of pole mounted equipment. We expect IEC 62271-200 will begin once IEC 62271-214 is further along in development.

b. ASC C37 – General Update

T. Olsen: No meeting minutes provided.

T. Olsen: I did not the most recent meeting. John Webb will be the vice chair and Carl Schneider will be the chair. The group will need to reconstitute its committee membership soon. Several documents will need revising with recent activity. Free downloads from the website is still available.

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C. Schneider: Chair will need help with membership to support balloting activities. A number of C37 standards are planned for revision. Committee will research ANSI rules and policies to ensure a valid ballot pool.

c. Document Coordination - General Update

T. Burse: some items from China on SCADA but not in circulation at this time.

E. Spiewak: an item from southern grid in China for the transformer group to review.

6. Membership

a. Senior Membership & Award for Young Professionals

D. Edwards: The following SA S/C members have achieved senior membership and are recognized.

- Michael Flack
- Anurag Jivanani
- Terry Woodward
- Tim Rohrer
- Tom Hawkins

D. Edwards: Please move forward with on-line efforts to obtain your senior membership. Our goal is to have SA S/C lead the way for a S/C with the highest percentage of senior membership.

D. Edwards – Award for Young Professionals recognizing individuals who have graduated with a technical degree within the last 10 years. A report does not exist to identify these individuals. If you qualify, please contact the Chair or Vice Chair.

- Michael Colesanti
- Diego Berenguela
- Mike Titus
- Dan Delfino
- Alex Lizardo

b. Switchgear Assemblies Subcommittee Membership

D. Edwards: The following participants have been added as SA S/C members.

- Terry Woodward
- Paul Gingrich
- John Shullaw

c. Main Committee Membership

D. Edwards: SA S/C proposed the following SA S/C members for membership to the Main Committee.

- Jerry Baskin
- Dave Dunne
- Paul Gingrich
- John McClelland
- Terry Woodyard

7. New Business

a. Partial Discharge Review – Partial Discharge Presentation (attached to the meeting minutes)

D. Edwards: We have a guest, B. Higinbotham, to present a discussion on partial discharge.

B. Higinbotham: Hosted a presentation of partial discharge topic to the SA S/C.

D. Edwards: Chair poses a question to the S/C if there is a need for additional partial discharge testing in the various types of equipment and which documents might need such information or an update to C37.301.

E. Dullni: Partial discharge testing can only detect when there are high electric fields where you can reliably detect a partial discharge occurrence. Partial discharge detection in switchgear assemblies has not been very reliable where detection of corona discharge testing has been more beneficial in switchgear assemblies.

B. Higinbotham: There have been several papers published on partial discharge testing in equipment. Surface discharge or corona events are more reliably measured. Customers in the field have been requesting partial discharge field testing of equipment. I wanted to inquiry if this

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S/C had any interest in defining a standard or guide for partial discharge field testing of switchgear assemblies.

T. Olsen: C37.20.2, C37.20.3, and C37.20.4 do not include any field testing information. The only clause that does address field testing and is common is a lower dielectric test value for field testing. Extending our standards to include partial discharge field testing would enter new technical subject. Challenges would include a high enough test voltage and a partial discharge free power transformer. C37.301 may be outdated but it is the best method we have for partial discharge testing.

Open Comment: Partial discharge events are not common during initial start-up. Partial discharge testing during commissioning should not be required.

D. Edwards: Canadian partial discharge standards are referenced and utilized for partial discharge field testing. SA S/C Chair will bring this subject up to the ADSCOM committee.

J. Shullaw: There are several companies that are offering on-line partial discharge testing.

B. Higinbotham: Both off- and on-line partial testing is available by many companies. We currently do not have a good document to perform partial discharge field testing for these types of equipment.

J. Wen: We have used partial discharge testing in parallel with dielectric testing for approximately 5 years. Our experience is partial discharge field testing is less reliable than dielectric testing.

A. Livshitz: NETA has a standard which covers field testing but does not include partial discharge testing for switchgear assemblies.

E. Dullni: Partial discharge is a pulse event and difficult to detect and determine its source. Would the S/C be able to provide the proper guidance to perform the test, find partial discharge sources, and state methods of remediation?

T. Olsen: Our documents do have optional partial discharge testing in C37.20.2, C37.20.3, and C37.20.4 for design tests and recommend that same test when applied to production testing.

T. Burse: SA S/C is really focused on bus in a box with lots of other components that reside within other committees. This is really a topic for ADSCOM to handle.

T. Olsen: Update on current status of C37.301, this document has a 7 page amendment published in 2015 and thus this document is valid and available.

K. Flowers: If a document or annex is desired for this topic, ADSCOM is the best forum for this new type of document.

T. Burse: Is partial discharge testing on the ADSCOM agenda?

D. Edwards: Are there any items of interest or proposals from the SA S/C? With no strong support for changes or updates to our documents, there will be no formal action taken at this time. C37.301 is on the ADSCOM agenda.

Note: After the SA S/C meeting, C. Taylor was assigned to Chair the C37.20.4 Amendment WG.

b. SA Document Status – Required action – review of proposed “SA Document Status” report.

D. Edwards: Document status has been reviewed with each WG Chair and Document Status Report is updated.

c. WG Meeting Room Requests – Update “SA Document Status” report

M. Lafond: Please contact me for any changes for meeting room requirements. Meeting room requests are circulated in SA Document status.

d. ADSCOM – Items for SA Chair to discuss at ADSCOM meeting

C37.20.4 Amendment WG formed to focus on mechanical endurance for switches.

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C37.20.9 and C37.24 WG are moving to ballot.

Partial discharge field testing discussed within S/C with no formal action taken.

- e. Visible Break** – Rode Discussion Group Report (attached to meeting minutes)
D. Edwards: RODE S/C is engaged in understanding the concepts of visible break and visible separation when applied to a circuit breaker integrated into a cubicle. RODE S/C had several question on this topic including when these concepts are needed, construction requirements, testing requirements, testing values, and mechanical operation requirements. Several SA S/C members participated in a meeting with RODE to help address these questions. SA S/C expects additional inquiries on this subject. A. Livshitz and E. Byron have volunteered to lead SA S/C responses to the RODE S/C activity.
- f. Main Committee Meeting Items** – Review items to be presented
Total: 14
Future PAR Activity: 1 (C37.20.4)
Active PAR's: 7 (C37.20.7, C37.20.9, C37.20.10, C37.21, C37.24, C37.81, C37.82)
Disbanded WG's: 1 (C37.23)
Not Active: 7 (C37.20.1, C37.20.2, C37.20.3, C37.20.4, C37.20.6, C37.23, C37.121)
- g. Working Group Minutes** – To SA S/C Secretary no later than April 29, 2016.
Email address: mike.lafond@ieee.org
- h. WG - Booklet & Website Synopsis** – To SA S/C Secretary no later than April 29, 2016.
Email address: mike.lafond@ieee.org
- i. Upcoming Meetings**
Fall 2016 (9 Oct – 13 Oct), Sheraton Station Square, Pittsburgh, PA USA
Spring 2017 (23 Apr – 28 Apr), Hilton Charlotte University Place, Charlotte, NC USA
Fall 2017 (8 Oct – 13 Oct), Marriott Portland Sable Oaks, Portland, ME USA
Spring 2018 (22 Apr – 27 Apr), Disney's Contemporary Resort, Lake Buena Vista, FL USA

8. Adjourn

Meeting adjourned at 2:51pm.

Reported by:

Michael P. Lafond
Switchgear Assemblies Sub-Committee Secretary
April 27, 2016

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Attendance record and as recorded in the AMS system:

Role	First Name	Last Name	Company
Chair	Doug	Edwards	Siemens Industry, Inc.
Secretary	Michael	Lafond	General Electric
Member	Paul	Barnhart	Underwriters Laboratories
Member	Ted	Burse	Powell Industries, Inc
Member	Eldridge	Byron	Schneider Electric
Member	David	Dunne	Schneider Electric
Member	Keith	Flowers	Siemens Industry, Inc.
Member	Paul	Gingrich	AZZ / Central Electric
Member	Sahadev	Gohil	AZZ/Central Electric Mfg. Co.
Member	Dan	Hrncir	Eaton
Member	Anurag	Jivanani	Schneider Electric
Member	Arthur	Jur	Eaton Corporation
Member	David	Lemmerman	PECO/Exelon
Member	Albert	Livshitz	CE Power Solutions
Member	Frank	Mayle	Technibus, Inc.
Member	Deepak	Mazumdar	Central Electric Manufacturing Co.
Member	John	McClelland	Technibus
Member	Charles	Morse	Siemens Industry, Inc.
Member	Darryl	Moser	ABB
Member	T	Olsen	Siemens Industry, Inc.
Member	Dave	Riffe	Westinghouse Electric Company
Member	Carl	Schneider	Schneider Electric
Member	John	Shullaw	Retired
Member	Dean	Sigmon	Eaton Corporation
Member	Paul	Sullivan	DuPont
Member	Chand	Tailor	Eaton Corporation
Member	Michael	Wactor	Powell Industries, Inc
Guest	Diego	Berenguela	Google
Guest	Jean-Marc	Biasse	Schneider Electric
Guest	Russell	Boyce	Eaton
Guest	Clint	Carne	Schneider Electric
Guest	Stephen	Cary	GE Energy Management
Guest	Robert	Cohn	Powercon Corp.
Guest	Michael	Colesanti	Google
Guest	Daniel	Delfino	General Electric
Guest	Anil	Dhawan	ComEd
Guest	Edgar	Dullni	ABB
Guest	Donald	Elliott	ABB
Guest	Sergio	Flores	Schneider Electric Inc. USA
Guest	Peter	Glaesman	PCORE Electric Company, Inc.
Guest	Lou	Grahor	Eaton Corporation
Guest	Ronald	Hartzel	Eaton Corporation
Guest	Jared	Hines	Eaton Corp.

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Role	First Name	Last Name	Company
Guest	Jose	Jarque	AZZ Switchgear Systems
Guest	Chad	Kennedy	Schneider Electric
Guest	Robert	Lau	Pentair Technical Solutions
Guest	Alex	Lizardo	ABB
Guest	Gary	Martin	Entergy
Guest	Jeffery	Mizener	Siemens Industry
Guest	Terry	Neighbours	ABB Inc.
Guest	Rahul	Pawar	ABB
Guest	Kevin	Rogerson	Eversource
Guest	Richard	Rohr	Powell Electrical Systems
Guest	Amy	Rowell	Eaton
Guest	Todd	Sauve	Rockwell Automation
Guest	Daniel	Sims	Eaton Corp.
Guest	Jordan	Snider	Pacific Gas & Electric Co.
Guest	Erin	Spiewak	IEEE
Guest	Jey	Thayalan	Schneider Electric
Guest	Michael	Titus	Schneider Electric
Guest	Jerry	Wen	BC Hydro

Should field testing for partial discharge be included in the Switchgear Standards?



Significant PD Standards – Non-Switchgear

[IEC TR 61294:1993](#) **Insulating liquids** – Determination of the partial discharge inception voltage (PDIV) – Test procedure

[IEC 60885-3:2015](#) Electrical test methods for electric cables – Part 3: Test methods for partial discharge measurements on lengths of **extruded power cables**

[IEC 60034-27:2007](#) "Rotating electrical machines – **Off-line** partial discharge measurements on the stator winding insulation of **rotating electrical machines**"

[IEEE Std 436™-1991](#) (R2007) "IEEE Guide for Making Corona (Partial Discharge) Measurements on **Electronics Transformers**"

[IEEE 1434-2014](#) "IEEE Trial-Use Guide to the Measurement of Partial Discharges in **Rotating Machinery**"

[IEEE 400.3-2006](#) "IEEE Guide for Partial Discharge Testing of **Shielded Power Cable** Systems in a Field Environment"

[ANSI/NETA MTS 2015](#) "STANDARD FOR MAINTENANCE TESTING SPECIFICATIONS for Electrical Power Equipment and Systems" **Cables, Transformers, Rotating Machinery**

Existing PD Standards - Switchgear

[IEC 60270:2000+AMD1:2015 CSV](#) High-voltage test techniques – Partial discharge

[IEEE Std 1291–1993](#) – “IEEE Guide for Partial Discharge Measurement in Power Switchgear “ **WITHDRAWN**

[IEEE Std C37.301™](#)– 2009 “IEEE Standard for High-Voltage Switchgear (Above 1000 V) Test Techniques – Partial Discharge Measurements“

“C37.301 adopts IEC60270–2000 and defines methods of measuring partial discharge... “

In IEC 60270, the only normative methods were direct connection. Alternate means were informative annexes.

The following line is in C37.301 – **“Most IEEE standards developed by the ... RODE subcommittee...now specify partial discharge testing measurement as a design (type) test and production (routine) test...”**

Summary

- IEEE standards exist for factory PD testing of Transformers, Rotating Machinery, Cables, and Distribution equipment
- IEEE standards exist for field testing of Transformers, Rotating Machinery, & cables
- C37.301 includes an out of date IEC standard and could be used for field testing but no application information is supplied
- Commissioning tests for PD on switchgear assemblies are routinely done but no standard exists defining the application or levels to be tested
- In service tests for PD can provide valuable predictive maintenance information but no standard exists for these types of tests.

Recommendation

Formation of a working group or task force to generate one of the following:

- Report
- Guide
- Standard

For partial discharge testing in the field for the purposes of commissioning and predictive maintenance