Meeting Minutes of the IEEE Materials Subcommittee of the Electric Machinery Committee of the Power and Energy Society

Date: Thursday, 07 November 2013
Location: Manitoba Hydro, Winnipeg, Canada

1. Meeting call to order, Review distributed agenda, Introductions and Attendance sheet.
   Dr. Frost called the meeting to order and introduced the agenda.
   The officers until end of 2013 are:
   - MSC Chair – Nancy Frost
   - Vice Chair – Aleksandra Jeremic
   - Secretary – Paul Gaberson
   The attendance sheet was circulated, with a total attendance of 36. (See Appendix C.)
   This set of IEEE MaSC WG meetings was held 06-07 November 2013.

2. Approval of the Minutes of the Last Meeting:
   Motion – Chuck Wilson
   Seconded – William Chen
   All in favor – YES

3. Chair’s Comments:
   a) Many thanks to Bill McDermid and Manitoba Hydro for hosting our Fall IEEE Materials Subcommittee meeting. Stellar job Bill!

   It is important to understand definition and responsibilities of being a Member of the Working Group. More information to be provided by the Chair at the upcoming meeting. (See old business section.)

   IEEE Standards Association requires that a request be made at each WG meeting for disclosure (identification) of any patents or copyrights that may be related to this work. The chair or the chair's delegate of an IEEE standards-developing working group or the chair of an IEEE standards Sponsor shall be responsible for informing the members of the working group/participants at a meeting that if any individual believes that Patent Claims might be Essential Patent Claims, that fact should be made known to the entire working group and duly recorded in the minutes of the working group meeting. This request shall occur at every standards developing meeting once the PAR is approved by the IEEE-SA Standards Board.

   The Working Group Chair or the Chair's delegate shall ask any patent holder or patent applicant of a Patent Claim that might be or become an Essential Patent Claim to complete and submit a Letter of Assurance in accordance with Clause 6 of the IEEE-SA Standards Board Bylaws. Information about the draft standard will be made available upon request.

   It is strongly suggested that copyright forms for figures or images be gathered as they are entered into the draft standards, so that credit for cited images and figures are maintained from the beginning.

   It is strongly recommended by the Chair to become member of IEEE Standard Association. “While membership is not required for participation, membership allows
participants to ballot on standards and assume leadership roles in Standards Working Groups.”
As per: http://standards.ieee.org/membership/

b) Election of MSC Officers:
Chair: Aleksandra Jeremic
Vice-Chair: Paul Gaberson
Secretary: Tyler Gaerke
Other Nominations - None
All in favor – YES
Dr. Stone reminded that when electing MSC Officers all eligible voting parties are to be represented.
If any MaSC member not in attendance has issues/concerns/questions about these officers, please contact Dr. Nancy Frost (present MaSC Chair) for discussion. If no contact, tacit acceptance is assumed.

4. Standards Coordinator Report and Discussion
Innocent Kamwa is the Standards Coordinator for the Electric Machinery Committee.
ACTION: The Chair will forward meeting minutes to him after this meeting.

5. Working Group Reports and Discussion Review of Documents and Active Working Group Reports
• 43-2000 (reaff 2006) IEEE Recommended Practice for Testing Insulation Resistance of Rotating Machinery, Chair: Ian Culbert / Eric David (P43 – active)

Ian submitted the document on 20 September to Rev Committee for December 2013 meeting. No work done on this standard at this meeting.
ACTION: Ian shall report results at the upcoming Spring meeting.

• 56-1977 (reaff 1991) IEEE Guide for Insulation Maintenance of Electric Machines Rated 35 kVA and Higher, Chair: Doug Conley, Vice Chair: Dave McKinnon (P56 – active)

Reviewed Ian’s comments during this meeting as well as other items.
ACTION: Chair shall move to straw ballot in January 2014. It is assumed that silence from the WG member is tacit approval.

• 95-2002 (reaff 2007) IEEE Recommended Practice for Insulation Testing of Large AC Rotating Machinery with Direct Voltage, Chair: Dave McKinnon

It was reaffirmed in August 2012, valid till 2022. No work done on this standard at this meeting.
ACTION: Open for discussion in 2017. Frost investigating website error, as it should say 2012 and does not.

It went to ballot, received several negative votes that were resolved internally through adjustment to PAR from 1000V back to original document 600V. No work done on this standard at this meeting.

**ACTION:** PAR approval and one year extension request submitted to RevCom for approval. It should be to reballot by early January 2014.

- **286-2000 (reaff 2006) IEEE Recommended Practice for Measurement of Power Factor and Power Factor Tip-up of Rotating Machinery Stator Coil Insulation, Chair: Gary Heuston**

Reaffirmation notice received on Dec 5, 2012 from IEEE-SA Board. No work done on this standard at this meeting.

**ACTION:** Frost investigating website error, as it should say 2012 and does not.


Howard Penrose and Jeff Hudson have previously expressed interest in reopening. MaSC expressed interest in access to document to review. No work done on this standard at this meeting.

**ACTION:** Dr. Frost to follow up with Howard Penrose and Jeff Hudson. Frost to distribute the latest version from IEEE to MaSC for review. Discussion in June 2014 in MaSC.

- **433- 2009 IEEE Recommended Practice for Insulation Testing of Large AC Rotating Machinery with High Voltage at Very Low Frequency (Discussions start June 2014, need chair)**

Issued in 2009. No work done on this standard at this meeting. Will need to be revised and approved again by December 2019. Consensus to initiate work in 2014. Hopefully only reaffirmation shall be required.

**ACTION:** Open for discussion in June 2014, and form the Working Group Committee. Ashfak Shaikh of Kinetics volunteered to serve as the WG Chair.


Reaffirmation notice received on Feb 6, 2013 from IEEE-SA Board, and valid till 2023. Congratulations to Stefano Bomben on a rapid resolution regarding the vote category distribution. No work done on this standard at this meeting.

**ACTION:** Open for discussion in 2018. Frost investigating website error, as it should say 2012 and does not.

- **522-2004 IEEE Guide for Testing Turn-to-Turn Insulation on Form-Wound Stator Coils for Alternating-Current Rotating Electric Machines**

Reaffirmed in late 2009. No work done on this standard at this meeting. Will need to be revised and approved again by December 2019.

**ACTION:** Open for discussion in 2015.
• 1043-1996 (reaff 2003) IEEE Recommended Test Procedure for Performing Voltage-Endurance Testing of Form-Wound Coils and Bars

Reaffirmed in 2009. No work done on this standard at this meeting. Will need to be revised and approved again by December 2019.
ACTION: Open for discussion in 2015.


It was reported that plan to incorporate aspects of this specification into IEEE Std. 117. No work done on this standard at this meeting.
ACTION: Dr. Frost to discuss resolution option with IEEE, including note in appendix.

• 1310-2012 (1996, 2004 reaffirmed) IEEE Recommended Practice for Thermal Cycle Testing of Form-Wound Stator Bars and Coils for Large Generators, Chair: Greg Stone

Issued in June 2012. Working group members received the appreciation letter at this meeting. Will need to be revised and approved again by June 2022. No work done on this standard at this meeting.
ACTION: Open for discussion in 2017.


Draft 9 comments were addressed, and Draft 10 with Meeting Minutes distributed to WG on Nov 10, 2013. Omicron had some comments on 3 phase simultaneous testing. Richard Gupton opened discussion about testing requirements for coupling capacitors. This appears to be a developing problem area. There was email exchange after the meeting. The PAR is good until Dec 2014.
ACTION: Comments requested by 09 December 2013. WG Chair to send for straw ballot in January 2014.

• 1553-2002 (reaff 2007) IEEE Test and Acceptance Criteria for Voltage-Endurance Testing of Form-Wound Coils and Bars used in Hydroelectric Generators and Large Pumped Storage Motors, Chair: Hugh Zhu

Revision needed by December 2018. At this meeting, there was a discussion to aid generation of PAR. Comments are to be received from WG to Chair (Zhu) by April 2014.
ACTION: WG Chair will request PAR prior to June 2014 meeting.

• P1719 IEEE Guide for Evaluating Stator Cores of AC Electric Machines Rated 1 MVA and Higher, Chair: Glenn Mottershead / Stefano Bomben (P1719 – active)

The PAR is good till December 2014. Draft of Stator Core Evaluation Table was discussed and revised accordingly, with input from Siemens representative.
**ACTION:** Please send comments to Stefano Bomben before the next meeting. Updated version will be distributed before next meeting. WG Chair to send for straw ballot by June 2014.

- **1776-2009 IEEE Recommended Practice for Thermal Evaluation of Sealed or Unsealed Insulation Systems for AC Electric Machinery Employing Form-Wound Pre-Insulated Stator Coils for Machines Rated 15000 Volts and Below**

Issued in 2009. No work done on this standard at this meeting. Will need to be revised and approved again by December 2019.  
**ACTION:** Open for discussion in June 2014, with one (1) hour meeting. Dr. Frost to poll LV/MV group/users.

- **P1798 / IEC 60034, Rotating Electrical Machines – Part 18-41: Qualification and Type Tests for Type I Electrical Insulation Systems Used in Rotating Electrical Machines Fed by Voltage Converters, Chair: Ramtin Omranipour**

PAR was allowed to expire, as IEC was making changes to the document. No work done on this standard at this meeting.  
**ACTION:** Once IEC 60024-18-41 document is approved and finalized, MaSC will discuss. Ramtin Omranipour will take Meredith Stranges position as lead. New PAR will be submitted to IEEE once stabilized IEC document is available and WG has change to review document.

- **1799-2012 IEEE Recommended Practice for Quality Control Testing of External Discharges on Form-Wound Coils, Vacuum Pressure Impregnated Stator Insulation and Fully Assembled Stator Windings, Chair: Remi Tremblay**

Document was issued in 2012. Good for 10 years. Frost suggests to review in 2017 as to use in field and revision level required. No work done on this standard at this meeting.  
**ACTION:** No action at this time. Good job Remi!

- **NEW - Endurance Test for Turn Insulation in Rotating Machine Coils, Chair: Joe Williams III / Kevin Alewine**

PAR was reviewed. Interested parties are still encouraged to run some tests to obtain statistical samples, and present their data for consideration.  
**ACTION:** WG Chair to submit PAR to IEEE for approval. Dr. Frost and WG Chair to work on recognition certificate for GREAT efforts put forth by team thus far.

- **NEW – IEEE Guide for Advanced Diagnostic Test Methods for AC Electric Machinery using Direct Voltage, Chair: Laurent Lamarre / Shawn Filliben**

No meeting was held in Fall 2013. New document.  
**ACTION:** Chair to submit PAR prior to June 2014 meeting.

6. **Other MSC activities**
   a) **Awards and Recognition** - Hugh Zhu
i) Bill McDermid was recognized with the IEEE DEIS Forster Award for his contributions to the IEEE DEIS. Many thanks Bill!! What a lovely venue for the award!

ii) P1799 was nominated for 2013 EMC Standard Award, to find out early in 2014.

iii) Dr. Nancy Frost was nominated for 2013 Service Award.

iv) EMC 2012 Standard Award (P1310) and 2012 Service Award (Stefano Bomben) were presented in the PES General Meeting in July 2013. Stefano was given his service award in our meeting. Well done Stefano!!

v) Bal Gupta was nominated for Lifetime Achievement Award. Unfortunately he did not receive it.

**ACTION:** Members are invited to submit nominations to Dr. Zhu.

7. **Liaison Reports**

a) CIGRE - Howard Sedding (Greg Stone commented in MSC meeting)

   i) Appendix A – full report attached

   ii) Please find attached a document that I prepared as the CIGRE SC A1 liaison report to SC D1 that provides an overview of A1 activities of relevance to the IEEE MSC.

   iii) Greg attended the D1 meeting in Brisbane so can probably update you on any activities of interest within D1.

   iv) As far as I know, the only current WG in D1 that is doing anything of relevance for rotating machines is looking at transient effects, e.g., inverter fed drives, on stator winding insulation.

b) IEC

   i) TC 2 (Rotating Machinery) – Greg Stone

      (1) Appendix B – full report attached.

   ii) TC112 (Qualification of Electrical Insulation Materials & Systems) – Nancy Frost

      (1) WG1, WG6, were high attendance at TC 112 meeting in Toronto in September 2013, with focus on thermal aging of electrical insulation.

      (2) US TAG will generate listing of USA standard methods that correspond to on-going TC112 projects and standards.

      (3) Need experts for >300MHz frequency (WG 4) experts as well as radiation (WG 2) experts.

c) Electric Machinery Committee

   i) Generator Subcommittee

      (1) IEEE/ANSI C50.13 – Jim Lau

         (a) Kay Chen is the chair of working group 8 of the Generator subcommittee, which is in charge of the C50.13 standard.

         (b) She was happy to have me help on that team, and I am willing to do that. Their next meeting is probably July of 2014. The working group 8 of the Generator Subcommittee which is working on IEEE/ANSI C50.13 has decided to start to make small and incremental updates to C50.13 for the next couple years down the road. They plan to make a PAR every 2 years. This somewhat is similar to what IEC is doing. They had balloted the document a few months ago and received on rather lengthy negative ballot. They have addressed this negative vote; however, the IEEE is apparently not reviewing new submissions this year; therefore, the updated document will go for reballot early next year.

         (c) They are still looking to remove electrical testing from the standard; however, Kay said that if the insulation testing rules are kept in the standard, at a
minimum, the DEIS needs to have some input to the working group to allow clarification and discussion of these points. They feel that the various DEIS standards, such as IEEE 95 may be the better place for defining insulation tests and levels.

ii) Motors Subcommittee
   (1) Frost discussed with Nick Stranges, unavailable as liaison
   (2) Liaison being sought – either from MaSC or MoSC

d) Transformers Committee – Dave Stankes
   i) Slides of organization were reviewed briefly
   ii) Activities of interest
       (1) Distribution Transformer Energy Efficiency Task Force Final Report
       (2) DOE DT Final Rule published April 18, 2013, Official June 17, 2013 and Effective January 1, 2016
       (3) Task Force final report issued at this meeting (Philip J. Hopkinson, TF Chair)
       (5) References new insulation classes per (revised) IEEE C57.100 Standard.
   iii) IEEE Transformer Committee meetings
       (1) Fall 2013 Meeting (St. Louis October 20-24)
       (2) Spring 2014 Meeting (Savannah, Georgia March 23-27)

e) Nanomaterials – CEIDP had a workshop. IEEE Electrical Insulation magazine has a good review of activities.

8. Old Business
   a) Website – Nancy Frost and Howard Penrose
      i) Website has been prepared. Demo given in MaSC meeting and well received.
      ii) Awaiting IEEE to link to their system
      iii) Once website is live, IEEE MaSC members will be informed. This will be the main communication tool for WG members.
      iv) Passwords to be generated to members for access to WG documents.
      v) Members will be able to upload documents and comments.
      vi) Schedule of meetings will appear on website for planning purposes.
   b) Membership rules – Nancy Frost
      i) NF reviewing IEEE and MaSC membership policies.
      ii) NF to report to MaSC WG members early 2014.
      iii) Individual status to be communicated and resolved as needed.
      iv) Spirit is to continue to be open to generous donation of time by leading experts!
      v) Resolution of membership status is to maintain integrity of standards activity and support.

9. New Business
   a) Dissection guide – new WG (Laurent suggested and was deferred to now. NF willing to chair) First meeting will be at June 2014 where contents for PAR will be discussed for submission to IEEE.
10. **Next Meetings**
- Spring 2014 meeting to be held 11-13 June 2014 at 2014 EIC – Philadelphia, PA. (EIC is from 8-11 June 2014.)
- Fall 2014 meeting to be hosted by Joe Williams III, Electrolock at their Greenville, South Carolina. Proposed date 28-29 October 2014 to be finalized by electronic vote of full MaSC.
- Spring 2015 meeting to be held in conjunction with 2015 EIC, Seattle, WA, most likely 10-12 June 2015 (EIC is from 07-11 June 2015)
- Fall 2015 meeting to be hosted by Reza Soltani, Andritz, Peterborough, ON, (Date to be confirmed)
- Other: Greg Stone, Qualitrol, Toronto, Canada is willing to host.

11. **Adjournment**
- Motion - Doug Conley
- Seconded - Richard Gupton
- All in favor – YES

Thank You ALL for a successful IEEE MSC Subcommittee meeting in friendly Manitoba!

12. Important announcement from incoming Chair Aleksandra Jeremic’s for IEEE MaSC team:
   a) **Incoming Chair reminded all the Standard Chairs of the following:**
      - Once the standard is issued, the form has to be signed and sent to the IEEE representative, Mr. Kamwa. Please send the pdf file to Aleksandra.
   b) WG Chairs are requested to email Aleksandra with the following information:
      - Names of the WG Chair and Secretary;
      - PAR form;
      - WG membership list;
      - Latest draft of the standard;
      - Any meetings taking place within the Working Group, outside the Spring and Fall meetings;
      - Copy Sandra on any communications with the IEEE.
Appendix A
SC A1 LIAISON REPORT 2013

SC A1 (Rotating Machines) Chair: Erli Figuereido (Brazil)

SC A1 met in Bucharest, Romania, September 1 – 5, 2013. Key points of interest for SC D1 are,

AG A1.01 (Turbine Generators) Convenor: Bob Fenton (US)
Current active projects are,

• WG A1.28. Guide – Corona Electromagnetic Probe Tests (TVA), convenor D. Zlatanovici (RO), draft guide based on a survey has been prepared and the draft was discussed at the meeting. TVA probe is used by some organizations to locate the source of high PD in stator windings. Technical brochure expected by February 2014.
• WG A1.39, Dielectric dissipation factor testing of new stator coils and bars, convenor H. Sedding (CA). WG formed in response to development of IEC 60034-27-3 governing dissipation factor testing of stator winding insulation. Survey is being developed for issue in November 2014. Final draft report by CIGRE general session in Paris in August 2014. Output of WG will be a technical brochure to include guidelines for acceptance criteria.
• WG A1.37, Turbogenerator stator winding support system experience, convenor A. Villarrubia (ES). Although the driving mechanisms are largely mechanical and thermal, the final failure mode is break down of the insulation. This is a significant issue for OEMs and end users. A draft questionnaire was discussed at the meeting with a final version available in November 2013. A final report (Technical brochure or Electra article) is due in 2015.

AG A1.02 (Hydraulic Generators) Convenor: Remi Tremblay (Canada)
Current active projects are,

• WG A1.13; Updating from class F to class H, convenor J. Garcia (ES). Purpose of this WG is to investigate whether OEMs are building, and end users accepting, class H (180) insulation systems applied to large generators. Reviewed the questionnaire, results and synthesis of answers. Relatively low number of responses but considered sufficient to form some opinions. None of the users has any plans to either buy a winding with 180 class insulation or operate at class F temperatures. Technical brochure written and will be updated by September 2013 and submitted for approval October 2013. WG will then disband.
• WG A1.21: Bearings with plastic linings, convenor L-E. Kampe (SE). Purpose was to gain experience from those using such bearings. Numerous questions such as bearing type, materials, use of oil lubrication, operating experience, etc. Predominant use in China, Finland, Japan and Russia (Russia has an order of magnitude higher use. Principally PTFE used but a few examples of PEEK (Japan). No reports of failure or breakdown in the survey. Report already sent for final approval.
• WG A1.30: Use of magnetic slot wedges in hydrogenerators, convenor J. Studir (CR). Wedges consist of a ferrite powder incorporated in an epoxy resin. Used to reduce harmonics but there has been bad experience with reliability of windings using such technology. Draft final report issued, awaiting approval. Only received 7 answers (2 positive (CR, BR), 5 negative (NZ, ZA, FI, JP, AR). Final report based on 2010 CIGRE paper and the experience obtained on two relatively small hydrogenerators in Croatia.

AG A1.05 (Novel Machines) Convenor: Sam Salem (US)

No work currently underway of relevance to SC D1.

AG A1.06 (Large Motors) Convenor: Enzo Tortello (Italy)
Recently completed projects are,

- WG A1.17, Methods of determination of condition of stator winding insulation in large motors, convenor S. Rodriguez (ES). Provides a guide on common stator winding deterioration mechanisms in large motors and their detection using numerous methods. This work should be published as a technical brochure in 2013 or 2014.
- WG A1.26, Monitoring, diagnosis and prognosis of large motors, convenor N. Smit, (ZA). This work is complete and a technical brochure will be published in 2013/2014.
APPENDIX B  
IEC TC 2 (Rotating Machine) Liaison Report to EMC, Materials Subcommittee  
Nov 6, 2013  

IEC TC 2 continues to be very active in the development and revision of rotating machine insulation-related standards. Generally there are two meetings per year, each lasting about 3-4 days. The most recent series of meetings were held in Toronto, Canada, Oct 15-17, 2013.

Over the past few years the entire series of IEC 60034-18 (rotating machine insulation systems) documents were under revision. The master insulation qualification document 60034-18-1 plus the subsidiary documents on thermal qualification, (-21 and -31), voltage endurance testing -32, thermal and voltage qualification (-33) and load cycling (-34) have been revised.

IEC 60034-18-41:2006 for the qualification of insulation systems for low voltage converter fed motors is being revised and a CDV version out for voting. It will now be a standard. There are small increases to the PDIV levels for such motors. **Of special note is that a new item will be added to the motor nameplate that defines Impulse Voltage Insulation Class (IVIC) of the motor.** This will also result in changes to IEC 60034-1 where nameplate items are defined. Assuming the CDV is successful, there will be a follow-on vote as an FDIS. We can then decide if we want to adopt this as an IEEE standard.

IEC 60034-18-42 is now being revised and used up 1.5 days of the last meeting series. It is concerned with the qualification of “type II” insulation for converter duty (normally form wound stators). A lot of important changes are being made on the series of voltage endurance tests that are needed to qualify the insulation system. I expect the revision will take another year or two, as there is a lot of discussion on the voltage endurance tests.

IEC 60894 on machine dissipation factor testing (originally based on IEEE 286) is being revised under the convenorship of Juergen Weidner of Siemens. The new document will be rebranded as IEC 60034-27-3. The new document will contain pass-fail criteria for DF and tip-up. The fairly stringent tip-ups first proposed (based on KEMA limits) were not supported. The proposed limits have been increased about two times. The current draft has a low voltage DF limit of 2% and a tip-up of 0.5%. I expect the standard will be issued late in 2014.

Two new work items were proposed. It looks like IEC will create a version of IEEE 43 on insulation resistance testing. I will likely be the project leader. They may also start working on an impulse PD measurement method specifically for rotating machines. Right now IEC 60034-18-41 refers to IEC 61934, which is a generic impulse PD guide.

The next series of meetings will occur June 17-19, 2014 in Berlin.

A new IEC WG (TC 2, WG 32) has been formed to create a guide for off-line and on-line stator endwinding vibration testing. The convener is Horst Kuemmlee of Siemens Germany, I am the vice-convener. It will describe the problem of endwinding vibration, as well as how to do bump tests and how to do on-line endwinding vibration monitoring. It is for all conventional motors and generators. It will **not** provide any limits. The first draft was issued in Sept 2013. There are several hundred substantive comments. It will be at least 2 years before it is issued.

Greg Stone
APPENDIX C
Attendance Sheet for Fall 2013 IEEE MaSC WG meeting, Manitoba Hydro

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