Annex E Transformers and Reactors for HVDC Applications Subcommittee

March 11, 2024, 4.45 pm local time – Regency E/F at Hyatt Regency Vancouver, BC, Canada

Chair: **Ulf Radbrandt (ulf.radbrandt@ieee.org)**

Vice Chair: **Les Recksiedler (lrecksiedler@mhi.ca) – could not come this time**

Secretary: **Klaus Pointner (klaus.pointner@ieee.org)**

E.1 Introduction / Attendance / Approval of the Agenda / Essential Patent Issues

There was a total of 32 persons in the meeting, 13 members and 19 guests present. 6 new requests for membership were received.

Call for patents (essential patent claim) and IEEE copyright policy have been addressed.

Actual membership prior the Spring 2024 meeting is shown below:

First Name	Last Name	Email	Company
Camilo	Casallas	camilo.casallas@trench-group.com	Trench Limited
David	Caverly	david.caverly@trenchgroup.com	Trench Limited
Solomon	Chiang	schiang@thegundcompany.com	The Gund Company
Eric	Davis	esetdavis@aol.com	Consultant (on his own)
Evgenii	Ermakov	evgenii.ermakov@hitachienergy.com	Hitachi Energy
Alexander	Gaun	alexander.gaun@coilinnovation.com	Coil Innovation GMBH
Peter	Heinzig	peter.heinzig@weidmann-group.com	Weidmann Electrical Technology
Giovanni	Hernandez	dayan_hernandez@vatransformer.com	Virginia Transformer Corp.
Kurt	Kaineder	kurt.kaineder@trench-group.com	Trench Austria GmbH
Sylvain	Plante	plante.sylvain.3@hydro.qc.ca	Hydro-Quebec
Christoph	Ploetner	cp.xfmr@gmail.com	Siemens Energy
Klaus	Pointner	klaus.pointner@trench-group.com	Trench Austria GmbH
Ulf	Radbrandt	ulf.radbrandt@ieee.org	Hitachi Energy
Leslie	Recksiedler	lrecksiedler@yahoo.ca	Manitoba Hydro
Hossain	Saif	saif.hossain@trench-group.com	Trench Limited
Lina	Sandsten	lina.sandsten@hitachienergy.com	Hitachi Energy
Michael	Sharp	sharp.michael@siemens-energy.com	Trench Limited
Waldemar	Ziomek	wziomek@ptitransformers.com	PTI Transformers

13 members out of 18 members were present, thus quorum was met.

The agenda for this meeting, that was distributed via E-mail on February 27, 2024, was presented. No comments received. Eric Davis made motion to approve the agenda, seconded by Peter Heinzig. The agenda was unanimously approved.

The list of all attendees of the meeting is shown below:

First Name	Last Name	Email	Company	Request SC Member-ship
Onome	Avanoma	o.avanoma@outlook.com	MJ Consulting	
Sean	Barker	sean.barker@hitachienergy.com	Hitachi Energy	X
Camilo	Casallas	camilo.casallas@trench-group.com	Trench Limited	
Binzhan	Chen	binzhan.chen@bchydro.com	BC Hydro	
Vivian	Chan	vivian.chan@hitachienergy.com	Hitachi Energy	
Solomon	Chiang	schiang@thegundcompany.com	The Gund Company	
Marcos	Czernorucki	marcos.czernorucki@hitachienergy.com	Hitachi Energy	X
Eric	Davis	esetdavis@aol.com	Consultant (on his own)	
Alexander	Gaun	alexander.gaun@coilinnovation.com	Coil Innovation GmbH	
Eduardo	Gomez-Hennig	eduardo.gomez_h@siemens-energy.com	Siemens Energy	X
Peter	Heinzig	peter.heinzig@weidmann-group.com	Weidmann Electrical Technology	
Kevin	Juchem	kevin.juchem@hitachienergy.com	Hitachi Energy	
Kurt	Kaineder	kurt.kaineder@trench-group.com	Trench Austria GmbH	
Nathan	Lange	nathan.lange@hspkoeln.de	Siemens Energy	
Gabriel	Mamede	gabriel.mamede@siemens-energy.com	Siemens Energy	
Omar	Mendez	omar.mendez@prolec.energy	Prolec GE	
Sylvain	Plante	plante.sylvain.3@hydro.qc.ca	Hydro-Quebec	
Christoph	Ploetner	cp.xfmr@gmail.com	Siemens Energy	
Klaus	Pointner	klaus.pointner@trench-group.com	Trench Austria GmbH	
Bertrand	Poulin	bertrand.f.poulin@hitachienergy.com	Hitachi Energy	
Thomas	Prevost	tom.prevost@weidmann-group.com	Weidmann Electrical Technology	X
Ulf	Radbrandt	ulf.radbrandt@ieee.org	Hitachi Energy	
Farnoosh	Rahmatian	frahmatian@nugridpower.com	NuGrid Power Corp.	
Hossain	Saif	saif.hossain@trench-group.com	Trench Limited	
Harmanpreet	Sekhan	hsekhan@ptitransformers.com	PTI Transformers	
Michael	Sharp	sharp.michael@siemens-energy.com	Trench Limited	
Chris	Steineman	csteineman@hubell.com	Hubbel/Meramec Instrument Transformers	
Dharam	Vir	dharam.vir@prolec.energy	Prolec GE	X
John	Wagner	jwagner@aep.com	AEP	
Stefan	Wirth	stefan.wirth@coilinnovation.at	Coil Innovation GmbH	
Terry	Wong	terry.wong@trench-group.com	Trench Canada Limited	X
Waldemar	Ziomek	wziomek@ptitransformers.com	PTI Transformers	

Qualification for membership of the received requests will be checked and the applicants will be notified.

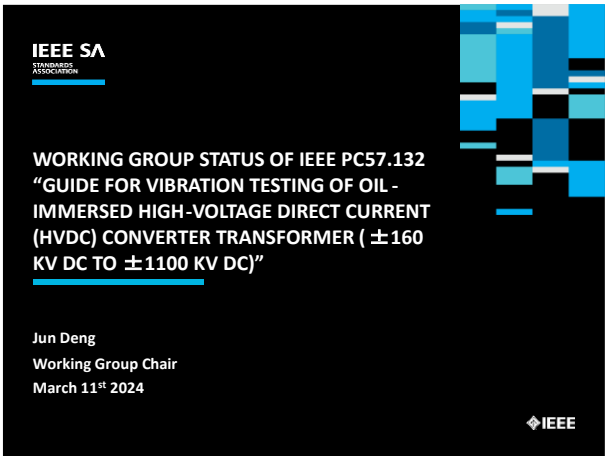
E.2 Approval of the minutes of the Fall 2023 meeting in Kansas City

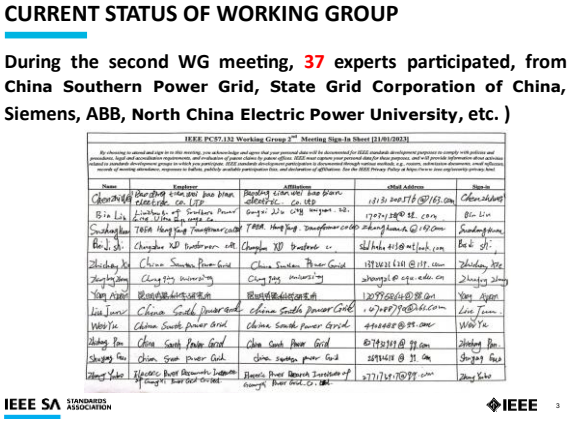
The minutes of the spring meeting as distributed by E-mail on February 27, 2024 have been presented. No comments were given. Mike Sharp made motion to approve the agenda, seconded by Sylvain Plante. The minutes have been unanimously approved.

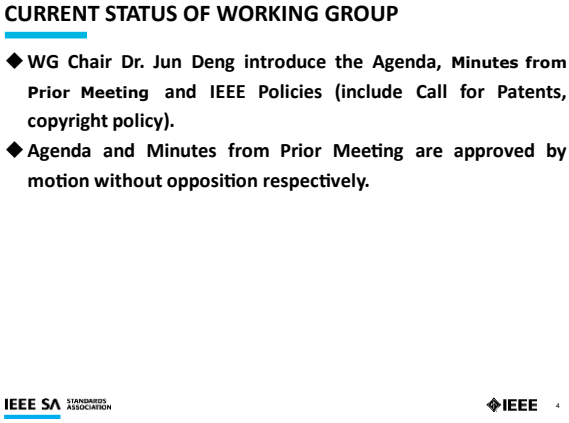
E.3 Status of the Entity WG for development of the Guide for vibration testing of oil immersed HVDC converter transformer. (Chairman: Dr. Jun Deng)

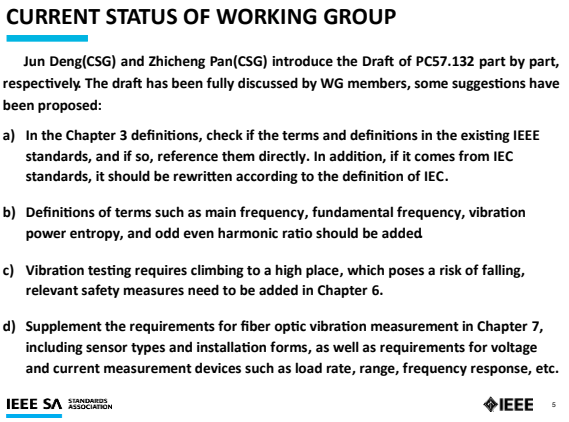
The SC HVDC is sponsoring this Entity WG. Therefore, future work of this WG is reported to this subcommittee. The actual status of the WG is outlined in the presentation submitted by the WG chair Jun Deng prior to the Spring 24 meeting. Unfortunately, the WG chair could not come to this meeting but is encouraged to do so for the Fall 2024 meeting in Saint Louis (MO).

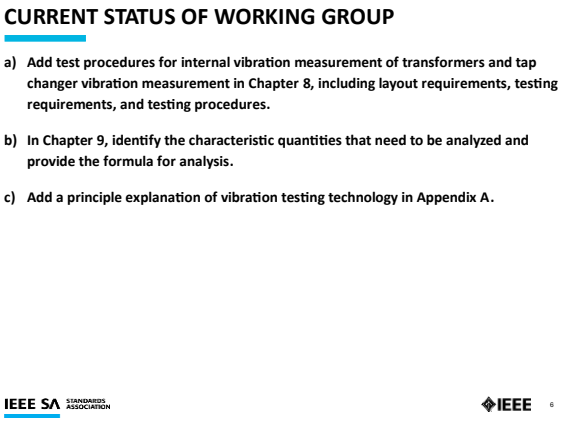
Status Report:

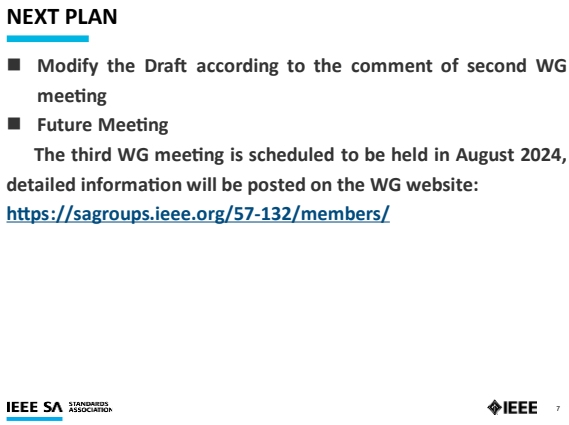












Details of the WG see: https://sagroups.ieee.org/57-132/

Safety measures are not in the scope of a guide and shall be taken out. Main reason are liability issues connected to such recommendations. The SC chair will inform the WG chair accordingly.

The SC shall stay involved in this WG. Participation in person would be possible in an expert function. However, the ballot will be organized according to the rules for such entity PAR's (one entity – one vote), but this SC has to agree that a draft proposed by the WG for balloting is in the required shape to start the ballot process.

E.4 Dual logo standard IEC/IEEE 60076-57-129 (WG Chair: Waldemar Ziomek)

In the time slot of the SC meeting, the first WG meeting of this revision work took place. Details can be found in the annex of these minutes

E.5 Future Work of this Sub Committee

The chairman of the SC encouraged members and guest to propose work items and activities that shall be considered by this SC. Input is welcome – please contact the SC chairman directly.

E.6 Old Business

There was no old business

E.7 New Business

There is no new business

E.8 Adjournment

The meeting was adjourned at 5:23pm.

Annex: Minutes of Meeting of the WG meeting “Dual logo standard IEC/IEEE 60076-57-129”

Minutes of Meeting
WG Rev. to IEEE Standard 60076-57-129 IEC/IEEE International Standard Power transformers-Part 57-129: Transformers for HVDC applications

March 11, 2024, 5.00 pm local time – Regency E/F at Hyatt Regency Vancouver, BC, Canada

Chair: **Waldemar Ziomek (wziomek@ptitransformers.com)**

Secretary: **Eric Davis (esetdavis@aol.com)**

1. Attendance / Approval of the Agenda / Essential Patent Issues

The meeting took place in the course of SC HVDC meeting. There was a total of 32 persons in the meeting

The list of all attendees of the meeting is shown below:

First Name	Last Name	Email	Company	Opt-out of member-ship
Onome	Avanoma	o.avanoma@outlook.com	MJ Consulting	
Sean	Barker	sean.barker@hitachienergy.com	Hitachi Energy	
Camilo	Casallas	camilo.casallas@trench-group.com	Trench Limited	
Binzhan	Chen	binzhan.chen@bchydro.com	BC Hydro	
Vivian	Chan	vivian.chan@hitachienergy.com	Hitachi Energy	
Solomon	Chiang	schiang@thegundcompany.com	The Gund Company	
Marcos	Czernorucki	marcos.czernorucki@hitachienergy.com	Hitachi Energy	
Eric	Davis	esetdavis@aol.com	Consultant (on his own)	
Alexander	Gaun	alexander.gaun@coilinnovation.com	Coil Innovation GmbH	X
Eduardo	Gomez-Hennig	eduardo.gomez_h@siemens-energy.com	Siemens Energy	
Peter	Heinzig	peter.heinzig@weidmann-group.com	Weidmann Electrical Technology	
Kevin	Juchem	kevin.juchem@hitachienergy.com	Hitachi Energy	X
Kurt	Kaineder	kurt.kaineder@trench-group.com	Trench Austria GmbH	
Nathan	Lange	nathan.lange@hspkoeln.de	Siemens Energy	
Gabriel	Mamede	gabriel.mamede@siemens-energy.com	Siemens Energy	
Omar	Mendez	omar.mendez@prolec.energy	Prolec GE	
Sylvain	Plante	plante.sylvain.3@hydro.qc.ca	Hydro-Quebec	
Christoph	Ploetner	cp.xfmr@gmail.com	Siemens Energy	
Klaus	Pointner	klaus.pointner@trench-group.com	Trench Austria GmbH	
Bertrand	Poulin	bertrand.f.poulin@hitachienergy.com	Hitachi Energy	
Thomas	Prevost	tom.prevost@weidmann-group.com	Weidmann Electrical Technology	
Ulf	Radbrandt	ulf.radbrandt@ieee.org	Hitachi Energy	
Farnoosh	Rahmatian	frahmatian@nugridpower.com	NuGrid Power Corp.	X
Hossain	Saif	saif.hossain@trench-group.com	Trench Limited	
Harmanpreet	Sekhan	hsekhan@ptitransformers.com	PTI Transformers	X
Michael	Sharp	sharp.michael@siemens-energy.com	Trench Limited	

First Name	Last Name	Email	Company	Opt-out of member-ship
Chris	Steineman	csteineman@hubell.com	Hubbel/Meramec Instrument Transformers	
Dharam	Vir	dharam.vir@prolec.energy	Prolec GE	
John	Wagner	jwagner@aep.com	AEP	
Stefan	Wirth	stefan.wirth@coilinnovation.at	Coil Innovation GmbH	X
Terry	Wong	terry.wong@trench-group.com	Trench Canada Limited	
Waldemar	Ziomek	wziomek@ptitransformers.com	PTI Transformers	

As this was the first WG meeting all attendees are members of the working group. However, some participants indicated to abstain from being a member as shown above.

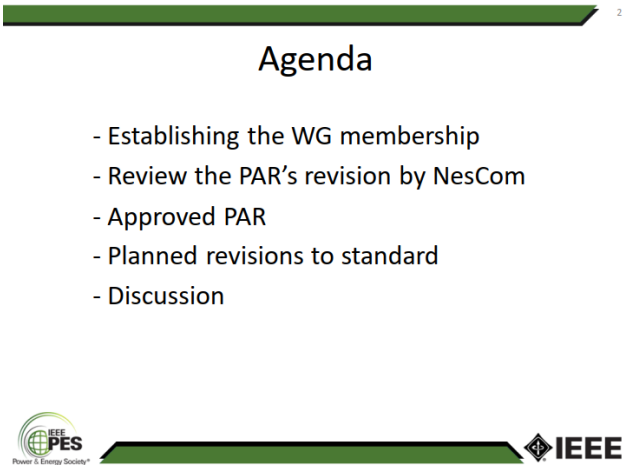
2. WG Secretary

Eric Davis was proposed by the WG chair to become the secretary of this WG. Chris Ploetner made motion to approve this proposal, seconded by Sylvain Plante. The proposal was approved unanimously.

3. Agenda

The agenda for the WG meeting as presented by the WG chair. Sylvain Plante made motion to approve the agenda, seconded by Kurt Kaineder. The agenda was unanimously approved.

4. Status Report as presented by the WG chair



3

Scope of submitted PAR

5.2 Scope of proposed standard: This part of 60076 International Standard specifies requirements of liquid-immersed three-phase and single-phase converter transformers for use in high voltage direct current (HVDC) power transmission systems including back-to-back applications. It applies to transformers having two, three or multiple windings. This document does not apply to converter transformers for industrial applications (see IEC 61378-1 or IEEE Std C57.18.10); converter transformers for traction applications (see IEC 60310).

4

Scope revision No1

The following comment on P60076-57-129 has been made on 10 Jan 2024 :

Please consider improving the first sentence of 5.2 as follows:

"This part of the IEC/IEEE 60076 family of standards specifies [...]"

5

Title revision - rejected

The following comment on P60076-57-129 has been made on 23 Jan 2024 by NesCom Member:

Does the title correctly align with the Scope?
Will a title "Requirements of liquid-immersed three-phase and single-phase converter transformers for use in high voltage direct current (HVDC) power transmission systems" more accurately reflect the scope and contents of the standards

We simply stated that this is a title for current standard, already approved by IEEE and IEC.

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Scope revision No 2

The following comment on P60076-57-129 has been made on 23 Jan 2024 :

Only some of IEC 60076 parts are IEC/IEEE dual logo standard, it's recommended to replace *This part of the IEC/IEEE 60076 family of standards* with this document. Regarding IEC 60310, it's only for traction transformers of rolling stock instead of converter transformer.
Proposed changes is list as below:
This document specifies requirements of liquid-immersed three-phase and single-phase converter transformers for use in high voltage direct current (HVDC) power transmission systems including back-to-back applications. It applies to transformers having two, three or multiple windings. This document does not apply to converter transformers for industrial applications (see IEC 61378-1 or IEEE Std C57.18.10), and transformers for rolling stock (see IEC 60310).

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Scope revision No 2 response

Chris Ploetner, IECT14 Chair, responded: The proposed text by the NesCom member is practically identical to current standard. The differences are
-the entry passage where the word 'document' is used instead of 'part of 60076-IS'. I support this proposal as it is neutral and applicable for IEC and IEEE.
-the second list entry where the word 'converter' is skipped before 'transformer'. I am not in favor of this because we deal with converter transformers and this applies also to rolling stock. Although not common anymore, rolling stock units may also be units not connected to converters. So, the clarification of unit types should stay as is. I also prefer to have the exemptions shown as list entries but do not insist here.
The corrected entry is as follows:
This document specifies requirements of liquid-immersed three-phase and single-phase converter transformers for use in high voltage direct current (HVDC) power transmission systems including back-to-back applications. It applies to transformers having two, three or multiple windings. This document does not apply to converter transformers for industrial applications (see IEC 61378-1 or IEEE Std C57.18.10), and converter transformers for rolling stock (see IEC 60310).

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Approved scope

5.2 Scope of proposed standard: This document specifies requirements of liquid-immersed three-phase and single-phase converter transformers for use in high voltage direct current (HVDC) power transmission systems including back-to-back applications. It applies to transformers having two, three or multiple windings. This document does not apply to converter transformers for industrial applications (see IEC 61378-1 or IEEE Std C57.18.10), and converter transformers for rolling stock (see IEC 60310)

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Additional Explanatory Notes

The dual logo standard IEC/IEEE 60076-57-129-2017 was published in 2017 and its valid till 2027. Therefore, the HVDC SC wants to initiate the work on its revision, to extend its validity and to include some improvements, as well as the comments from the users. The HVDC transformers applications are becoming more common around the world, including the renewable energy stations and schemes, and it continuously brings new configurations and solutions. The revision and expansion of the standard would potentially include several items, such as: (i) the standard should recognize both LCC and VSC schemes – the transformers for VSC should be moved from Annex to main body, (ii) both LCC and VSC schemes should be explained in details, (iii) the LI and SI levels shall be based on the system studies and if the end user wants to use higher levels, it must be addressed in specification, (iv) the monitoring devices and systems should be included. More aspects of HVDC converter transformers may be covered, if raised during a work of the WG on this revision.

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Initial steps for revision

- the standard should recognize both LCC and VSC schemes – the transformers for VSC should be moved from Annex to main body, and
- both LCC and VSC schemes should be explained in details,

New clause (s):
- 5.2.6. operation of LCC
-5.2.7. operational schemes of VSC

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Initial steps for revision

- Add explanation that the LI and SI levels shall be based on the system studies and if the end user wants to use higher levels, it must be addressed in specification, - improve existing wording
- the monitoring devices and systems should be included.

14. Monitoring devices

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New additions to revised standard

- comments from users,
- comments from IEC and/or IEEE
- comments from manufacturers

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Rough Timeline

- formation of WG – Spring 24
- first draft preparation – Fall 24
- first draft review and correction – S25
- ballot within Subcommittee HVDC transformers – F25
- balloting standard – S2026, incl. comments resolution
- submit draft to RevCom F2026

It is noted that the IEC counterpart is not nominated yet. Chris Ploetner confirmed that prior the Fall 2024 meeting the nomination and call for experts in IEC TC14 will be done.

A task force for the new clauses 5.2.6 and 5.2.7 has been formed. This will be led by Ulf Radbrandt supported by Marcos Czernorucki and Peter Heinzig.

A second task force regarding LIWL and SIWL levels has been formed, led by Sylvain Plante and supported by Harmanpreet Sekhan

5. Old Business

There was no old business

6. New Business

There is no new business

7. Adjournment

The meeting was adjourned at 5:20pm.