

IEEE/PES TRANSFORMERS COMMITTEE

Dry-Type Transformer Subcommittee

PC57.16 Standard for Requirements, Terminology, and Test Code for Dry-Type Air-Core Series-Connected Reactors Virtual

Monday, November 15, 2021

The working group for the revision of C57.16 met virtually in WebEx on Monday November 15, 2021, at 9:25 AM.

1. Introductions and Call for Patents

- The meeting was called to order at 9:25 AM by the WG Chair Art Del Rio.
- The meeting was opened with the introduction of participants.
- The WG Chair, Art Del Rio, did a call for potentially essential patents. None was reported.

2. Verification of Quorum

- The attendance was checked with a Poll.
- There was a total of 27 participants: 8 Members and 20 Guests out of which no guest requested membership.
- 8 of the current 15 WG Members were present and quorum to carry out business was met.
- The meeting agenda, which was circulated by email among members and guests on November 9, 2021, by email, was presented to the participants.
- There were no objections or comments, and the agenda was approved unanimously.

3. Approval of the minutes of the April 26, 2021, virtual meeting

- The minutes from the S21 virtual meeting, which were circulated on November 9, 2021, by email, were presented to the participants.
- Dave Caverly has provided a changed text regarding sync with IEC. With that change, the agenda was approved unanimously.

4. Continue to discuss and review

- Dave Caverly gave a presentation regarding the latest update/clean-up status with Annex B, Annex B-1 and Annex F.
- A week ago, the chair Art Del Rio distributed the latest versions of these Annexes.
- At the spring meeting it was concluded, after recommendations from the Switchgear Committee, that with a little bit of “clean-up” the Annexes would then be ready to go to Ballot. Dave Caverly has done the clean-up.

4.a Annex F – Informative, Circuit Breaker Transient Recovery Voltage Implications of Series Reactors

- Dave Caverly presented the latest draft.
- The changes have been mostly editorial and not so much technical.

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- The title of Annex F has been changed to better reflect its content
- The format of Table F1, model values for PI model, has been changed to fit better in the text. Some units have been changed to be more convenient, e.g., H changed to mH, and F changed to pF.
- Most of clause F.3, TRV study, has been removed as this information is covered in IEEE C37.011 which is referenced in this Annex.
- Figure F.2 has been updated to show the current limiting reactor on both sides of the breaker. The text has been updated to also cover reactor on both sides of the breaker. This is after comment from Pierre Riffon.
- Alexander Gaun, commented that the capacitance calculation, shown in Clause F.2, is seldom used. Normally the capacitance to ground is simulated, e.g., with finite element simulations. The text will be updated to also state that simulations can be used to define the capacitance to ground.
- With these modifications, Annex F is ready to be balloted as part of the standard.
- Klaus Pointner made a motion to copy this updated Annex F into the draft standard. This motion was seconded by Ulf Radbrandt.

4.b Annex B - Normative, Specific requirements for dry-type air-core shunt capacitor reactors

- Dave Caverly presented the latest draft.
- There have been few changes since the spring meeting.
- The plan at the beginning was to change Annex B as little as possible and to put new information in the newly created informative Annex B-1 instead.
- The text addresses the benefits of putting the TLI, paralleled by an arrester, on the neutral side of the capacitor. As worded, it unintentionally implies that the arrester is applied to reduce the required short circuit rating of the reactor. This was discussed. That would require very high energy of the arrester to withstand the fault current. Alternatively, and more likely, the arrester would be sacrificed in the event of bank flashover. Dave Caverly will develop revised text regarding the fault current aspect and review it with Pierre Riffon and Mike Sharp in advance of copying this updated Annex B into the draft standard.
- Klaus Pointner made a motion to copy this updated Annex B into the draft standard. This motion was seconded by Mike Sharp.

4.c Annex B1 – Informative. Application and Rating Aspects of Shunt Capacitor Reactors (TLI's)

- Dave Caverly presented the latest draft.
- Equation numbers must be corrected before inclusion into the draft standard.
- The text related to Figure 3c will be corrected regarding difference in cost to refer to only 3a instead of 3a and 3b.
- The text regarding the neutral side TLI and parallel arrester will be modified to be more clear (same as mentioned above regarding the similar text in Annex B). Dave

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Caverly, Mike Sharp and Pierre Riffon will together modify the text. modify the text (same as new text for Annex B).

- The overall factors in Table 1 were originally shown as 1.25 and 1.35 but were modified in the version of the document shown in the meeting to 1.24 and 1.36. Further checking after the meeting found that Annex B shows 1.25 and 1.35 and also that this is consistent with IEEE 1036-2010 and also IEEE C37.012 - 2014. Accordingly, after the meeting, the factors have been changed back to 1.25 and 1.35. If needed this can be discussed again at the interim virtual meeting in December.
- The text regarding mechanical forces has been rewritten
- Figures and text are added to show components of inrush TLI fault current for different timings of fault occurrence, i.e., time (in electrical degrees) from voltage zero crossing until fault occurrence. Pierre Riffon provided these from simulations.
- Ulf Radbrandt made a motion to do the modifications and to copy Annex B-1 into the draft standard. This motion was seconded by Klaus Pointner.

5. Discussion

- Why do we have an Annex named B-1? Should it get its own letter, e.g., Annex G? There was some discussion but no clear consensus. No vote was taken (we were under time pressure to end the meeting). The reason to name it B-1 is that it is so tightly connected to Annex B. The Chair suggested that we keep the name Annex B-1 but we probably must correct names of clause, equations, figures, and tables to include “B-1”. It is also unsure if this will pass the MEC review. The Chair will investigate further with IEEE as we start the process of merging the revised and new Annexes back into the master document.
- We will try to have the document ready for Ballot before the spring 2022 meeting. Then it might be higher possibility to get a necessary PAR extension. To achieve this, we will need to have at least one virtual working meeting (and possibly two) before the spring meeting. We should have the timeline for the Ballot when we request the PAR extension.
- The rest of the standard will be distributed for review among WG members.
- The next working meeting is scheduled for December 14. Art Del Rio will send an invitation. All members should try to attend the extra working meetings in order to get quorum.

5. New Business

- There was no new business.

6. Adjournment

- The meeting was adjourned at 10:48 AM.

Next meeting:

Spring 2022 – Denver, Colorado USA, March 27 – 31, 2022

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F21 Attendance list and membership status.

Role	First Name	Last Name	Company
Guest	Mubarak	Abbas	Siemens Energy
Guest	Edmundo	Arevalo	Bonneville Power Administration
Vice-Chair	David	Caverly	Trench Limited
Chair	J. Arturo	Del Rio	Siemens Energy
Member	Alexander	Gaun	Coil Innovation GMBH
Guest	Thomas	Blackburn	Gene Blackburn Engineering
Guest	Solomon	Chiang	The Gund Company
Member	Sylvain	Plante	Hydro-Quebec
Guest	Sami	Debass	Electric Power Research Institute (EPRI)
Guest	Thomas	Falkenburger	Coil Innovation USA, Inc.
Member	Klaus	Pointner	Trench Austria GmbH
Guest	Rob	Ghosh	General Electric
Secretary	Ulf	Radbrandt	Hitachi Energy
Guest	Andrea	Glynn	Xcel Energy
Guest	Jeffrey	Gragert	Xcel Energy
Guest	Thomas	Hartmann	Pepco Holdings Inc.
Guest	Giovanni	Hernandez	Virginia Transformer Corp.
Guest	Kurt	Kaineder	Siemens Energy
Guest	Ken	Klein	Grand Power Systems
Guest	Aniruddha	Narawane	EATON Corporation
Member	Pierre	Riffon	Pierre Riffon Consultant Inc.
Guest	Livia	Neeson	Entergy
Guest	Paulette	Payne-Powell	Retired
Guest	Caroline	Peterson	Xcel Energy
Guest	Patrick	Rock	American Transmission Co.
Guest	Ullises	Rodriguez	Grand Power Systems
Member	Michael	Sharp	Trench Limited
Guest	Dervis	Tekin	Meramec Instrument Transformer Co.
Guest	Michael	Warntjes	American Transmission Co.
Guest	Helena	Wilhelm	Vegoor Tecnologia Aplicada
Guest	Terry	Wong	Trench Limited

Respectfully submitted,

Chairman: Art Del Rio (a.delrio@ieee.org)

Secretary: Ulf Radbrandt (ulf.radbrandt@ieee.org)