



Fellesmøte for Den norske komite for CIGRE

Onsdag 09.04.2025 - kl 09.30 – 15.00

Rapport fra SC A2

Hans Kr. Høidalen
NTNU



Rapport om status for SC A2

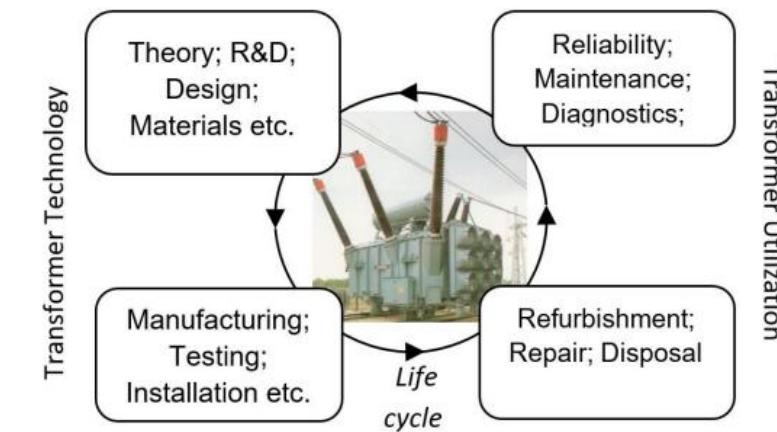
- Leder: Pascal Mueller
- Sekretær: Marc Foata
- Rådgivende grupper:
 - Strategy/Access: Pascal Mueller
 - Tutorials: Tara-lee MacArthur
 - Technology: Khayakazi Dioka
 - Utilization/Operation: Brendan Diggins
 - Green Book: Simon Ryder
 - Digitalization: Patrick Picher
 - Lower voltages: Peter Werle

Chairman Pascal Mueller (CH)	Secretary Marc Foata (DE)			
24 Regular members				
16 Observer members				
8 Advisory Groups				
A2.1 Strategic				
A2.2 Tutorial				
A2.3 Technology				
A2.4 Utilisation				
A2.5 Access to electricity				
A2.6 Green book				
A2.7 Digitalization				
A2.8 Distribution				
Liaison IEEE				
Liaison IEC TC 14 & TC 10				
Liaison AG D1.01				
JWG A2/D2.65	Transformer Digital Twin – concept and future perspectives	Patrick PICHER	2022	
JWG A2/D1.66	Breathing systems of liquid filled transformers and reactors	Daniel KOCH	2022	
JWG A2/D1.67	Guideline for online dissolved gas analysis monitoring	Tara-lee MACARTHUR	2022	
WG A2.68	Failure survey of lower voltage generator step up transformers installed in wind farms and photovoltaic parks	Peter WERLE	2022	
WG A2.69	Guide for Transformer Maintenance – Update	Claude RAJOTTE	2022	
JWG A2/C3.70	Life Cycle Assessment (LCA) of Transformers	Myles Caleb MARGOT	2023	
JWG A2/D1.71	Modern insulating liquids qualification for OLTC, bushings and other accessories	Lars LIDEN	2023	
JWG A2/D1.72	Retrofit of mineral oil in transformers – Motivations, considerations and guidance	Roberto ASANO JUNIOR	2023	
JWG D1/A2.79	Improved understanding of dynamic behaviour of winding insulating materials in liquid insulated power transformers	Orlando GIRLANDA	2023	
JWG D1/A2.80	Functional properties of non-metallic solid materials for liquid filled transformers and reactors and their compatibility with insulating liquids	Dejan VUKOVIC	2023	
Task Force	Power Transformer Tank Specification for Passive Protection Against Internal Arc	Jean-Bernard DASTOUS	2022	
Task Force	Power Transformers Sound Levels on Site	Janine DICKINSON	2022	
Task Force	Silver Corrosion in Transformers	Jelena LUKIC	2024	
Task Force	Explore how Differences Internationally in Regulation, Society Expectations and Government Policies Impact the Replacement Age of Power Transformers	Dan MARTIN	2024	

<https://a2.cigre.org/>

Rammeverk

- **Krafttransformatorer**, inkludert industri, dc omforming, faseskift, storskala distribuerte kilder.
 - **Reaktorer**, inkludert parallel, serie, strømbegrensere og glattere.
 - **Transformatorkomponenter**, inkludert gjennomføringer, trinnkoblere og hjelpeutstyr
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- **Konstruksjon**. Theory principles and concepts, functionality, technology development, design, performance and application of materials, efficiency
 - **Anskaffelse**. Manufacturing, quality assurance, application guidance, planning, routing and location, construction, installation, erection, installation
 - **Drift**. Reliability, availability, dependability, maintainability and maintenance, service, condition monitoring, diagnostics, restoration, repair, loading, upgrading, uprating, digitalization
 - **Levetid**. Refurbishment, re-use/re-deployment, deterioration, dismantling, disposal



Paris 2024

- PS1 Design of resilient transformers (37 papers)
 - On-site GIC withstand experiment on a 1000 MVA 3-limb autotransformer and a 300 MVA 5-limb transformer Part 1: Design, Modelling, Instrumentation, DAQ and Testing, Roald KLEIVI , Dietrich BONMANN , Claes CARRANDER , Geir Morten BJØRKVIK , Dejan SUSA
- PS2 Advances in transformer analytics (50 papers)
 - Detecting degraded bushings with DFR – A case study, Lars Andreas ERIKSSON1 , Evgenii ERMAKOV , Lars JONSSON , Erik NICOLAISEN
 - Monitoring Clamping Pressure in 40 MVA Power Transformer: A Study of Short and Long-Term Trends, Inge MADSHAVEN , Henrik ENOKSEN , Stefan JAUFER , Christoph KRAUSE, Borut PRASNIKAR , Asgeir MJELVE , Alexander REITBAUER , Mohamed RYADI
- PS3 Reliability of Transformers for Renewable Energy (14 papers)

Drivere

- Utvikling av større strømnett gjennom utvidelser og sammenkoblinger;
- Endringer i internasjonal handel;
- Endringer i leverandørindustrien, både for shuttleleverandører og underleverandører;
- Distribuerte energikilder og interaksjon med transmisjon og distribusjonsnett;
- Bruk av kraftelektronikk (FACTS etc.) for styring av effektflyt for økning av laster i systemet;
- Forbedret metodikk for tilstandsbasert vedlikehold;
- Aldring av transformatorparken, og behovet for riskikostyring (ex: ISO 55000);
- Andre trender som krever utvikling politikk for reparasjon og levetidsforlengelse;
 - Krav til kortere nedbetalingstid for nytt utstyr;
 - Strammere kostnadsrammer;
 - Nye myndighetskrav;
 - Økt datadrevet vedlikehold (digitalisering);
 - Mangel på personell med teknisk kompetanse;

Strategi

- Teknisk
 - Kundehjelp utviklingsland: Transformatorøkonomi, drift vedlikehold. Guider/TB, tutorials, Green Books.
 - Teknologi: Nye materialer og driftsmønstre. Digitalisering. Nye verktøy. Miljø og sikkerhet.
 - Kompetanse: Beholde og utvikle. NGN-WiE. Symposium.
- Administrativt
 - Utviklingsland
 - Samarbeid med nasjonale komiteer
 - JWG utover D1: A3, B1, B3, B4, B5, C1, C3 and C4

Hva er spesielt viktig for Norge?

- Sirkulærøkonomi. Reparasjon av transformatorer.
- Nye driftsmønstre: Hyppige start-stopp. Vann-Vind.
- Klima. Lave temperaturer. Fuktighet.
- Geomagnetisk induserte strømmer.
- Driftserfaringer offshore, subsea.
- Transport.

Arbeidsgrupper med norske medlemmer



- A2.60: Dynamic thermal behaviors of power transformers,
 - Medlem: Camilla Espedal (Sintef)
- A2.63: Transformer impulse testing
 - Medlem: Lars Lundgaard (Sintef)
- A2.65: Transformer digital twin - concept and future perspectives (Leder: Patrick Picher) , 2022-2025
 - Medlemmer: Annie Heiern (Statnett), Inge Madshaven (SINTEF)
- A2/D1.67: Guidelines for online dissolved analysis monitoring,
 - Medlemmer: Annie Heiern, Camilla Espedal
- A2.68: Failure survey of LV GSU windpark/photo voltaic,
 - Medlem: Maria Bang (Statkraft)
- A2/D1.74: Online moisture assessment of transformer for ageing,
 - Medlem: Lars Lundgaard

Nyere arbeidsgrupper

- A2.78 Bushing diagnostics: Off-line testing and on-line monitoring systems (P. Poorvi, USA), 2025-2029
- JWG A2/C4/D1.77: Design of transformers for very fast transient overvoltage (J. Bruno, Croatia), 2025-2029
- A2/D1.71: Modern Insulating Liquids Qualification for OLTC, Bushings and other accessories, 2024-2026
- A2/D1.72: Retrofill of Mineral Oil in Transformers – Motivations, Considerations and Guidance, 2024-2026

Andre forhold

Brosjyrer med vesentlig norsk bidrag siste par år:

- TB900-905: High-Frequency Transformer and Reactor Models for Network Studies - Part A-E: White-, Black-, Grey- Box models, Data, Målinger.
- TB944: Effect of DC bias on power transformers.

Ny oppdatert feilstatistikk:

- Surveys: TB939 Analysis of AC transformer reliability