CIGRE Study committe A1
PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG A1.81

NAME OF THE CONVENOR
MAILULA Katudi Oupa (SOUTH AFRICA)

TITLE
Generator Shaft Voltage and Current: Monitoring, Diagnostics and Mitigation in Large Turbo Generators

THE WG APPLIES TO DISTRIBUTION NETWORKS: NO

ENERGY TRANSITION
3 / Digitalization
4 / Sustainability and Climate Change

POTENTIAL BENEFIT OF WG WORK
4 / state-of-the-art or innovative solutions or directions

STRATEGIC DIRECTION
2 / Making the best use of the existing systems

SUSTAINABLE DEVELOPMENT GOAL
9 / Industry, innovation and infrastructure

BACKGROUND :

Generator shaft voltage and shaft current phenomena remain an important but insufficiently addressed reliability concern in large turbo-generators. These phenomena arise due to electrostatic coupling, electromagnetic induction, excitation-system harmonics, switching transients, and grounding-path variations. If not properly monitored and mitigated, shaft voltages and associated shaft currents may lead to:

- Bearing electrical discharge damage and fluting
- Premature bearing failure
- Shaft grounding brush degradation
- Increased maintenance costs
- Reduced generator reliability and forced outages

The problem is becoming increasingly important due to:

- Aging generator fleets
- Greater adoption of static excitation systems and power electronics
- Increased harmonic distortion
- Higher expectations for plant reliability and availability

Although utilities, OEMs, and service providers recognize the problem, current practices remain inconsistent regarding:

- Measurement methods
- Diagnostic criteria
- Monitoring strategies
- Mitigation techniques

There is currently no comprehensive CIGRE Technical Brochure dedicated specifically to generator shaft voltage and current phenomena in large turbo-generators.

PURPOSE / OBJECTIVE / BENEFIT OF THIS WORK :

The purpose of this Working Group is to establish a consolidated industry reference for understanding, monitoring, diagnosing, and mitigating generator shaft voltage and current phenomena in large turbo-generators.

The objectives are to:

- Develop a common technical understanding of shaft voltage and current mechanisms
- Review the influence of machine design, excitation topology, and grounding arrangements
- Evaluate current monitoring and diagnostic practices
- Identify characteristic failure modes and fault signatures
- Review mitigation technologies and best practices
- Develop practical guidance for utilities, OEMs, and service providers

Benefits include:

- Improved generator reliability
- Reduced forced outages
- Improved condition monitoring capability
- Better maintenance planning
- Extended asset life

SCOPE :

The Working Group will investigate shaft voltage and shaft current phenomena in large turbo-generators. The scope includes:

- Physical mechanisms responsible for shaft voltage generation
- Shaft current flow paths and bearing current mechanisms
- Influence of excitation systems (static and brushless)
- Influence of grounding configurations
- Online monitoring and measurement techniques
- Diagnostic methodologies
- Mitigation and maintenance strategies
- Utility and OEM case studies

Key technical topics include:

- Capacitive coupling and electrostatic effects
- Electromagnetic induction
- Excitation harmonics and converter effects
- Bearing current discharge mechanisms
- Shaft grounding brush performance
- Time-domain and frequency-domain diagnostics
- Advanced digital monitoring and AI/ML-based diagnostic methods

The Working Group will focus primarily on utility-scale turbo-generators.

Remarks:

This Working Group will support utilities and industry stakeholders by consolidating global experience and best practices related to shaft voltage and shaft current management.

The proposed work aligns strongly with CIGRE A1 objectives related to improving reliability, performance, and life-cycle management of rotating electrical machines.

The Working Group will encourage participation from:

- Utilities
- OEMs
- Service providers
- Research institutions
- Universities

DELIVERABLES AND EVENTS

Deliverables Types

Annual progress and activity report to Study Committee
Technical Brochure and Executive Summary in Electra
Tutorial
Webinar

Deliverables schedule

Technical Brochure | Q2 | 2029 | Technical Brochure

Tutorial | Q3 | 2029 | Tutorial

Webinar | Q4 | 2029 | Webinar

Time schedule

Q4	2026	Recruit members (National Committees, WiE, NGN)
Q1	2027	Develop final work plan
Q4	2028	Draft TB for Study Committee Review
Q2	2029	Final TB & Electra Executive Summary
Q3	2029	Tutorial
Q4	2029	Webinar

APPROVAL BY TECHNICAL COUNCIL CHAIRMAN:
Rannveig S. J. Loken
October 20th, 2026