CIGRE Study Committee A3

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

<table>
<tr><td>WG A3.49</td><td colspan="2">Name of Convenor: Roberto Tinarelli (IT)</td></tr>
<tr><td colspan="2">Strategic Directions #[2]: The electrical power system of the future reinforcing the End-to-End nature of CIGRE: respond to speed of changes in the industry by preparing and disseminating state-of-the-art technological advances</td><td>Sustainable Development Goal #[3]: SDG 9: Industry, innovation and infrastructure
Facilitate sustainable infrastructure development; facilitate technological and technical support</td></tr>
<tr><td colspan="3">The WG applies to distribution networks: ☒ Yes / ☐ No</td></tr>
<tr><td colspan="3">Potential Benefit of WG work #[4] : Work is likely to contribute to new or revised industry standards or with other long term interest for the Electric Power Industry</td></tr>
<tr><td colspan="3">Title of the Group: Aging effects on accuracy class of Instrument Transformers</td></tr>
<tr><td colspan="3">Scope, deliverables and proposed time schedule of the Group:

Background:

The correct operation and control of the modern power networks can be achieved only with a complete observability of the power network, which, in turns, can be obtained by deploying a distributed and synchronized measuring system, featuring high characteristics of accuracy. Of course, this also implies the use of accurate, reliable and stable Instrument Transformers (ITs), given that their operation impacts substantially on the whole performance of a measuring system.

In the recent years Low Power Instrument Transformers (LPIT) are replacing to inductive ITs, mainly because they perform far better than inductive IT in terms of accuracy, bandwidth, reliability, dynamic response, etc. They are very compact and light in weight, resulting then suitable for being embedded in existing equipment (like bushings, cable terminations, brakers, etc.) or even for replacing post-insulators. They are suitable for outdoor as well as indoor installation.

Energy System Operators have then preferred LPIT instead of inductive ITs and started in the recent years a mass-deployment worldwide. So, in the short and mid-term both inductive ITs and LPITs will be present in Power Networks.

Due to their expected long-life as well as to the expected large number of them deployed, the stability of their metrological characteristics over time, which may change for ageing, becomes the critical parameter to be assured by IT manufacturers given that the periodic verification of their accuracy class is a complex task and requires a huge effort.

Scientific studies and experimental tests for assessing the behaviour of electrical assets over time have been done since some decades. Many scientific papers can be found in literature on this subject. However, very few and not scientifically important attempts to investigate the long-term stability of metrological features of IT over time have been done so far. Moreover, those few examples are all related to inductive IT.

Of course the metrological characteristic of an IT may change over time for changes in physical, chemical or electrical properties of the materials it is made of, that is for ageing.</td></tr>
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As long as the IT remains within its accuracy class, no problem occurs. On the contrary, the IT must be considered fault, given that it is no more able to perform as required.

This leads to consider the effect of ageing on ITs in terms of reliability and related degradation model.Therefore, it would result crucial and of extreme market relevance to investigate and collect experimental results and theoretical models aimed at describing the mechanisms that lead to a degradation of accuracy characteristics of all kind of IT over time.

Scope:

The working group will deliver a technical brochure on aging effects on the metrological performance of IT. The brochure will take into consideration the environmental conditions, degradation mechanisms of the components inside IT, electrical operation (either sinusoidal or distorted primary quantities).

The technical brochure of the working group will include:

1. Discussions about the main effects that can affect the performance of IT over time (weather, electric field, magnetic field, high frequency components, transients,)
2. Theoretical (mathematical and physical) discussions about the ageing mechanisms in both insulation means and other key-components inside IT contributing to accuracy.
3. Definition of “Reliability” from a metrological perspective of IT in general. Definition of “metrological failure” and how to evaluate it through a law of degradation of reliability
4. Design of Experiments for assessing Accelerated Tests to be applied to both IT for testing the Aging effect and evaluating experimentally the MTTFF (Mean Time To the First Failure)
5. Test set up for accelerating tests on IT for aging effect evaluation.

The working group will be supported by liaison with IEC TC38.

Deliverables:

☒ Annual Progress and Activity Report to Study Committee
☒ Technical Brochure and Executive Summary in Electra
☒ Electra Report
☐ Future Connections
☐ CIGRE Science & Engineering (CSE) Journal
☒ Tutorial
☒ Webinar

Time Schedule:

- Recruit members (National Committees) Q4 2022
- Develop final work plan Q1 2023
- Draft TB for Study Committee Review Q2 2025
- Final TB Q3 2025
- Tutorial Q4 2024
- Webinar Q2 2022

Approval by Technical Council Chairman:

Date: January 6th, 2023

Notes:
[1] Working Group (WG) or Joint WG (JWG),
[2] See attached Table 1,
[3]See attached Table 2 and CIGRE reference Paper: Sustainability – at the heart of CIGRE's work.
[4] See attached Table 3

WG Membership: refer Comments at end of document

Table 1: Strategic directions of the Technical Council

1	The electrical power system of the future reinforcing the End-to-End nature of CIGRE: respond to speed of changes in the industry by preparing and disseminating state-of-the-art technological advances
2	Making the best use of the existing systems
3	Focus on the environment and sustainability (in case the WG shows a direct contribution to at least one SDG)
4	Preparation of material readable for non-technical audience

Table 2: Environmental requirements and sustainable development goals

	CIGRE selected the 7 SDGs that are the most relevant to CIGRE. In case the WG work refers to other SDGs or do not address any specific SDG, it will be quoted 0.
0	Other SDGs or not applied
7	**SDG 7: Affordable and clean energy** Increase share of renewable energy; e.g. expand infrastructure for supplying sustainable energy services; ensure universal access to affordable, reliable, and modern energy services; energy efficiency; facilitate access to clean energy research and technology
9	**SDG 9: Industry, innovation and infrastructure** Facilitate sustainable infrastructure development; facilitate technological and technical support
11	**SDG 11: Sustainable cities and communities** Increase attention on sustainable and resilient buildings utilizing local (raw) materials, power for electric vehicles, strengthening long-line transmission and distribution systems to import necessary power to cities, developing micro-grids to reinforce the sustainable nature of cities; protect and safeguard the world's cultural and natural heritage; reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and waste management
12	**SDG 12: Responsible consumption and production** E.g. Promote public procurement practices that are sustainable; address reducing use of SF6 and promote alternatives, encourage companies to adopt sustainable practices and to integrate sustainability information into their reporting cycle, address inefficient fossil-fuel subsidies that encourage wasteful consumption
13	**SDG 13: Climate action** E.g. Increase share of renewable or other CO_2-free energy; energy efficiency; expand infrastructure for supplying sustainable energy; strengthen resilience and adaptive capacity to climate-related hazards and natural disasters; integrate climate change measures into national policies, strategies and planning; improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
14	**SDG 14: Life below water** E.g. Effects of offshore windfarms; effects of submarine cables on sea-life
15	**SDG 15: Life on land** E.g. Attention for vegetation management; bird collisions; integration of substations and lines into the landscape

Table 3: Potential benefit of work

1	Commercial, business, social and economic benefits for industry or the community can be identified as a direct result of this work
2	Existing or future high interest in the work from a wide range of stakeholders
3	Work is likely to contribute to new or revised industry standards or with other long term interest for the Electric Power Industry
4	State-of-the-art or innovative solutions or new technical directions
5	Guide or survey related to existing techniques; or an update on past work or previous Technical Brochures
6	Work likely to contribute to improved safety.

Comments:

1) CIGRE Official Study Committee Rules: WG Membership

https://www.cigre.org/GB/about/official-documents

a. Only one member per country (by exception of SC Chair)

b. WG nominees must first be supported by their National Committee (or local SC Member) as an appropriate representative of their country.

c. Acceptance of the nomination is granted by the SC Chair and advised to the WG Convener

2) Collaboration Space

https://www.cigre.org/article/GB/collaborative-tools-2

CIGRE will provision the WG with a dedicated Knowledge Management System Space.

The WG will use the KMS for drafting collaboration, capture and retention of discussion and meeting records.

Official country WG Members will be sent registration instructions by the Convener.

Official country WG Members may request the WG Convener to allow additional access for an extra national subject matter specialist to aid in the work at the national level, including NGN members.