CIGRE Study committe B2

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG B2.97

NAME OF THE CONVENOR
Bucca Giuseppe (ITALY)

TITLE
Galloping effect on overhead line (OHL) components and mitigations

THE WG APPLIES TO DISTRIBUTION NETWORKS: YES

ENERGY TRANSITION
4 / Sustainability and Climate Change

POTENTIAL BENEFIT OF WG WORK
4 / state-of-the-art or innovative solutions or directions
5 / Guide or survey on techniques, or updates on past work or brochures
6 / work likely to contribute to improve safety

STRATEGIC DIRECTION
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-ofthe-art technological advances

SUSTAINABLE DEVELOPMENT GOAL
9 / Industry, innovation and infrastructure

BACKGROUND :

The ice galloping phenomenon occurring on overhead lines (OHL) is a wind-induced vibration phenomenon characterized by large amplitudes at low frequencies related to the first modes of vibration of bundled and single conductors. Galloping occurs when an ice deposit is present on the conductors, and it can significantly damage the OHL due to possible phase-to-phase flashover and large dynamic loads on the support structures (fittings and towers). Severe damages and failures of conductors and their interconnected equipment have been reported after galloping events in CIGRE B2 TB 322 “State of the art of conductor galloping”. Moreover, nowadays, considering the potential effects of climate change, the occurrence of galloping on the OHL is likely to intensify.

Numerous studies in the literature focus primarily on numerical models that try to estimate the galloping vibration amplitudes. Many of them are based on the finite element method (FEM) and on the value of aerodynamic coefficients for different ice accretion shapes. In these models, the iced conductor aerodynamics data are obtained through wind tunnel tests. In WG B2.84, a numerical-experimental benchmark has been performed to verify the model effectiveness in predicting the conductor oscillation amplitude. The benchmark allowed to highlight the potentialities of numerical models in predicting the galloping vibration amplitudes but also to point out the need for deeper analyses of the galloping phenomenon and the related numerical models. In this new framework the focus will also be put on the dynamic effects caused by galloping on towers and fittings, starting from the already developed models.

Despite the number of works published on galloping, the complex combination of mechanical, aerodynamic and meteorological aspects still makes it an open research topic, and there are margins for improvement in modelling the phenomenon. An increased modelling accuracy can play a significant role in the use of numerical simulations to find the optimal mitigation technology: for instance, choice of the type, number and position of the interphase spacers or choice of other mitigation actions, depending on the specific line condition. Regarding interphase spacers, it will be taken advantage of the work carried out in WG B2.71 on the study of the different typologies employed in the field.

PURPOSE / OBJECTIVE / BENEFIT OF THIS WORK :

The purpose of this work is to identify and address knowledge gaps regarding the galloping phenomenon on OHL (single and bundled conductors), while also exploring methods and devices to mitigate its occurrence. The WG B2.84 reported the results of a numerical-experimental benchmark performed to verify the model effectiveness in predicting the conductor oscillation amplitude. Two different numerical models were analysed, and the related results were compared with experimental results. Despite the work done in WG B2.84 has been emphasized the important potentialities of numerical models in predicting the galloping vibration amplitudes, it has highlighted how the galloping phenomenon is still an open research topic presenting important margins for improvement in modelling the phenomenon. As an example, an important point to be addressed is the influence of different accretion typologies (wet snow, ice rime, etc...) on the severity of the phenomenon. The development of reliable numerical models to simulate the galloping phenomenon has the aim of properly design and verify mitigation systems and to compute the dynamic loads acting on towers and on the different components in the span. The reliability of numerical models can be proved by comparing experimental results with results provided by numerical models. Concerning this point, the recently developed wireless sensors simplify the installation and the measurement setup, and they could be used to obtain experimental measurements to be compared with numerical results. Collecting experiences on the measurements of galloping phenomenon in terms of data and in terms of measurement setup (kind of sensors, position of sensors along the span, etc.) will be one of the objectives of this work. Finally, in order to compute the dynamic loads acting on towers and on the different components in the span, more sophisticated numerical models that include these elements and that include the different phases and fittings have to be introduced. Concerning fittings, interphase spacer plays an important role when galloping is studied. In this work, taken advantage of the work carried out in WG B2.71 on the study of this system, an analysis of a suitable dynamical model of interphase spacer will be done. The final purpose of the work will be to provide useful recommendations to the operators to mitigate the consequences of galloping phenomenon.

SCOPE :

The general scope of this working group can be summarized in the following items:

1. Analysis of the state of the art and experiences on galloping phenomenon occurring on OHL
2. Analysis of how different types of ice accretion (freezing rain, wet snow, etc.) influence galloping
3. Providing a comprehensive explanation of the galloping mechanisms for a single conductor in comparison to a conductor bundle, and analysis of their respective impacts on the probability of occurrence and the amplitude of galloping
4. Identification of knowledge gaps
5. Numerical models to estimate the galloping vibration amplitudes and the related forces transmitted to the towers and fittings. Among fittings, interphase spacers play an important role when galloping is studied: concerning interphase spacers, it will be taken advantage of the work carried out in WG B2.71. Moreover, other devices used for the mitigation of galloping phenomenon will be taken into account, as an example, detuning pendulum, air flow spoiler, loose spacer.
6. Collection of experiences on the measurements of galloping phenomenon in terms of data and in terms of measurement setup. The available experimental data can be used to analyse the reliability of numerical models by means of comparison between numerical results and experimental measurements.
7. The analysis of experiences on the measurements of galloping phenomenon will be used to provide guidelines on how these measurements should be carried out, as an example in terms of sensors to be used (types and minimum number), data to be collected, characteristics of these data, etc.
8. Dynamical characterization of fittings through laboratory tests can be used to introduce the contribution of these fittings in the dynamical behaviour of the system during the galloping phenomenon.
9. Use of the numerical models to evaluate the efficiency of methods and devices to mitigate galloping occurrence and severity.
10. The results of the work will be used to provide recommendations to the operators to mitigate the consequences of galloping phenomenon.

DELIVERABLES AND EVENTS

Deliverables Types

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

Deliverables schedule

Annual progress and activity report | Q3 | 2026
Annual Progress and Activity Report to Study Committee

Technical Brochure | Q2 | 2029 Technical Brochure and Executive Summary in Electra

Tutorial Q3 2026 Tutorial

Time schedule

Q1 2026 Recruit members (National Committees, WiE, NGN)

Q3 2026 Develop final work plan

Q4 2028 Draft TB for Study Committee Review

Q2 2029 Final TB

Q3 2029 Tutorial

APPROVAL BY TECHNICAL COUNCIL CHAIRMAN:
Rannveig S. J. Loken
January 06th, 2026